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**ANTISOCIAL BEHAVIOUR  
OVER THE LIFE COURSE  
AMONG FEMALES AND MALES  
TREATED FOR SUBSTANCE MISUSE**

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**To Nille, with love**



## ABSTRACT

**Aims:** (1) To compare the prevalence of adverse outcomes in adulthood between a clinic cohort and a matched sample from the general population; (2) To examine the associations between adolescent antisocial behaviour and adverse outcomes in adulthood; (3) To identify subgroups of male and female offenders with distinct features of offending, and to examine the long-term continuity of offending in the subgroups, and; (4) To identify long-term offending trajectories and examine the relationship between these offending trajectories and concurrent problems in other areas.

**Method:** Participants were part of a longitudinal study of adolescents who were treated at a substance misuse clinic during two periods: 1968-1971 (Cohort 1; 1992 participants), and 1980-1984 (Cohort 2; 1576 participants). The same number of individuals were randomly selected from the general population and matched to the clinic cohorts. Baseline data was extracted from archival data, and participants were followed to 2002 through multiple national registers.

**Results:** Individuals from cohort 1 were at increased risk of several adverse outcomes in adult life when compared to the matched sample. Additionally, adolescent antisocial behaviour increased the risk of adversity in multiple domains up to age 50 in cohort 1. Several subgroups of offenders could be identified in adolescence and again in adulthood in cohort 1, and considerable continuity in offending was shown among several subgroups. Individuals with high levels of violent and non-violent offending in adulthood also demonstrated high levels of substance-related crimes. Multiple long-term offending trajectories were identified in cohort 2 and in the matched sample. Cohort 2 showed less desistance in offending than the matched sample, and trajectories with the highest offending rates displayed the highest rates of concurrent problems. Both sex differences and similarities were demonstrated in all studies; larger differences in outcomes were found between women in cohort 1 and women in the matched sample, than between their male counterparts. In cohort 1, males demonstrated higher offending levels and more offending diversity, and specific subgroups and trajectories were identified among the males that were not replicated among the females. Conversely, adolescent antisocial behaviour was associated with adult adversity equally in females and males in cohort 1, and no sex differences were found in the continuity of offending, or in the relationship between substance-related crimes and other crimes in the same cohort. Both genders also demonstrated similarities in the associations between concurrent problems and offending trajectories in cohort 2.

**Conclusions:** An increased risk of both homotypic and heterotypic continuity of problems through 30 years of adult life was demonstrated among individuals treated for substance misuse as adolescents. This highlights the importance of assessing and treating the multiplicity of problems to prevent continuation of current problems, and the emergence of new ones. Treatment should also acknowledge heterogeneity and aim to target specific needs, instead of accommodating a wide range of problems with the same intervention strategy. The findings further suggest that intervention is equally needed among girls who present antisocial behaviour in adolescence, as this is predictive of adult adversity. Altogether, the findings point to the importance of early and effective interventions to prevent further antisocial behaviour, and the problems associated with it.

## LIST OF PUBLICATIONS

- I. Hodgins, S., Larm, P., Molero-Samuleson, Y., Tengström, A., & Larsson, A. (2009). Multiple adverse outcomes over 30 years following adolescent substance misuse treatment. *Acta Psychiatrica Scandinavica*, *119*, 484-493.
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- III. Molero, Y., Larsson, A., Larm, P., Eklund, J., & Tengström, A. Violent, non-violent, and substance-related offending over the life course in a cohort of males and females treated for substance misuse as youths. *Aggressive Behavior*.
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## LIST OF ABBREVIATIONS

AIC	Akaike Information Criterion
APD	Antisocial Personality Disorder
ASB	Antisocial Behaviour
BIC	Bayesian Information Criterion
BRÅ	Brottsförebyggande Rådet [The Swedish National Council for Crime Prevention]
CAN	Centralförbundet för Alkohol- och Narkotikaupplysning [The Swedish Council for Information on Alcohol and Drugs]
CASBA	The Consequences of Antisocial Behaviour in Adolescence Study
CD	Conduct Disorder
CFA	Configural Frequency Analysis
DSM-IV	Diagnostic and Statistic Manual of Mental Disorders, 4 <sup>th</sup> edition
GMM	Growth Mixture Models
ICC	Intraclass Correlation Coefficient
ICD-10	International Statistical Classification of Diseases, 10 <sup>th</sup> revision
LCA	Latent Class Analysis
LMR-LRT	Lo-Mendel-Rubin Likelihood Ratio
SAMSHA	Substance Abuse and Mental Health Services Administration
SD	Standard Deviation
SES	Socioeconomic Status

# 1 INTRODUCTION

Antisocial behaviour is the term commonly used to describe a subclass of externalising actions in which the rights of others or society are violated (Berger, 2008). Antisocial behaviour can manifest itself in a wide range of behaviours that change over time: In childhood and adolescence, it can be characterised by impulsive behaviour, fighting, cruelty to animals, shoplifting, disrespect for rules, drinking, using illegal substances, and reckless and risk-taking acts. In adulthood, this pattern can evolve into behaviours such as violent acts, the use of weapons, spouse assault, substance abuse, persistent criminality, and adjustment problems (American Psychiatric Association, 1994; Farrington, 2005; Moffitt, Caspi, Rutter, & Silva, 2001). In the literature, several definitions have been used to capture unlawful and norm-breaking behaviour in the first two decades of life; many studies use Conduct Disorder (CD), a psychiatric diagnosis characterised by behaviours that violate the basic rights of others or societal norms (American Psychiatric Association, 1994). Other studies use the term behaviour problems, referring to risk behaviour departing from familial or social standards (Siegel & Scovill, 2000), including offences, status offences, and dysfunctional behaviour. Another, more narrow, definition often used in studies is delinquency. This term refers to behaviours that are defined as offences in the penal code in Western industrialised societies, and includes theft, burglary, robbery, assault, fraud, vandalism etc. The focus in the studies included in the present thesis is mainly on antisocial behaviour (Studies I and II), and on delinquency (Studies III and IV). However, there is a great overlap between the delinquency, CD, behaviour problems, and antisocial behaviour. Consequently, when reviewing the literature in the introduction section, the broad term antisocial behaviour, including all aforementioned definitions, is adopted. This definition is in line with the definition of antisocial behaviour offered by Thornberry and Krohn (2005), who adopt a broad definition of antisocial behaviour that includes behaviours that range from oppositional behaviour to serious criminal acts.

Many adolescents engage in antisocial behaviour, and statistics on delinquency show that adolescents are involved disproportionately in criminal offending (Bongers, Koot, van der Ende and Verhulst, 2003; Bushway, Piquero, Broidy, Cauffman, & Mazerolle, 2001). The prevalence of CD is between 1% and 10% in general population samples in Western industrialised societies, and is more common among boys than girls (Fergusson, Horwood & Lynskey, 1994; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004; Moffitt et al., 2001; Nock, Kazdin, Hiripi & Kessler, 2009). Conduct problems are a common cause of referral problems to child and adolescent psychiatry clinics in Sweden (Kopp & Gillberg, 2003), and research has shown that an early onset of antisocial behaviour is associated with a higher risk of persistent antisocial behaviour (Moffitt, 1993; Odgers et al., 2008). Research indicates that antisocial behaviour is relatively stable throughout adolescence (Loeber & Farrington, 2000). For instance, Farrington and Maughan (1999) analysed two samples of London males, and 63.5% of those who were convicted of a crime at age 10-16 were also convicted at age 17-20. Antisocial behaviour is associated with heavy costs to society, in both monetary and social terms. Even by age 28, the public service costs for individuals who displayed CD as children, are 10 times higher than for individuals without conduct problems as

children (Scott, Knapp, Henderson, & Maughan, 2001). In order to develop more effective treatment programs that prevent further antisocial behaviour and associated negative conditions, there is increasing societal pressure to identify the factors associated with long-term antisocial behaviour. The present thesis contributes new knowledge on the long-term development of antisocial behaviour among individuals who were treated at a clinic for their adolescent substance misuse, through examining the adverse outcomes associated with antisocial behaviour, and the heterogeneity of offending, up to mid-life.

The thesis introduction consists of several chapters. The first chapter describes the literature on adolescent offending and adolescent substance misuse, and the relationship between substance misuse and crime. Further, it presents a review of the literature on homotypic and heterotypic continuity of antisocial behaviour, followed by a theoretical and empirical background to the heterogeneity of crime. Also, sex differences in antisocial behaviour are discussed, and a brief description of changes in the areas of crime, alcohol, and drugs in Sweden for the periods studied is included. The second chapter describes the aims of the thesis. The third chapter is devoted to the overall method of the thesis. The fourth chapter describes the aims and results of each of the four papers. Finally, the fifth chapter includes a discussion of the main findings of the thesis, and explores the implications of the findings as well as directions for future research.

## **1.1 OFFENDING IN ADOLESCENCE**

Adolescence is a developmental stage that occurs between childhood and adulthood and that involves biological, social, and psychological changes. Adolescence as an area of scientific research began with G. Stanley Hall's publication of *Adolescence* in 1904 (Hall, 1904). Hall defined adolescence as a time of 'storm and stress', when young people experience different degrees of emotional and behavioural turmoil before finding balance in adulthood. The definition of adolescence is not absolute, but has a cultural and historical context (Arnett & Taber, 1994), and varies between scholars and perspectives; in Hall's view, adolescence extended from age 14 to age 24.

Contemporary researchers commonly consider adolescence to take place in the second decade of life (Arnett, 2000). Arnett (2000) defines adolescence as ages 10-18, a period of time when young people normally live at home with their parents, attend school and go through puberty. Other researchers have suggested that the late teens (up to age 20) also should be considered part of adolescence (for a review, see Arnett, 2000). In this thesis, the definition of adolescence departs from Arnett's definition and extends to age 20, as the age of 21 marked two important legal transitions in the time periods studied (Sweden in the 1960s and 1980s): being allowed to buy alcoholic beverages at the government owned retail stores, and reaching the legal age of responsibility.

Owing to a mix of society's norms, research, practice, and policy during the last century, adolescence has been seen as a critical window of vulnerability for developing problems (Siegel & Scovill, 2000). There is a double-edged view of adolescents who engage in delinquency; they are seen both as at-risk individuals in need of treatment, and as immoral individuals who violate the norms of society and the rights of others,

and who therefore should be disciplined (Estrada & Flyghed, 2007). Delinquency is certainly not solely a problem of adolescence (Siegel & Scovill, 2000). On the other hand, criminal offending is not a rare phenomenon in adolescence (Bird, Canino, Davies, Haiying, Ramirez & Lahey, 2001) as many individuals, particularly males, engage in delinquency in adolescence (Hicks et al., 2007; Moffitt, 1993; Piquero & Brezina, 2001). The age-crime curve is normally depicted as a count of the total number of crimes committed against age (Figure 1). Sources of official criminal data show that rates of offending are the highest in adolescence and peak during late adolescence, to decline steeply in young adulthood (Moffitt, 1993). The relationship between age and crime is found among males and females, though females offend at lower rates (Moffitt, Caspi, Rutter, & Silva, 2001). However, longitudinal research including self-reports on delinquency shows that antisocial behaviour begins long before adolescence. In fact, there is an increase in antisocial behaviours in late childhood (Moffitt, 1993). Nagin and Tremblay (2005) conclude that if early behaviour problems are taken into account, the age-crime curve has an earlier onset and the peak in adolescence is much less sharp. Additionally, the age-crime curve is a collective product of many different types of offences, which in themselves, display great variations in the age-crime relationship. For example, some types of crime, such as burglary, peak earlier than others, while motoring offences, drug offences, fraud, and forgery peak later (Soothill, Francis, Ackerley & Humphreys, 2008). Still, despite the variations in the age-crime curve, depending on information source and types of offences, the bulk of research suggests that adolescence represents a period of life when offending is common, and engaging in delinquency has even been suggested to be normative for males (Moffitt, 1993).

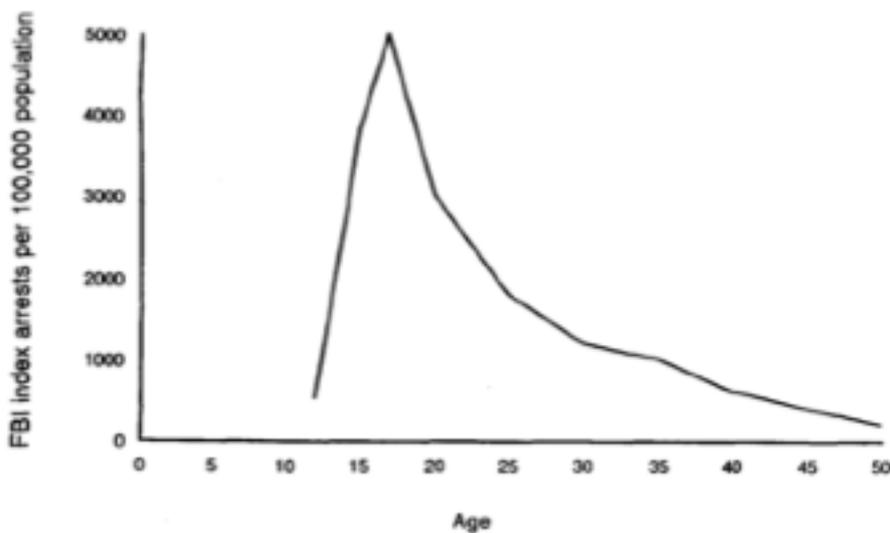


Figure 1. Age-specific arrest rates for Unites States Federal Bureau of Investigation’s (FBI) index offences in 1980. Figure taken from Moffitt (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review*, 4, 674-701, p. 675. Published with permission from the American Psychological Association.

According to Swedish national self-reports, the most common crimes among 15-year-old boys and girls are different types of theft and vandalism, followed by fencing, burglary, assault, threats, and car theft. For example, in 2008, 58.0% of Swedish boys in the 9<sup>th</sup> grade (age 15) reported theft, 37.7% reported vandalism, and 20.8% reported a violent crime. Among the girls, 50.4% reported theft, 26.8% reported vandalism, and 9.0% reported a violent crime (Swedish National Council on Crime Prevention [Brå], 2010). National data on official crime statistics follow the same pattern as self-reported statistics, with the exception that assault and car theft are more prevalent in official statistics, probably due to the fact that these types of crimes are more easily detected by the police than other types of crimes (Estrada, 2007). Adolescents tend to commit fewer crimes as they enter young adulthood (Ullman & Newcomb, 1999), and Arnett (2000) argues that adolescents tend to have fewer problems when they partake in daily adult activities. Also, changes in lifestyle such as getting married (Laub, Nagin & Sampson, 1998) or obtaining a job (Laub, Nagin & Sampson, 1998; Rönkä, Oravala & Pulkkinen, 2002; Rönkä, Oravala & Pulkkinen, 2003), can decrease criminal activity. However, while a larger group of individuals engage in antisocial behaviour only during adolescence (Paternoster, Brame & Farrington, 2001; Stouthamer-Loeber, Wei, Loeber & Masten, 2004), a small group of individuals show persistent antisocial behaviour (Farrington, 2000; Moffitt, 1993). Still, knowledge of the long-term development of persistently antisocial individuals is scarce, as few studies stretch beyond early adulthood.

Risk factors of antisocial behaviour are well established in the literature and include individual factors, family factors, structural factors, peer factors, school factors, and community factors. Further, individuals with risk factors in some areas may have compensating advantages in other areas (i.e. protective factors) that reduce the likelihood of delinquency. However, a detailed examination of which risk and protective factors are associated with antisocial behaviour is beyond the scope of this thesis (for reviews, see Lahey, Moffitt & Caspi, 2003; Lipsey & Derzon, 1998).

## **1.2 SUBSTANCE MISUSE IN ADOLESCENCE**

A wide array of definitions that describe frequency and severity of alcohol and illicit drug use are described in the literature, ranging from alcohol and drug use, to abuse and dependence disorders (American Psychiatric Association, 1994; World Health Organization, 1992). Because of the varying definitions used in different studies, the term misuse is employed throughout the literature review of the introduction section of the present thesis to describe problematic use of substances. This definition includes at minimum the use of illicit drugs or binge drinking of alcohol (i.e. heavy consumption of alcohol over a short period of time, usually defined as consuming five or more alcoholic drinks on one occasion; Cooney, Dobbins & Flaherty, 1994).

Many adolescents are exposed to controlled substances, and the 2009 national survey on students in the 9<sup>th</sup> grade in Sweden (age 15), showed that 58% of the boys and 65% of the girls had consumed alcohol during the past year. Further, 9% of the boys and 7% of the girls reported having used illicit drugs during their lifetime (Swedish Council for Information on Alcohol and Other Drugs [CAN], 2009). Data on nationally

representative samples of adolescents in the United States showed that more than 70% of adolescents in the 12th grade reported having used alcohol in their lifetime, and almost 50% reported using alcohol in the past month (Johnston, O'Malley & Bachman, 2002). With respect to drug use, 11.6% of adolescents aged 12 to 17 years reported using drugs within the past month (Substance Abuse and Mental Health Services Administration [SAMHSA], 2004), and 8.9% of this age group met diagnostic criteria for a substance use disorder. Among 14- to 17-year-olds, marijuana was the dominant drug used, followed by prescription-type drugs used non-medically (SAMHSA, 2004). Several studies have suggested a later peak for substance misuse than for delinquency; in general, substance misuse starts in adolescence, peaks in the early twenties, and decreases thereafter (Bachman, O'Malley, Schulenberg, Johnston, Bryant, Merline, 2002; Johnston, O'Malley & Bachman, 2003; SAMHSA, 2004). Most longitudinal studies on adolescent misuse have focused on continued misuse in adulthood and reported an increased risk for misuse in adult life, for both alcohol and drugs (Fergusson & Horwood, 2000; Patton, Coffey, Lynskey, Reid, Hemphill et al., 2007; Wells, Horwood & Fergusson, 2006). Early exposure to alcohol and drugs has also been found to be associated with poor outcomes in other areas in adulthood, including health problems and early pregnancies, even after controlling for prior conduct problems (Odgers et al., 2008). Several studies on adolescent substance misuse have demonstrated an increased risk for mental disorders (Arseneault, Cannon, Poulton, Murray, Caspi & Moffitt, 2002; Fergusson, Horwood & Ridder, 2005; Marmorstein, Iacono & Malone, 2010; Wells, Horwood & Fergusson, 2004), health problems (Ellickson, Martino, & Collins, 2004), financial and employment problems (Ellickson et al., 2004), and mortality in adulthood (Andréasson, Romelsjö & Allebeck, 1991). However, most studies on substance misusing-adolescents have only followed their participants into young adulthood, and few studies have examined long-term outcomes. Furthermore, the majority of studies have focused on continued substance misuse or on the longitudinal association between substance misuse and one other outcome, typically mental health problems. Also, few studies have included both clinic samples and general population samples for comparison on long-term development.

### **1.3 THE ASSOCIATION BETWEEN DELINQUENCY AND SUBSTANCE MISUSE**

Numerous studies have provided evidence for a strong relationship between substance misuse and delinquency among adolescents, both cross-sectionally and longitudinally (Barnes, Welte & Hoffman, 2002; Bui, Ellickson & Bell, 2000; D'Amico, Orlando Edelen, Miles & Morral, 2008; Fergusson & Horwood, 2000; Huang, White, Kosterman, Catalano & Hawkins, 2001; Mason, Hitchings, McMahon & Spoth, 2007; Rainone, Schmeidler, Frank & Smith, 2006). For example, adolescents with heavy use of use alcohol have an increased likelihood of delinquent behaviour (Ellickson & McGuigan, 2000; French, McGeary, Chitwood, McCoy, Inciardi & McBride, 2000; Loeber & Farrington, 2000). Similarly, it has been shown that youth demonstrating serious delinquency have the highest consumption rates of alcohol and illicit drugs (White, Loeber, Stouthamer-Loeber & Farrington, 1999). However, the direction of this relationship remains unclear as the developmental interaction between substance misuse and delinquency is often difficult to disentangle (White et al., 1999). (For a

summary on the association between substance misuse and delinquency, see Figure 2 on page 13.)

### **1.3.1 Delinquency before substance misuse**

Many studies have reported that conduct problems precede alcohol and drug misuse (Disney, Elkins, McGue & Iacono, 1999; Doherty, Green & Ensminger, 2008; Flory & Lynam, 2003; Hamil-Luker, Land & Blau, 2004). McGue and Iacono (2005) investigated the association between problem behaviours in adolescence and diagnoses in adulthood in a general population sample of twins, and found that adolescent problem behaviour was significantly related to alcohol and drug abuse and dependence diagnoses at follow-up. Similarly, Kim-Cohen and colleagues (Kim-Cohen, Caspi, Moffitt, Harrington, Milne & Poulton, 2003) followed up a birth cohort up to age 26 and found that individuals with substance use disorder were more likely to have a history of CD. Fergusson and colleagues (Fergusson, Woodward & Ridder, 2007) followed a birth cohort of children and found that conduct problems in childhood and adolescence were significantly related to substance use, abuse, and dependence in young adulthood. Evidence for the notion that delinquency leads to misuse has been found for both alcohol and illicit drugs; among high school students, prior delinquency predicted later marijuana use (van den Bree & Pickworth, 2005), and in a longitudinal study of boys and girls in rural communities, earlier delinquency predicted later alcohol use (Mason, Hitchings, McMahon & Spoth, 2007). Some studies have also presented evidence of a dose-response relationship between delinquency and substance misuse, where the severity of delinquency increased the likelihood of substance misuse (for a review, see Waldman & Slutske, 2000). It has been suggested that delinquency offers both peers and a context that encourage initiation to substance misuse (D'Amico et al., 2008; Wiesner & Windle, 2006). Even though the causal relationship between delinquency and substance misuse has proven to be difficult to unravel, the bulk of the research points to delinquency, or conduct problems, as a developmental precursor to substance misuse.

### **1.3.2 Substance misuse before delinquency**

Other longitudinal studies, albeit fewer, have presented evidence for the opposite direction of this relationship (French, McGueary, Chitwood, McCoy, Inciardi & McBride, 2000; Loeber and Farrington, 2000; Stenbacka & Stattin, 2007). Data from the National Youth Survey showed that prior marijuana and other illicit drug use predicted delinquency, but prior delinquency only predicted other illicit drug use and not marijuana use (Ford, 2005). Several suggestions have been offered to explain why substance misuse may increase the likelihood of delinquency; the pharmacological explanation posits that the effects of intoxication can cause offending through disinhibition, cognitive-perceptual distortions, weakening judgement etc. (Parker & Auerhahn, 1998). However, research has shown that the pharmacological effects of alcohol, for example, are more prominent among individuals with a previous tendency toward aggression (Giancola, 2002). Alternatively, the systemic explanation posits that the market of illicit drugs is inherently associated with violent crimes (White et al., 1999). In addition, many individuals finance their misuse through acquisitive crimes (Lahey & Waldman, 2005), particularly heroin, crack, and cocaine abusers (Bennett, Holloway & Farrington, 2008). This is supported by studies that reported higher levels of offending during periods of addiction than during periods of non-addiction (Gossop,

Trakada, Stewart & Witton, 2005). On the other hand, it has been suggested that many individuals are involved in delinquency before initiation to the illegal drug market (van Kammen & Loeber, 1994). Also, the association between substance misuse and crime may depend on the timing and course of development; for example, individuals who otherwise might desist from offending, may become 'ensnared' in a course of continued offending, due to substance abuse problems (Marmorstein & Iacono, 2005).

### **1.3.3 The risk factor approach**

Many studies show that substance abuse and delinquency share various risk factors. For example, parental substance abuse, harsh discipline, community factors, genetic influences, and school problems, have consistently been found to be precursors of both behaviours, both in studies of general population samples and in clinical samples (Button, Hewitt, Rhee, Young, Corley & Stalling, 2006; Knopik, Heath, Bucholz, Madden, & Waldron, 2009; King et al., 2009; Slutske et al., 1998; Van Horn, Hawkins, Arthur & Catalano, 2007; White & Gorman, 2000; White et al., 1999). It has been suggested that the association between misuse and offending exists partly because they share the same dimensions of personality, such as low pro-sociality, sensation-seeking traits, and impulsivity, that increase the likelihood of the development of both behaviours (Lahey & Waldman, 2005). However, delinquency and substance misuse do not cluster together for all individuals and the two behaviours can display different developmental pathways. This has led some researchers to suggest that, although the behaviours share several common risk factors, distinct risk factors then determine specialisation in one or the other of the behaviours (White & Gorman, 2000; White et al., 1999). Still, which specific risk factors influence the manifestation of each behaviour, remains to be demonstrated.

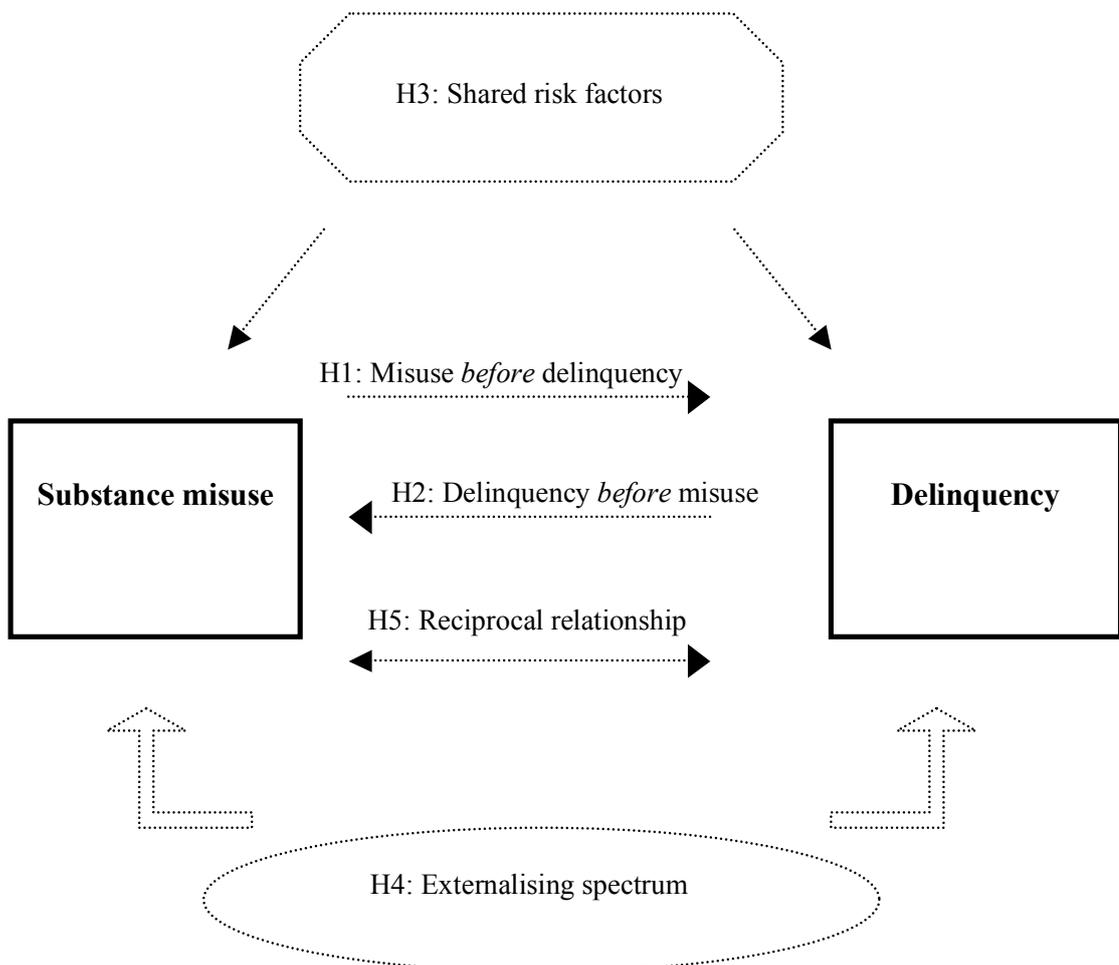
### **1.3.4 A reciprocal relationship**

Other studies have found a relationship between substance misuse and delinquency that transcends their mutual risk factors, and have suggested that the relationship may be bidirectional (Dembo et al., 2002; Huang, White, Kosterman, Catalano & Hawkins, 2001). White and colleagues (1999) showed that the relationship between substance use (alcohol and marijuana) and violence was reciprocal during adolescence, and slightly stronger for alcohol and violence than for marijuana and violence. The strength of the relationship between substance use and violence did not change when controlling for mutual risk factors, suggesting a reciprocal relationship. In a study of high-risk youth it was demonstrated that substance use and delinquency influenced each other equally (D'Amico et al., 2008). Other longitudinal studies examining reciprocal relationships between substance use and delinquency have found mixed results; in a longitudinal study of high school students, a reciprocal relationship between substance use and delinquency was found for boys, but not for girls (Mason and Windle, 2002). Nevertheless, the reciprocal relationship between substance misuse and offending is yet to be examined thoroughly in longitudinal studies (MacCoun, Kilmer & Reuter, 2003), particularly in high-risk samples (D'Amico et al., 2008).

### 1.3.5 Externalising spectrum

The strong correlation between substance misuse and delinquency may be an indicator of a latent factor. Krueger and colleagues (Krueger, Markon, Patrick, Benning & Kramer, 2007) have suggested a broad underlying factor, the externalising spectrum, linking both behaviours. In addition, a disinhibitory personality style (e.g. novelty seeking, impulsivity and disinhibition) is suggested to be part of the externalising spectrum. Krueger and colleagues proposed a hierarchical model where broader factors influence the risk of an externalising syndrome, and specific factors differentiate between the specific syndromes (i.e. substance misuse, delinquency or disinhibitory personality style). Using data from a genetically informative study (Krueger, Hicks, Patrick, Carlson, Iacono, & McGue, 2002), the results suggested that delinquency, substance misuse, and disinhibitory personality were facets of the same externalising spectrum rather than distinct phenomena, and heritable influences accounted for a large part of the variance. However, the results pointed to aetiologic distinctions between the specific syndromes. That is, although genetic factors influenced the general probability of developing a syndrome within the externalising spectrum, unique factors determined how this syndrome was expressed (Krueger et al., 2002). Still, more work is needed to examine how genes and environment interact, and how this affects the specific expressions of an externalising spectrum.

Figure 2. Five hypotheses (H1-5) on the association between delinquency and substance misuse



## 1.4 HOMOTYPIC CONTINUITY

Homotypic continuity refers to the association between a behaviour at one point in time, and the same behaviour at another point in time, for example, the relationship between prior and future delinquency (Pajer, 1998). There is considerable evidence of an association between antisocial behaviour in childhood or adolescence, and antisocial behaviour in adulthood (Elander, Simonoff, Pickles, Holmshaw, & Rutter, 2000; Kempf-Leonard, Tracy & Howell, 2001; Kjelsberg, 2002; Moffitt, Caspi, Harrington & Milne, 2002; Nagin and Paternoster, 2000; Piquero, Brame & Moffitt, 2005; Piquero & Buka, 2002; Simons, Stewart, Gordon, Conger & Elder, 2002). Farrington's (2000) long-term follow-up of males in a working-class area showed high continuity of antisocial behaviour. For example, 60% of the males who were antisocial at age 18 were antisocial at age 32. In a study of male juvenile offenders committed to the California Youth Authority, over 91% of the men with one juvenile arrest were arrested again after age 21 (Ge, Donnellan & Wenk, 2001). Similarly, in a sample of substance-abusing female offenders, conduct problems prior to age 18 predicted more criminal behaviour in adulthood (Grella, Stein & Greenwell, 2005). Although several studies have examined the homotypic continuity of delinquency, most of these studies have included male-only samples, and knowledge of the continuity of antisocial behaviour among females is limited. Furthermore, even in male samples, few studies have followed participants after their early thirties, limiting knowledge on long-term homotypic continuity.

Those who initiate offending can experience great variance in criminal careers in terms of length, seriousness, and frequency of offending (Bushway, Thornberry & Krohn, 2003; Thornberry, 2005). Gottfredson and Hirschi (1990) suggested that variations in criminal behaviour can be explained by stable individual differences in self-control. Self-control is formed early in life and is time-stable, and the amount of self-control determines the propensity to commit crimes. According to this perspective, offenders differ in degree and not in kind, as self-control is continuously distributed (although in a skewed manner) across the population. Gottfredson and Hirschi's theory is anti-developmental in the sense that self-control is established early and is stable across life, and continued offending is not affected by later life events, such as an employment or marriage (Bushway, Brame & Paternoster, 1999).

An opposite explanation for the correlation between past and future offending, the state dependence explanation, suggests that prior criminality has a direct effect on later criminality (Nagin & Paternoster, 1991). According to this view, earlier offending affects later offending, as it can reduce the chances of marriage and work (i.e. weaken constraints), and reinforce relationships with antisocial peers (i.e. strengthen motivation), thereby making offenders more involved in delinquency. Similarly, a good marriage or employment can improve the situation of former offenders, and lead to cessation of criminal offending. A pure state dependence explanation implies that offending across the life-span is a process of transmission, where earlier offending increases the likelihood of future offending by reducing constraints and increasing incentives for crime (Nagin & Paternoster, 1991).

Although the self-control and state dependence explanations are opposite theories, they are not incompatible. The continuity in offending may be due to a mixture of both propensity to engage in delinquency, and to transmission. Sampson and Laub (1993) have suggested a theory of age-graded informal social control that combines both self-control and state dependence explanations of offending. According to this view, all individuals possess a proneness to offend, however, offending per se has negative consequences that may lead to additional criminality (Sampson & Laub, 1997). The continuity of offending is thus not only a result of differences in the proneness to commit crimes, but also a result of earlier delinquency fostering later delinquency by damaging pro-social bonds.

Despite the explanations offered, few studies have followed participants beyond early adulthood, limiting knowledge on the causes of homotypic continuity, and most hypotheses are based on research on male samples.

### **1.4.1 Continuity of offending**

As stated previously, two opposite processes have been suggested to account for the continuity of offending over the life course; either the factors causing the delinquency remain stable throughout life, continuing to cause delinquency (i.e. self-control), or delinquency has negative developmental consequences, where earlier involvement in crime generates future crime through its consequences (i.e. state dependence) (Thornberry, 2005). In addition, substance abuse has been suggested to act as a 'snare', hindering desistance (Hussong, Curran, Moffitt, Caspi & Carrig, 2004). According to this hypothesis, substance misuse can play a role in the continuity of offending by influencing a prolonged criminal career in otherwise desisting individuals. Substance misuse can maintain delinquency through several mechanisms; substance misuse can delay entry into adulthood and the conventional adult roles associated with desistance, such as marriage. Substance misuse is also associated with imprisonment and interrupted education, which may exert an additional prolonging effect on offending. Substance misuse may also ensnare the individual in further offending by motivating criminal behaviour to finance the misuse, or offer a context with deviant peers, which in turn maintains delinquency. Finally, the disinhibitory effects of substances may lead to impulsivity and poor judgement, thus causing continued delinquency. Hussong and colleagues (2004) tested the snare hypothesis in a longitudinal study of males in a birth cohort and found that both alcohol and marijuana abuse accounted for elevated antisocial behaviour over time, supporting the snare hypothesis.

Sex differences in the continuity of offending have been discussed; some researchers have suggested that delinquency is less stable among females than males (Francis, Soothill & Piquero, 2007), while others have found no sex differences in the stability of offending (Piquero, Moffitt & Wright, 2007). However, few longitudinal studies have examined female offending from adolescence to adulthood, pointing to a need for more long-term follow-up studies including female offenders (Piquero, Brame & Moffitt, 2005).

### **1.4.2 Desistance**

Although there is a great deal of continuity in offending, not all adolescents who commit crimes continue to offend in adulthood (Paternoster, Brame & Farrington, 2001). Stouthamer-Loeber and colleagues (2004) followed up a school sample of males to age 25, and found that almost 40% of those who were serious delinquents in adolescence desisted from serious offending after age 20. Desistance is the process of moving from involvement in crime to non-involvement in crime. The development of this process can vary greatly; from being immediate, to being a gradual process that starts with a reduction on frequency and severity of offending, and eventually leads to 'true desistance' (Bushway et al., 2001; Bushway, Thornberry & Krohn, 2003). A great part of desistance from delinquency takes place in early adulthood (Stouthamer-Loeber et al., 2004), and research has shown that the peak age of desistance is between 20 and 29 years (Farrington, 1992). Several explanations of desistance have been proposed: (1) cessation of offending is associated with biological, physiological, developmental, or sociological changes that occur with age; (2) the formation of informal social controls or bonds with others, such as romantic relationships or work, lead away from crime; (3) the factors that cause initiation into offending either change or their impact diminishes; (4) desistance is a rational decision made by the individual; (5) individual differences in the propensity to offend also account for the propensity to desist; (6) changes occur in opportunities, rewards, and costs of delinquency across life; and (7) desistance results from a combination of maturation, internal and external constrictions, and influences by pro-social models (for reviews, see Farrington, 2007; Stouthamer-Loeber et al., 2004). However, there has been comparatively little attention paid to examining desistance from crime, thereby limiting empirical support of the explanations offered.

### **1.4.3 Turning points**

Desistance can also be caused by turning points, which are factors that cause long-lasting changes in offending trajectories (Rutter, 1996). A wide range of experiences have been associated with these changes, including marriage, a good job, an education, or military service (Brame, Bushway, & Paternoster, 2003; Laub, Nagin & Sampson, 1998; Paternoster, Bushway, Brame & Apel, 2003; Stouthamer-Loeber et al., 2004). Turning points serve as triggering events that gradually and cumulatively influence the cessation of criminal activity (Laub, Nagin & Sampson, 1998). They create new, or strengthen existing, social bonds that discourage committing of crimes by raising the stakes for violations of societal norms (D'Unger, Land & McCall, 2002). Longitudinal research has shown that turning points are mostly related to the areas of family, occupation, and social transitions. Some sex differences have also been found; in a Finnish longitudinal study, adult women more often than men considered parenthood, health problems of close ones, and change of residential area, as turning points, whereas men more often than women regarded occupation, military service, and changes of lifestyle, as turning points (Rönkä, Oravala & Pulkkinen, 2003). A crucial factor for the impact of a turning point is the amount of personal choice associated with it. If a turning point is associated with inability to control one's own life, it may lead to negative outcomes. Conversely, if coupled with a sense of control over one's life, it is more likely to lead to a positive outcome (Rönkä, Oravala & Pulkkinen, 2003). Although research on turning points has grown over the past decades, the exact

mechanisms have not been delineated. More research is also needed on the long-term effects of turning points, and the effects of turning points among women, as most studies on turning points have been conducted with males, resulting in more male-oriented turning points being identified (for example, military service).

## 1.5 HETEROTYPIC CONTINUITY

Among males, there is clear evidence of homotypic continuity of offending throughout life. However, individuals who offend in adolescence may not always, or solely, continue to offend in adulthood, but exhibit adversities in other areas instead (Pajer, 1998). Heterotypic continuity can be seen as the opposite of homotypic continuity, and refers to the developmental process of a behaviour in which the manifestations change. Gottfredson and Hirschi (1990) argue that antisocial behaviour changes with age, and antisocial individuals may desist from some behaviours, like crime, but initiate other behaviours, like gambling. This is confirmed by Massoglia (2006), who studied adolescents from a national probability sample and found that even though many adolescents desisted in their criminal offending, they moved into drug use in the transition into early adulthood. Studies have shown that individuals with antisocial behaviour in childhood or adolescence are at increased risk of a wide range of unfavourable outcomes (Figure 3, page 20) (Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001; Jaffee, Belsky, Harrington, 2006; Laub & Vaillant, 2000; Simonoff, Elander, Holmshaw, Pickles, Murray & Rutter, 2004). Odgers and colleagues (2008) followed up males and females in the Dunedin Multidisciplinary Health and Development Study at age 32 years, and found that antisocial individuals had problems in several areas, including mental health problems, physical illnesses, and work and financial problems.

It has been suggested that problems in different areas tend to accumulate, as the presence of one problem increases the likelihood of another problem (Rönkä, Kinnunen & Pulkkinen, 2001). Two possible hypotheses to explain heterotypic continuity have been offered; either underlying factors cause both antisocial behaviour and later adversity in other areas, or antisocial behaviour may disrupt normal development, eventuating in dysfunction in several areas of life (Pajer, 1998). However, knowledge of the heterotypic continuity of antisocial behaviour is limited, because few studies have measured a broad array of outcomes in the same individuals, or tracked changes in outcomes through adult life.

The association between prior and later offending is less strong in females, which has been interpreted as evidence of desistance. However, the apparent desistance from crime may reflect maladjustment in other areas instead (Pajer, 1998). For instance, a review of studies on adult outcomes of antisocial adolescent girls reported high mortality rates, psychiatric problems, and suicidal behaviour as consequences in adulthood (Pajer, 1998). Several other studies have confirmed that antisocial girls are at increased risk of adverse outcomes in several areas, including mental disorders, abusive relationships, poor educational outcomes, suicidal behaviour, and sexual victimisation (Ehrensaft, Moffitt & Caspi, 2004; Fergusson & Horwood, 2002; Fombonne, Wostear, Cooper, Harrington & Rutter, 2001; White & Piquero, 2004). Even though the

prevalence of antisocial behaviour in women is lower than in men (Lahey et al, 2000), some studies suggest that women tend to be more seriously affected by the consequences of antisocial behaviour (Frick & Silverthorn, 1999; Loeber, Burke, Lahey, Winters & Zera, 2000). A sex paradox has been suggested, whereby female sex is a protective factor against low and medium levels of risk. Girls are therefore hypothesised to surpass a higher threshold of risk to become antisocial, and consequently, are at higher risk of adverse outcomes (Tiet, Wasserman, Loeber, McReynolds & Miller, 2001). Others have not found sex differences in outcomes (Moffitt et al., 2001). Still, much of the knowledge of the development of antisocial behaviour is based on research of male samples and generalised to women, and little is known about heterotypic continuity among females, particularly in a long-term perspective.

### **1.5.1 Mental health problems**

Antisocial behaviour precedes many adult disorders. One of the most notable findings from the Multidisciplinary Health and Development Study was that childhood CD was a part of the developmental history of every adult disorder, including anxiety disorders, depressive disorders, manic episodes, eating disorders, schizophreniform disorders, and antisocial personality disorder (APD) (Kim-Cohen et al., 2003). In another follow-up of the same birth cohort, Bardone and colleagues (Bardone, Moffitt and Caspi and Dickson, 1996) found that girls with CD at the age of 15, were at increased risk for mental disorders at age 21. Data from another longitudinal study of an unselected birth cohort revealed that childhood conduct problems were associated with adult mental health problems, even after controlling for confounding factors (Fergusson, Horwood & Ridder, 2005).

Additionally, several studies have provided evidence for an association between CD and an adult diagnosis of APD (Kim-Cohen et al., 2003). Simonoff and colleagues (2004) followed-up a clinical sample of twins into adulthood, and results showed that childhood CD predicted adult APD. In the same way, Loeber, Burke and Lahey (2002) studied clinically referred boys and found that CD in adolescence was a strong predictor of later APD. In contrast, Lahey and colleagues analysed longitudinal data of male outpatients of a child mental health clinic and found that CD predicted adult APD only in boys from families of lower socioeconomic status (Lahey, Loeber, Burke, & Applegate, 2005). Although the relationship between earlier antisocial behaviour and later psychiatric disorders, particularly APD, has been established, few studies have examined this relationship in a long-term perspective that stretches beyond young adulthood, and with attention to sex differences.

### **1.5.2 Physical health problems**

In addition to mental health problems, antisocial behaviour in adolescence may also be associated with long-lasting physical health problems. Bardone and colleagues carried out a longitudinal study and reported that girls with CD, compared with controls, were at greater risk for medical problems and poor overall health (Bardone, Moffitt, Caspi, Dickson, Stanton & Silva, 1998). Research has shown that physical health problems are more common in prison samples than in the general population, and that individuals sentenced to prison present health problems much earlier than

individuals in the general population (Glamser & Cabana, 2003). Data from a general population sample confirm this association; results from a longitudinal study of a birth cohort revealed that males with early conduct problems experienced the worst health burden in a number of areas, including number of general practitioner visits, hospitalisations, dental health problems, respiratory functions problems, and injuries. Similarly, males with adolescent-onset conduct problems were at elevated risk for health problems in adulthood (Odgers, Moretti, Burnette, Chauhan, Waite & Repucci 2007). However, the literature on physical health problems as outcomes of antisocial behaviour has thus far been comparatively scarce. Although an increase has been noted in the past few years, there is still a need for more studies examining the association between antisocial behaviour and physical impairment.

### **1.5.3 Suicidal behaviour**

Several studies have demonstrated a link between antisocial behaviour and suicide attempts and self-directed harm (Douglas et al., 2008; Charles, Abram, McClelland & Teplin, 2003; Fazel & Danesh, 2002; Fruehwald, Frottier & Matschnig, 2003). In a study of hospitalised adolescents, CD was associated with an increased risk for attempted suicide up to 13 years later (Goldston et al., 2009). Similarly, Corneau and Lanctôt (2004) followed adjudicated youths into young adulthood, and reported that individuals with a history of juvenile delinquency presented elevated rates of suicide attempts and psychiatric hospitalisation. Still, more research is needed as most studies have followed their participants for a few years only, and few studies have included both males and females.

### **1.5.4 Work and financial instability**

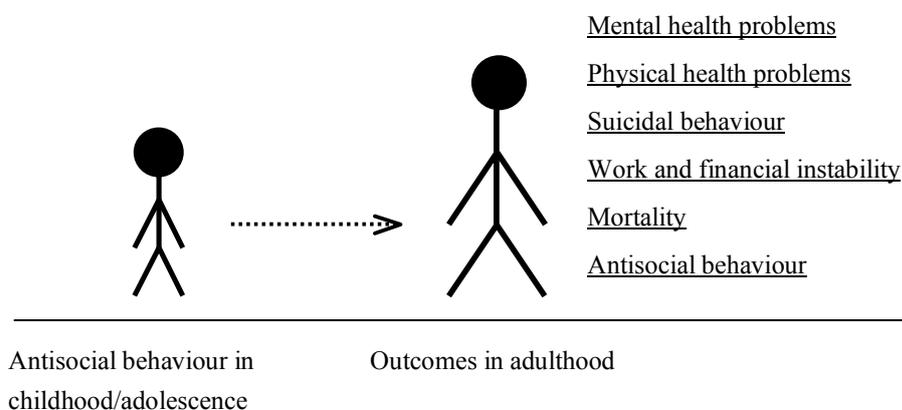
It has been proposed that antisocial behaviour provides a detrimental start in life; in a prospective study of a birth cohort, conduct problems at age 8 were associated with leaving school without qualifications and unemployment by age 18 (Fergusson & Horwood, 1998). Furthermore, early onset antisocial behaviour is associated with disturbances in social relationships with co-workers and poor educational achievement, affecting later employment opportunities (Loeber & Farrington, 2000). Similarly, earlier antisocial behaviour increased the risk of unemployment at age 21 (Caspi, Wright, Moffitt & Silva, 1998) in the Dunedin birth cohort. In the same birth cohort, participants with a history of CD experienced more social deprivation at age 30 (Jaffee et al., 2006). Two European studies have confirmed the association between antisocial behaviour and social deprivation; results of a prospective longitudinal study of males in a working-class area in London showed that chronic offending was associated with life failure at age 48, including problems with accommodation and employment (Piquero, Farrington, Nagin & Moffitt, 2010). In the same way, results from a study of a birth cohort in Stockholm demonstrated that males and females who were convicted of crimes both in adolescence and in adulthood, displayed an increased likelihood of being unemployed or receiving welfare payments up to age 48 (Nilsson & Estrada, 2009). Yet, more research is needed as relatively few studies have focused on work and financial stability as an outcome of adolescent antisocial behaviour, and even fewer have examined this outcome up to mid-life.

### 1.5.5 Mortality

Several studies have shown that delinquent individuals are more likely to die prematurely than non-delinquent individuals. In a 50-year follow-up of delinquent and matched non-delinquent boys, Laub and Vaillant (2000) reported that 13% of the delinquent subjects had suffered unnatural deaths, as compared to 6 % of non-delinquent subjects. Another study, which followed Swedish adolescents who were admitted to probationary schools, noted the same trend; eighteen years later, 13% of the boys and 10% of the girls had died. This can be compared to the death expectancy of healthy adolescents in corresponding age groups, which is approximately 3% (Rydelius, 1988). Several longitudinal studies on males in both the general population and in high-risk samples showed that offenders had a greater likelihood of dying during follow-up, as compared to non-offenders. Further, offenders were more likely to die of unnatural and violent causes (Sailas et al., 2006; Shepherd, Shepherd, Newcombe & Farrington, 2009; Stattin & Romelsjö, 1995). Shepherd and colleagues (2009) concluded that the association between antisocial behaviour and death could be due to underlying traits that influence both criminal behaviour and an unhealthy lifestyle.

Few long-term studies on the association between antisocial behaviour and mortality have included both males and females. Nieuwbeerta and Piquero (2008) examined a European sample of men and women sentenced to prison, and Teplin and colleagues (Teplin, McClelland, Abram & Mileusnic, 2005) examined adolescents who had been handled by the juvenile justice system in the United States; both studies found that although males had higher mortality rates when compared to their female counterparts, both male and female delinquents were more likely to die a premature death, compared to males and females in the general population. Yet, more studies on females are imperative to understand the relationship between antisocial behaviour and mortality in females, as are more studies that include both general population samples and high-risk samples.

Figure 3. Homotypic and heterotypic continuity of antisocial behaviour



## 1.6 OFFENDING HETEROGENEITY

Data collected on different types of samples, and during different time periods, have provided proof of considerable heterogeneity in offending (Bersani, Nieuwbeerta & Laub, 2009), and it is evident that all youth who offend do not follow the same developmental trajectory (Lahey & Waldman, 2005). A trajectory is a pathway of progression, and can be used to describe the course of a behaviour (e.g. antisocial behaviour) over time (Loeber, Keenan & Zhang, 1997). To develop appropriate prevention and intervention strategies, it is essential to understand how antisocial behaviour develops and changes over the course of life, and to examine between-individual differences (Park, Lee, Bolland, Vazsonyi & Sun, 2008). Consequently, offending heterogeneity has been established as an important area of research within developmental criminology during the past few years (Odgers et al., 2007).

### 1.6.1 Offender typologies

Within developmental criminology, several typologies of antisocial individuals have been proposed (Frick, 1995; Lynam, 1996). One of the most influential taxonomies is Moffitt's (1993) classification of the *life-course-persistent* and *adolescence-limited* types of antisocial behaviour. This categorisation is based on individual differences in the causes of problem behaviour, on interactionism, and on cumulative continuity. The developmental taxonomy proposed by Moffitt features two primary developmental pathways: life-course-persistent antisocial behaviour, which has its onset during childhood, and adolescence-limited antisocial behaviour, which has its onset during adolescence. Moffitt posits that life-course-persistent antisocial behaviour is rooted in neuropsychological deficiencies that are present before, or soon after, birth. The deficiencies in the child's brain functions lead to difficulties in rearing the child, and in interaction with troubled environments, the neuropsychological deficits are exacerbated, thus leading to the development of antisocial behaviour. Life-course-persistent antisocial behaviour is seen in a small group of individuals who consistently display high rates of antisocial behaviour. For example, compared to those showing adolescence-limited antisocial behaviour, life-course-persistent antisocial individuals exhibit more serious physical aggression, meet criteria for oppositional defiant disorder earlier in childhood, experience academic failure and peer rejection, display neuropsychological deficits, are more likely to exhibit attention deficit hyperactivity disorder and have a greater likelihood of displaying early CD, and of developing APD as adults. Life-course-persistent individuals are also versatile offenders, committing both violent and non-violent crimes. Although life-course-persistent antisocial behaviour has its roots in neuropsychological vulnerabilities, early antisocial behaviour also has an exacerbating effect on future antisocial behaviour, showing evidence of a cumulative continuity. By contrast, adolescence-limited offenders have no neuropsychological deficits and show no notable history of childhood behaviour problems. Instead, their antisocial behaviour is influenced by their affiliation with delinquent peers and a tendency to endorse unconventional values (Caspi & Moffitt, 1995), and arises from a normative attempt to display autonomy. Adolescent-limited offenders are mostly involved in minor and status offences, and since their pre-delinquent development was healthy, most of these individuals are able to desist from antisocial behaviour in

adulthood. However, their recovery may be delayed if they encounter snares, such as incarceration or substance addiction. According to the theory, adolescence-limited antisocial behaviour is common, relatively temporary, and near normative. Conversely, life-course-persistent antisocial behaviour is rare, persistent, and pathological. Moffitt's theory combines individual differences, the environment as an important contributory factor, and cumulative continuity across development, and stresses the interaction between these factors. Furthermore, life-course-persistent and adolescence-limited offenders represent two separate types of offenders with different aetiologies, marked by the age of onset of antisocial behaviour. This is a distinct difference from the heterogeneity perspective suggested by Gottfredson and Hirschi (1990), by which differences in offending do not reflect different typologies, but the variance of an underlying propensity.

Loeber and colleagues have argued that there are distinguishable developmental pathways for different types of antisocial behaviour and that these may correspond to aetiological variations (Loeber, Keenan & Zhang, 1997). They have suggested three pathways that best describe the development of antisocial behaviour among boys; the first pathway, *the overt pathway*, usually starts in late childhood or early adolescence with less serious aggressive behaviour, such as disturbing, fighting, or bullying others, and then moves on to more serious forms of aggression, such as serious fighting. In the final stage, different types of violent crimes are committed. The second pathway, *the covert pathway*, also arises in late childhood or early adolescence, and is characterised by minor delinquent behaviours such as shoplifting and lying, then moves on to vandalism, and eventually to more serious forms of property crimes such as fencing, theft, and burglary. The third pathway, *the authority conflict pathway*, starts as stubborn and defiant behaviour in childhood, continues with more defiance and disobedience, and eventually leads to truancy or running away from home. Individuals on one pathway can also embark on one of the other pathways. For each stage on a pathway, the antisocial behaviour becomes more advanced and serious, and the behaviour is extended to other areas (e.g. from home to school) and to other people (e.g. from parents or friends to strangers).

Typologies of offenders have traditionally been based on research with males, and have been criticised as not applying to females (Silverthorn & Frick, 1999). In response to this criticism, Moffitt (Moffitt et al., 2001) suggested that the dual taxonomy comprised females as well as males. However, because fewer neuropsychological deficiencies are present in females, it was proposed that females were more likely to follow the adolescence-limited pathway than the life-course persistent pathway. Still, results from other studies have been conflicting (Marmorstein & Iacono, 2005; Silverthorn, Frick & Reynolds, 2001; White & Piquero, 2004; Bongers, Koot, van der Ende, & Verhulst, 2003; Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Fergusson & Horwood, 2002), and more research is needed to elucidate whether the dual taxonomy applies to females too.

### **1.6.2 Group-based modelling**

The traditional typologies have relied on a priori definitions of offenders. However, progress in statistical techniques has advanced the understanding of developmental

pathways of offending. In a paper from 1993, Nagin and Land suggested group-based modelling to identify groups of offenders. Group-based modelling presupposes that, in a population of offenders, there are distinctive groups of offenders with different offending patterns, and the aim of group-based modelling is to identify the heterogeneity within the population. Within each group, individuals have a unique offending pattern that is different from other groups, with a distinct intercept (the level of offending at a measured age) and slope (the trend of offending, increasing or decreasing). Offending patterns can be examined at several points in time over the life course (i.e. trajectories), or at a single time-point (i.e. classes) (Bushway, Thornberry & Krohn, 2003; Nagin & Land, 1993; Nagin & Tremblay, 2005). One important aspect of group-based modelling is that there are no a priori assumptions about the number of trajectories generated by the model, and results are not biased towards any theories (Thornberry, 2005).

There are several statistical techniques used to unveil unobserved heterogeneity and finding meaningful groups of individuals with similar patterns in their responses to the measured variables (Muthén, 2004). One of the techniques, latent class analyses (LCA), assumes that the relationship among a set of observed variables can be explained by the existence of mutually exclusive latent classes, with each class having a distinct profile of the behaviour that is constant for all members in that class (McCutcheon, 1987). In LCA, the principle of local independence is a central assumption; the relationship between two variables is predicted on a third, latent, variable and when the latent variable is taken into account, the relationship between the observed variables no longer exists. Similarly, growth mixture models (GMM) are used in longitudinal data to identify distinct developmental trajectories of a behaviour measured at several points in time. GMM assumes that individuals are part of different subpopulations, and allows trajectories of individuals to vary around different mean growth curves (Hancock & Samuelsen, 2007).

Studies using group-based modelling techniques have identified between three and seven delinquent pathways, depending on information source, measures of delinquency, sex, type of sample, and length of follow-up. Though the number of pathways differs, most studies have identified a high-level persistent pathway, a low-level persistent pathway, an adolescence-limited or desisting pathway, and a non-offending pathway (D'Unger, Land & McCall, 2002; Eggleston, Laub & Sampson, 2004; Fergusson & Horwood, 2002; Hoeve, Blokland, Semon Dubas, Loeber, Gerris, & van der Laan, 2008; Lacourse, Côté, Nagin, Vitaro, Brendgen, & Tremblay, 2002). For example, in one of the first attempts to apply the group-based modelling approach, Nagin and Land (1993) identified four trajectories of offenders among 403 males from a working-class area in London followed from age 10 to 32: a non-offending trajectory, a high-rate chronic offending trajectory, an adolescence-limited trajectory, and a low-rate chronic offending trajectory. The high-rate offenders displayed troublesome behaviour and lack of concentration as children, and untruthful conduct and substance misuse as adolescents. This trajectory resembled the life-course persistent pathway suggested by Moffitt (1993). Individuals in the adolescence-limited trajectory demonstrated higher peer popularity and better school performance than the other offenders. The distinctive character for individuals in the low-rate chronic offending trajectory was low IQ, which was hypothesised to be the cause of their involvement in

offending through poor judgement. Wiesner and colleagues (Wiesner, Capaldi & Kim, 2007) studied arrest data for a school sample of males at heightened risk, and identified three trajectories up to young adulthood: a trajectory of high-level chronic offenders, a trajectory of low-level chronic offenders, and a trajectory of rare offenders. Other studies have also identified a late-onset trajectory of offending (Bushway, Thornberry & Krohn, 2003; Farrington, Ttofi & Coid, 2009; Thornberry, 2005; Thornberry & Krohn, 2005). Individuals in this pathway, referred to as late bloomers, are not involved in delinquency earlier because of the social control exerted by their environment. However, with increasing independence at later ages comes an increasing opportunity to commit crimes (Thornberry, 2005). (Table 1 summarises results from longitudinal studies on offending heterogeneity).

The variance of delinquency suggests that theories on crime should not be general, and given that many youths are involved in delinquency, adolescence is an important period of time to focus on. Still, there is little research on heterogeneity in long-term offending, as few studies extend beyond young adulthood (Piquero, Brame & Moffitt, 2005). Moreover, boys have traditionally been constituted as the norm in research and there is limited information on how heterogeneity varies by sex. More studies are needed to expose the distinctive characteristics of adolescent female offenders. Further, most studies have been conducted on general population samples, and examinations of clinical samples are imperative for informing intervention strategies within treatment settings (Odgers et al., 2008).

*Table 1.* Offending heterogeneity identified in longitudinal studies using group-based modelling techniques

<b>Offender type</b>	<b>General characteristics</b>	<b>Studies</b>
High-level persistent offender	Early onset, persistent offending in adulthood, high rates of offending	D’Unger et al., 2002; Eggleston et al., 2004; Fergusson & Horwood, 2002; Hoeve et al., 2008; Nagin & Land, 1993; Odgers et al., 2008; Wiesner et al., 2007.
Adolescence-limited offender	Onset in adolescence, desists or decreases in offending in adulthood, mid-level rates of offending	D’Unger et al., 2002; Eggleston et al., 2004; Fergusson & Horwood, 2002; Hoeve et al., 2008; Nagin & Land, 1993; Odgers et al., 2008; Wiesner et al., 2007.
Low-level persistent offender	Persistent low-rate offending throughout life	D’Unger et al., 2002; Eggleston et al., 2004; Nagin & Land, 1993; Wiesner et al., 2007.
Late bloomer	Late onset, increasing offending in adulthood	Bushway et al., 2003; Farrington et al., 2009; Thornberry, 2005; Thornberry & Krohn, 2005.

## 1.7 ANTISOCIAL BEHAVIOUR AND SEX

Applying a gender perspective to research implies treating gender as a problematic concept through focusing on power structures between men and women, and describing how gender is constructed ('doing gender') (Lander, Pettersson & Tiby, 2003).

Research with a focus on gender is not solely restricted to the study of women; the study of masculinity is an important element of gender studies that has grown during the past few years (Messerschmidt, 1993). The majority of the studies in the literature review, as well as the four studies that make up the present thesis, have employed biological sex when analysing similarities and differences between females and males, even though the terms gender and sex are used interchangeably (Maccoby, 2004). This does not mean that they are applying a gender perspective to research (Pettersson, 2007a), but simply that they are focusing on females in particular, or on sex as an influence on antisocial behaviour. However, these studies still contribute knowledge about the biological, cultural, and social conditions that determine the manner in which females and males enact their antisocial behaviour.

Much of the knowledge of antisocial behaviour is based on studies of males (Farrington & Maughan, 1999; Loeber, Keenan & Zhang, 1997; Moffitt, 1993; Paternoster, Brame & Farrington, 2001), and traditionally, little attention has been paid to female antisocial behaviour (Cernkovich, Lanctôt, & Giordano, 2008; Piquero, Brame & Moffitt, 2005). Males offend at disproportionately higher rates than females (Piquero, Brame & Moffitt, 2005; Storvoll, Wichstrøm & Pape, 2003; Zahn et al., 2008). In childhood and adulthood, boys are more likely to meet criteria for CD (Lahey et al., 1998; Lahey, Waldman & McBurnett, 1999; Simonoff et al., 2004), and the male-to-female ratio of CD is 4:1 (American Psychiatric Association, 1994). In adulthood, men are more likely to be diagnosed with APD than women (Zlotnick, Clarke, Friedmann, Roberts, Sacks & Melnick, 2008). However, female delinquency is growing (Ehrensaft, 2005), and the gender gap is narrowing (for a review, see Odgers & Moretti, 2002). Many girls present CD, especially in clinical settings (Karnik et al., 2009; Kopp & Gillberg, 2003). In a nationally representative US sample, the lifetime prevalence of CD was 7.1% among females (Nock, Kazdin, Hiripi & Kessler, 2006). Both official reports and self-report data on crime suggest a rising trend in offending among females over the past two or three decades (for reviews, see Moretti, Catchpole, & Odgers, 2005; Odgers & Moretti, 2002; Snyder & Sickmund, 2006; Brå, 2008). For example, charges of violent crimes among females in the United States and Canada have increased sharply; in the United States, there was a 77% increase between 1991 and 2000, and in Canada there was a 66% increase during the same period (for a review, see Odgers & Moretti, 2002). Official crime statistics in Sweden confirm this trend; between 1995 and 2007, there was a 90% increase in women suspected of violent crimes (Brå, 2008). Part of the increase in violent crimes has been attributed to females engaging more frequently in minor forms of violent acts (Odgers & Moretti, 2002), while the gender gap is much wider for serious violent crimes. Despite the increase in offending among females, males still offend at much higher rates (Harrison & Beck, 2002; Harrison & Beck, 2004), and male gender is one of the strongest predictors of delinquency in both self-report and official data (D'Unger, Land, & McCall, 2002). Given the discrepancy, much of the research has traditionally been carried out on male samples, to explain male delinquency, and sex differences have been ignored (Chesney-Lind, 1989).

### **1.7.1 Expressions of antisocial behaviour**

Studies have suggested that female antisocial behaviour is less serious, begins later in adolescence, and is less persistent than male antisocial behaviour (Lanctôt & LeBlanc, 2002; Moffitt et al., 2001). The gender gap in antisocial behaviour is largest for serious violent offending (Steffensmeier, Schwartz, Zhong, & Ackerman, 2005), and smallest for substance misuse (Moffitt et al., 2001). It has also been suggested that girls express other types of antisocial behaviour, such as relational, or social, aggression (Crick, Ostrov, Appleyard, Jansen & Casas, 2004). Relational aggression refers to acts that aim to cause harm in social relations through exclusion, humiliation, or rejection (Underwood, Galen & Paquette, 2001). Sex differences in the expression of aggression may reflect sex differences in social goals; for males, the emphasis is on physical dominance, while social goals for females stress interpersonal relationships (Crick & Grotpeter, 1995). Several studies on relational aggression have found that girls have a greater likelihood of displaying relational aggression than boys (for a review, see Crick, Ostrov, Appleyard, Jansen & Casas, 2004), and evidence has also pointed to relational aggression as a precursor to physical aggression (Odgers & Moretti, 2002). On the other hand, others have not found evidence of relational aggression being exclusive to girls (Geiger, Zimmer-Gembeck & Crick, 2004), or have even found evidence of boys being more likely to engage in relational aggression (Wolke, Woods, Bloomfield & Karstadt, 2000). Still, more research that illuminates the relationship between relational aggression and antisocial behaviour is needed.

### **1.7.2 Age of onset**

It has been proposed that the majority of girls who present antisocial behaviour start doing so in adolescence and thus have a 'delayed onset' (Silverthorn & Frick, 1999). Despite the delay in onset, antisocial girls have adverse backgrounds and poor adult outcomes, which is more consistent with the taxonomy of life-course-persistent antisocial boys than that of adolescence-limited antisocial boys (Silverthorn & Frick, 1999). Silverthorn, Frick, and Reynolds (2001) studied an adjudicated juvenile sample and found that childhood-onset CD was quite rare among girls, supporting the notion of a delayed-onset in girls. White and Piquero (2004) tested the delayed-onset pathway proposed by Silverthorn and Frick (1999) in a large cohort of urban African-American males and females, and found that both sexes were equally likely to have an early onset of offending. However, females with a late-onset resembled the early-onset male offenders in several risk factors, in accord with Silverthorn and Frick's hypothesis. Similarly, Marmorstein and Iacono (2005) analysed data of an epidemiological study of twins and found a late-onset group who were predominately female. Despite the later onset of antisocial behaviour, this group had increased rates of substance dependence at follow-up, also in line with Frick and Silverthorn's hypothesis. On the other hand, several longitudinal studies have identified an early-onset pathway among females (Bongers et al., 2003; Broidy et al., 2003; Côté et al., 2002; Fergusson & Horwood, 2002; Lahey et al., 2006; Schaeffer et al., 2006), providing support for Moffitt's (Moffitt et al., 2001) suggestion that the dual taxonomy can be applied to females. Evidently, more research is needed to clarify whether females follow the same developmental patterns as males, or whether they require a taxonomy of their own.

### 1.7.3 The role of risk factors

A number of studies on high-risk samples have suggested that various risk factors are more common in girls than in boys. For example, girls in forensic or clinical settings show a greater likelihood of victimisation of physical or sexual abuse, and of meeting criteria for post-traumatic stress disorder than boys. Furthermore, family dysfunction has shown to be more strongly associated with girls' externalising problems, and girls with CD are more likely to exhibit co-morbid psychiatric disorders (for reviews, see Moretti, Catchpole & Odgers, 2005; Odgers & Moretti, 2002). Other researchers have suggested that the causes of antisocial behaviour are the same for boys and girls. However, sex differences in the prevalence of antisocial behaviour are due to sex differences in the levels of the causative factors (Lahey, Waldman & McBurnett, 1999). Findings from high-risk samples suggest that girls and boys present similar risk factors, however, girls are more likely to display several co-occurring risk factors and higher levels of risk factors (Odgers & Moretti, 2002). Conversely, when examining sex differences in antisocial behaviour in the Dunedin Multidisciplinary Health and Human Development Study, Moffitt and colleagues (2001) found that girls demonstrated fewer of the neuro-cognitive risk factors associated with the life-course-persistent antisocial pathway. Thus, the causal factors were the same across gender, but fewer females were life-course-persistent offenders due to a lower individual liability. Consequently, females were more likely to follow the adolescence-limited pathway. Risk factors could also influence behaviour differentially across gender; in a clinical sample of adolescent girls and boys, exposure to maternal inter-partner violence was associated with aggression towards friends for girls but not for boys, whereas paternal inter-partner violence was associated with aggression towards friends for boys but not for girls (Moretti, Obsuth, Odgers & Reebeve, 2006).

In general, more sex differences in risk factors are found in high-risk samples than in general population samples (Moretti, Catchpole & Odgers, 2005). The conflicting findings could be due to differences in the composition of samples; the fact that girls in clinical samples are often more exposed to risk factors could be attributed to the selection mechanisms that determine which females end up in high-risk settings. For example, it has been suggested that the juvenile justice system has been used to protect girls from damaging environments and to treat other problems presented, in addition to the antisocial behaviour. This could explain the higher occurrence of risk factors among females in high-risk samples (Odgers et al, 2007) as compared to males, a finding that is not replicated in general population samples. Furthermore, studies on general population samples generally include few antisocial girls, resulting in low statistical power and difficulties in detecting sex differences (Bergman & Andershed, 2009). Clearly, further research is needed to elucidate the relationship between risk factors and antisocial behaviour across sex. Previous studies on general population samples have tended to include male-oriented risk factors (Odgers & Moretti, 2002), and future studies need to address sex-specific factors, the interaction between risk factors and the development of antisocial behaviour, the role of protective factors, and within-sex differences.

#### **1.7.4 Socialisation of aggression**

Sex differences in aggression are not evident during the first years of life (Hay, 2007), however, from about 4 years of age on, boys have an increased likelihood of engaging in aggressive behaviour (Lahey et al., 2000). It has been proposed that differences in socialisation help create sex differences in aggression (Zahn-Waxler & Polanichka, 2004). Socialisation is the process of acquiring the norms, customs, and beliefs of society. Several studies have found differences in how girls and boys are treated by others; mothers are more likely to show disapproval when their infant daughters express anger, and are more likely to support the same expression in infant sons. Parents are more accepting of anger and retaliation among 2- to 3-year-old boys, while girls more often warned about the negative consequences to others of their troublemaking behaviour. Day care teachers also show greater leniency towards boys' misconduct (for a review, see Zahn-Waxler & Polanichka, 2004). Furthermore, socialisation of girls tends to emphasise interpersonal relationships and encourage attention to others, whereas socialisation for males stresses independence and differentiation from others (Odgers, & Moretti, 2002). Still, more research on the long-term effects of sex-differentiated socialisation is needed in order to examine a potentially important contributing factor to aggression and antisocial behaviour.

#### **1.7.5 Menarche**

Sexual maturation has been proposed as a sex-specific risk factor, increasing the risk of antisocial behaviour in girls, but not in boys. Research has shown that girls who reach menarche early are more likely to develop antisocial behaviour, and display an earlier and higher peak of antisocial behaviour (Burt, McGue, DeMarte, Krueger & Iacono, 2006; Graber, Seeley, Brooks-Gunn & Lewinsohn, 2004). Girls are believed to engage in antisocial behaviour after the onset of menarche for a number of reasons: they may use such behaviour as means to obtain adult privileges, or the behaviour may be due to an increased exposure to relationships with older antisocial males, or vulnerability to peer pressure may be increased because physiological development is not paired with psychological maturity (Caspi, Lynam, Moffitt & Silva, 1993; Odgers & Moretti, 2002). It has also been suggested that early menarche and CD share common genes, however, studies are scarce and conflicting (Burt, McGue, DeMarte, Krueger & Iacono, 2006; Comings, Muhleman, Johnson & MacMurray, 2002). In a longitudinal study of a birth cohort, the onset of menarche was examined and results demonstrated that early onset of menarche was associated with conduct problems. However, this effect was only demonstrated for girls with a history of conduct problems. It was suggested that stressful events, such as an early-onset menarche, could amplify already existing behavioural problems (Caspi & Moffitt, 1991). In another study of the same birth cohort, it was shown that the effect of early menarche varied across school context; early menarche had an effect on delinquency, however, only for girls in mixed-sex schools. For girls in same-sex schools, no effect was found. Girls in mixed-sex schools may have more opportunities to affiliate with delinquent peers (i.e. boys), suggesting that two factors are required for the initiation of offending: puberty and boys (Caspi, Lynam, Moffitt & Silva, 1993). Nevertheless, the relationship between the onset of puberty and antisocial behaviour has not been studied to the same extent in boys, and more research including both sexes is needed to shed light on whether sexual maturation is a sex-specific risk factor.

### **1.7.6 Similarities across sex**

Several studies have found more similarities than differences across sex (Piquero, Brame & Moffitt, 2005; Piquero & Sealock, 2004). Fergusson and Horwood (2002) examined sex-related variations in offending trajectories in a longitudinal study of a birth cohort, and found that males and females followed similar offending pathways, although females offended at a lower rate (about half the male rate). The sex differences reported in high-risk samples have been attributed to the selection mechanisms that determine which males and females end up in clinical settings (Jennings et al., 2010). When sex differences have been examined in birth cohorts, few differences have emerged (Moffitt et al., 2001). However, research on female antisocial behaviour is still developing, and a future task would be to bring together the conflicting results from diverse populations (Odgers & Moretti, 2002). More long-term longitudinal comparisons between females and males, to determine both sex-specific and sex-neutral aspects as well as within-sex differences, are crucial in criminological research.

## **1.8 SWEDEN IN THE 1960S TO 1980S**

The current thesis includes studies on two cohorts from two different periods in Swedish history, the late 1960s and early 1970s (cohort 1), and the early 1980s (cohort 2). Both these periods were marked by important structural and economical changes, and differences in the areas of criminal, alcohol, and drug policy. It is therefore imperative to provide a brief historical, social, and cultural context for the cohorts studied, as this may have had a direct or indirect impact on the studies.

After World War II, Sweden took a giant leap towards becoming one of the leading welfare states in the world. The gross domestic product, average incomes, and living standards increased, and infant mortality decreased. The educational system changed, introducing 9-year compulsory primary education among other things, and the public sector expanded. When the baby boom generation reached adolescence a new phenomenon, the teenagers, emerged. Many teenagers were part of new countercultures (bikers and greasers) that listened to rock 'n' roll and drank alcohol, much to the dismay of adults (Hägg, 2005). In 1955, the alcohol rationing system was abolished, and individuals aged 21 could now buy alcohol without restrictions. This also meant the availability of alcohol increased among adolescents, who now were able to buy alcohol from illegal dealers with unlimited access to alcohol (Lenke, 2007). Alcohol consumption increased after the abolition, and as a consequence, prices for alcohol were raised sharply in an effort to counteract alcohol consumption (Lenke, 2007). Official crime statistics of theft convictions among adolescents showed a sharp increase, while assault rates remained low until the end of the 1950s, and then started to increase steadily (Estrada, 2007).

Economic advancement persisted in the 1960s and reached its peak in the latter part of the decade. Social and educational reforms took place and young people were now able to study at university, thanks to generous loans and grants from the state. However, not all members of society benefited from the economic upswing; many manual labourers

had seen their jobs rationalised along with technical development, and had lower wages and worse conditions than the average citizen. The prevalence of criminality, substance abuse, and prostitution were given as examples, by political activists, of the gap that existed between the deprived minority and a more prosperous majority (Hägg, 2005). The liberalisation of alcohol continued in the 1960s, and following a decision of the parliament, grocery stores began to sell medium-strength beer in 1965. Alcohol rates continued to increase (Lenke, 2007), and drugs were introduced among adolescents. Drug use rose sharply in the late 1960s; the number of young drug abusers reported to the child welfare agencies increased considerably (Söderholm Carpelan, 1992), and an investigation of needle marks in male arrestees reported an increase during this period (Bejerot, 1978). In an attempt to rebuff drug abuse, the medicinal board introduced legal prescription of drugs to a group of addicts between 1965 and 1967, an experiment that was later deemed unsuccessful by critics (Bejerot, 1978). Convictions of theft among adolescents continued to increase in the 1960s, as did convictions of assault (Estrada, 2007).

After two decades of financial improvement, a worldwide oil crisis and recession followed, and economic growth started to slow down in Sweden in the 1970s. After many years of liberalisation, a moral backlash ensued. The sale of medium-strength beer ended in 1977, and a harsher attitude against drug use prevailed (Söderholm Carpelan, 1992). Surveys of students in the 9<sup>th</sup> grade showed that the percentage of individuals who had tried narcotics started to decrease in the 1970s (CAN, 2008), however binge drinking stayed on the same levels (CAN, 2006). In the 1970s, convictions of theft among adolescents decreased, while convictions of assault remained steady (Estrada, 2007).

Despite the earlier economic downturn, Sweden was still one of the leading welfare states in the 1980s, with extant social benefits and economic equality. Campaigns against alcohol, drugs and smoking were launched in schools, and starting in 1982, the Swedish government liquor stores were closed on Saturdays. Previously considered a social problem, with focus on informal social control, drug use was now considered a police matter (Söderholm Carpelan, 1992). The percentage of students in the 9<sup>th</sup> grade who had tried narcotics continued to decrease steadily in the 1980s (CAN, 2008). Binge drinking decreased in the early 1980s and then levelled off (CAN, 2006). For the same time period, convictions of theft and assault remained steady (Estrada, 2007).

## 2 AIMS

The overall aim of the present thesis was to study the development of antisocial behaviour over the life course among individuals who were treated at a clinic for their adolescent substance misuse, through examining adverse outcomes in adulthood, and through analysing the heterogeneity and development of offending.

The specific aims of each study were to:

1. Compare the prevalence of six adverse outcomes over 30 years between a sample who were treated at a clinic for substance misuse problems when they were adolescents, and a randomly selected sample matched for sex, age, and place of birth.
2. Examine the association between the severity of antisocial behaviour before age 15, and eight adverse outcomes up to age 50, and assess whether the association between the severity of antisocial behaviour before age 15 and the adverse outcomes varied by sex.
3. Identify subgroups of male and female offenders with distinct features of violent, non-violent, and substance-related offending in adolescence and again in adulthood, and examine the associations between adolescent and adult subgroups to study the continuity of offending.
4. Identify long-term offending trajectories in a cohort of males and females who were treated at a clinic for their substance misuse problems, and in a randomly selected sample from the general population, and examine the relationship between offending trajectories and problems in six other areas.

### 3 METHOD

The present project is named *The Consequences of Antisocial Behaviour in Adolescence Study* (CASBA), and is a longitudinal study of adolescents who were treated at a substance misuse clinic in Stockholm during two periods: from January 1, 1968 to December 31, 1971 (Cohort 1), and from January 1, 1980 to December 31, 1984 (Cohort 2). The study design is a retrospective collection of baseline-data with a prospective follow-up (Robins, 1978). The same number of individuals randomly selected from the general population, and matched for sex, birthdate, and place of birth, were also included in the study.

#### 3.1 ETHICAL PERMISSION

In May of 2003, The Karolinska Institute Research Ethical Committee North approved the application for CASBA with the condition that Statistics Sweden would be responsible for merging baseline data and follow-up data, and that the merged data would be de-identified before sending it back to the research team.

#### 3.2 PROCEDURE

The procedure of CASBA was divided into five steps: (1) identification of participants; (2) construction of a protocol and manual for baseline data; (3) collection of baseline data; (4) collection of follow-up data; and (5) merging baseline data and follow-up data.

##### *Step (1): Identification of participants*

Identification of study participants started in spring of 2003. No record with information on which adolescents had been treated at the clinic during the selected years existed, and thus identification of participants had to be carried out manually at the archives. The Archive of Public Medical Services did not contain files old enough to include Cohort 1, and for that reason, social services files at the City Archives were screened. In order to identify study participants who had been treated at the clinic between 1968 and 1971, all case files of individuals born between 1947 and 1963 were screened. Also, all family cases with parents were born between 1900 and 1950 were screened in order to identify the children who had been treated at the clinic during the chosen years. For Cohort 2, the Archive of Public Medical Services at the Stockholm City Council contained the adequate clinic files, and all clinic files were screened to identify individuals who had been treated at the clinic between 1980 and 1984.

##### *Step (2): Construction of the protocol and manual for baseline data*

The construction of a protocol for data collection of baseline data, and a manual to guide data collection, started in spring of 2003, parallel with the identification of participants at the archives. Initially, the body of literature on antisocial behaviour was reviewed in order to distinguish which variables were to be included in the protocol. An

extensive number of files were also screened to assess the type of information that could be extracted from the files. A first version of the protocol was constructed, along with a manual containing definitions of the variables in the protocol, and instructions on how to rate them. Six research assistants rated a large amount of files simultaneously, and after each rating, the files were discussed and the protocol and manual were revised in order to improve the collection of baseline data. A final version of the protocol was constructed as a data entry file in SPSS. In autumn of 2004, an inter-reliability test of 20 files was conducted by the six raters. Inter-rater agreement was analysed using Cohen's Kappa (Cohen, 1960) for categorical variables, and Intraclass Correlation Coefficient (ICC; Shrout & Fleiss, 1979) for continuous variables. Only variables with Kappa above 0.6 or ICC above 0.8 were retained in the protocol.

#### *Step (3): Collection of baseline data*

The collection of baseline data started in December 2004, and ended in May 2006. Baseline data was extracted from archival data, including old clinic files (Cohort 2) and social services files (Cohort 1). Social services files also included police reports, court convictions, school reports, and medical examinations. During the collection of baseline data, all six raters would inter-rate two files each month to ensure that the rating of files was done properly throughout the data collection. The inter-rated files were then examined, and discrepancies were discussed. Throughout the data collection, 10% of the files were rated independently to calculate inter-rater agreement.

#### *Step (4): Collection of follow-up data*

In autumn of 2004, the collection of follow-up data began. Applications for extracting register data were sent to the responsible authorities, including Statistics Sweden (maintaining the Social Welfare Payments Register and the Crime Convictions Register), The Swedish National Board of Health and Welfare (maintaining the Swedish Hospital Discharge Register and the Cause of Death Register), and the National Social Insurance Board (maintaining registers on disability pensions). In January of 2005, all the responsible authorities had approved the applications. In spring of 2005, a list of the participants' personal identification numbers (a unique number assigned to each Swedish citizen and resident) was forwarded to the responsible authorities, along with a list of the variables requested for extraction. The responsible authorities subsequently sent the extracted register data to Statistics Sweden, who was responsible for merging register data with baseline data.

#### *Step (5): Merging baseline data and follow-up data*

After the completion of the baseline data collection in May 2006, baseline data was sent to Statistics Sweden for merging. Statistics Sweden merged the baseline data collected by the research team with the follow-up data from the registers, and de-identified the file. The new file was sent to the research team at the end of August 2006. Statistics Sweden also created a comparison sample by randomly selecting an individual in the general population with the same sex, month and year of birth, and

birthplace (city, outside city, outside Sweden), as each individual in the two cohorts. For the comparison sample, only register data was available.

### **3.3 PARTICIPANTS**

Participants were individuals who were treated at the clinic in Stockholm, Sweden, during two periods. The first cohort was treated at the clinic between January 1, 1968 and December 31, 1971, and the second cohort was treated at the clinic between January 1, 1980 and December 31, 1984. Cohort 1 initially consisted of 2088 individuals. Out of those, 96 individuals were excluded because of incorrect personal identification numbers or lost files. The final cohort 1 included 332 females and 1660 males, and was included in Study I and Study III. In Study II, an additional 45 participants were excluded because they had either died or left Sweden permanently before follow-up started, and for that reason, Study II included 324 females and 1623 males. Mean age at intake in cohort 1 was 16.78 years ( $SD = 1.83$ ) for girls, and 17.84 years ( $SD = 1.70$ ) for boys. The comparison sample randomly selected from the general population included 332 girls and 1660 boys, matched to each individual in the cohort for sex, birthdate, and birthplace, and was included in Study I.

In Cohort 2, 1808 individuals were initially identified. A more careful investigation of the clinic files also revealed that several of the individuals had to be removed because they had been treated at the clinic in other years than 1980 to 1984, and 118 individuals were removed from the study for this reason. After this, 1690 individuals were identified as having been treated at the clinic between 1980 and 1984. An additional 114 individuals were excluded because of incorrect personal identification numbers or lost files. Cohort 2 then included 566 females and 1010 males. However, in Study IV, 7 females and 1 male were excluded from the analyses because they had either died or emigrated permanently from Sweden before age 15, and the final cohort 2 included 559 females and 1009 males in Study IV. At intake, mean age was 17.37 ( $SD = 1.88$ ) years for girls, and 16.94 ( $SD = 1.73$ ) years for boys. The comparison sample randomly selected from the general population initially included 566 girls and 1010 boys, matched to each individual in cohort 2 for sex, birthdate, and place of birth. However, 31 females and 45 males were excluded from the analyses in Study IV because they had either died or emigrated permanently from Sweden before age 15. The final matched sample included in Study IV included 535 females and 965 males.

### **3.4 THE CLINIC**

In the 1960s, alcohol misuse and binge drinking among Swedish adolescents began to attract the attention of government officials. Following a proposal by the commission of 'Youth and Alcohol', a clinic for youths was opened in Stockholm in October of 1966, in a shack adjacent to an existing clinic for adults with alcohol abuse problems (Söderholm Carpelan, 1992). The initial purpose of the clinic was to take care of drunken young males who were brought in by the police. The clinic was the first in the country aimed specifically at young people with alcohol misuse problems, and was run jointly by the social services and the county council. Medical and social resources were brought together under one roof to provide comprehensive care. Soon after the clinic

opened, a need to contend with the emergence of adolescents with drug misuse problems was identified, and in 1967, the clinic started to treat adolescents with illicit drug misuse problems too. The increasing number of patients eventually led to the clinic's move to a larger building in 1970. Until the mid-1970s, the clinic was run in a conventional manner. The medical staff had responsibility for the medical care, and the social workers were responsible for the social care (Söderholm Carpelan, 1992).

In the mid-1970s, a radical change occurred and a new organisational model, which involved the integration of the medical and social care, was introduced. Medical and social personnel shared responsibility for the treatment of each individual. The staff was divided into treatment teams, in which all categories of professionals were represented and had a joint responsibility for the treatment. The treatment model was largely based on the Hassela model (Söderholm Carpelan, 1992), which in turn was based on Bejerot's (1969) theories of drug addiction. According to this view, drug addiction was not a symptom of underlying problems, but an acquired behaviour. Drug misuse was considered a counterculture with its own norms, values, attributes, and clothing. Drug misusers were seen as psychologically healthy, but poorly reared. Education and work were two cornerstones in the treatment at the clinic, and misusers were encouraged to regain their social status within the working class. The staff's role was as educators, to set limits, and to serve as positive role models. The clinic was the centre of a chain of several treatment services, including communes, foster homes, and other treatment centres. However, the clinic had the primary responsibility for the adolescents, regardless of their location in the treatment chain. Outpatient treatment at the clinic included conversational therapy, social planning, and urine tests to control for abstinence. The medical care section performed physical examinations, tests for sexually transmitted diseases, gynaecological examinations, and minor surgery, and included a service for acute alcohol intoxication and drug overdoses. Also, psychiatric evaluations and medical certificates for compulsory custody were undertaken. Residential treatment at the clinic included a unit for detoxification, and a ward for inpatient treatment, where social pedagogical principles were applied and the youths followed scheduled practices and activities. For adolescents with externalising problems or an 'abuser identity', inpatient treatment or placement was considered more appropriate (Söderholm Carpelan, 1992).

Over the years, the clinic has served the county of Stockholm, which includes 24 municipalities and a catchment area of about 1.8 million inhabitants, and is the only facility in the area for children and adolescents up to age 20 with misuse problems. In a prior study, it was shown that most of the adolescents who came in contact with the clinic, came on the initiative of the social services. The average length of treatment was almost two years, and most individuals used a combination of outpatient and inpatient services. Further, individuals treated at the clinic demonstrated high rates of injecting drugs, and had an early onset of drug abuse. Girls treated at the clinic displayed heavier drug abuse, more unemployment, more previous contacts with the social services, and more parental substance abuse than boys (Söderholm Carpelan, 1992).

## 3.5 MEASURES

### 3.5.1 Baseline data

All baseline data was extracted from archival data, including social services files (Cohort 1) and old clinic files (Cohort 2), and included information on the participants up to age 21.

#### 3.5.1.1 Sex

Information on sex was derived from the personal identification number (the second to last number in the personal identification number is 1, 3, 5, 7 or 9 for males, and 0, 2, 4, 6 or 8 for females).

#### 3.5.1.2 Age

The personal identification number was used for information on birth year and month (the first six numbers include information on year, month and day of birth, in that order).

#### 3.5.1.3 Parents' socioeconomic status

Information on parent's occupation was collected from the files. Parents' socioeconomic status (SES) was defined according to the classification system used by Statistics Sweden (1982), and included six categories; unskilled workers, skilled workers, assistant non-manual employees, intermediate non-manual employees, high-level non-manual employees, and self-employed professionals. The parent with the highest SES was coded. Low parent SES was defined as unskilled workers. Inter-rater reliability was 0.867 (Cohen's kappa). Parents' SES was used in Study II.

#### 3.5.1.4 Severity of alcohol use

Information on alcohol use was extracted from the clinic files. A three-point scale was constructed to index the severity of alcohol use. The scale was defined as: (0) Light use (less than once a month); (1) Moderate use (one to three times a month); (2) Severe use (at least once a week, or meeting criteria for alcohol abuse or dependence according to DSM-IV). Inter-rater reliability was 0.843 (ICC). Severity of alcohol use was used in Study I, and was included as one of five types of ASB before age 15 in Study II.

#### 3.5.1.5 Severity of illicit drug use

A three-point scale was constructed to index the severity of illicit drug use. Information was extracted from the clinic files. The scale was defined as: (0) Abstainers (no use of illicit drugs); (1) Experimental use (used one or two drugs); (2) Severe use (used three or more illicit drugs or meeting DSM-IV criteria for drug abuse or dependence or injecting heroin and/or morphine). Inter-rater reliability was 0.958 (ICC). Severity of illicit drug use was used in Study I, and was included as one of five types of ASB before age 15 in Study II.

### 3.5.1.6 *Severity of delinquency*

A three-point scale was constructed to index the severity of delinquency based on information file information. The scale was defined as: (0) No offending; (1) Minor offending (one non-violent crime); (2) Serious offending (two or more non-violent crimes or one or more violent crimes). Inter-rater reliability was 0.922 (ICC). Severity of delinquency was used in Study I, and was included as one of five types of ASB before age 15 in Study II.

### 3.5.1.7 *Severity of conduct problems*

A three-point scale was constructed to index conduct problems. Information was extracted from the clinic files. The scale was defined as: (0) No conduct problems; (1) Moderate conduct problems (truancy); (2) Serious conduct problems (running away from home or prostitution). Inter-rater reliability was 0.751 (ICC). Conduct problems was included as one of five types of ASB before age 15 in Study II.

### 3.5.1.8 *Severity of aggressive behaviour*

A three-point scale was constructed to index aggressive behaviour. Information was extracted from the clinic files. The scale was defined as: (0) No aggression; (1) Some aggression (bullying); (2) Serious aggression (physical or sexual abuse). Inter-rater reliability was 0.775 (ICC). Aggressive behaviour was included as one of five types of ASB before age 15 in Study II.

### 3.5.1.9 *Antisocial behaviour before age 15*

Antisocial Behaviour (ASB) before age 15 was defined to include five different behaviours – severity of alcohol use, severity of illicit drug use, severity of delinquency, severity of conduct problems, and severity of aggressive behaviour - each rated *none* (0), *moderate* (1), or *high* (2), based on file information. The scores for the five types of ASB were summed to index ASB before age 15. Inter-rater agreement was 0.881 (ICC), and internal consistency of the ratings of the five types of ASB was estimated using Cronbach's alpha (Cronbach, 1951), and reached .68. ASB before age 15 was used in Study II.

### 3.5.1.10 *Violent and non-violent criminality*

For each subject, occurrence and frequency of violent and non-violent crimes was summed to constitute the number of each type of crime. Violent crimes were defined to include attempted or completed homicide or manslaughter, criminal negligence causing death, assault resulting in death, assault on official, assault, arson, robbery, kidnapping, stalking, harassment, unlawful threats, rape, sexual assault, sexual molestation, sexual abuse of minors, incest, procuring, and child pornography crimes. Non-violent crimes were defined to include all other offences in the penal code. Information on violent and non-violent crimes up to age 20 was collected from file data and was used in Study III.

### **3.5.2 Follow-up data**

In Study I, II and III, follow-up data was analysed from age 21. In Study IV, outcome data was analysed from age 15.

#### **3.5.2.1 Registers**

All outcome data was collected through multiple registers in Sweden with national coverage, and were documented until December 31, 2002. Authorities are responsible for updating and securing the quality of their registers, and Swedish registers are updated annually and have been shown to have good validity (Mortensen, Allebeck, & Munk-Jørgensen, 1996).

##### *3.5.2.1.1 The Swedish National Board of Health and Welfare*

This register maintained the Cause of Death register, including information on all deaths in Sweden from 1961 onwards, and the Swedish Hospital Discharge Register. From 1969 to 1971, all hospital in-patient admissions in the county were registered, with the exception of the municipality where the clinic was situated. From 1972 to 1986, all admissions in the county were registered, including admissions in the municipality where the clinic was situated. From 1987 onwards, all admissions to any hospital in Sweden were recorded.

##### *3.5.2.1.2 The National Social Insurance Board*

This register provided information on disability pensions due to physical diseases or mental illness from 1972 onwards.

##### *3.5.2.1.3 Statistics Sweden*

Statistics Sweden provided with the Social Welfare Payments Register, containing information on social welfare payments from 1990 onwards, and the Crime Convictions Register, with information on convictions for offences from 1973 and onwards. The age of criminal responsibility in Sweden is 15, and crimes committed before age 15 are investigated but do not lead to prosecution. Instead they result in interventions by the social services and are thus not registered in the Crime Convictions Register.

#### **3.5.2.2 Measures**

##### *3.5.2.2.1 Death*

Information on date of death was extracted from the Cause of Death Register and was used in Study I, Study II, and Study IV.

##### *3.5.2.2.2 Physical illness*

Physical illness related to substance misuse was defined as admission to an inpatient ward with a discharge diagnosis of a disease related to alcohol or drug use (Cook & Clark, 2005; Mathers, Lopez, & Murray, 2006; Room, Babor, & Rehm, 2005; Single, Rehm, Robson, & Truong, 2000), as defined in the Global Burden of Disease Study (Mathers et al., 2006). Diagnoses included sexually transmitted diseases, neoplasms,

cardiovascular diseases, digestive diseases, and unintentional injuries. In addition, HIV/AIDS and Hepatitis B and C were included. This definition was used in Study II and Study IV. In Study I, the definition of physical illness also included having received a disability pension because of a physical illness related to alcohol or drug use. Information on hospitalisations for physical illness was provided by the Swedish Hospital Discharge Register, and information on disability pensions was provided by The National Social Insurance Board.

#### 3.5.2.2.3 *Mental illness*

Mental illness was defined as admission to an inpatient ward with a discharge diagnosis of schizophrenia, schizotypal disorders, delusional disorders, mood disorders, neurotic, stress-related, and somatoform disorders, eating disorders, or personality disorders. This definition was used in Study II and Study IV. In Study I, the definition of mental illness also included having received a disability pension because of a mental disorder. Information on hospitalisations for mental illness was provided by the Swedish Hospital Discharge Register, and information on disability pensions was provided by The National Social Insurance Board.

#### 3.5.2.2.4 *Self-inflicted harm*

Self-inflicted harm was defined as an admission to inpatient care with a discharge diagnosis of intentional injuries. Information on hospitalisations for self-inflicted harm was provided by the Swedish Hospital Discharge Register. Self-inflicted harm was used in Study I and Study IV.

#### 3.5.2.2.5 *Substance misuse*

Substance misuse was defined as: (a) an admission to in-patient treatment with a discharge diagnosis of substance dependence syndrome or harmful use; and/or (b) an admission to in-patient treatment for alcohol- or drug-induced conditions; and/or (c) criminal convictions related to alcohol or illicit drugs, including public drunkenness, intoxication on the job, driving while intoxicated, supplying illicit substances, possession of illegal substances, personal misuse of illegal substances, manufacturing illegal substances, recklessness with narcotics, narcotics for non-medical use, smuggling, unlawful import and export of illegal substances, and crimes against the law on prohibition of certain doping substances. Information on in-patient treatment was provided by the Swedish Hospital Discharge Register, and information on criminal convictions was extracted from the Crime Convictions Register. This definition of substance misuse was used in Study I and Study II. In Study IV, criminal convictions related to alcohol and illicit drugs were excluded from the definition of substance misuse.

#### 3.5.2.2.6 *Violent, non-violent, and substance-related crimes*

Violent crimes were defined to include attempted or completed homicide or manslaughter, criminal negligence causing death, assault resulting in death, assault on official, assault, arson, robbery, kidnapping, stalking, harassment, unlawful threats, rape, sexual assault, sexual molestation, sexual abuse of minors, incest, procuring, and child pornography crimes. Non-violent crimes were defined to include all other

offences in the penal code. In Study I and Study IV, no distinction was made between violent and non-violent crimes. In Study II, crimes were divided into violent and non-violent crimes. In Study III, non-violent crimes were further divided into substance-related crimes, including criminal convictions of public drunkenness, intoxication on the job, driving while intoxicated, supplying illicit substances, possession of illegal substances, personal misuse of illegal substances, manufacturing illegal substances, recklessness with narcotics, narcotics for non-medical use, smuggling, unlawful import and export of illegal substances, and crimes against the law on prohibition of certain doping agents, and non-violent crimes, including convictions of all other non-violent offences in the penal code. Information on crimes was extracted from the Crime Convictions Register.

#### 3.5.2.2.7 *Poverty*

Poverty was defined as receiving social welfare payments due to low income, and information was available from 1990 on from Statistics Sweden. This definition was used in Study I, Study II, and Study IV.

### 3.6 STATISTICAL ANALYSES

Outcome data was divided into six age periods in the analyses of Cohort 1; 21-25 years, 26-30 years, 31-35 years, 36-40 years, 41-45 years, and 46-50 years, and into four age periods in the analyses of Cohort 2; 15-19 years, 20-24 years, 25-29 years, and 30-33 years. Participants who migrated from Sweden for a period longer than six months were excluded from the analyses of that age period, in order for all participants to have equal possibilities to experience the adverse outcomes. Similarly, participants who died before the end of an age period were excluded from the analyses of that age period, and subsequent age periods.

In Study I, the proportions of women and men with adverse outcomes were compared using chi-square tests. The prevalence of each outcome was estimated using generalized linear models, log link function and assuming binomial outcomes. Estimates of relative risk were used to compare the clinic and the general population samples. Relative risk is a ratio of the probability of an event occurring in one group versus another group. First, the clinic and the general population samples were compared within sex. To examine differences in risk ratios for women and men, a sex  $\times$  group interaction term was included in the model, and tested for statistical significance using Wald statistics.

In Study II, logistic regression models were calculated in order to examine the associations between ASB prior to age 15 and each adverse outcome. Logistic regression is used to assess the probability (odds) of a particular outcome, if a certain factor is present. First, crude odds ratios were calculated, and in a subsequent step, odds ratios were adjusted for parental SES, sex, and sex  $\times$  ASB. Odds ratios were then recalculated, controlling for the presence of substance misuse in the current or any preceding period. Generalised linear models assuming a negative binomial distribution were used to assess the associations between the severity of ASB before age 15, and the number of adverse outcomes. To examine changes over time in the association of ASB

and each adult outcome, generalised linear models were applied to fit a repeated measures logistic regression, with age period, sex, and severity of ASB as predictors, including interactions. These models provided odds ratios estimating the change at each age period, the change in the effect that ASB had on each outcome at age period, and gender differences.

In Study III, patterns of offending were identified with LCA. When determining the optimum number of latent classes, a combination of criteria was used. First, a one-class model was fitted, and classes were then added stepwise. The Bayesian Information Criterion (BIC; Schwarz, 1978) was applied. BIC has been suggested as a good indicator for class enumeration (Hagenaars and McCutcheon, 2002), where lower BIC values indicate improvement over the previous model with the number of classes minus 1. Class enumeration was also established using the Akaike Information Criterion (AIC; Akaike, 1974), a standard method for model selection. Similarly to the BIC, models with lower AIC are preferred. Other indices of the goodness-of-fit of a particular class examined, were the Lo-Mendel-Rubin likelihood ratio (LMR-LRT; Lo, Mendell & Rubin, 2001), which has been suggested for mixture models, and entropy (Ramaswamy, DeSarbo, Reibstein & Robinson, 1993), a measure of the precision of individual classification, where high entropy (=1) indicates clear class separation. To examine the link between latent classes up to age 20, and latent classes between age 21 and 50, a first-order Configural Frequency Analysis (CFA) was performed. CFA is a data analysis technique developed to detect patterns of categorical variables (von Eye, Spiel & Wood, 1996). Categorical data (i.e. latent classes) are cross-classified, and interactions are examined. CFA departs from the null hypothesis that no relationship exists between variables. CFA then identifies value configurations that occur significantly more often than expected by chance (types), significantly less often than expected by chance (antitypes), or as often as expected (no significant difference). *P*-values were adjusted using the Bonferroni formula to account for multiple comparisons. All analyses were run separately for males and females.

In Study IV, GMM were applied to identify distinct developmental trajectories of criminal convictions across ages 15 to 33. The same range of fit indices used for LCA were used for model comparison; BIC, AIC, LMR-LRT, and entropy. Developmental trajectories of criminal convictions across ages 15 to 33 then served as dependent variables in multinomial logistic regression analyses, examining the relationship between background factors and each of the classes. Multinomial logistic regression analyses are an extension of the logistic regression analyses, and allow for more than two discrete outcomes. All analyses were run separately for males and females.

## 4 STUDIES I - IV

This section presents a summary of the aims and results of each of the four studies.

### 4.1 STUDY I

*Multiple adverse outcomes over 30 years following adolescent substance misuse treatment.*

#### 4.1.1 Aims

The aims of the study were to compare the prevalence of six adverse outcomes over 30 years in a sample who was treated at a clinic for substance misuse problems when they were adolescents, and a randomly selected sample matched for sex, age, and place of birth. Adverse outcomes included death, hospitalisation for physical illnesses related to substance misuse, hospitalisation for mental illness, substance misuse, criminality, and poverty.

#### 4.1.2 Results

##### *4.1.2.1 Relative risks of adverse outcomes in the clinic sample as compared to the general population sample over 30 years*

Over three decades, the risks for all six adverse outcomes were elevated among both women and men in the clinic sample, compared to the general population sample. The differences in relative risk estimates were generally larger between the women in the two samples than between the men in the two samples, and these differences reached statistical significance for death, substance misuse, and criminality. The elevated risks of adverse outcomes in the clinic sample, as compared to the general population sample, remained significant after adjusting for the presence of substance misuse, hospitalisation for mental illness, substance misuse co-morbid with hospitalisation for mental illness, and poverty in adulthood among both women and men. By contrast, the risk of death was not elevated in the clinic sample relative to the general population sample after adjustment.

##### *4.1.2.2 Co-occurrence of adverse outcomes*

The number of adverse outcomes experienced by the women and men in the clinic and general population samples showed that among the women, 19.4% of the clinic sample and 53.9% of the general population sample, experienced none of the adverse outcomes. Among the men, this was true for 20.7% of the clinic sample, and 45.7% of the general population sample. Among the women and men in the clinic sample, 39.8% experienced three or more adverse outcomes, while this was true of only 3.4% of the women, and 9.8% of the men in the general population sample. When examining co-morbid conditions, substance misuse combined with criminality, substance misuse plus criminality and physical illness, substance misuse and mental illness, and substance misuse and mental illness and crime, were significantly more common among both women and men in the clinic sample than in the general population sample.

#### *4.1.2.3 Trends in the prevalence of adverse outcomes over time*

The prevalence of death increased over the 30-year follow-up period with no significant sample or sex differences. The prevalence of physical illnesses related to substance misuse remained stable over time, however the trend differed in the clinic and general population samples, while no sex differences were detected. The prevalence of hospitalisation for mental illness was also stable over time but differed by sex, with the prevalence decreasing among women and increasing among men. The prevalence of substance misuse significantly declined over time, similarly for each sample and sex. The prevalence of criminal convictions also decreased over time, with significant sample and sex effects, indicating a steeper decline in the clinic sample than in the general population sample, and a steeper decline among men than among women. There was a significant decrease in poverty that was similar for each sample and sex.

## **4.2 STUDY II**

*Adolescent Antisocial Behavior as Predictor of Adverse Outcomes to Age 50: A Follow-Up Study of 1,947 Individuals*

### **4.2.1 Aims**

The aims of the study were to examine the associations between adolescent antisocial behaviour and adverse outcomes in adulthood. We hypothesised that: (1) the more severe the Antisocial behaviour (ASB) before age 15, the higher the odds of adverse outcomes up to age 50; (2) the more severe the ASB before age 15, the greater the number of adverse outcomes; and (3) the associations between the severity of ASB before age 15 and the adverse outcomes would persist over time.

### **4.2.2 Results**

#### *4.2.2.1 The more severe the ASB before age 15, the higher the odds of adverse outcomes up to age 50*

Each unit increase in the severity of ASB prior to age 15 was associated with increased odds of death, hospitalisation for physical illnesses related to substance misuse, self-inflicted harm, substance misuse, criminal convictions for violent and non-violent crimes, and poverty for the entire 30-year period. After controlling for current or prior substance misuse, the odds ratios decreased but remained significant for seven outcomes over the 30-year follow-up. Severity of ASB was, however, not associated with an increased risk of hospitalisation for mental illness. The sexXASB interaction term was not significant for any of the odds ratios of the eight outcomes over the 30-year follow-up period, suggesting no differences between males and females. Elevations in odds of the eight adverse outcomes conferred by ASB prior to age 15 were similar among males and females.

#### 4.2.2.2 *The more severe the ASB before age 15, the greater the number of different adverse outcomes*

Linear regression models showed that each unit increase in the severity of ASB prior to age 15, increased the number of adverse outcomes for men and for women. The interaction term sexXseverity of ASB prior to age 15 was not significant, indicating no differential association among men and women.

#### 4.2.2.3 *The associations between the severity of ASB before age 15 and the adverse outcomes persisted over time*

The associations between the severity of ASB prior to age 15 and the eight adverse outcomes in adulthood did not differ across time among women and men. This demonstrated that the effect of ASB on the adverse outcomes did not decrease with time, but remained stable throughout the entire 30-year follow-up period in both women and men.

### 4.3 STUDY III

*Violent, non-violent and substance-related offending over the life-course in a cohort of males and females treated for substance misuse as youths*

#### 4.3.1 Aims

The aims of the study were to: (1) Identify classes with distinct features of violent and non-violent offending up to age 20; (2) Identify classes with distinct features of violent and non-violent offending, including substance-related crimes, between age 21 and 50, and; (3) examine the associations between classes up to age 20 and classes between age 21 and 50 to study continuity and desistance of offending.

#### 4.3.2 Results

##### 4.3.2.1 *Identification of classes up to age 20*

Among males, six latent classes were chosen as providing the best fit to data, including: a *Low criminality class*, characterised by scarce non-violent criminal activity; a *Minor criminality class*, with few non-violent crimes and nearly no violent crimes; an *Intermediate criminality class*, with mid-level rates of non-violent crimes and lower rates of violent crimes; an *Elevated criminality class*, with the next-to-highest rates of non-violent crimes and lower rates of violent crimes; a *Violent criminality class*, characterised by the highest rates of violent crimes and intermediate rates of non-violent crimes, and; a *High criminality class*, represented by a small group of males with the highest rates of non-violent crimes and the next-to-highest rates of violent crimes.

For females, three latent classes provided best fit to data, including: a *Low criminality class*, with very low criminal activity; an *Intermediate criminality class*, characterised by elevated levels of non-violent crimes and lower levels of violent crimes, and; a *High*

*criminality class*, that consisted of a small group of females who presented the highest rates of both non-violent and violent crimes.

#### 4.3.2.2 Identification of classes between age 21 and 50

Among males between age 21 and 50, model fits pointed to a five-class solution that included: a *Low criminality class*, with males who committed less than one crime on average for each category of crime during follow-up; a *Minor criminality class*, with males who displayed mid-levels of offending of all three types of crimes; an *Elevated criminality class*, with high rates of all categories of crimes; a *Violent criminality class*, with a group of males with the next-to-highest rates of non-violent and substance-related crimes and the highest rates of violent crimes, and; a *High criminality class*, with males who presented the highest rates of non-violent and substance-related crimes and the next-to-highest and rates of violent crimes.

For females between age 21 and 50, a three-class solution was chosen: females in the *Low criminality class* presented very low rates of non-violent crimes, violent crimes, and substance-related crimes; the *Intermediate criminality class* was represented by a group of females with mid-level rates of non-violent crimes, and lower rates of violent and substance-related crimes, and; the *High criminality class* consisted of a group of females who presented the highest rates of all three categories of crimes.

#### 4.3.2.3 Linkage between classes up to age 20 and classes between age 21 and 50

The results from the CFA showed that males in the *Low criminality class* up to age 20 indicated no tendency to increase in levels of offending in adulthood. Males in the *Minor criminality class* up to age 20 demonstrated stability of minor offending throughout adulthood. Further, males in the *Intermediate criminality class* up to age 20 showed a tendency to increase in their level of their offending in adulthood. Males in the *Elevated criminality class* up to age 20 demonstrated both stability and increase in adult offending. Moreover, males in the *Violent criminality class* up to age 20 showed a decrease in offending in adulthood. Finally, males who were in the *High criminality class* up to age 20 demonstrated both stability and decrease in offending levels in adulthood.

Females in the *Low criminality class* up to age 20 showed continuity of low-rate offending in adulthood, while females in the *High criminality class* up to age 20 displayed stability of high-level offending in adulthood. No significant differences were found for females in the *Intermediate criminality class*.

## 4.4 STUDY IV

*Long-term offending trajectories in males and females and their associations with multiple problems*

### 4.4.1 Aims

The aims of the study were to: (1) identify long-term offending trajectories between ages 15 and 33 in a cohort of males and females who were treated at a clinic for their

substance misuse problems; (2) identify long-term offending trajectories between ages 15 and 33 in a randomly selected sample from the general population; (3) examine the relationship between offending trajectories in both the clinic cohort and the general population sample and problems in six other areas, including physical illness, mental illness, self-inflicted harm, substance misuse, poverty, and mortality.

#### 4.4.2 Results

##### 4.4.2.1 *Trajectories of criminal convictions among females in the clinic cohort and in the matched sample between 15 and 33*

In the GMM analyses for females in the clinic cohort, fit indices indicated that the three-class model was the model with the optimal number of trajectories. The first trajectory, labelled *Rare offending*, was characterised by low levels of criminal convictions at age 15 that rapidly decreased with age and reached zero-levels in the early 20s, which remained until age 33. The second trajectory, labelled *Stable offending*, was characterised by females with elevated levels of criminal convictions at age 15 that remained on the same level throughout the entire follow-up. The third trajectory, labelled *Increasing offending*, was characterised by low levels of criminal convictions at age 15 that increased sharply with age, and reached top levels at age 33.

For females in the matched sample, the two-class model was the model with the optimal number of trajectories. The first trajectory, labelled *Increasing offending*, was characterised by low levels of offending at age 15 that increased continuously with age. The second trajectory, labelled *Rare offending*, was characterised by very low levels of criminal convictions at age 15 that decreased through adolescence, reaching a level of non-offending in early adulthood that persisted to age 33.

##### 4.4.2.2 *Trajectories of criminal convictions among males in the clinic cohort and in the matched sample between 15 and 33*

The results of the GMM analyses among males in the clinic cohort showed that fit indices pointed to four trajectories as the best solution. The first trajectory, labelled *Decreasing offending*, included males who demonstrated elevated levels of criminal convictions at age 15 that decreased steadily with age to low-level offending at age 33. The second trajectory, labelled *Rare offending*, was characterised by low levels of criminal convictions at age 15 that had decreased to zero-levels by age 33. The third trajectory, labelled *Increasing offending*, was characterised by low levels of criminal convictions at age 15 that increased sharply with age and demonstrated the highest levels of convictions in the cohort at age 33. The final trajectory, labelled *Stable offending*, was characterised by elevated levels of criminal convictions at age 15 that remained virtually unchanged up to age 33.

Among males in the matched sample, fit indices pointed to a three-trajectory solution. The first trajectory, labelled *Decreasing offending*, demonstrated the highest levels of criminal convictions at age 15 which decreased steadily to reach complete desistance by age 33. The second trajectory, labelled *Rare offending*, was characterised by very

low levels of criminal convictions at age 15 that continuously decreased until age 33. The third trajectory, labelled *Increasing offending*, was characterised by low levels of criminal convictions at age 15 that increased with age, and demonstrated the highest levels of convictions in the matched sample at age 33.

#### 4.4.2.3 *Trajectory associations with concurrent problems among females in the clinic cohort and in the matched sample*

Among females in the clinic cohort, results showed that either the *Increasing offending trajectory* or the *Stable offending trajectory* demonstrated the highest prevalence rates of all concurrent problems at all age periods, with the exception of death and social welfare age 15-19. Multinomial logistic regression analyses showed that five of the outcomes were associated with significantly higher odds of belonging to the *Stable offending trajectory*, than to the *Rare offending trajectory* during the entire follow-up period from age 15 to 33. For example, for each admission to hospital for a physical illness, the odds of belonging to the *Stable offending trajectory* increased with 1.19 (CI 1.07-1.33), as compared to the *Rare offending trajectory*. Further, four outcomes were associated with significantly increased odds of belonging to the *Increasing offending trajectory*, as compared to the *Rare offending trajectory*. No significant differences between concurrent problems were found when comparing the *Increasing offending trajectory* to the *Stable offending trajectory*.

For females in the matched sample, the *Increasing offending trajectory* and the *Rare offending trajectory* demonstrated the highest prevalence rates for twelve and nine of the age periods respectively. In the multinomial logistic regression analyses, four of the outcomes were associated with significant increased odds of belonging to the *Increasing offending trajectory*, as compared to the *Rare offending trajectory*.

#### 4.4.2.4 *Trajectory associations with concurrent problems among males in the clinic cohort and in the matched sample*

Among males in the clinic cohort, the *Increasing offending trajectory* demonstrated the highest prevalence of the majority of concurrent problems in the age periods, followed by the *Stable offending trajectory*. The multinomial logistic regression analyses showed that all six concurrent problems were associated with significantly higher odds ratios of belonging to the *Increasing offending trajectory*, when compared to the *Rare offending trajectory* during the entire follow-up from age 15 to 33. Four outcomes were associated with significantly higher odds ratios of belonging to the *Stable offending trajectory*, when compared to the *Rare offending trajectory*. Further, five outcomes were associated with significantly higher odds ratios of belonging to the *Decreasing offending trajectory*, when compared to the *Rare offending trajectory*. When comparing the *Increasing offending trajectory* and the *Stable offending trajectory* to the *Decreasing offending trajectory*, social welfare was associated with significantly higher odds of belonging to the *Stable offending trajectory*, and death was associated with significantly higher odds of belonging to both the *Stable offending trajectory* and the *Increasing offending trajectory*.

For males in the matched sample, the *Increasing offending trajectory* demonstrated the highest prevalence rates for the major part of the concurrent problems in the age periods. In the multinomial logistic regression analyses, all but one outcome were associated with significantly higher odds of belonging to the *Increasing offending trajectory*, as compared to the *Rare offending trajectory* during the entire follow-up from age 15 to 33.

## **5 DISCUSSION**

### **5.1 MAIN FINDINGS FROM EACH STUDY**

#### **5.1.1 Study I: Multiple adverse outcomes over 30 years following adolescent substance misuse treatment**

Study I was the first study to assess multiple adverse outcomes over three decades of adult life, comparing a sample of individuals who engaged in substance misuse while adolescents and a matched sample drawn randomly from the general Swedish population. The breadth of outcomes assessed provided a valid indicator of the long-term development of adolescents treated for substance misuse. The length of the follow-up period extended previous knowledge through the examination of negative development up to age 50, showing continuity of substance misuse, and also elevated rates of criminality, mental and physical health problems, poverty and death through 30 years of adult life. Study I also added new knowledge to the field by including a matched sample from the general population, and showed that the clinic sample experienced more breadth and severity of adversity through adult life, as compared to the general population sample. Notably, the clinic cohort also differed from the general population sample in the prevalence of various combinations of substance misuse, criminality, mental and physical health problems, and poverty. Thus, seeking help for substance misuse problems in adolescence predicted multiple psychosocial problems through adulthood. Importantly, the results remained significant after taking account of substance misuse in adulthood defined strictly as having received treatment for substance misuse or for a related physical illness, or having been convicted for an alcohol or drug related crime. This suggested that the adversity experienced by the clinic sample during adult life was not simply the result of continued substance misuse. Nor was it the result of serious mental illness, substance misuse co-morbid with mental illness, or poverty. The findings may be interpreted to suggest that factors operating earlier in life were driving the negative life trajectories, and moving these individuals towards a pathway of maladjustment. Individuals who had misused substances as teenagers presented multiple problems as they began their adult lives, and results clearly showed that these problems persisted throughout adulthood. A number of methodological features affect the interpretation of the results; the strict definitions of the six adverse outcomes and the information available from the national registers would, in many cases, provide underestimations of the prevalence of adverse outcomes. Coverage of all regions of the country for various time periods was incomplete, and information on poverty was available for only the last 13 years of the follow-up. A further limitation of Study I was the lack of information about the general population sample in adolescence. While we know that none were treated at the clinic from 1968 to 1971, we do not know if they received treatment at another time.

### **5.1.2 Study II: Adolescent antisocial behavior as predictor of adverse outcomes to age 50: A follow-up study of 1,947 individuals**

Study II extended previous findings through measuring a broad array of outcomes in the same individuals, tracking changes in outcomes beyond age 30, and examining a large sample of females and males. The results showed that the severity of ASB before age 15 was associated with a broad array of adult outcomes indexing serious physical and mental health problems, criminal convictions, and poverty up to age 50. The total number of adverse outcomes experienced by the participants, increased as a function of the severity of ASB before age 15. This extended prior knowledge by demonstrating that individuals who displayed antisocial behaviour in early adolescence accumulated multiple problems that persisted to age 50. Furthermore, no differences were detected in the association of ASB prior to age 15 and outcomes from ages 21 to 50 among women and men, demonstrating that antisocial behaviour in adolescence was associated with negative outcomes in adulthood equally among females and males. The results of Study II suggested that the beginnings of these multiple problems might have been present in adolescence. However, the association between early antisocial behaviour and negative outcomes remained after controlling for parental socioeconomic status. It could be that socioeconomic status had a weaker impact on adversity in adulthood in Sweden than in other countries. Still, we were unable to assess the presence of other factors in adolescence from the data available in the old clinic files, and consequently other contributing factors were not controlled for. The current investigation included several limitations; by examining ASB prior to age 15, associations with negative outcomes may have been underestimated, as most other studies have examined the outcomes of conduct problems prior to age 10. The severity of ASB was low, especially when compared to current clinical samples (Hodgins et al., 2007). In the late 1960's, mental health professionals in Sweden were reluctant to assess ASB among adolescents, likely underestimating the antisocial behaviour in the archival data. Another limitation was the restrictive definitions of the adult adverse outcomes, including for example only hospitalisations for physical illnesses related to substance misuse and serious mental illnesses, and official criminal convictions. Finally, the participants were a select group of individuals with ASB prior to age 15 who sought treatment for their substance misuse problems, and results should therefore only be generalised to other clinical samples.

### **5.1.3 Study III: Violent, non-violent, and substance-related offending over the life course in a cohort of males and females treated for substance misuse as youths**

Study III contributed knowledge by examining long-term offending heterogeneity in a high-risk sample of males and females. The results showed that several offender classes could be identified, and that the number and type of classes were comparable both in adolescence and in adulthood, suggesting that the heterogeneity of crime was similar through five decades of life. Among the males, several offender classes with high rates of delinquency emerged in the sample, suggesting that more refined distinctions between high-level offenders can be made in high-risk samples, as compared to general population samples. Although some classes included few individuals, these classes could have important implications for clinical practice in

terms of targeted treatment (Loeber, Farrington & Waschbusch, 1998). The present study also added knowledge by showing that distinct subgroups of offenders could be identified among females too. While males demonstrated higher levels and more diversity of offending, no sex differences were found in the continuity of offending; highly delinquent males and females both demonstrated an increased likelihood to continue to offend in adulthood. Furthermore, the findings of Study III extended previous knowledge by showing that substance-related offending was strongly related to committing other types of crimes, even though it did not constitute a specific subgroup. Substance-related offending could be an indicator of continued substance misuse, and thus reduce the chance of desistance in adulthood, as misuse has been suggested to act as a snare for offending (Hussong, Curran, Moffitt, Caspi, & Carrig, 2004). No sex differences were found in the relationship between substance-related crimes and other crimes in adulthood, as substance-related crimes constituted a substantial part of criminal activity in both sexes in adulthood. The similarities between sexes could be attributed to the selection processes governing which individuals received treatment at the clinic, and resulting in similarities in offending patterns. The similarities between sexes could also be attributed to the gender paradox, by which females, although offending at lower levels, demonstrate an equally persistent behaviour (Tiet et al., 2001). Limitations in Study III included: the use of file and register data, which may have underestimated criminality; the use of a cohort of individuals who were treated for substance misuse, limiting the generalisation of the findings, and; the inclusion of individuals who came of age in the 1960s, affecting comparisons to more contemporary samples.

#### **5.1.4 Study IV: Long-term offending trajectories in males and females and their associations with multiple problems**

Study IV extended previous trajectory-based studies by identifying distinct long-term trajectories among males and females in both a clinic cohort and a matched sample, and by linking a wide range of concurrent problems to the trajectories from adolescence to adulthood. Several long-term trajectories with different rates and trends of offending could be identified among males and females in both the clinic cohort and in the matched sample. However, individuals who had been treated at the clinic demonstrated considerably higher rates of offending, larger offender classes, and more diversity in offending patterns than individuals in the matched sample. This could be explained the selection processes determining which individuals ended up being treated at the clinic, resulting in more diversity and more severe offending in the clinic cohort. Also, males in the *Decreasing offending trajectory* in the clinic cohort showed less desistance than males in the matched sample by age 33. This could be explained by substance misuse acting as a snare for offending, eventuating in later desistance in the clinic cohort. Males generally offended at higher rates and demonstrated more diversity in offending trajectories than females. Furthermore, the *Decreasing offending trajectory* was not discernable among the females, as female offending trajectories demonstrated stable or increased offending up to age 33. These results could lend support to the suggestion that the development of delinquent females is more consistent with the development of life-course-persistent males than with adolescence-limited males (Silverthorn & Frick, 1999). Alternatively, a gender bias in the criminal justice system (Ahola, Hellström & Christianson, 2010) could contribute to females with less serious criminal offending

evading convictions to a larger extent than their male counterparts. Across sex and samples, trajectories with the highest offending rates also showed the highest prevalence rates of concurrent problems. However, in the present study, few concurrent problems distinguished between trajectories with mid- or high-levels of offending. An explanation could be that co-morbidity is higher in clinical samples (Odgers & Moretti, 2002). The co-morbidity of concurrent problems could also contribute to adversity; for example, misuse increases the risk of diseases, accidents, and premature death (Nieuwebeerta & Piquero, 2008). Both sexes demonstrated similarities in the prevalence rates of concurrent problems, and in the associations between concurrent problems and trajectories, suggesting that delinquent females in high-risk samples are equally at risk of long-term problems in multiple domains as their male counterparts. Limitations of Study IV included the use of official conviction data, resulting in an underestimation of criminal offending and no information on offending prior to age 15. The use of official records of concurrent problems likely presented an underestimation of problems, and including participants treated for substance misuse limited the generalisation of the findings. Further, the samples' location in place and time may also affect generalisation, as rates and patterns of convictions may change over time.

## **5.2 GENERAL CONCLUSIONS**

In the present thesis, several findings emerged that warrant further discussion.

### **5.2.1 A greater risk for negative outcomes in adulthood in the clinic cohort**

Individuals from the clinic cohort were at increased risk of continued substance misuse and several other adverse outcomes, and for various combinations of adverse outcomes, when compared to matched individuals from the general population through 30 years of adult life. The breadth and severity of adverse outcomes throughout adulthood in the clinic cohort could have several explanations. Committing crimes may be a way of financing substance misuse, particularly for individuals with severe and costly abuse problems. This is supported by studies that reported higher levels of offending during periods of addiction than during periods of non-addiction (Gossop, Trakada, Stewart, & Witton, 2005). Drug use has also been shown to be inversely related to desistance from serious delinquency in early adulthood (Stouthamer-Loeber et al., 2004), which could explain the continued offending in the clinic cohort. In the same way, excessive drinking has been shown to increase the risk of diseases, accidents, victimisation, and premature death (Nieuwebeerta & Piquero, 2008). Moreover, being treated at the clinic could have stigmatising consequences, influencing the identity and behaviour of the clinic cohort members (Becker, 1963). Also, problems in different areas tend to accumulate, and the presence of one problem could increase the likelihood of other problems (Rönkä, Kinnunen & Pulkkinen, 2001), and encourage a process of marginalisation, further promoting a negative developmental pathway. Future research should therefore aim at investigating long-term outcomes in multiple domains after misuse treatment among both men and women, and examining the risk factors that might contribute to the development of the negative outcomes beyond early adulthood.

### **5.2.2 Heterotypic continuity**

Additionally, it was shown that antisocial behaviour before age 15 conferred risk for death, hospitalisation for physical illnesses related to substance misuse, self-inflicted harm, substance misuse, convictions for violent and non-violent crimes, and poverty, during the subsequent 30 years in cohort 1. Furthermore, offending trajectories with the highest offending rates, also displayed the highest prevalence rates of concurrent problems during 18 years of follow-up in cohort 2. Taken together, these findings suggest antisocial behaviour in adolescence had life-long negative consequences in multiple domains. This could be due to underlying factors causing both antisocial behaviour and adversity in other areas, or to a process of cumulative continuity adding to the burden of problems, or a combination of both (Pajer, 1998). The results point to a need of further research to examine how factors in adult life may affect continued adversity, how outcomes vary by sex, and the specific role of substance misuse and delinquency for long-term maladjustment in multiple domains.

### **5.2.3 Homotypic continuity**

Considerable continuity between adolescent and adult offending was shown, whereby several subgroups of offenders in both clinic cohorts tended to show both stability and increase of offending throughout adulthood. Furthermore, differences in desistance were found between the clinic cohort and the matched sample, with the clinic cohort showing less desistance. A reason for this could be that substance misuse acted as a snare for offending; individuals who otherwise might desist from offending would become 'ensnared' into a pathway of continued offending, through their substance abuse problems (Hussong, Curran, Moffitt, Caspi, & Carrig, 2004). Alternatively, the continuity of offending could be indicative of the nature of the clinic cohort. Individuals who were treated at the clinic could represent the deep end of antisocial behaviour problems, and thus display more severe and persistent pathways of offending. Thus far, most research has been conducted on birth cohorts and general population samples. More longitudinal research on high-risk youth, including females, who demonstrate higher levels of delinquent behaviour, is needed to understand whether proposed findings from general population samples can be extended to high-risk samples (Odgers, Moretti, Burnette, Chauhan, Waite & Reppucci, 2007).

### **5.2.4 Substance-related offending**

The findings further showed that individuals with high levels of violent and non-violent offending in adulthood also displayed high levels of substance-related crimes. However, none of the subgroups tended to specialise in substance-related offending only, indicating that the propensity to commit substance-related crimes was not distinct from the propensity to commit other non-violent crimes or violent crimes among individuals treated for substance misuse in adolescence. These findings suggested that substance-related offending was strongly related to other types of crimes, but did not constitute a specific subgroup with distinct offending patterns. Still, substance-related offences may be important in the development of a criminal career among individuals who presented misuse problems as youths, whether associations are causal (Arseneault, Moffitt, Caspi, Taylor & Silva, 2000; Fergusson & Horwood, 2000; Fergusson, Lynskey & Horwood, 1996) or reciprocal (D'Amico et al., 2008; White et al., 1999).

Future research would benefit from including substance-related crimes when studying offending heterogeneity among misusing adolescents (Huizinga & Jacob-Chien, 1998).

### **5.2.5 Heterogeneity of offending**

Evidence from the present thesis demonstrated that several subgroups of offenders could be identified in adolescence and again in adulthood in cohort 1, and likewise, trajectories of offenders could be identified throughout adolescence and adulthood in cohort 2. This showed that more refined distinctions could be made between different types of high-level offenders in high-risk samples. Although classes with the highest rates of offending included few individuals, and could therefore be difficult to identify in general population samples, these classes could have important implications for clinical settings. For example, in cohort 1, a small but distinct subgroup of males demonstrated markedly high rates of violent crimes, as compared to the rest of the cohort, suggesting a specialisation in violent offending. Similarly, a small group of females in cohort 1 displayed high rates of both violent and non-violent crimes, indicating a more severe manifestation of antisocial behaviour. Identifying these groups of individuals could be of importance, as serious and violent offenders tend to be multiple-problem youth at greater risk for future crime (Loeber, Farrington & Waschbusch, 1998). The need to address heterogeneity has become commonly accepted within criminological research during the past few years (Odgers et al., 2007). Still, studies on high-risk samples, studies that include females, and longitudinal studies that extend beyond the early twenties are scarce, calling for more research that meets these requirements.

### **5.2.6 Lack of negative outcomes**

The focus of the present thesis was on the adverse outcomes of adolescent antisocial behaviour, and on the continuity of offending. However, it is equally important to examine not just how antisocial behaviour affects the individual negatively across the life course, but also how positive adaptation develops (Stouthamer-Loeber et al., 2004). The findings demonstrated that a considerable number of individuals treated at the clinic did not experience serious consequences in adulthood. For example, in Study I, it was shown that 19.4% of the females and 20.7% of the males did not experience any of the adverse outcomes studied. Furthermore, in Study IV, rare offenders generally showed much lower prevalence rates of concurrent problems throughout follow-up. The lack of negative outcomes among some individuals could have been caused by turning points that served as triggers to influence desistance of antisocial behaviour, and to promote positive adaptation (Laub, Nagin, & Sampson, 1998). Also, the presence of protective factors could have insulated individuals from further antisocial behaviour after adolescence, and from developing problems in other areas. Antisocial behaviour is typically considered exclusively as a negative symptom, and is seldom viewed from the point of view of the function that it may serve (Siegel & Scovill, 2000). For instance, it has been suggested that substance use in adolescence may be a part of acquiring a wide range of experiences and exploring self-identity, or it may relieve the confusion of self-identity, before one settles into adult life (Arnett, 2005). Thus, antisocial behaviour could simply be left behind in adulthood. Moreover, adolescence-limited antisocial behaviour is hypothesised to arise from a normative attempt to display autonomy and to bridge the gap between biological maturity and

adult status, and is eventually outgrown. On the other hand, the use of register data could also explain why a number of individuals seemingly demonstrated no adult adversity, as some individuals might continue to exhibit problems in adulthood, however, not severe enough to be detected in official register data. The results from the present study point to a need for research on the positive development of antisocial behaviour in both genders, on research that examines why individuals desist from antisocial behaviour, and on studies of the factors associated with desistance and positive development.

### **5.2.7 Sex differences and similarities**

With regard to sex, some differences emerged in the current thesis; larger differences were found in outcomes between women in the clinic cohort and women in the matched sample than between their male counterparts. Males also demonstrated higher levels and more diversity of offending, and specific subgroups and trajectories were identified in the males that were not replicated in the females. At the same time, the findings pointed to several similarities across sex; antisocial behaviour before age 15 was associated with negative outcomes in adulthood equally among females and males. No sex differences were found in the continuity of offending, or in the relationship between substance-related crimes and other crimes in adulthood. Both genders demonstrated similarities in prevalence rates of correlates, and in the associations between correlates and trajectories, although sex differences were not tested directly. Previous research on sex differences in the development of antisocial behaviour has been conflicting, where some researchers suggest sex differences (Silverthorn & Frick, 1999), whereas others do not (Moffitt et al., 2001). The present studies pointed to more similarities than differences between genders, however, the nature of the cohorts included could be a reason for caution when comparing males and females to each other; females in the clinic cohort could reflect a process of selection bias where the ‘worst’ cases ended up at the clinic. For example, it has been suggested that clinical settings are used to protect girls from damaging environments and to treat other problems, in addition to the antisocial behaviour, thus resulting in more severe cases among females in high-risk samples as compared to their male counterparts (Odgers et al., 2007). A previous study of individuals treated at the clinic pointed to girls having more problems in terms of substance misuse, psycho-social adversity, and parental misuse than boys (Söderholm Carpelan, 1992). On the other hand, antisocial girls in general could present a different aetiology than boys, where most antisocial girls follow a more severe pathway, consistent with the taxonomy of life-course-persistent boys, as demonstrated in both high-risk and general population studies (Marmorstein & Iacono, 2005; Silverthorn, Frick & Reynolds, 2001; White & Piquero, 2004).

Nonetheless, it is evidently clear that girls no longer are regarded as representing ‘noise’ in the analyses (Odgers et al., 2007), as more and more researchers are studying both sexes. Yet, more research is needed within developmental criminology to examine sex differences and similarities, to elucidate whether sex-specific theories should be developed or if a more parsimonious approach to antisocial behaviour should be taken (Moffitt et al., 2001), and, importantly, to examine differences *within* sex - not applying a “one size fits all approach” to antisocial females (Odgers, Moretti, Burnette, Chauhan, Waite & Repucci, 2007, p. 340).

### **5.3 METHODOLOGICAL CONSIDERATIONS**

The present thesis was characterised by several strengths. The follow-up period for each cohort was 18 and 30 years respectively. The cohorts were relatively large and included both males and females. Two matched samples from the general population were provided for comparisons. Attrition was minimal, including only the few individuals who had permanently emigrated from Sweden. Outcomes included a wide array of problems, and each outcome was documented from national registers that have been shown to be complete and reliable (Mortensen, Allebeck & Munk-Jørgensen, 1996). Furthermore, the studies in the thesis met the growing demand within research for long-term studies on samples outside the United States (Bersani, Nieuwebeerta & Laub, 2009). However, the present thesis also included some limitations that should be taken into account when interpreting the results.

#### **5.3.1 Participants**

One important aspect was that the preponderance of the results was based on clinical cohorts, although matched samples were included for comparison. When interpreting results, it is imperative to consider the type of sample, as different types of samples may yield different types of results, and the nature of the cohorts limits the generalisation of the findings. The findings of the present thesis were based on individuals treated for substance misuse, and may therefore not be representative of antisocial behaviour in general. For instance, individuals treated for substance misuse may demonstrate a different aetiology of antisocial behaviour than individuals in general population samples. Also, the selection mechanisms that operate to determine which individuals end up at the clinic may be biased in terms of socioeconomic status, gender, the severity of antisocial behaviour presented, etc. For example, fewer females than males were treated at the clinic in both cohorts; in cohort 1, 16.7% of the participants were females, and in cohort 2, 35.9% of the participants were females. Then again, longitudinal studies of antisocial behaviour have generally followed birth cohorts or school samples, in which the prevalence of serious antisocial behaviour is low (Kreuter & Muthén, 2007), particularly among females (Bergman & Andershed, 2009). As many of the individuals who engage in serious or persistent delinquency end up in treatment or forensic settings (Odgers & Moretti, 2002; Odgers et al., 2007), an examination of such samples, with a comparison to general population samples, may provide important information. This could contribute to the understanding of the mechanisms that operate among adolescents in treatment settings (Odgers & Moretti, 2002; Odgers et al., 2007), and to the knowledge on long-term development of serious antisocial behaviour. Knowledge that is important when designing appropriate prevention and intervention strategies (McDermott & Nagin, 2001).

A further limitation of the study was the lack of information about the matched samples in adolescence. While we know that none were treated at the clinic during the studied years, we do not know if they received treatment at another time, or if they presented antisocial behaviour problems in adolescence.

### **5.3.2 Archival and register data**

Another important aspect was the use of archival and register data. While the retrospective collection of baseline data allowed for a long-term follow-up of individuals, it also meant that the information from the clinic and social services files was collected for other purposes than those of this study, affecting the type of information available. For instance, in the late 1960s, many professionals in Sweden had less experience in detecting and assessing antisocial behaviour among adolescents, particularly among girls, likely underestimating the prevalence of antisocial behaviour in cohort 1. Similarly, the use of register data for assessing adverse outcomes and continued offending in adulthood was unquestionably an underestimation of the actual adversity experienced by the participants. For example, individuals with minor injuries might not seek treatment, and not all individuals that are treated at the general practitioner or in the emergency room, are hospitalised. In the same way, official records of convictions provided a conservative estimate of the actual number of offences committed, as many crimes went undetected by the police. Furthermore, the justice system can be biased with respect to sex and ethnicity (Ahola, Hellström, & Christianson, 2010; Pettersson, 2007b). At the same time, official records are an objective measure of offences that are not biased by memory and concealment problems (Wiesner, Capaldi & Kim, 2007), and demonstrate a greater degree of agreement with self-reported crime for serious offences (Kazemian & Farrington, 2005). Another important aspect to consider is that exposure time (i.e. incarceration) was not taken into account, which may influence inferences, when analysing offending patterns (Eggleston, Laub & Sampson, 2004).

### **5.3.3 Cohort effects**

Studying individuals who came of age 30 or 40 years ago may also affect generalisation, as adolescents of that time may have been different from adolescents in more contemporary samples. Adolescents of today settle down into adult roles and responsibilities of marriage, parenthood, and work later than previous generations (Arnett, 2005). Furthermore, alcohol, drug, and criminal policies have changed considerably over the years, affecting each generation differently. For example, medium-strength beer was introduced in Swedish grocery stores when the individuals in the first cohort were adolescents, initially with a minimum legal age for purchasing of 16 years, although this was later raised to 18 years. The ready availability of alcohol has not been experienced by later generations, which could have caused differences in drinking patterns between cohorts (Andersson, Hansagi, Damström Thakker & Hibell, 2002). Similarly, previous research has identified cohort effects of offending among males and females, with later cohorts being less likely to desist, which could either reflect a change of behaviour, or a change of the justice system (Francis, Soothill & Piquero, 2007).

### **5.3.4 Treatment**

Although the findings of the present thesis were based on individuals who were treated at a clinic for their substance misuse problems, the role of treatment was not examined. The question of how treatment in adolescence influenced adult adversity is of importance when interpreting the results. However, in another study carried of cohort 1,

the effect of treatment on resilience was measured, and only one significant association between treatment type and long-term outcomes was found; shorter treatment duration was associated with moderate-to-high resilience in adulthood (Larm, Hodgins, Tengström & Larsson, 2010). Still, future research should aim at studying the impact of treatment on the long-term development of antisocial behaviour.

## **5.4 CONCLUSIONS**

The results clearly demonstrate an increased risk of both homotypic and heterotypic continuity of problems through 30 years of adult life among individuals treated for substance misuse as adolescents, and highlight the importance of assessing and treating the multiplicity of problems to prevent the continuation of current problems and the emergence of new ones. Interventions should aim reducing antisocial behaviour and associated risk factors within the domains of the individual, family, peers, and school. Interventions should also focus on promoting protective factors. Evidence-based treatment for children and adolescents with antisocial behaviour problems include parent management training, school programs, and programs aiming at increasing social skills and improving conflict resolution (Loeber & Farrington, 2000). Yet, the availability of these programs remains limited. This is a further incentive to provide adolescents who are misusing substances with evidence-based treatments, not only to eliminate their substance misuse, but also to reduce the associated mental and physical health problems and criminality, and to increase academic achievement and employment opportunities. Moreover, treatment should acknowledge heterogeneity, and aim to target specific needs and problems behaviours presented, instead of accommodating a wide range of problems with the same intervention strategy. The findings further suggest that intervention is equally needed among girls who present antisocial behaviour in adolescence, as this is predictive of adult adversity in both sexes. Still, knowledge about ‘what works’ when responding to antisocial females is limited (Jennings et al., 2010), and treatment settings many times fail to meet the needs of adolescent girls with antisocial behaviour problems. The development of sex-sensitive programs has been suggested, although further research is needed to examine this issue. It would be reasonable to propose that effective treatment, when antisocial behaviour first emerges, might lead to reductions in personal suffering and costs to society, and also protect future offspring. Instead, society appears more willing to carry the burden of dealing with individuals with serious antisocial behaviour in adulthood, rather than taking preventive measures earlier in life (Loeber & Farrington, 2000).

To conclude, the findings of the present thesis point to the importance of early and effective interventions to prevent further antisocial behaviour, and the long-term personal and societal costs associated with it.

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