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LONG-TERM ADVERSE OUTCOMES AND RESILIENCE OF INDIVIDUALS WHO MISUSED SUBSTANCES AS ADOLESCENTS

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ABSTRACT

Background: Little is known about the long-term outcomes in multiple domains of adult functioning of individuals who as adolescents misused substances. The goal of this thesis was to examine adverse and resilient outcomes through 30 years of adulthood of individuals who as adolescents had consulted a clinic for substance misuse problems and to identify risk and protective factors present in adolescence that distinguished trajectories of adult development.

Method: Data were used from a longitudinal project, the Consequences of Antisocial Behaviour in Adolescence (CASBA), a follow-up study documenting adult outcomes of two cohorts of individuals who were treated for substance misuse as adolescents and a general population sample matched on age, gender, and birth place. Cohort 1 consisted of 1992 individuals who were treated from 1968 to 1971 while Cohort 2 consisted of 1576 individuals who were treated from 1980 to 1984. Information about the clinic sample in adolescence was extracted from the old clinic files while information about adult outcomes was obtained from national registers.

Results: Eight main findings emerged. One, individuals who as adolescents had consulted a clinic for substance misuse problems, as compared to the general population sample, were significantly more likely to experience adverse outcomes defined as death, physical illness, mental illness, substance misuse, criminality, and poverty, during the subsequent 30 years. Two, not only did the clinic sample experience high levels of adversity in each outcome domain, they also experienced adversity in multiple domains of adult functioning. Three, among the individuals who as adolescents had engaged in substance misuse distinct developmental trajectories of resilience over 25 years of adulthood were identified. Four, factors operating in adolescence were associated with outcomes throughout three decades of adulthood. Five, substance misuse in adulthood appeared to drive criminal offending. Six, treatment received at the clinic in adolescence was not associated with resilience in adulthood. Seven, few differences in adult outcomes were found between Cohort 1 and 2. Eight, while gender differences in the risk of adverse outcomes were observed and gender independently predicted the adverse outcomes, no gender differences were observed in trajectories of resilience through adulthood, few gender differences were observed in the great majority of the associations of risk and protective factors with outcomes. Female gender was found to be protective against criminal offending.

Conclusions: Adolescence is a critical life period. Both risk factors and protective factors present in adolescence impact outcomes in adulthood. Gender is associated with distinct adult outcomes but not with the accumulation of adverse outcomes or developmental trajectories of resilience in adulthood. The concept of resilience requires modification to take account of the findings that resilience is dynamic and changes over the life course and that it differs across domains of functioning. Defining distinct sub-types of adolescent substance misusers is a necessary first step to identifying causal mechanisms. Substance misuse may play a major role in promoting criminal offending in adulthood.

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LIST OF ABBREVIATIONS

ADHD	Attention Deficit Hyperactivity Disorder
AFR	Adolescent Family Risks
AIDS	Acquired Immune Deficiency Syndrome
ANOVA	Analysis of variance
APB	Adolescent Problem Behaviours
APF	Adolescent Protective Factors
CASBA	The Consequences of Antisocial Behaviour in Adolescence
CATOR	The Comprehensive Assessment and Treatment Outcome Research
CS	Clinic sample
DARP	The Drug Abuse Reporting Program
DATOS-A	The Drug Abuse Treatment Outcome Studies for Adolescents
DSM-IV	Diagnostic and statistical manual of mental disorders, 4^{th} edition
FORUM	Research Centre for Psycho-Social Health
GMM	Growth Mixture Modelling
GP	General Population sample
HIV	Human Immunodeficiency Virus
HLM	Hierarchical Linear modelling
ICC	Intra Class Correlation
ICD-10	International statistical classification of diseases, 10^{th} revision
LCGA	Latent Class Growth Analysis
RR	Risk Ratios
SEM	Structural Equation Modelling
SES	Socioeconomic Status
SROS	The Services Research Outcome Study
TOPS	Treatment Outcome Prospective Study

1 INTRODUCTION

Substance misuse during adolescence compromises this critical life period, negatively impacting on academic performance and career opportunities, physical and mental health, and increasing the risk of premature death (Patel, Flisher, Hetrick & McGorry, 2007; Toumbourou et al., 2007). Substance misuse constitutes 23.3% of the total burden of disease for individuals aged 15 to 29 years old in economically developed countries (Patel et al., 2007). Substance misuse usually begins in adolescence, peaks in the early 20s, and decreases rapidly thereafter (Chen & Kandel, 1995). While it is known that a small group of individuals persist in misusing substances in early adulthood, little is known about the long-term outcomes in multiple domains of adult functioning of individuals who as adolescents misused substances. Nevertheless, substance misuse is often associated with criminality (Bennett, Holloway & Farrington, 2008; White & Gorman, 2000). Many adolescents with conduct problems present substance misuse (Vermeiren, 2003) while substantial proportions, if not most, adolescents with substance misuse present conduct problems (Armstrong & Costello, 2003). Knowledge of factors present in adolescence that are associated with substance misuse and criminality that persist beyond young adulthood is limited (Farrington & Pulkkinen, 2009; Schulenberg & Maggs, 2008). However, numerous studies from the Dunedin birth cohort demonstrate a small group that initiates offending in childhood that persists into their early 30s with inadequate parenting, neurocognitive problems, undercontrolled temperament, severe hyperactivity, psychopathic personality traits, and aggressive behaviour present in childhood or/and adolescence (Moffitt & Caspi, 2001; Moffitt, Caspi, Harrington & Milne, 2002; Odgers et al., 2007; Odgers et al., 2008). Similar heritable factors and personality traits are associated with both substance misuse and criminality (Kreuger et al., 2002; Kreuger, Markson, Patrick, Benning & Kramer, 2007). Yet, much research and theory suggests that antisocial behaviour in adolescence, including substance misuse, resolves by early adulthood (Odgers et al., 2008; Olsson, Hansson & Cederblad, 2006; Rohde, Lewinsohn, Kahler, Seeley & Brown, 2001; von Sydow et al., 2001; Wells, Horwood & Fergusson, 2006). Knowledge is needed to explore the long-term consequences in multiple domains of substance misuse in adolescence, and the factors that increase the risk of adverse outcomes and those that promote resilience. This thesis provides new knowledge about both adverse and adaptive outcomes during 30 years of adulthood among individuals who misused substances in adolescence, and explores factors present in adolescence that contribute to divergent life-course developments.

In the literature, different measures of substance use are described. The term "substances" is used to refer to tobacco, alcohol, illicit drugs (cannabis, cocaine, amphetamines, hallucinogens, inhalants and other), and medications not prescribed for the individual. The use of illicit drug has been acknowledged as a significant public health problem worldwide and therefore any use of illicit drugs in adolescence is potentially hazardous. Alcohol use is legal, and misuse of alcohol is commonly referred to as at least binge drinking (Bauman & Phongsavan, 1999) measured by a certain number of drinks on one occasion (Courtney & Polich, 2009; Kuntsche, Rehm & Gmel, 2004), or defined as a mental disorder. Diagnoses of alcohol abuse and dependence, or abuse and dependence of specific illicit drugs are made based on criteria included in the

Diagnostic and Statistical Manual of the American Psychiatric Association, version IV, (American Psychiatric Association, 1994) as mental disorders, or in the International Classification of Disease (World Health Organization, 1992). Various other terms and criteria are used to refer to the severity or frequency of use. It is critical to distinguish between intoxification and misuse. Misuse is usually used to indicate harmful use affecting the user or others (Bauman & Phongsavan, 1999). Studies often use the term problem use referring to consumption that limits or impairs psychosocial functioning (Swadi, 1999). Heavy use or hazardous use often refers to use above a certain threshold. Throughout this thesis, the term substance misuse includes any use of illicit drugs and at least binge drinking of alcohol.

This first chapter of the thesis begins with a review of the literature on adverse outcomes in adulthood following adolescent substance misuse and the associated factors. Next, the association of substance misuse and delinquency is explored. In the final section, studies of adaptive adult outcomes or resilience and the associated factors are reviewed. The second chapter describes the general and specific aims of the thesis. The third chapter presents the overall method of the research, including a description of the data collection procedures, of the measures, of the participants, and of the different statistical analyses conducted in the four papers. The fourth chapter describes the aims and results of each of the four papers. The fifth chapter begins with a discussion of the main findings of the thesis, a presentation of the strengths and limitations of the research, and concludes with remarks on the scientific and clinical implications of the research.

1.1 OUTCOMES IN ADULTHOOD

Outcomes in adulthood of adolescent substance misuse have been examined in longitudinal studies of population cohorts and birth cohorts and follow-up studies of adolescents who were treated for substance misuse. Several features characterise these studies and point out the gaps in knowledge about the development of individuals who as adolescents misused substances. One, most studies have included relatively short follow-up periods tracking subjects into young adulthood or, in a few studies, to their mid 30s (Zucker, 2008). Treatment outcome studies usually assessed participants one year after the end of treatment (William & Chang, 2000). Consequently, little is known about outcomes of adolescent substance misuse through adulthood. Two, most studies measured a limited number of outcomes. Longitudinal studies of population cohorts or birth cohort samples often assessed continued substance misuse and only one additional outcome, usually mental health. Consequently, little is known about other domains of functioning in adult life that may be affected by substance misuse in adolescence (Bonomo et al., 2001; Hall & Babor, 2000). Studies on treatments for adolescents with substance misuse are limited to measures of abstinence or relapse (William & Chang, 2000; Winters, 1999). The third feature of studies of outcomes of adolescent substance misuse that impacts current knowledge is the lack of comparison groups in the follow-up studies of treated adolescents. Few studies have compared the development of individuals who as adolescents did and did not receive treatment for substance misuse, thereby seriously limiting the understanding of the specific consequences in adult life of substance misuse in adolescence (Bukstein & Winters, 2004).

1.1.1 Investigations of population cohorts and birth cohorts

The majority of investigations of population and birth cohorts have focused on the association between substance misuse in adolescence and misuse through young adulthood. A number of studies have established an association between adolescent substance misuse and continued misuse in young adulthood. Alcohol misuse in adolescence has been linked to continued misuse of alcohol in young adulthood (Rohde et al., 2001; Wells et al., 2006), and alcohol misuse into the 30s (McCarty et al., 2004; Merline, O'Malley, Schulenberg, Backman & Johnston, 2004; Wennberg, Andersson & Bohman, 2002). Misuse of cannabis in adolescence has been linked to later misuse in young adulthood (Patton et al., 2007) and cannabis misuse into the 30s (Chen & Kandel, 1998). Misuse of alcohol and cannabis in adolescence has been associated with misuse of other illicit drugs in young adulthood (Ellickson, Martino & Collins, 2004; Ellickson, Tucker & Klein, 2003; Fergusson, Boden & Horwood, 2006; Fergusson & Horwood, 2000). Taken together, these studies clearly demonstrate that substance misuse in adolescence increases the risk for continued misuse into the third decade of adult life. Only a few studies have documented the association between adolescent substance misuse and continued misuse into the fourth decade of life (Pitkänen, Kokko, Lyyra & Pulkkinen, 2008). Thus, further knowledge is needed of how substance misuse in adolescence contributes to misuse that continues into the 40s and of how substance misuse interacts with impairments in other domains during the life course.

Alcohol misuse in adolescence has been associated with continued misuse of substance, and in addition, with various mental disorders in young adulthood including depression (Brook, Brook, Zhang, Cohen & Whiteman, 2002; Wells, Horwood & Fergusson, 2004; Rohde et al., 2001), anxiety (Brook, Cohen & Brook, 1998; Rohde et al., 2001), antisocial personality disorder and borderline personality disorder (Rohde et al., 2001). Cannabis misuse in adolescence has been associated with the subsequent development of antisocial personality disorder (Brook et al., 1998), depression (Brook et al., 2002; Fergusson, Horwood & Swain-Campbell, 2002; Patton et al., 2002), anxiety among females (Patton et al., 2002), and schizophrenia and psychotic symptoms (Andreasson, Allebeck, Engström & Rydberg, 1987; Arseneault et al., 2002; Fergusson, Horwood & Ridder, 2005; Zammit, Allebeck, Andreasson, Lundberg & Lewis, 2002). Misuse of other illicit drugs in adolescence has been associated with depression (Brook et al., 2002; Brook et al., 1998) and antisocial personality disorders in young adulthood (Brook et al., 1998). The exact nature of the relationship between substance misuse and mental health problems over the life course is unclear. Some studies indicate that depressive symptoms in childhood may precede substance misuse in adolescence (King, Iacono & McGue, 2004), while other studies suggest the reverse association, that substance misuse in adolescence precedes depression in young adulthood (Brook et al., 2002, Marmorstein, Iacono & Malone, in press). The link between substance misuse and antisocial personality disorder is also complex with conduct disorder as a common precursor for both disorders (Clark, 2004; Glantz & Leshner, 2000; Robins, 1966, 1991), and some researchers suggest that both disorders are part of a wider externalising spectrum of disorders (Kreuger et al., 2002, 2007). Evidence demonstrates a clear association between cannabis misuse and later schizophrenia and psychotic symptoms (Arseneault, Cannon, Witton & Murray, 2004; Moore et al., 2007) but two

recent reviews concluded that schizophrenia and psychosis emerge in individuals who possess an underlying vulnerability (Degenhardt & Hall, 2006; McLaren, Silins, Hutchinson, Mattick & Hall, in press). Further knowledge is needed of how substance misuse in adolescence influences mental health beyond young adulthood.

Alcohol and cannabis misuse in adolescence has not only been associated with later mental health problems but also with poor health in young adulthood (Ellickson et al., 2004; Oesterle et al., 2004). Hingson and colleagues (2000) showed additionally that initiation of alcohol use before age 14 was associated with an increased likelihood of being injured under the influence of alcohol in young adulthood. Winqvist and colleagues (2006) demonstrated that alcohol misuse in adolescence increased the risk of traumatic brain injury up to age 35. Cross-sectional associations have been demonstrated between alcohol misuse and violence-related injuries (Mattila, Parkkari & Rimpelä, 2006; Spirito, Rasile, Vinnick, Jelalian & Arrigan, 1997; Swahn, Simon, Hammig & Guerrero 2004), and between alcohol misuse and other unintentional injuries (Spirito et al., 1997). Further, an association between alcohol misuse in adolescence and mortality 15 and 20 years later has been reported (Andreasson, Allebeck & Romelsjö, 1988; Andreasson, Romelsjö & Allebeck, 1991). This association has also been shown for other drugs with the exception of cannabis (Andreasson & Allebeck, 1990). The longitudinal studies assessing physical health problems of adolescent substance misuse have in general used self-reported ratings of experienced health, while diseases or injuries requiring medical care have been studied less often. Thus, the knowledge of the burden to society of physical illnesses that is imposed by adolescent substance misuse is limited.

An association between alcohol misuse in adolescence and violent and non-violent criminal offending in young adulthood has been reported (Duncan, Alpert, Duncan & Hops, 1997; Ellickson et al., 2003; Wells et al., 2004). Cannabis misuse in adolescence has also been associated with both violent and property crimes in young adulthood (Fergusson et al., 2002), while any illicit drug misuse in adolescence predicted criminal offending into the fourth decade of life (Stenbacka & Stattin, 2007). The nature of the relationship between substance misuse and criminal offending is complex and a further review of this association is provided later in this chapter. The majority of the longitudinal studies have measured the criminal offending following adolescent substance misuse to the mid 20s. Only a handful of studies have addressed the substance misuse-criminality relationship from adolescence through the fourth decade of adult life. Doherty and colleagues (2008) found that serious delinquency in adolescence predicted initiation of drugs through the fourth decade of adult life, while Stenbacka and Stattin (2007) found that substance misuse in adolescence predicted criminal offending in adulthood but did not control for the reverse relationship. Knowledge of how substance misuse influences criminal offending in adulthood and especially after age 20 is just beginning to emerge. In addition, early alcohol misuse has been associated with unemployment in young adulthood (Ellickson et al., 2003), while cannabis misuse in adolescence has been associated with poverty (Ellickson et al., 2004), and job instability and unemployment among females only (Kandel, Davies, Karus & Yamaguchi, 1986). The association of substance misuse in adolescence and later employment and income is partly hidden. Townsend and colleagues (2007) concluded in their review that both cannabis and alcohol misuse in adolescence

contribute to school dropout although this relationship for alcohol misuse was confounded by family variables and deviant peers. Leaving school without qualifications limits the likelihood of finding employment and achieving financial independence (Brook, Adams, Balka & Johnson, 2002) or forces early entry to the labour market. For example, cross-sectional studies have demonstrated that adolescents who are employed have higher rates of substance misuse than those who remain in school (Paschall, Ringwalt & Flewelling, 2002; Valois, Dunham, Jackson & Waller, 1999). While substance misuse in adolescence has been related to unemployment in the mid 20s (Ellickson et al., 2003), and with lower income in the mid 30s (Kandel, Chen & Gill, 1995; Schwenk, 1998), further knowledge is needed of how substance misuse in adolescence influences unemployment and income later in life and when taking account of functioning in other domains.

1.1.2 Studies of adolescents treated for substance misuse

Only a small number of studies have examined long-term outcomes of treatments of adolescents misusing substances (Bukstein & Winters, 2004). However, multisite and multiprogram evaluations, such as the Drug Abuse Treatment Outcome Studies for Adolescents (DATOS-A), the Drug Abuse Reporting Program (DARP) by Sells & Simpson (1979), the Treatment Outcome Prospective Study (TOPS) by Hubbard and colleagues (1985), the Comprehensive Assessment and Treatment Outcome Research (CATOR), and the Services Research Outcome Study (SROS), have followed adolescents treated for substance misuse. DARP and TOPS included mostly adults and a small number of adolescents followed for four to five years after discharge. These two studies and 14 others were reviewed by Catalano et al. (1990/1991) who concluded that post-treatment factors such as work, school, friends, and leisure activities were the most important determinants of outcome. In addition, Hubbard et al. (1985) showed reductions in drug misuse and criminal offending 12 months after discharge in the TOPS study. A number of studies have been published from the DATOS-A evaluation with participants assessed 12 months after treatment. Etheridge and colleagues (2001) compared the match between services and participants' needs in the TOPS and the DATOS-A studies. Rounds-Bryant and associates (1999) examined client characteristics and pre-treatment behaviours in the TOPS and DATOS-A studies. Galaif et al. (2001) focused on risk factors for treatment outcomes. Hser and associates (2001) reported reductions in alcohol misuse and illicit drug misuse and in criminal offending. The study of Farabee and colleagues (2001) found that a reduction in substance misuse was associated with reductions in criminal offending the year after treatment. Hsieh et al. (1998) found in the CATOR study that in the first year after treatment, self-help support groups and after care contributed most to abstinence. Schildhaus and associates (2000) reported no differences in misuse of any illicit drugs or property crimes but an increase in drunk driving in their five year follow-up of the SROS study. Taken together, these studies indicate a decrease in substance misuse after discharge from treatment, but the longer the follow-up period, the higher the risk for relapse. Most of these studies have only followed participants into their early 20s. Thus, little is known of what course their substance misuse takes later in life.

A group of studies that evaluated outcomes of adolescent treatments divided participants by level of substance misuse after discharge. Two studies with a four year

follow-up found that participants with lower levels of substance misuse had better educational attainment and occupational status and lower unemployment than those with higher levels of substance misuse (Brown, D'Amico, McCarthy & Tapert, 2001; Doyle, Delaney & Tobin, 1994), and one study with an eight-year follow-up confirmed higher education among participants with low levels of substance misuse (Chung et al., 2003). Other studies have documented reductions in criminal offending (Friedman, Utada & Glickman, 1986), violent behaviour (Friedman, Schwartz & Utada, 1989), and improvements in psychological functioning (Griffen-Shelley, Sandler & Park-Cameron, 1991; McPeake, Kennedy, Growman & Beaulieu, 1991) 15 to 22 months after discharge from substance misuse treatment. Although these studies suggest a large decrease in substance misuse after discharge from treatment, as well as improvements in other areas of life, the length of the follow-up periods are limited as is the breadth of the measures of outcome. Overall, the studies of outcomes of treatment for substance misuse in adolescence are limited by including only short follow-up periods, usually 12 months after discharge, and measures of outcome are usually defined as relapse or abstinence from substances only (William & Chang, 2000; Winters, 1999).

1.1.3 Gender differences

The extant literature indicates a higher prevalence of substance misuse among males compared to females at all ages (Rehm, Room, van den Brink & Jacobi, 2005; Rehm, Room, van den Brink & Kraus, 2005). However, studies have reported an increase in alcohol misuse among females during the last decades (Zilberman, Tavares & el-Guebaly, 2003). The progression from problematic drinking and drug use to adverse consequences is faster among females than males, a phenomenon usually referred to as the telescoping effect (Greenfield, 2002; Kloos, Weller, Chan & Weller 2009; Zilberman et al., 2003). The aetiological processes leading to substance misuse appear to be more similar than different among females and males (for a recent review, see Nolen-Hoeksema, 2004). Earlier studies have suggested that heritability of substance misuse was higher among males than females (Caldwell & Gottesman, 1991; Jang, Livesley & Vernon, 1997; McGue, Pickens & Svikis, 1992), but studies utilising larger samples have reported similar heritability estimates among females and males (Heath et al., 1997; Prescott, Aggen & Kendler, 1999). Co-morbid depression is more common among females than males who misuse substances, even when the higher prevalence of depression among women is taken into account. However, studies have reported that females develop depression before misusing alcohol while the reverse association is found in males. On the other hand, co-morbid antisocial personality disorder is more common among males than females, as are traits like impulsivity, sensation seeking and behavioural undercontrol, each of which increase the risk for developing substance misuse (For a review, see Nolen-Hoeksema, 2004). Additionally, the risk for alcohol misuse in adolescence is increased in males as compared to females through a lower response to equal quantitities of alcohol, later maturation in brain structures and in executive functions, and more peers using alcohol (Schulte, Ramo & Brown, 2009).

Few studies have addressed gender differences in the consequences of substance misuse, and these studies have focused on physical health. In a meta-analysis of 38 studies of individuals misusing alcohol, females reported more health problems than males (Fillmore et al., 1997). Females misusing alcohol have also been found to be

more vulnerable than males to cognitive impairments, alcohol induced liver disease, breast cancer, and sexually transmitted diseases including HIV (Greenfield, 2002; Lynch, Roth & Caroll, 2002; Nolen-Hoeksema, 2004). Even less is known about gender differences in the adult consequences of substance misuse that begins in adolescence. Patton and colleagues (2002) found that substance misuse in adolescence was associated with an increase in the risk for later depression and anxiety among females, but not males, in their early 20s. Holmberg (1985) reported a higher prevalence of psychotic symptoms and long-term sick leave among females than males in their mid 20s. Kandel et al. (1986) reported that misuse of alcohol or illicit drugs in adolescence was associated with job instability and unemployment in the mid 20s among females, while only illicit drug misuse predicted the same outcomes among males. Among adults, higher unemployment has also been found among females compared to males one year after discharge from treatment (Oggins, Guydish & Delucchi 2001).

Inconsistent findings about gender differences in recovery from adolescent substance misuse have been reported. Some studies have demonstrated that females more often desist from substance misuse than males (Chen & Kandel, 1998; Jackson, O'Neill & Sher, 2006; Walitzer & Dearing, 2006), while other studies failed to detect gender differences (Grant, Stinson & Harford, 2001). In a large treatment outcome study of adults, females showed greater reductions in use after treatment than males (Marsh, Cao & D'Aunno, 2004). Such gender differences in response to treatment have not been reported in studies of adolescents, even in follow-ups of up to five years after discharge (Jainchill, Hawke & Messina, 2005; Stevens, Estrada, Murphy, McKnight & Tims, 2004).

Taken together, females, as compared to males, seem to be more vulnerable to mental health problems in young adulthood following substance misuse in adolescence. In addition, females have more difficulties in the labour market compared to males, while inconsistent findings have been reported concerning abstinence, especially in follow-up studies of adolescents treated for substance misuse. Clearly, further knowledge is needed of how adolescent substance misuse affects females and males in the subsequent decades of adulthood.

1.1.4 Cohort differences

The prevalence of substance misuse has increased in younger birth cohorts compared to older ones (Holdcraft & Iacono, 2002; Nelson, Heath & Kessler, 1998). Initiation of substance use occurs earlier in the younger birth cohorts (Grant, 1997), which puts them at higher risk for substance misuse (Grant, 1997; Grant & Dawson, 1998). The increased prevalence of substance misuse has been especially dramatic among females (Grucza, Bucholz, Rice & Bierut, 2008). Only a few studies have documented differences in the outcomes of substance misuse among different birth cohorts. But the ones that addressed this topic report inconsistent findings. Stoltenberg and colleagues (1999) report more negative correlates among younger birth cohorts while Rosén and Haglund (2006) showed that females and males born in the 1960s and 1970s had the lowest rates of alcohol-related deaths compared to both earlier and later birth cohorts. Wahren and associates (1997) found no difference in the overall death rate 11 years

after treatment between two treatment cohorts 10 years apart. Taken together, little is known about the consequences in adulthood of substance misuse in adolescence among individuals born in different periods. In Sweden this is an important topic since changes in the alcohol policy have occurred since the late 1960s (Rosén & Haglund, 2006), and little is known of how these different policies affect the consequences of misuse that begins in adolescence.

1.2 THE RISK FACTOR APPROACH

The concept of risk factors for maladaptive behaviour is used extensively both in scientific publications as well in prevention work, but few efforts have been made to conceptually define this concept. However, Kazdin and Kraemer together with their colleagues have developed this concept in a series of papers. They divide risks into correlates or variables that are associated with an outcome when the temporal or direction of the association is unknown and limit the term risk factors to variables that precede the outcome. They have identified three types of risk factors: (1) fixed markers are risk factors that cannot be changed or change the outcome (gender, ethnicity and genotype); (2) variable markers are risk factors that can change the outcome but cannot be changed by manipulation (age); and (3) causal risk factors are risk factors that can be changed or manipulated and when doing so also change the outcome (Kazdin, Kraemer, Kessler, Kupfer & Offord, 1997; Kraemer, 2003; Kraemer et al., 1997; Kraemer, Stice, Kazdin, Offord & Kupfer, 2001). Building on the work of Kazdin, Kraemer and colleagues, Murray et al. (2009) divided risks into correlates, risk factors that are correlated with, and precede the outcome, and causal risk factors that can be changed or manipulated and when doing so also change the outcome. Causal risk factors are thereby possible targets for interventions (Kraemer, Lowe & Kupfer, 2005). Two types of data are of interest when assessing risk factors. Retrospective data where time-order can be established by asking people to remember past events (Murray et al., 2009), but the reliability of such information is limited by recall bias (Hardt & Rutter, 2004). The other type of data is prospective data when the risk factor is measured before the outcome, usually in longitudinal studies where people are followed over time. Prospective data from archival records can also be used to predict later events and to draw conclusions about risk factors (Murray et al., 2009). Taken together, in order to study risk factors it is essential that prospective data in a longitudinal design are used and it is important to distinguish between correlates, risk factors, and causal risk factors.

1.2.1 Risk factors for substance misuse

There is a wealth of research on risk factors in a variety of domains for substance misuse. A common approach is to divide the risk factors into four dimensions including individual, relationship (with parents and peers), community, and societal risk (Krug, Mercy, Dahlberg & Zwi, 2002).

1.2.1.1 Genetic influence

Behavioural genetic studies of family, adoption, and twin studies have provided robust evidence of a substantial genetic influence for the development of substance misuse.

Agrawal and Lynskey (2006, 2008) concluded in two recent reviews that heritability estimates range from 20% to 70% for alcohol misuse and from 34% to 78% for cannabis misuse. Environmental factors strongly impact the initiation of the use of substances in adolescence, while the influence of genes becomes stronger for substance misuse in young and middle adulthood (Hopfer, Crowley & Hewitt, 2003; Rhee et al., 2003; Kendler, Schmitt, Aggen & Prescott, 2008). It has been suggested that the genetic vulnerability for substance misuse is expressed by impaired behavioural disinhibition that includes high levels of sensation seeking and impulsivity. But the genetic vulnerability is also expressed by more symptoms of mental disorders and a reduced response to alcohol (For reviews, see Schuckit, 2009; Tessner & Hill, 2009).

Genes interact with the environment to increase the risk for substance misuse. Studies have shown that specific genotypes interact with high levels of stress (Bau, Almeida & Hutz, 2000; Madrid, MacMurray, Lee, Anderson & Comings, 2001), maltreatment and family relations (Kaufman et al., 2007; Nilsson et al., 2007; Rose & Dick, 2005), sexual abuse (Ducci et al., 2007), and negative life events (Blomeyer et al., 2008) to increase the risk for substance misuse. Thus, behavioural genetic studies have established that the genes confer a vulnerability for substance misuse and that the environment plays a critical role in enhancing or suppressing this vulnerability.

Behavioural disinhibition is defined as an inability to constrain impulses so as to behave in socially acceptable manner (Iacono, Malone & McGue, 2008). It is reflected in measures of executive functions and personality features such as sensation seeking and impulsivity (Iacono et al., 2008; Schuckit, 2009; Tessner & Hill, 2009). Impaired behavioural disinhibition has been associated with earlier initiation of alcohol use (McGue, Iacono, Legrand, Malone & Elkins, 2001), and a higher risk for substance misuse (For a review, see Jacob et al., 2001). Behavioral disinhibition also mediates the relationship between parental alcohol misuse and substance misuse among offspring in young adulthood (King & Chassin, 2004). A recent meta-analysis suggests that the magnitude of the influence of sensation seeking on alcohol misuse is small to moderate (Hittner & Swickert, 2006). But high sensation seekers often begin using substances earlier than others (Ball, Carroll & Rounsaville, 1994; Jaffe & Archer, 1987). Impulsive behaviour has been associated with an earlier onset of substance misuse, and impulsive behaviour is common among children of alcoholics (For a review, see Verdejo-Garcia, Lawrence & Clark, 2008). Taken together, there is considerable evidence that behavioural disinhibition plays a role in the development of substance misuse.

1.2.1.2 Mental disorders in childhood

Substance misuse is often co-morbid with other mental disorders (Compton, Thomas, Stinson & Grant, 2007; Hasin, Stinson, Ogburn & Grant, 2007; Kessler, 2004). In childhood and adolescence, substance misuse is primarily associated with conduct disorder, Attention Deficit Hyperactivity Disorder (ADHD), and depression (For a review, see Weinberg & Glantz, 1999). The overlap between alcohol and cannabis misuse and conduct disorder varies between 38% and 65% in community samples, and between 44% and 82% in clinical settings. Few studies conducted on community samples have assessed the co-morbidity of substance misuse and ADHD, but the majority of studies on substance misuse in clinical samples indicate a co-morbidity of

13% to 38%. Among adolescents who misuse substances, the prevalence of depression range from 20% to 32% in community samples and between 15% and 65% in clinical samples (For reviews, see Armstrong & Costello, 2002; Couwenberg et al., 2006). The literature concerning the temporal ordering between mental disorders and substance misuse suggests, that in most cases, the mental disorders precede the substance misuse (Costello, Erkanli, Federman & Angold, 1999), an ordering often found in clinical studies as well (Hodgins et al., 2007). For example, conduct disorder often precedes substance misuse (Bukstein, 2000; Cadoret et al., 1995) and children with conduct disorder often start to misuse substances at an earlier age than other children (Robins & McEvoy, 1990). Thus, conduct disorder is considered as a major risk factor for later misuse of substances (Swadi, 1999; Weinberg & Glantz, 1999). Some studies indicate that depressive symptoms in childhood precede substance misuse in adolescence (King, Iacono & McGue, 2004) while others have not reported this temporal ordering (Patton, Coffey, Carlin, Degenhardt, Lynskey & Hall, 2002). In addition, ADHD often precedes the development of substance misuse in adolescence but this association is weak after taking account of the effect of co-morbid conduct disorder (Lynskey & Fergusson, 1995). However, children and adolescents with both conduct disorder and ADHD have a higher risk for developing substance misuse than adolescents presenting only one of these disorders (Faraone et al., 2000). Four aetiological models have been proposed to explain the co-morbidity between substance misuse and other mental disorders. One, the common factor model, where shared risk factors contribute to both the mental disorders and the substance misuse. Two, the mental disorder causes the substance misuse. Three, substance misuse causes other mental disorders. And four, the bi-directional model, where the presence of either mental disorders or substance misuse increases the likelihood that the other condition will develop (Hawkins, 2009; Mueser, Drake & Wallach, 1998). However, the evidence suggests that mental disorders in childhood, especially conduct disorder, constitute an important risk factor for substance misuse in adolescence.

1.2.1.3 Family characteristics

Several family characteristics are associated with an increased risk for adolescent substance misuse. Substance misuse tends to run in families, with offspring of alcoholics being two to ten times more likely to develop alcoholism compared to the offspring of healthy parents (For reviews, see Johnson & Leff, 1999; Lieberman, 2000). Other mental disorders among parents that have been associated with substance misuse among their offspring in adolescence include antisocial personality disorder (Herndon & Iacono, 2005) and depression (Weissman et al., 2006). Beman (1995) offered three explanations for the relationship between parental misuse and offspring misuse. One, parents model reliance on substances for their children. Two, children learn from their parents that the use of substances is acceptable and that substances may be used as a coping strategy. Three, parental misuse negatively impacts parenting styles and family environments leading to an increased risk of substance misuse among offspring. Not only does substance misuse among parents increase the risk of substance misuse among offspring, other mental disorders among the parents also matter. The transfer of risk from parents to offspring is not only expressed by behavioural disinhibition (King & Chassin, 2004), but also through parenting socialisation processes. It is also important to emphasise that substance misuse among offspring of parents with substance misuse

problems is not the only risk imposed. They also have an increased risk for aggressive behaviour, delinquency, school problems and problems with peers (Chassin, Rogosch & Barrera, 1991; Hill & Muka, 1996). Although, there is evidence that parents' substance misuse negatively impacts their offspring in adolescence, little is known about the effects later in life (Christoffersen & Soothill, 2003).

Evidence of an association between socioeconomic disadvantage of the family and substance misuse in adolescence is not consistent. Hanson and Chen (2007) concluded in their review of socioeconomic status (SES) and health behaviours in adolescence that no clear association could be found between SES of the family and alcohol or marijuana misuse from ages 10 to 21. A similar conclusion was drawn by Wiles and associates (2007) in their review of socioeconomic status in childhood and later alcohol misuse in young adulthood. By contrast, Lemstra and colleagues (2008) found in a meta-analysis that low SES of the family of origin increased the risk for alcohol and marijuana misuse from age 10 to 15, and that the risk was higher in studies conducted in the United States and New Zealand, and lower in studies conducted in Europe. Daniel and his colleagues (2009) demonstrated a weak but consistent association between low SES in childhood and later misuse of cannabis and other drugs. Thus, the evidence of a link between family SES and later substance misuse is contradictory. Some researchers have suggested that family SES has the biggest impact in young adolescence, between ages 10 to 14, as younger teens spend more time with their families, while the influence of peers may limit the effect of family SES in late adolescence (Hanson & Chen, 2007; West & Sweeting, 2004). This could explain the inconsistent findings. Other researchers suggest that the influence from family SES is the same in adolescence as in adulthood (Power, Manor & Matthews, 2003; Starfield, Riley, Witt & Robertson, 2002). Nevertheless, family SES is still important for later substance misuse since indirect effects have been found. Parental SES influence academic achievement negatively (McLoyd, 1998), economic distress among parents negatively affects their parenting style, and low SES may reflect living in poor neighbourhoods characterised by social disorganisation and crime (Stern, Smith & Jang, 1999).

Parenting practises constitute an important predictor for adolescent substance misuse and several parenting characteristics that increase the risk for adolescent substance misuse have been identified. Physical abuse, sexual abuse, and high levels of family conflict increase the risk for substance misuse (Fergusson, Boden & Horwood, 2008; Molnar, Buka & Kessler, 2001). Less severe disturbances in the family such as parent-child conflict, inconsistent parenting, and poor communication have also been shown to increase the risk for substance misuse among adolescents (For reviews, see Marsh & Dale, 2005; Sher, Grekin & Williams, 2005; Swadi, 1999). Parenting is influenced by alcohol misuse among parents (Beman, 1995), but also by the presence of other mental disorders (Burke, 2003), and may interact with SES (McLoyd, 1998). Parenting practices are also an important target for interventions since parenting styles can be changed. Petrie and colleagues (2007) concluded in their review of parenting programmes for substance misuse of children under 18 years of age that parenting programmes can be effective in reducing or preventing substance misuse.

1.2.1.4 Peers and community factors

The influence of peers has been identified as a major risk factor for the initiation of substance use, for the development of substance misuse, and for a faster transition from use to misuse (Chassin, Curran, Hussong & Colder, 1996; Fergusson, Horwood & Lynskey, 1995, Fergusson, Swain-Campbell & Horwood, 2002; Windle, 2000). Peer influence has been proposed to work through two processes. Adolescent substance use may be shaped by peer group influences through social learning and modelling (Deater-Deckard, 2001; Fergusson et al., 2002). Alternatively, adolescents may select peers who have a similar pattern of substance use and/or deviant behaviour. Fergusson and colleagues (1999) suggested that adolescents from disadvantaged or dysfunctional family environments, and those who have a predisposition toward antisocial behaviour, have an increased risk of selecting substance misusing peers. But the selection of peers is also influenced by adolescents' relationship with their parents (Brown, Mounts, Lamborn & Steinberg, 1993), and for adolescents from families who provide them with little security, relationships with peers take on greater importance (Swadi, 1999). Generally, the influence from parents decreases in adolescence while the influence from peers increases. In young adulthood the influence from romantic partners increases (Andrews, Tildesley, Hops & Li, 2002).

Several neighbourhood factors have been associated with the initiation of substance use, such as price and availability of substances (von Sydow, Lieb, Pfister, Höfler & Wittchen, 2002). Other neighbourhood factors such as high unemployment and educational disadvantage have been associated with more misuse of substances (Fergusson, Horwood & Woodward, 2001; Hammer, 1992). Spooner and Hall (2002) argued that disadvantaged environments influence feelings of alienation, hope, and expectations for the future and thereby increase the propensity for using substances. Taken together, peers constitute a major risk factor for substance misuse, but their influence is modified by the adolescent-parent relationship. Neighbourhood factors additionally contribute to substance misuse primarily by social deprivation and the availability of substances.

1.2.1.5 Specific risks

Evidence suggests that specific risk factors are only weakly associated with problem behaviours (McMahon, Grant, Compas, Thurm & Ey, 2003), while the accumulation of risk factors is more strongly associated (Appleyard, Egeland, van Dulmen & Sroufe, 2005; Goodyer, Kolvin & Gatzanis, 1988; Stattin, Romelsjö & Stenbacka, 1997). Further when evaluating specific risk factors, it is important to consider not only the presence but also the severity (Rutter, 2006). Although, evidence suggests that the accumulation of risk is more important than any one factor, examining the severity of specific risks is essential in order to begin to understand the mechanisms leading to adverse outcomes. Thus, it is important to consider both the accumulation of risks but also the severity of the specific risks for outcomes in adulthood.

1.3 THE SUBSTANCE MISUSE – DELINQUENCY NEXUS

The association between substance misuse and criminality is well recognised (Bennett et al., 2008; White & Gorman, 2000), and three types of studies have been undertaken in order to further the understanding of this association. Prospective, longitudinal studies have focused on identifying common risk factors or on demonstrating causal relationships between substance misuse and criminality in childhood and adolescence. Experimental studies have assessed psychopharmacological effects of substances on offending behaviours, primarily alcohol intoxication and aggressive behaviour. Studies of social factors have attempted to identify causal relationships, primarily between drug misuse and criminality.

1.3.1 Developmental studies

Developmental researchers have provided two aetiological models to explain the association between substance misuse and delinquency. The first model proposes that there is a common set of risk factors for both substance misuse and delinquency, while the second model suggests either that substance misuse causes delinquency or vice-versa (White & Gorman, 2000). Common risk factors include both genetic and environmental influences. Slutske and colleagues (1998) demonstrated in an Australian twin study that common genetic risks for conduct disorder and alcohol misuse accounted for 35% of the genetic variance for males and 17% for females in the liability to develop alcohol misuse. They showed in a later study that the majority of the genetic overlap between conduct disorder and alcohol misuse involved genetic influence on behavioural undercontrol (Slutske et al., 2002). Additionally, Jang and associates (2000) demonstrated a strong influence of conduct problems, narcissistic traits and attention-seeking behaviour, on alcohol misuse. Behavioural undercontrol or disinhibition expressed by high novelty seeking, impulsivity, and harm avoidance has been suggested to influence both substance misuse and criminality (Sher & Trull, 2002; Verheul, 2001). Numerous studies have demonstrated family risk factors to be common to both substance misuse and criminality, including parental alcohol misuse, harsh discipline, rejection, and lack of parental nurturance (For reviews, see White, Loeber, Stouthamer-Loeber & Farrington, 1999; White & Gorman, 2000). Taken together, genetic, temperament, and parenting factors have been suggested to be common risk factors for both substance misuse and delinquency. However, knowledge of how these common risk factors influence the association between substance misuse and criminality through adulthood is limited since only a few longitudinal studies that assessed risk factors in childhood or adolescence have followed their participants for so long (Farrington & Pulkkinen, 2009; Schulenberg & Maggs, 2008).

The direction of the association between substance misuse and delinquency has been addressed by other developmental studies with mixed findings (Farrington, 1995; Kandel, Simcha-Fagan & Davies, 1986, Kaplan & Damphousse, 1995; White, Brick & Hansell, 1993, White & Hansell, 1996). In general, early aggressive behaviour contributes to later substance misuse as concluded in two recent reviews (Clark & Winters, 2002; White & Gorman, 2000), and conduct disorder constitutes a significant risk for developing later substance misuse (Clark, 2004; Glantz & Leshner, 2000). Other studies have found the association between substance misuse and criminality to be bi-directional (Mason & Windle, 2002; White et al., 1999). Despite extensive

research on the developmental sequence of the substance misuse and delinquency relationship, few studies have addressed this relationship beyond young adulthood (Doherty et al., 2008). At least three studies have examined the direction of the association between substance misuse and delinquency among adults in the fourth decade of life. Kerner et al. (1997) reported in sample of prison inmates that alcohol misuse and delinquency interacted to create a deviant lifestyle that decreased the opportunity to develop a healthy lifestyle. Doherty and colleagues (2008) found that serious delinquency in adolescence predicted initiation of drug use in middle adulthood. Stenbacka and Stattin (2007) found that substance misuse in adolescence predicted criminal offending in adulthood, although the reverse relationship was not assessed. All three studies included only a limited number of predictors. White and Gorman (2000) suggest that the relationship between substance misuse and criminality can vary at different stages in the life course, and emphasise the importance of distinguishing individuals who engage in substance misuse and delinquency only in adolescence from those who continue to engage in these behaviours through adulthood. While a good deal is known about the latter group (Moffitt & Caspi, 2001; Moffitt et al., 2002), little is known about individuals who misuse substances in adolescence.

1.3.2 Psychopharmacological explanations

Psychopharmacological effects have been studied to explain the relation between intoxication from alcohol and aggressive behaviour. Murdoch and associates (1990) found in a meta-analysis of 26 studies that 62% of offenders who had been convicted for a violent crime had consumed alcohol shortly before committing the crime. Psychopharmacological effects have mainly been addressed in experimental studies and several meta-analyses have demonstrated their impact on aggression (Bushman, 1993, 1996; Bushman & Cooper, 1990; Ito, Miller & Pollock, 1996). A set of mechanisms have been proposed to explain the psychopharmacological effects of alcohol intoxication on aggressive behaviour. Alcohol influences the psychomotor system increasing levels of excitement and reward, which in turn increase behaviours such as sensation seeking, impulsivity, and novelty seeking, which in turn increase the risk of aggressive behaviour. Alcohol reduces feelings of anxiety and fear and impairs cognitive functions with the most pronounced effects on the prefrontal cortex and functions such as planning, inhibition, and active monitoring (For a review, see Hoaken & Stewart, 2003). When these executive functions, are low, the association of alcohol intoxication and aggressive behaviour is high (Giancola, 2000, 2004; Godlaski & Giancola, 2009). Psychopharmacological effects have been shown to explain more of the alcohol-aggression association among adults than among adolescents (White & Gorman, 2000). However, alcohol intoxication does not affect aggressive behaviour in the same way in all individuals. Giancola and colleagues (2002, 2003) propose that alcohol intoxication leads to aggressive behaviour among a sub-group of individuals with a predisposition for aggression. But few studies have addressed how the association between alcohol intoxification and aggression is related to risk factors present in childhood and/or adolescence that are common to both alcohol misuse and aggressive behaviour.

1.3.3 Sociological explanations

Two explanations have dominated the sociological literature concerning the association between substance misuse and criminality. The economic motivation model, mainly derived from the literature on heroin misuse, proposes that misusers support their drug misuse with criminal activities including robbery, theft and prostitution (Goldstein, 1985). This model has gained recent support in a meta-analysis of 30 studies that confirmed associations between substance misuse and shoplifting, burglary, robbery, and prostitution. The association was the strongest for heroin, crack, and cocaine, weaker for amphetamine, and the weakest for cannabis (Bennett et al, 2008). This model is more applicable to drug misuse in adults than among adolescents (Bennet et al., 2008). The systemic model derives from studies of drug-related homicides and suggests that drug misuse and violence are both elements of a deviant lifestyle. Participation in the illegal drug market contributes to a systematic pattern of violence and criminality, such as assault, robbery and murder (Goldstein, 1985, 1998). Committing crimes in order to finance substance misuse is more common among individuals with no criminal history prior to misuse than among those with a history of offending prior to misuse (Nurco, 1998). Further, criticisms have been raised of the systemic model based on evidence that many of the individuals who were involved in the illegal drug market were violent and had committed crimes before becoming involved in using and/or selling drugs (Inciardi & Pottieger, 1991; van Kammen & Loeber, 1994). The latter two findings underline the importance of including earlier risk factors when studying the relationship between substance misuse and criminality in adulthood, but few studies have done this.

1.4 RESILIENCE

Research on resilience began during the 1970s when a group of researchers realised that some children developed well despite having experienced considerable adversity (Anthony, 1974; Garmezy, 1974; Rutter, 1979; Werner & Smith, 1982). Resilience is typically referred to as a dynamic process by which individuals overcome significant adversity or trauma (Luthar & Cicchetti, 2000; Rutter, 1999), but also as recovery from a period of maladaptation or developmental difficulties (Luthar & Brown, 2007; Roisman, 2005). In two reviews, Masten and colleagues have identified four waves of resilience research. The first wave aimed at identifying characteristics of the child, family, and environments associated with resilience. The second wave aimed at studying the interaction between risk and protective factors underlying resilience, an effort that is still under way. The third wave focused on experiments to enhance resilience through prevention or interventions designed to reduce behavioural or emotional problems. The fourth wave included research that targeted resilience processes across multiple levels of functioning and their interplay from environmental factors to genes and brain functioning (Masten, 2007; Masten & Obradović, 2006). Resilience is a two-dimensional construct including exposure to adversity and adaptation (Luthar & Cicchetti, 2000). Adversities typically assessed include parental psychopathology, socioeconomic disadvantage, urban poverty and community violence, negative life events, child maltreatment, and cumulative risks (For a review, see Vanderbild-Adriance & Shaw, 2008a). Broadly, two approaches to measuring adaptation have been employed. The first approach includes competence criteria based

on stage-salient developmental tasks such as functioning at school, attachment to caregivers, and social competence. The second approach includes the absence of negative outcomes such as emotional or behavioural maladjustment, and is especially applied in the fields of substance misuse and psychopathology (Luthar & Cicchetti, 2000; Masten, 2001; Vanderbilt-Adriance & Shaw, 2008a). In general, the research on resilience has used cross-sectional designs (Fergus & Zimmerman, 2005), been conducted on child or adolescent samples (Luthar, Cicchetti & Becker, 2000), addressed only one outcome (Kinard, 1998; Werner, 2000), and measured resilience only once or twice. Consequently, there is little knowledge of resilience defined as adaptation in multiple domains of functioning in adulthood, nor of the stability of resilience over time among individuals exposed to different levels of risk earlier in life (Fergus & Zimmerman, 2005; Werner, 2000).

In the field of developmental psychopathology, there has recently been a growing interest in exploring heterogeneity and within-group variations in resilience (Luthar, Sawyer & Brown, 2006; Masten & Obradović, 2006; Vanderbilt-Adriance & Shaw, 2008a). However, only a few studies of resilience have addressed this issue empirically. Two studies have used cluster analysis to examine social competence in relation to subtypes of resilience (Oades-Sese & Esquivel, 2006; Mendez, Fantuzzo & Cicchetti, 2002), while one study used structural equation modeling (SEM) to derive two latent constructs of resilience (Tiét & Huizinga, 2002). Other studies have used a trajectory framework, for example, two studies used hierarchical linear modeling (HLM) to evaluate the interaction between risk and protective factors for different trajectories of academic competence (Sameroff & Rosenblum, 2006) and problem behaviours (Calkins, Blandon, Williford & Keane, 2007). One study focused on within-group variations in disadvantage and used latent class growth analysis (LCGA) to study how trajectories of neighbourhood disadvantage affected later resilience to antisocial behaviour and social skills (Vanderbilt-Adriance & Shaw, 2008b), while another study used growth modelling to identify trajectories of self-esteem and depressive symptoms that followed maltreatment (Kim & Cicchetti, 2006). These studies have been conducted on child and adolescent samples. To my knowledge, only one study has identified developmental trajectories of competence in an adult population up to age 36, but this study only included a subsample that had been exposed to risks, and consequently it measured normal development of competence (Obradović, Burt & Masten, 2006). Thus, knowledge of developmental trajectories of resilience in adulthood is scarce.

Studies on resilience to substance misuse have been conducted, examining risk contexts such as parental substance misuse (Colder & Chassin, 1999; Werner & Johnson, 2004; Zhou, King & Chassin, 2006), parental psychopathology (For a review, see Mowbray & Oyserman, 2003), negative life events (Wills & Cleary, 1996; Wills, Vaccaro & McNamara, 1992), and parental attitudes (Brody, Ge, Katz & Arias, 2000). These studies have primarily focused on the absence of substance use or low levels of substance misuse as indicators of resilience. It is known that the majority of adolescents who misuse substance desist in adulthood (McCarty et al., 2004; Merline et al., 2004; Rohde et al., 2001; von Sydow et al., 2001; Wells et al., 2006; Wennberg et al., 2002), and the available literature suggests that approximately half of them show no further mental health or psychosocial problems (Ellickson et al., 2003; Ellickson et al., 2004).

This phenomenon has been referred to as “maturing out” (Bennett, McCrady, Johnson & Pandina, 1999) and is thought to be related to the adoption of adult roles (For a review, see O’Malley, 2004/2005). Knowledge of resilience through adulthood following substance misuse in adolescence is limited because studies have followed participants for only short periods of time, focused on a limited number of outcomes, and failed to measure continuity and discontinuity of resilience over time.

1.4.1 Protective factors

Protective factors are not just the opposite or the absence of risk factors (Bynner, 2001; Farrington, 2000; Rutter, 1990). Rather, protective factors modify or moderate the effects of risks (Luthar & Cichetti, 2000; Schoon & Bynner, 2003). Rutter (2000) proposed that risk and protective factors are conceptually distinct and refer to different mechanisms. Protective factors are markers while the term protective mechanism refers to the process by which the factor is protective. Several approaches have been described to understand protective factors and how they operate. Fergus and Zimmerman (2005) suggested three models of protective factors. The first model, the compensatory model, applies to situations in which the protective factor has a main effect on the outcome independently of the risk factor. The second model, the protective model, applies when the protective factor reduces the effect of the risk factor on the outcome. The third model, the challenge model, applies when moderate levels of a risk factor are positively associated with outcome, while both high and low levels of the risk are negatively associated with outcome. Luthar and colleagues (2000) advocate the use of the term “protective” when the protective factor influences both high and low levels of risk, “protective-stabilising” when the influence from the protective factor contributes to stability in outcome regardless of the level of risk, “protective-enhancing” when the influence from the protective factor gets stronger as the risk increases, and “protective but reactive” when the influence of the protective factor weakens as risk increases. During recent decades, a variety of protective factors that contribute to resilience have been identified. As summarised by Masten (2001), the “short list” of protective factors includes cognitive abilities, self-esteem, easy temperament and personality, self-regulation skills, positive outlook on life, parenting quality, close relationships with competent adults, connections to prosocial peers, and good schools (Masten & Powell, 2003; Wright & Masten, 2006). Protective factors have been proposed to be divided into individual, family related, and community factors (Garmezy, 1991; Luthar & Cicchetti, 2000).

1.4.2 Protective factors for substance misuse and delinquency

The two most commonly identified protective factors for adolescent substance misuse and delinquency have been aspects of parenting and academic achievement (Fergus & Zimmerman, 2005; Meschke & Patterson, 2003; Wright & Masten, 2006). Decreased risk for substance misuse in various vulnerable populations has been associated with attachment with a parent (Hawkins, Catalano & Miller, 1992; Stronski, Ireland, Michaud, Narring & Resnick, 2000), parental emotional support and communication (Wills & Clearly, 1996), and academic achievement (Stronski et al., 2000). Other studies have addressed processes including both protective factors and risk factors. Family connectedness or parental support are protective against the effects of emotional distress and other risk behaviours (Fleming, Kim, Harachi & Catalano, 2002; Scheier,

Botvin, Griffin & Diaz, 1999), peer substance misuse (Farell & White, 1998; Kim, Zane & Hong, 2002), parental substance misuse (For a review, see Mowbray & Oyserman, 2003), and neighbourhood effects (Brook, Brook, De La Rosa, Whiteman & Montoya, 1999) on substance misuse. Academic achievement and parental involvement with school are protective against the effects of emotional distress (Fleming et al., 2002), other risk behaviours (Scheier et al., 1999) and peer substance misuse (Costa, Jessor & Turbin, 1999) on substance misuse. These findings demonstrate that parenting and academic achievement do not only protect against misuse of substances, but also against the effects of different risk factors on substance misuse. Similarly, family attachment and family support (Alarid, Burton & Cullen, 2000; Anderson, Holmes & Ostresh, 1999; Canter, 1982) and academic achievement and school bonding (Anderson et al., 1999; Daigle, Cullen & Wright, 2007) have been found to be protective against delinquency. Further, parental monitoring and support protect against the effects that peer delinquency (Griffin, Scheier, Botvin, Diaz & Miller, 1999; Zimmerman, Steinman & Rowe, 1998), poor neighbourhood (Griffin et al., 1999), and accumulative risks (Borowsky, Ireland & Resnick, 2002) constitute for delinquency. Academic achievement protects against the effect that accumulated risks have on delinquency (Borowsky et al., 2002). The literature on protective factors for substance misuse and delinquency consists of almost only cross-sectional studies. The longitudinal studies include only two time points. Fergus & Zimmerman (2005) conclude in their review of studies of resilience that it is necessary to include several time points in order to understand the developmental processes that are associated with resilience to substance misuse and delinquency.

2 AIMS

The goal of this thesis was to examine adverse and resilient outcomes through 30 years of adulthood of individuals who as adolescents had consulted a clinic for substance misuse problems and to identify risk and protective factors present in adolescence that distinguished adult development.

Specific aims:

1. To examine multiple adverse outcomes through adulthood of two cohorts of individuals that were treated for substance misuse in adolescence and to assess the effects of gender and cohort on outcomes.

2. To compare adverse outcomes over 30 years experienced by a clinical sample of individuals who misused substances as adolescents and a randomly selected sample of the general population matched for sex, age, and birthplace.

3. To identify trajectories of resilience through 25 years of adulthood and to identify adolescent characteristics that distinguished the trajectories.

4. To determine the extent to which individual problem behaviours, family risks, and protective factors present in adolescence were associated with resilience to substance misuse and violent and non-violent criminal offending from age 21 to 30 and from age 31 to 45.

3 METHOD

All four papers in the thesis use data from a longitudinal project, the Consequences of Antisocial Behaviour in Adolescence (CASBA), a follow-up study documenting adult outcomes of two cohorts of individuals who were treated for substance misuse as adolescents and two general population samples matched on age, gender, and birth place. Members of Cohort 1 were treated from January 1, 1968 to December 31, 1971, while members of Cohort 2 were treated from January 1, 1980 to December 31, 1984. Participants in both cohorts were followed in national registers until December 31, 2002. Once ethical permission for the study had been granted by the Ethics Committee of the Karolinska Institute, the clinic files were screened to extract the person number (a unique number assigned to each Swedish resident) of every individual who had been seen at the clinic. A request was sent to different agencies responsible for records of death, health care, crime, welfare and disability payments describing the study and requesting collaboration. As each agency agreed to provide information they sent the data to Statistics Sweden. Information on participants in the clinic sample was extracted from the old clinic files and these data were also sent to Statistic Sweden. Statistic Sweden created two comparison samples by randomly selecting a case from the general population matched by gender, month and year of birth, and birth place (in the city or outside, in Sweden or outside) for each individual in the two clinic samples. Once all data were at hand, the data were de-identified, individuals were assigned a study identification number, and the data files were forwarded to the research team.

3.1 PARTICIPANTS

Members of Cohort 1 were treated from 1968 to 1971. This cohort initially included 2088 participants while Cohort 2, who were treated between 1980 and 1984, included 1690 participants. Some individuals were excluded from the analyses: 70 members of Cohort 1 and 78 members of Cohort 2 were excluded as their person numbers could not be traced; 26 members of Cohort 1 and 35 members of Cohort 2 were excluded because their clinic files could not be found; and one member of Cohort 2 was excluded due to an error in the cause of death register. Cohort 1 included 1992 participants (332 females and 1662 males) who as adolescents had consulted a clinic for substance misuse problems, referred to as the clinic sample (CS), and a similar number of individuals randomly selected from the general population matched for sex, birthdate and birthplace (within or outside of Sweden) and referred to as the general population sample (GP). Cohort 2 included 1576 participants (566 females and 1010 males) who as adolescents had consulted a clinic for substance misuse problems.

3.1.1 Participants in study I and II

Study I focused on the clinic samples, that is the individuals who as adolescents had consulted a clinic for substance misuse problems, from both Cohorts 1 and 2. The clinic sample from Cohort 1 included 1992 individuals and the clinic sample from Cohort 2 included 1576 individuals. Study II focused on Cohort 1, and compared the clinic and general population samples, each of which included 1992 participants.

3.1.2 Participants in study III and study IV

Study III included the clinic and general population samples from Cohort 1, and Study IV only the clinic sample from Cohort 1. These studies focused on resilience that was defined as the absence of adverse outcomes, and required complete data for the entire follow-up period. Outcome data in all registers were not available until 1973 and thus, participants who had not reached age 21 by January 1, 1973 when all data were first available, and those who had not reached age 45 or died or left Sweden before the end of the data collection in 2002 were excluded. Study III included 701 participants from the clinic sample and 731 participants from the general population sample. The fewer number in the clinic sample resulted from a higher death rate. Study IV included the 701 participants from the clinic sample.

3.2 MEASURES

Adolescent characteristics and outcomes in adulthood were assessed.

3.2.1 Adolescent characteristics

Information on the clinic sample in adolescence was extracted from the old clinic files. Initially, a pilot study of the old files was conducted to identify variables that could be assessed reliably. A manual was written to guide data extraction and six research assistants were trained to extract information using the manual. Ten percent of the files were rated independently by two research assistants in order to calculate inter-rater reliability. Inter-rater reliability coefficients for categorical variables were calculated with Kappa statistics and intraclass correlations (ICC) were used for continuous variables.

3.2.1.1 Parents' socio-economic status (SES)

SES was defined according to the classification system developed by Statistics Sweden (1982) and was collapsed into blue collar (unskilled workers and skilled workers) and white collar (assistant non-manual employees, intermediate non-manual employees, high-level non-manual employees, and self-employed professionals) workers. Inter-rater reliability for the coding was high as indicated by a Kappa=0.867. SES was used in Study I.

3.2.1.2 Adolescent family risk (AFR)

AFR was defined to include the presence or absence of poverty indexed by state welfare payments to the family (Kappa=0.50), parental alcohol misuse (Kappa=0.85), and parental mood problems (Kappa=0.69). Absence was rated as 0 and presence as 1. A total score was created by summing the value for each of the three risks to provide a variable ranging from 0 to 3. AFR was used in Study IV.

3.2.1.3 Severity of alcohol use

Alcohol use was categorised as: (1) abstainers (never used); (2) experimental use (used once); (3) occasional use (less than once a month or unknown number of times); (4) continual use (one to three times a month); (5) regular use (once a week, or met criteria

for alcohol abuse according to DSM-IV); and (6) heavy use (at least three times a week or met criteria for alcohol dependence according to DSM-IV). Inter-rater reliability was high as indicated by an ICC=0.843. The severity of alcohol use was used in all four papers. In Papers II and IV, the number of categories was reduced.

3.2.1.4 Severity of drug use

Drug use was categorised as: (1) abstainers (never used); (2) experimental use (used only one illicit drug); regular use (used two illicit drugs); (4) problem use (used three illicit drugs or fulfilled criteria for a drug abuse and/or dependence disorder according to DSM-IV criteria); (5) multiple drug/multiple problem use (used four illicit drugs or fulfilled criteria for a drug abuse and/or dependence for two illicit drugs); (6) heavy use (used five illicit drugs, or fulfilled criteria for drug abuse and/or dependence for three or more illicit drugs, or injected heroin, and/or morphine). Inter-rater reliability was high as indicated by an ICC = 0.958. The severity of drug use was used in all four papers. In Paper II and IV, the number of categories was reduced.

3.2.1.5 Types of drugs

Types of drugs were categorised as: cannabis (hashish, marijuana, hashish oil, skunk/niederweed); stimulants (amphetamines, ecstasy, methylphenidate, phenmetraline, cocaine, crack, and khat); opiates (heroin, morphine, opium, codeine, methadone, and subutex); hallucinogens (LSD, mushrooms, mescaline, and PCP/ketamine); benzodiazepines/barbiturates (barbiturates, rohypnol, and valium/stesolid); inhalants; and other illicit drugs (all substances classified as illicit drugs and not listed above). Inter-rater reliability for the coding of drug types exceeded Kappas of 0.9, except for benzodiazepines/barbiturates 0.8 and other illicit drugs 0.7. Types of drugs was used in Paper I and II.

3.2.1.6 Severity of delinquency

Delinquency included official documents of crimes committed from age 15 to 20 and was categorised as: (1) no criminal convictions; (2) minor offending (one act of vandalism or one shoplifting); (3) non-violent offending (one substance-related crime or one non-violent crime but not vandalism or shoplifting); (4) frequent offending (two substance-related crimes, non-violent crimes, or acts of vandalism or shoplifting); (5) serious offending (three substance-related crimes, non-violent crimes, acts of vandalism or shoplifting, or one violent crime); (6) serious and violent offending (four or more substance-related crimes, non-violent crimes, acts of vandalism or shoplifting, or at least two or more violent crimes). Inter-rater reliability was high ICC=0.922. The severity of delinquency was used in all four papers. In Paper II and IV, the number of categories was reduced.

3.2.1.7 Depression/Anxiety

Depression/Anxiety was defined as present (1) or absent (0) based on notes in the clinical files. Inter-rater reliability reached Kappa=0.73. Depression/anxiety was used in Paper III and IV.

3.2.1.8 Adolescent problem behaviours (APB)

APB was defined as the absence (0) or presence (1) of the two worse categories of alcohol use and delinquency, the three worse categories of drug use, and depression/anxiety. The composite score was created by summing the value for each of the four risks to provide a variable ranging from 0 to 4. APB was used in Paper IV.

3.2.1.9 Relationship with parents

Relationship with parents was categorised as: (1) bad (physical abuse); (2) poor (conflicts); (3) neutral; (4) good (communicative). Inter-rater reliability for coding this variable reached Kappa=0.74. Relationship with parents was used in Paper IV.

3.2.1.10 Academic achievement

Academic achievement was categorised as: (1) poor (poor grades and/or school problems); (2) neutral (average grades, or good grades and school problems, or unknown grades); (3) good (high grades). Inter-rater reliability reached Kappa=0.60). Academic achievement was used in Paper IV.

3.2.1.11 Adolescent protective factors (APF)

APF was a composite score defined as the absence (0) or presence (1) of good relationships with parents and good academic achievement. In order to assess the protective effect and not the risk influence, we dichotomised protective factors as has been done elsewhere (Stouthamer-Loeber, Wei, Loeber & Masten, 2004) into bad/neutral versus good. The ratings for the two protective factors were summed to provide values for APF ranging from 0 to 2. APF was used in Paper IV.

3.2.1.12 Treatment characteristics

Treatment received at the clinic was categorised as: (1) none; (2) detoxification only; (3) out-patient treatment only; and (4) in-patient treatment. Inter-rater reliability reached Kappa=0.64. Treatment duration was assessed in number of months (ICC=0.77). Treatment characteristics were used in Papers II, III, and IV.

3.2.2 Adult outcomes

Adult outcomes were documented until December 31, 2002 through the use of multiple national registers.

3.2.2.1 Death

Information on the date of death was extracted from the register maintained by the Swedish National Board of Health and Welfare since 1961. Death was used in Paper I and II.

3.2.2.2 Physical illness

Physical illness was defined as having been admitted to a hospital for a physical disease that previous research had related to substance use (Cook & Clark, 2005; Room, Babor & Rehm, 2005; Single, Rehm, Robson & Truong, 2000), and/or having received a disability pension due to a physical illness related to substance use. Physical illness

included sexually transmitted diseases, neoplasms, cardiovascular diseases, digestive diseases, unintentional injuries, and intentional injuries, and was defined as in the Global Burden of Disease Study (Mathers, Lopez & Murray, 2006) with the addition of HIV/AIDS, Hepatitis B, and Hepatitis C. Information about physical illness was extracted from the Swedish hospital discharge register maintained by the Swedish National Board of Health and Welfare. From 1969 to 1971, this register contained information about all hospital admissions in the county excluding the municipality where the clinic was situated. From 1972 to 1986 this register covered admissions to all hospital in the county and the municipality where the clinic where situated, and from 1987 to 2002 the register covered all admissions to any hospitals in Sweden. For further information about the definition of physical illness, see Appendix 1. Physical illness was used in all four papers.

3.2.2.3 Mental illness

Mental illness was defined as having received in-patient treatment at a psychiatric ward with a diagnosis for a mental disorder, and/or having received a disability pension due to a mental disorder. Mental disorders leading to hospitalisations included schizophrenia, schizotypal and delusional disorders, mood disorders, neurotic, stress-related and somatoform disorders, eating disorders, and personality disorders, and were extracted from the Swedish hospital discharge register. Information on disability pensions due to a mental disorder was obtained from the National Insurance Board. For further information about the definitions of mental illness, see Appendix 1. Mental illness was used in all four papers.

3.2.2.4 Substance misuse

Substance misuse was defined as having received in-patient treatment in a hospital due to a substance use disorder, and/or with a substance-induced condition, for example, alcoholic myopathy or alcoholic liver disease, and/or having been convicted for a substance-related crime. Information about substance use disorders and substance-induced conditions were extracted from the Swedish hospital discharge register while substance-related crimes were extracted from Lagfördaregistret maintained by Statistics Sweden since 1973. More detailed information about the definition of substance misuse is provided in Appendix 1. Substance misuse was used in all four papers.

3.2.2.5 Violent crime

Violent crime was defined as conviction for attempted or completed homicide or manslaughter, criminal negligence causing death, assault resulting in death, assault and aggravated manslaughter, criminal negligence causing death, assault resulting in death, assault and aggravated assault, assault on official, arson and aggravated arson, robbery and aggravated robbery, kidnapping, stalking, harassment, unlawful threats, rape and aggravated rape, sexual assault, sexual molestation, sexual abuse of minors, incest, procuring and child pornography crimes. Information about violent crime was extracted from Lagfördaregistret. Violent crime was used in all four papers.

3.2.2.6 Non-violent crime

Non-violent crime was defined as conviction for all offences in the criminal code other than violent. Information about non-violent crime was extracted from Lagfördaregistret. In Papers I and II, substance-related crimes were included as an index of substance misuse and in non-violent crime. In Paper III and IV substance-related crimes were excluded from non-violent crime. Non violent crime was used in all four papers.

3.2.2.7 Poverty

Poverty was defined as having received social welfare payments due to low income. This information was available from 1990 onwards from Statistic Sweden. Poverty was used in Paper I and II.

3.2.2.8 Resilience

Resilience was defined as the absence of adverse outcomes. Two constructs of resilience were used. Degrees of resilience were defined as the sum of the number of adverse outcomes within each domain. This construct was used in Paper III. The second construct of resilience consisted of a binary measure within each domain of the presence or absence of resilience. Binary measures of resilience to substance misuse, violent crimes, and non-violent crimes were created. These binary measures were used in Paper IV.

3.3 STATISTICAL ANALYSES

In Paper I, gender differences and cohort differences in adverse outcomes were analysed using *chi-square* tests with *Yates's corrected chi-square,* with the exception of variables with less than five observations in one cell that were compared using *Fisher's Exact test*. Trends in the prevalence of each outcome over time were analysed using *Poisson regression* models.

In Paper II, differences between the clinical sample and the general population sample in the prevalence of each adverse outcome were assessed using generalised linear models with log link function and assuming binomial outcomes. This procedure is similar to the *logistic regression model* but assesses differences between groups in risk instead of odds and thus yielded estimates of relative risk (RR). Trends in prevalence for each outcome over time were analysed using *Poisson regression* models.

In Paper III, developmental trajectories of resilience were identified using *growth mixture modelling* (GMM). GMM differs from traditional growth curve analysis in that it introduces categorical latent variables that constitute subgroups following their own unique trajectories and has been widely applied in developmental research. Conventional model fit tests were used to evaluate classification quality. Since the distributions of the degrees of resilience were highly skewed at each five year age period, unconditional models with Poisson distribution and *zero-inflated Poisson regression models* were assessed. Post-hoc comparisons with *Scheffé's test* were used

to compare trajectory groups and *multinomial logistic regression analysis* was used to assess adolescent predictors of trajectory classification.

In Paper IV, profiles of adolescent risk and protective factors were compared among participants achieving resilience in different domains using *chi-square tests* for binary variables and *ANOVA* for count variables. *Path analysis* was used to test hypothesised relationships between risk factors, protective factors, and resilience within three developmental periods (adolescence, age 21 to 30, and age 31 to 45) and across developmental periods. One hypothesised and one improved final model were identified using conventional tests for evaluating model fit for resilience in each domain. Unstandardised path coefficients (regression coefficients) were provided since the majority of predictors were binary.

4 AIMS AND RESULTS OF EACH PAPER

This chapter presents the aims and results of each paper.

4.1 STUDY I

Long-term outcomes of adolescents treated for substance misuse.

4.1.1 Aims

The aims of Study I were to: examine multiple adverse outcomes, including death, physical illnesses related to substance misuse, mental illness, substance misuse, criminality, and poverty, of adolescent substance misuse from age 21 to 50; compare adverse outcomes among females and males; examine the extent to which gender differences in adverse outcomes remained after taking account of the severity of adolescent substance misuse and delinquency; and examine cohort differences in adverse adult outcomes of adolescent substance misuse among an older cohort that consulted the clinic between 1968 and 1971 and a younger cohort that consulted the clinic between 1980 and 1984.

4.1.2 Results

4.1.2.1 Prevalence of separate and accumulative number of adverse outcomes

Approximately 11% of the females and 15% of the males died before age 50. Over 60% of the females and nearly half of the males had experienced a serious physical illness related to substance misuse, while rates of serious mental illness were lower, with 23% of the females and 17% of the males having been hospitalised in psychiatry. Approximately 35% of the females and 43% of the males continued to present substance misuse in adulthood, and 43% of the females and 62% of the males had been convicted for at least one criminal offence. Not surprisingly given these outcomes, approximately 48% of the women and 34% of the males had received welfare payments due to poverty. The prevalence of serious physical illness and poverty were higher among females than males, while more males than females had been convicted for a criminal offence. Further, approximately 20% of the females and males experienced no adverse outcomes, one-quarter experienced only one adverse outcome, and over half of both females and males experienced two or more adverse outcomes. No significant differences between females and males were detected in the total number of adverse outcomes.

4.1.2.2 Factors associated with outcomes

A set of logistic regression models revealed that being a female, as compared to being a male, increased the odds for physical illness and poverty but decreased the odds for substance misuse and criminality. Having parents with low SES increased the odds for death. The severity of alcohol use in adolescence was associated with increased odds for death, physical illness, and substance misuse. The severity of illicit drug use in adolescence was associated with increased odds for all six adult outcomes. The severity of adolescent delinquency was associated with increased odds for all outcomes except

mental illness. Only one interaction was found, being a female who had severe alcohol use in adolescence increased the odds for poverty.

4.1.2.3 Comparisons of outcomes of the clinical samples in Cohorts 1 and 2

The prevalence of five adult outcomes (not poverty) from age 21 to 35 in an older cohort treated between 1968 and 1971 and a younger cohort treated between 1980 and 1984 was compared. Among females in the two cohorts, no significant differences in the prevalence of the five adult outcomes were found. Among males, significant differences emerged for the prevalence of substance misuse and criminality, both of which were higher in the younger cohort than in the older cohort.

4.2 STUDY II

Multiple adverse outcomes over 30 years following substance misuse treatment.

4.2.1 Aim

The aim of Study II was to compare the prevalence of six adverse outcomes over 30 years among the clinic sample who had consulted a clinic for substance misuse problems when they were adolescents and a sample randomly selected from the general population matched for sex, age and place of birth. Adverse outcomes included death, hospitalisation for physical illness related to substance misuse, hospitalisation for mental illness, substance misuse, criminality and poverty.

4.2.2 Results

4.2.2.1 Adverse outcomes in the clinic sample compared to the general population sample

Differences between the clinic sample and the general population sample were assessed with risk ratios. Over the three decades, the risks for all six adverse outcomes were elevated among both females and males in the clinic sample, as compared to the general population sample. The differences between females in the clinic sample and females in the general population sample were larger for death, substance misuse, and criminality than the corresponding difference between males in the clinic sample versus males in the general population sample. The elevated prevalence of adverse outcomes in the clinic sample for females and males, compared to the general population sample, remained significant after taking account of concurrent substance misuse, hospitalisation for mental illness, substance misuse co-morbid with hospitalisation for mental illness, and poverty. The only exception was the likelihood for death which was no longer increased in the clinic sample as compared to the general population sample after adjustment for concurrent poverty.

4.2.2.2 The number and co-occurrence of adverse outcomes

Among females, 19.4% of the clinic sample and 53.9% of the general population sample experienced none of the adverse outcomes, while among males this was true for 20.7% of the clinic sample and for 45.7% of the general population sample. Among females and males in the clinic sample, 39.8% experienced three or more adverse

outcomes, while this was true for only 3.4% of the females and 9.8% of the males in the general population sample. Both females and males in the clinic sample experienced a significantly higher number of adverse outcomes in adulthood compared to females and males in the general population sample. The prevalence of only substance misuse and only mental illness was similar in the clinic and general population samples among both females and males. By contrast, 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 females and males in the clinic than in the general population sample.

4.3 STUDY III

Trajectories of resilience over 25 years of individuals who as adolescents consulted for substance misuse and a matched comparison group.

4.3.1 Aims

The aims of Study III were to: identify developmental trajectories of resilience from age 21 to 45 among a sample of individuals who as adolescents had consulted a clinic for substance misuse problems and among a general population sample matched for age, sex and birthplace; examine continuity and discontinuity of resilience over time; and examine the characteristics in adolescence of the resilience trajectory groups.

4.3.2 Results

4.3.2.1 Trajectories of resilience

Fifty two point four percent of the general population sample escaped all adverse outcomes through 25 years of adulthood demonstrating high resilience. Among the other participants within the general population sample, growth mixture modelling identified a single trajectory that almost achieved perfect resilience and that remained stable over time. This good-resilience trajectory included 47.6% of the participants in the general population. Among the clinic sample, in addition to the high resilience trajectory followed by 24.4% of the participants, growth mixture modelling identified four trajectories of resilience. The moderate-to-high resilience trajectory, followed by 33% of the participants, initially displayed moderate resilience that increased to high over time. The high-to-moderate resilience trajectory, followed by 24.5% of the participants, initially displayed high levels of resilience that decreased to moderate levels over time. The low-to-moderate resilience trajectory, followed by 9.3% of the participants, initially displayed low levels of resilience that increased to moderate levels over time. Finally, the low resilience trajectory, followed by 8.8% of the participants, displayed low levels of resilience during the 25 years of adulthood.

4.3.2.2 Degrees of resilience over time and domains of resilience

The four trajectories (excluding the high resilience trajectory) identified in the clinic sample were compared to the good-resilience trajectory group identified in the general population sample. The clinic sample moderate-to-high resilience trajectory continued to engage in substance misuse and non-violent offending until age 25, when resilience

was achieved. By contrast, the clinic sample high-to-moderate resilience trajectory achieved resilience in all domains from age 21 to 35 and then relapsed into persistent substance misuse and after age 40 hospitalisations for physical illnesses related to substance misuse. The clinic sample low-to-moderate resilience trajectory failed to achieve resilience in any domain up to age 35, but from age 36 to 40, resilience in the domains of physical health and non-violent offending emerged, and from age 41 to 45 resilience was achieved in all domains except for violent criminality. The clinic sample low resilience trajectory did not achieve resilience in any domain at any age period, except for mental illness from age 26 to 30 and physical illness from age 31 to 35.

4.3.2.3 Adolescent characteristics of the trajectory groups in the clinic sample

Multinomial regression analyses were used to estimate the associations between characteristics present in adolescence and trajectory group memberships among the clinic sample with the high resilience trajectory as the comparator. Neither gender, birth in or outside of Sweden, or treatment intensity was associated with trajectory group membership. The severity of alcohol use in adolescence increased the odds of membership in the moderate-to-high resilience group and of membership in the low resilience group. The severity of illicit drug use in adolescence increased the odds of membership in the moderate-to-high resilience group, the high-to-moderate resilience group, the low-to-moderate resilience group, and the low resilience group. The severity of delinquency in adolescence increased the odds of membership in the moderate-to-high resilience group, the low-to-moderate resilience group, and the low resilience group. The presence of depression/anxiety in adolescence increased the odds of membership in the high-to-moderate resilience group only. A shorter treatment duration in adolescence was associated with membership in the moderate-to-high resilience group.

4.4 STUDY IV

Adolescent risk and protective factors associated with resilience to substance misuse and criminality from age 21 to 45.

4.4.1 Aims

The aims of Paper IV were to elucidate the development of resilience among individuals who as adolescents had sought treatment for substance misuse by determining the extent to which risk and protective factors present in adolescence would be associated with resilience from age 21 to 30 and from age 31 to 45. Resilience was defined as a healthy lifestyle, as indicated by the absence of substance misuse, and the presence of law abiding behaviour among individuals who had been exposed to risk, that is substance misuse, in adolescence.

4.4.2 Results

Four models of resilience were evaluated using Path analysis. The first model included only resilience to substance misuse in adulthood. The second model included resilience to substance misuse and/or violent offending in adulthood. The third model included resilience to substance misuse and/or non-violent offending in adulthood. The fourth

model included resilience to substance misuse, violent offending, and non-violent offending in adulthood. But first, participants were divided into four groups based on the domains of resilience that they achieved – to both substance misuse and criminality, only to substance misuse, only to criminality, or no resilience – achieved from age 21 to 30 and from age 31 to 45. These four groups were compared with respect to family risks, problem behaviours, and protective factors present in adolescence and to treatment characteristics.

4.4.2.1 Resilience

Overall, 48.2% of the participants (44.9% males, 58.7% females) achieved resilience to both substance misuse and criminal offending from age 21 to 30, and 60.5% (57.9% males, 68.9% females) from age 31 to 45. Another 22.8% (25.3% males, 15.0% females) achieved resilience to substance misuse but not criminal offending from age 21 to 30, and 13.1% (14.6% males, 8.4% females) from age 31 to 45. Another 5.3% (4.1% males, 9.0% females) achieved resilience to offending but not substance misuse from age 21 to 30, and 5.0% (5.1% males and 4.8% females) from age 31 to 45. Finally, 23.7% (25.7% males, 17.4% females) did not develop resilience from age 21 to 30, and almost as many, 21.4% (22.5% males, 18.0% females) failed to achieve resilience from age 31 to 45. Generally, univariate comparisons suggested that the greater the degree of resilience shown through adulthood, the fewer the number of family risks and problem behaviours and the greater the number of protective factors present in adolescence. The number of domains in which resilience was achieved in adulthood was inversely associated with the intensity and duration of treatment for substance misuse in adolescence.

4.4.2.2 Resilience to substance misuse

The first model included only resilience to substance misuse in adulthood. Adolescent family risks were associated with a reduction in resilience to substance misuse from age 31 to 45 and indirectly with a reduction in resilience to substance misuse from age 21-30. Adolescent problem behaviours were associated with reduced resilience to substance misuse from age 21 to 30 and from age 31-45. Adolescent protective factors enhanced resilience to substance misuse from age 21 to 30 and also indirectly enhanced resilience to substance misuse from age 31 to 45 through the earlier resilience. Protective factors present in adolescence also reduced the negative association between adolescent problem behaviours and resilience to substance misuse from age 21 to 30. Female gender was protective against substance misuse from age 31 to 45.

4.4.2.3 Resilience to substance misuse and/or violent behaviour in adulthood

The second model included resilience to substance misuse and/or violent offending in adulthood. Resilience to substance misuse from age 31 to 45 was not directly associated with any adolescent factors. But adolescent problem behaviours reduced resilience to substance misuse from age 21 to 30. Similarly, resilience to violent offending from age 31 to 45 was reduced by adolescent problem behaviours and resilience to violent offending from age 21 to 30 was reduced by family risks present in adolescence and by concurrent substance misuse. Protective factors present in adolescence enhanced resilience to substance misuse at age 21 to 30, indirectly enhanced resilience to substance misuse from age 31 to 45, and resilience to violent offending from age 21 to 30 through the resilience to substance misuse at age 21-30. Adolescent protective factors also reduced the negative association between adolescent problem behaviours and resilience to substance misuse from age 21 to 30. Homotypic (when one behaviour

is associated with earlier occurrence of the same behaviour), but not heterotypic (when one behaviour is associated with earlier occurrence of another behaviour) continuity was observed for both resilience to substance misuse and to violent offending from age 21 to 30 and from age 31 to 45. In the age period 31 to 45, resilience to violent offending was strongly associated with resilience to substance misuse, while in the age period 21 to 30, the reverse association was observed. Female gender enhanced resilience to violent offending from age 21 to 30 and from age 31 to 45.

4.4.2.4 Resilience to substance misuse and/or non-violent behaviour in adulthood

The third model included resilience to substance misuse and/or non-violent offending in adulthood. Problem behaviours present in adolescence reduced resilience to substance misuse from age 21 to 30 and 31 to 45, and contributed indirectly to the association between adolescent family risks and resilience to substance misuse from age 21 to 30. Family risks present in adolescence and concurrent substance misuse reduced resilience to non-violent offending from age 21 to 30. Adolescent protective factors enhanced resilience to substance misuse from age 21 to 30, and indirectly enhanced resilience to misuse from age 31 to 45 and resilience to non-violent offending from age 21 to 30 via an effect on resilience to substance misuse from age 21 to 30. Resilience to substance misuse from age 31 to 45 was associated with similar resilience in the earlier period, but also with resilience to non-violent offending in the earlier period. Female gender enhanced resilience to non-violent offending from age 21 to 30.

4.4.2.5 Resilience to substance misuse, non-violent and violent offending in adulthood

Family risks present in adolescence reduced resilience from age 21 to 30. Adolescent problem behaviours reduced resilience from age 21 to 30 and were also associated indirectly via an effect from adolescent family risks. Protective factors present in adolescence enhanced resilience from age 31 to 45 and also had an indirect association by reducing the influence of adolescent problem behaviours. Resilience from age 21 to 30 contributed to resilience at age 31 to 45. Female gender enhanced resilience from age 21 to 30.

5 DISCUSSION

The goal of this thesis was to examine adverse and resilient outcomes in adulthood of individuals who as adolescents sought professional help for substance misuse and to identify risk and protective factors associated with distinct trajectories through adulthood. Papers I and II focused on adverse outcomes experienced from ages 21 to 50. Paper I described the adverse outcomes experienced by individuals who as adolescents had consulted a clinic for substance misuse problems and examined the effects of adolescent risk factors, gender, and cohort on these outcomes. Paper II compared adverse outcomes experienced by individuals who as adolescents had consulted a clinic for substance misuse problems and a general population sample matched for sex, age, and birthplace. Papers III and IV focused on resiliency in adulthood. Paper III used growth mixture modelling to identify trajectories of resilience, comparing the clinic sample and the general population sample from age 21 to 45. Paper IV examined the association of adolescent risk and protective factors to substance misuse, violent and non-violent criminality through adulthood. This final chapter begins with a discussion of the main findings of the research reported in this thesis, followed by a presentation of the strengths and limitations of the four studies, and concludes with a brief section on the scientific and clinical implications of the findings.

5.1 MAIN FINDINGS

The research presented in this thesis generated eight main findings. One, adverse outcomes defined as death, hospitalisation for physical illnesses related to substance misuse, hospitalisation for mental illness, substance misuse, criminality, and poverty, during 30 years of adulthood were common among individuals who as adolescents had consulted a clinic for substance misuse problems. Two, not only did these individuals experience high levels of adversity in each outcome domain, they also experienced adversity in multiple domains of adult functioning. Three, among the individuals who as adolescents had engaged in substance misuse distinct developmental trajectories of resilience over 25 years of adulthood were identified. Four, factors operating in adolescence were associated with outcomes throughout three decades of adulthood. Five, substance misuse in adulthood appeared to drive criminal offending. Six, treatment received at the clinic in adolescence was not associated with resilience in adulthood. Seven, few differences in adverse outcomes were detected among a cohort who had consulted a clinic for substance misuse problems from 1968 to 1971 and a cohort who had consulted from 1980 to 1984. Eight, while gender differences in the risk of adverse outcomes were observed and gender independently predicted the adverse adult outcomes, no gender differences were observed in trajectories of resilience through adulthood, few gender differences were observed in the great majority of associations of risk and protective factors with outcomes. Female gender was found to be protective against criminal offending primarily.

5.1.1 The prevalence of adverse outcomes

Individuals who as adolescents consulted a clinic for substance misuse problems demonstrated high levels of all six adverse outcomes (death, hospitalisation for physical illnesses related to substance misuse, hospitalisation for mental illness, substance misuse, criminality, and poverty) throughout three decades in adulthood as shown in Paper I. Among the females by age 50, 11% had died, 60% had experienced a serious physical illness related to substance misuse, 23% had experienced mental health problems requiring hospitalisation, 35% continued to present substance misuse problems, 43% had been convicted of at least one criminal offence, and 48% had received social welfare payments. The proportions of the males who experienced adverse outcomes by age 50 were equally high, 15% were dead, 48% experienced serious physical illnesses related to substance misuse and 18% demonstrated mental illness, 43% continued to present substance misuse problems, 62% had been convicted for a crime, and one-third received social welfare payments. The elevated rates of adverse outcomes experienced through adulthood by individuals who as adolescents had consulted a clinic for substance misuse were confirmed in Paper II, in which the relative risk of each adverse outcome was established for the clinic sample as compared to a general population sample matched for sex, age, and birthplace. The elevated risk of each adverse outcome was observed in six five-year age periods from age 21 to 50.

This was the first study to examine multiple outcomes of adolescent substance misuse over 30 years, and to compare the risks of these adverse outcomes among individuals who as adolescents had sought help for substance misuse and a general population sample. The findings concur with previous results showing that among individuals who abused substances in adolescence, substance misuse and elevated rates of criminality, mental and physical health problems often persist into the first decade of adult life. The results extend previous findings by showing elevated rates of death, substance misuse, physical and mental illnesses, criminality, and poverty beyond young adulthood to age 50.

5.1.2 The numbers of adverse outcomes

Individuals who as adolescents had misused substances were not only more likely than a general population sample to experience each adverse outcome throughout three decades of adulthood, but additionally they experienced a greater number of adverse outcomes. Results showed that among women, 19.4% of the clinic sample and 53.9% of the general population sample experienced none of the adverse outcomes, while among the males this was true for 20.7% of the clinic sample and 45.7% of the general population sample. Among the females and males in the clinic sample, 39.8% experienced three or more adverse outcomes, while this was true for only 3.4% of the females and 9.8% of the males in the general population sample.

Generally, the clinic sample presented co-morbid problems while the general population sample experienced single adverse outcomes. Notably, the proportions of participants in the clinic and general population samples experiencing only substance misuse or hospitalisation for mental illness in adulthood did not differ. Differences appeared in the prevalence of various co-morbid combinations of substance misuse, criminality, mental and physical health problems. These findings are in line with results

of studies showing that adolescents who misuse substances present elevated risks for multiple adverse outcomes during the first decade of adult life (Ellickson et al., 2004; Ellickson et al., 2003; Wells et al., 2004). Importantly, these findings extend previous findings by showing that these co-morbid adverse outcomes persisted beyond young adulthood up to age 50. The greater number of adverse outcomes observed in the clinic sample compared to the general population sample showed that adolescents who misused substances began their adult lives with multiple problems that persisted throughout adulthood. In addition, these results demonstrated that while the majority of adolescents with substance misuse did not continue their substance misuse in adulthood as had been previously demonstrated for shorter follow-up periods (Chen & Kandel, 1995; Sher & Gotham, 1999), many of them experienced other adverse outcomes as adults. Thus, these findings extend previous knowledge by showing that although substance misuse and mental health problems in adulthood are predicted by substance misuse in adolescence (Macleod et al., 2004; McCarty et al., 2004), the proportions of the clinic and general population sample who experienced either substance misuse or hospitalisation for mental illness only were similar, while various combinations of substance misuse, mental illness, physical illness, and criminality were significantly more prevalent among the clinic sample than among the general population sample.

Importantly, the elevated rates of death, physical illness, mental illness, criminality and poverty presented by the clinic sample were not explained by substance misuse in adulthood. As demonstrated in Paper II, the elevations in risk of the adverse outcomes could not be explained by concurrent adversity. Rather, the results seemed to suggest that factors operating earlier in life were driving the negative life trajectories and limiting movement from a pathway of maladjustment to one characterised by health and positive social functioning.

5.1.3 Developmental trajectories of resilience

Paper I demonstrated high prevalence of all adverse outcomes in adulthood among individuals who as adolescents had misused substances, and Paper II extended these findings by showing elevated rates not only for each outcome, but also a greater number of adverse outcomes compared to a general population sample. These results indicated that in order to further the understanding of adaptation and resilience it was important to examine functioning within multiple domains and also across domains during adulthood. Based on measures of functioning within and across specific domains, five distinctive trajectories of resilience over 25 years were identified in Paper III among individuals who as adolescents had sought professional help for substance misuse problems. Approximately one-quarter of these individuals displayed high resilience, escaping all adverse outcomes throughout the entire follow-up period. Members of this trajectory group fit the description of adolescents who experimented with alcohol and/or illicit drugs for a short time (Bushway, Piquero, Broidy, Cauffman & Mozerolle, 2001; Casswell, Pledger & Hooper, 2003; Chen & Kandel, 1995; Farrington, 1995). One-third of the clinic sample followed a trajectory with continued substance misuse and non-violent offending to age 25 and resilience thereafter. This trajectory concurs with previous findings that delinquency and substance misuse often desists in the early 20s (Farrington, 2002; Rohde et al., 2001; Stouthamer-Loeber et al., 2004; von Sydow et al., 2001). One-quarter of the clinic sample followed a trajectory

that displayed resilience to age 35 and then re-engaged in substance misuse followed by physical illness at age 40. Resilience followed by relapse has been previously described among individuals displaying antisocial behaviour (Farrington, Gallagher, Morley, Ledger & West, 1988), but future studies are needed to confirm whether resilience was truly established and the reasons for the relapse that occurred after 15 years of resilience. Approximately one-fifth of the clinic sample never displayed resilience and showed similarities with a repeatedly identified group of individuals who display persistent conduct problems through childhood and adolescence and serious criminal offending in adulthood (Odgers et al., 2008; Moffitt et al., 2002; Kratzer & Hodgins, 1999), as well as physical and mental health problems and low psychosocial functioning (Odgers et al., 2008; Moffitt et al., 2002; Odgers et al., 2007). Up to age 25, these findings are similar to those from one of the two previous studies that used latent growth models to identify outcomes among individuals who as adolescents received treatment for substance misuse (Chung, Martin & Clark, 2008; Chung et al., 2003). These results extend the developmental trajectory approach by including a broader array of outcomes and by following participants up to age 45.

The trajectories through adulthood identified in Paper III in the clinic sample also showed that resilience was dynamic and that levels of resilience changed over the life course. Previously, little evidence had been available to test hypotheses concerning the stability of resilience (Kinard, 1998; Luthar et al., 2000). Only half of the clinic sample who displayed resilience in their early 20s continued to exhibit resilience through the subsequent decades. Surprisingly, given differences in samples, measures, and contexts, similar rates of continuity in resilience have been found with respect to the childhood period (Cicchetti & Rogosch, 1997; Jaffee & Gallop, 2007), and the transition from childhood to adolescence (Herrenkohl, Herrenkohl & Egolf, 1994; Sameroff, 1998, 2005). The results of Paper III show that this pattern of continuity is also observed in adulthood. On the other hand, a considerable proportion of the individuals who as adolescents had consulted a clinic for substance misuse problems recovered by their early 20s, extending previous knowledge that was limited to measures of resilience in childhood and adolescence. Results from the present thesis highlight the importance of including young adulthood in studies of resilience.

5.1.4 The associations of factors present in adolescence with outcomes in adulthood

Paper II showed that the increased risk for adverse outcomes in adulthood of the clinic as compared to the general population sample remained significant after taking account of substance misuse, mental illness, concurrent substance misuse with mental illness, and poverty in adulthood. This finding was interpreted to suggest that factors operating earlier in life were driving the negative life trajectories in adulthood. Results from Papers I, III and IV confirmed this interpretation. Paper I addressed the impact of the severity of adolescent problem behaviours on adversity in adulthood, Paper III addressed the importance of adolescent problem behaviours for trajectories of resilience, and Paper IV addressed the associations of adolescent risk and protective factors with resilience to substance misuse and criminal behaviours in adulthood.

Paper II demonstrated that one-third of the females and 56% of the males in the clinic sample had not used illicit drugs when they consulted the clinic and two-thirds of the females and half of the males used alcohol only experimentally or not at all. Sixty-one percent of the females and 41% of the males had no record of delinquency. Yet, Paper I clearly demonstrated that the severity of alcohol use, illicit drug use, and delinquency prior to age 20 were each independently and linearly associated with higher probabilities of most of the six adverse outcomes in the subsequent three decades of life. The importance of these externalising behaviours in adolescence for adversities in adulthood was confirmed and extended in Paper III in which degrees of resilience were examined. The severity of alcohol use, illicit drug use, and delinquency in adolescence were the most robust predictors of trajectory group classification. Thus, the lower the level of resilience achieved through adulthood, the higher the severity of externalising problems in adolescence. Paper IV further confirmed the strength of the associations of adolescence risk factors by showing that adolescent externalising problems were associated with substance misuse and criminal offending up to age 45, even after taking account of substance misuse and criminality from age 21 to 30. Family risks were primarily associated with criminal offending from age 21 to 30, while individual problem behaviours were associated with substance misuse or criminal offending from age 31 to 45. This paper also demonstrated that the severity of family risks and problem behaviours in adolescence limited resilience to substance misuse and criminal behaviours throughout adulthood. The more risks presented in adolescence, the less resilience was observed through adulthood to substance misuse or/and criminal behaviours.

Taken together, these results concur with earlier research that severe externalising behaviours in adolescence are associated with adversity in young adulthood (Ellickson et al., 2004; Patton et al., 2007; Semple, McIntosh & Lawrie, 2005), and extend these findings by demonstrating that the severity of delinquent behaviours in adolescence are, in addition, associated with death, physical illness, and poverty in adulthood. Only a handful of studies have addressed how childhood or adolescent factors influence substance misuse and/or criminal behaviours up to age 40 (Farrington & Pulkkinen, 2009; Schulenberg & Maggs, 2008). Thus, results from the present thesis not only contribute to furthering the understanding of the association of early risk factors with adverse outcomes up to the fourth decade of life, but also demonstrate that risk factors in adolescence continue to be associated with substance misuse and criminal behaviours even after taking account of these behaviours in earlier adulthood. Further, in line with previous studies documenting that the greater the number of risk factors the greater the later adversity (Appleyard et al., 2005; Goodyer et al., 1988; Stattin et al., 1997), results from the thesis also demonstrated that the accumulation of family risks and individual problem behaviours in adolescence limited resilience to both substance misuse and criminal behaviours in adulthood compared to resilience to only one or other of these problems.

Paper IV showed that protective factors in adolescence, defined as a good relationship with parents and academic achievement, primarily enhanced resilience to substance misuse from age 21 to 30. Protective factors also reduced the negative impact that problem behaviours in adolescence constituted for substance misuse in young adulthood. When resilience to both substance misuse and criminal behaviours was

examined, protective factors present in adolescence were found to enhance resilience from age 31 to 45. These findings clearly demonstrate that for adolescents engaging in substance misuse a positive relationship with parents and success at school can over-ride the negative effects conferred by family and individual factors and that this effect may endure until age 45. The findings also suggest that when individuals misuse substances and commit crimes, protective factors have the strongest impact on the misuse rather than the criminal behaviour. While earlier studies established that good parenting and academic achievement in adolescence were associated with lower risk of alcohol misuse and criminal offending in young adulthood (Fergus & Zimmerman, 2005; Hoeve et al., 2009; Meschke & Patterson, 2003; Wright & Masten, 2006), results from Paper IV confirm the importance of adolescent protective factors for limiting externalising behaviours beyond young adulthood.

5.1.5 Substance misuse may encourage criminal offending

A major advantage of Paper IV for furthering the understanding of the relationship between substance misuse and criminal behaviours was the examination of both of these factors at different developmental stages. Resilience to violent and non-violent offending from age 21 to 30 was limited by family risks present in adolescence and concurrent substance misuse. This finding suggests that family adversity and substance misuse in young adulthood increased the likelihood for an individual to engage in criminal activities in their early 20s. Concurrent substance misuse limited resilience to persistent non-violent offending from age 31 to 45, while both problem behaviours in adolescence and earlier violent behaviour in young adulthood limited resilience to persistent violent offending from age 31 to 45. Throughout adulthood, concurrent substance misuse limited resilience to non-violent offending providing further support for the notion that crimes are committed in order to buy drugs and support a life-style of persistent drug use (Bennet et al., 2008; Goldstein, 1985). Concurrent substance misuse limited resilience to violent offending from age 21 to 30 and it may be that alcohol and/or illicit drugs have a stronger influence on violent behaviour in young adulthood than later in life. Violent offending from age 31 to 45 has been observed among life-course persistent offenders (Farrington et al., 2009; Kratzer & Hodgins, 1999; Odgers et al., 2007). These findings demonstrate the importance that substance misuse constitutes for criminal behaviours in young adulthood and have implications for prevention programmes that target misuse among young adults. Paper IV also shows that protective factors enhance resilience to substance misuse in this age period, suggesting that prevention programs in adolescence that enhance family relations and academic achievements have the potential not only to prevent substance misuse but also criminal behaviours in young adulthood.

5.1.6 Treatment for substance misuse in adolescence was not associated with adult outcomes

There was little association between the type of treatment received in adolescence for substance misuse, the duration of this treatment, and outcomes through adulthood. Paper III measured the association of treatment in adolescence for substance misuse and trajectory group membership. Members of the trajectory that become resilient at age 25 had received treatment for a shorter time than individuals that were resilient

throughout adulthood. No other associations were found between treatment type or duration and outcomes. Although, the treatment provided between 1968 and 1971 cannot be compared to treatments today, the lack of association of treatment with outcomes was surprising. Given this lack of association, however, it will be important to examine the effect of current treatments for adolescent substance misuse on functioning in multiple domains through several decades of adult life. Most studies of treatment outcomes are limited to one dependent variable, usually relapse to substance misuse, over a relatively short period of time, six months to one year. Results from the research presented in this thesis suggest that such studies would fail to capture the breadth and depth of the problems experienced by individuals who as adolescents misused substances over three decades of adult life.

5.1.7 Cohort differences

Paper I compared adult outcomes for two cohorts of individuals who as adolescents had consulted a clinic for substance misuse problems. Cohort I had received treatment sometime between 1968 and 1971, while Cohort II had received treatment between 1980 and 1984. In general, few cohort differences were found. One difference was identified though, the prevalence of substance misuse and criminality was higher among males in the younger than the older cohort. The higher rates of externalising problems in adulthood among males in the younger cohort may have resulted from more severe illicit drug use and delinquency at the time they were seen as adolescents at the clinic. This finding contrasts with statistics from the National Council for Crime Prevention (2006) showing a decline in criminal convictions among males in Sweden since 1975. However, two recent studies reported that the prevalence of substance misuse has increased in younger birth cohorts (Holdcraft & Iacono, 2002; Nelson et al., 1998). Paper I is the first study to my knowledge that estimated cohort differences in adult outcomes among individuals who as adolescents had consulted a clinic for substance misuse problems.

5.1.8 Gender differences

Paper I showed that adverse outcomes through 30 years of adulthood varied for females and males. The prevalence of physical illness and poverty was elevated among females compared to males, while the prevalence of criminality was lower. Gender differences in adult outcomes were confirmed in Paper II. The differences between females in the clinic sample and females in the general population sample were larger for death, substance misuse, and criminality, than differences in these domains between males in the clinic and general population samples. These findings confirm previous results indicating that there are gender differences in the sequelae of adolescent substance misuse through the first decade of adult life, specifically higher rates of physical illness and poverty and lower rates of criminality among females than males. These results extend previous knowledge by showing that different patterns of gender differences emerge when the clinic sample was compared to a general population sample. Further research is needed to understand the implications of these different patterns of gender differences in outcomes.

Paper I showed that males and females in the clinic sample accumulated similar numbers of adverse outcomes through 30 years of adulthood. Although gender

differences were present in the risks for specific adverse outcomes, the accumulated burden in adulthood was similar in both genders. This finding was confirmed in Paper III where gender did not predict membership in the developmental trajectories of resilience. Taken together, gender differences were evident in the type of adversity experienced in adulthood, but not in the total number of adverse outcomes. Further knowledge is needed to establish the reasons for these differences.

An important finding from Paper I was that gender influenced physical illness, substance misuse, criminality, and poverty through 30 years of adulthood even after taking account of socio-economic status of the family of origin and externalising behaviours in adolescence. Results from Paper IV extended this finding by demonstrating that female gender enhanced resilience to criminal offending, and especially to violent offending, but not to substance misuse when these outcomes were examined simultaneously. Studies of adults report that females, as compared to males, less often develop substance misuse (Zilberman et al., 2003), but if they do abuse substances they more quickly transition from problem use to dependence (Lynch et al., 2002), and they are more likely to recover (Marsh et al., 2004). By contrast, results from research present in this thesis are consistent with follow-up studies of adolescent substance misuse treatment showing few gender differences up to five years after the end of treatment (Stevens et al., 2004; Jainchill et al., 2005), and extend these findings by showing that there were no differences in substance misuse among females and males up to age 45 when criminal offending and substance misuse were examined simultaneously. Female gender has been shown to be protective against aggressive behaviour in the preschool years (Hay, 2007), in childhood (Kim-Cohen et al., 2005) through adolescence and into young adulthood (Bergman & Andershed, 2009; Fergusson & Horwood, 2002; Kratzer & Hodgins, 1999; Moffitt & Caspi, 2001). These findings extend this body of evidence by confirming the protective effect, even after taking account of concurrent substance misuse, up to age 45.

5.2 STRENGTHS AND LIMITATIONS

The research presented in this thesis was characterised by several strengths that increase confidence in the results. One, the length of the follow-up period was extensive, 30 years in Studies I and II and 25 years in Studies II and IV. The long follow-up periods provided an opportunity to document adverse outcomes beyond young adulthood which had rarely been accomplished previously. The length of the follow-up periods also provided the opportunity to study the continuity and discontinuity of resilience over the life course. Two, the inclusion of multiple domains of outcomes provided a more comprehensive picture of adversity and resilience in adulthood than had emerged from previous studies. Three, large samples that included both females and males allowed for an examination of gender differences. Four, the information on outcomes was extracted from national registers that have been shown to be accurate and up-to-date and that were not biased by participants' substance misuse in adolescence.

Several limitations have to be considered, however, when interpreting the results. One, strict definitions of adverse outcomes were used throughout. Physical and mental illness were indexed by hospitalisations or disability pensions, while misbehaviour was indexed by convictions for crimes. These strict definitions of the adverse outcomes

meant that only severe outcomes were documented. The findings may thereby underestimate the consequences of adolescent substance misuse. Two, this limitation additionally affected resilience as studied in Papers III and IV, as resilience was defined as the absence of adverse outcomes. This definition was lenient in such that participants may have engaged in problem behaviours that were not detected, leading to an overestimation of resilience. One consequence of these lenient definitions of resilience may have been the identification of a limited number of trajectories identified in Paper III due to smaller variance in the outcomes. This may be one reason why only one trajectory was identified in the general population sample after excluding the perfect resilience group. Three, characteristics of the samples may limit the generalisability of the findings. The samples were ethnically homogeneous and included few females, 16.7% of the participants who consulted the clinic between 1968 and 1971 were females, and 23.8% of the samples included in Paper III and IV were female. Currently approximately half of the adolescents who seek help for substance misuse problems at this same clinic are girls (Hodgins et al., 2007). Four, the quality and quantity of the information that was available in the old clinic files was limited. In the late 1960s and early 1970s when participants were adolescents, the clinic did not systematically collect the type of information that today is routine. This meant that adolescent risk factors, problem behaviours, and protective factors were likely under-reported. Under-reporting of adolescent characteristics may weaken the associations with adult outcomes. Finally, a fifth limitation was the lack of information on the general population sample in adolescence, except that they did not consult the only clinic for substance misuse within the urban area where they lived.

5.3 CONCLUDING REMARKS

The research presented in this thesis has six important scientific implications. One, socioeconomic deprivation of the family of origin was only associated with premature death after taking account of externalising problem behaviours in adolescence. This lack of association between family socio-economic status and adversity in adulthood may have resulted from an effect of socio-economic status of the family on externalising problem behaviours that in turn were associated with adult outcomes. It may be that socio-economic status of the family has a weaker association with adversity in adulthood in European countries compared to the United States or New Zealand, as suggested in a recent meta-analysis (Lemstra et al., 2008). Thus, it is important to take account of the level of socio-economic deprivation experienced by samples in different countries in drawing conclusions about its association with adult outcomes. Two recent studies of externalising problems in Sweden suggest that the social system may be providing protective effects that are not observed elsewhere (Sundell et al., 2008; Wikström & Svensson, 2008).

Another implication of the research presented in this thesis, is that adolescence is a critical life period. The severity of adolescent problem behaviours showed a linear association with death, physical illness, mental illness, substance misuse, and poverty in the subsequent three decades of life. In addition, protective factors present in adolescence continued to impact externalising behaviours up to age 45. Thus, the problems that had accumulated from birth to adolescence had a major impact on the

subsequent 30 years of life. Future research is needed to further understanding of the complex interactions of biological and non-biological factors that occur prior to adolescence to cause these problems.

A third scientific implication of the research presented in this thesis is that gender independently predicted physical illness, substance misuse, criminality, and poverty, after taking account of SES and externalising behaviours in adolescence. Gender had no association with the accumulation of adverse outcomes or with the developmental trajectories of resilience in adulthood, and affected primarily resilience to criminal offending when risk and protective factors were assessed. The differences in the rates of death, substance misuse, and criminal offending were greater among females who had consulted a clinic for substance misuse problems in adolescence and a general population sample of females than among men who had consulted a clinic for substance misuse problems in adolescence and a general population sample of men. More research is needed to further understanding of the role of gender for both adverse and resilient outcomes in adulthood and to determine the reasons for the severity of adverse outcomes from substance misuse in adolescence among females.

A fourth scientific implication is that the concept of resilience requires modification to take account of the findings that resilience was dynamic and changed over the life course and that it differed across domains of functioning. Future studies of resilience need to measure this phenomenon in a way that allows changes over time to emerge in multiple domains of adult life. This will allow more accurate identification of the factors that promote resilience.

A fifth scientific implication is that within a population of adolescents who sought help for substance misuse problems, there were sub-groups whose problems likely result from differing mechanisms. The trajectory analyses clearly depicted differences in life courses that suggest distinct vulnerabilities to various adverse outcomes. Defining distinct sub-types of adolescent substance misusers is a necessary first step to identifying causal mechanisms.

Finally, and importantly, results from the research presented in this thesis suggest that substance misuse plays a major role in promoting criminal offending in adulthood. Further research is needed to confirm the direction of this association.

Taken together, these findings underline the importance of establishing treatment programmes that effectively reduce, and hopefully eliminate these problems, and that enhance protective factors such as developing healthy relationships with adults and attaining educational qualifications, prior to the transition to adulthood.

As noted in the introduction, Kazdin and colleagues (Kazdin et al., 1997; Kraemer, 2003; Kraemer et al., 1997; Kraemer et al., 2001) identified three types of risk factors. They defined causal risk factors as factors that can be changed in order to effect a change in outcome. It is presently not known whether the adolescent risk factors for the multiple adverse outcomes identified in this research constitute causal risk factors or whether they result from earlier difficulties, for example the presence of conduct disorder or depression or anxiety. If eliminating substance misuse and delinquency in

adolescence led to resilience in adulthood, then the adolescent misuse and delinquency would constitute causal factors as conceptualised by Kazdin and colleagues. Results of the studies presented here support both possibilities. It may be that for some adolescents externalising problems in adolescence are causal risk factors. These would be the individuals who developed resilience in adulthood and who responded to interventions to reduce their problems. However, among the small group of individuals who never achieved resilience up to age 45, adolescent externalising problems may simply be the consequences of causal factors that operated earlier in life. For these adolescents, treatment of the substance misuse would have a limited effect on the multiple adverse outcomes they experienced during the subsequent 25 years. Further research is needed to test these hypotheses. The family risk factors examined in the present research may be a combination of fixed markers according to the Kazdin model, parents transmitting a genetic vulnerability to substance misuse, externalising problems, and/or mood problems, and causal factors such as family adversity. But again, the available literature suggests that the role of the risk factors varies among sub-types of adolescents misusing substances.

The research presented in this thesis also has implications for clinical services. One, investing in effective treatment to reduce and eliminate adolescent substance misuse and to enhance protective factors prior to the transition to adulthood would prevent lifelong suffering of the affected individuals, the suffering of the victims of their crimes, and the costs of police, courts, and incarceration, of health care, and social welfare. Two, adolescents with substance misuse problems present co-morbid problems such as delinquency and depression/anxiety that require effective treatments in order to ensure that they have healthy and productive adult lives. Additionally, their parents require effective treatments for substance misuse and mental health problems in order to reduce the risk of adverse outcomes for the adolescents through adulthood. Three, it is critically important for clinical services not to underestimate the future risks for externalising behaviours among teenage girls who are misusing alcohol and/or drugs. Four, although treatment programmes offered today probably show few similarities with those that were provided in the late 1960s and early 1970s, the lack of association that emerged between treatment and adult outcomes underlines the importance of providing evidence-based treatment programmes that have been shown to limit adverse outcomes over lengthy follow-up periods. Five, treatment in adolescence needs to include the development of skills to cope with stress throughout adult life and the development of positive attitude to mental health care that would encourage help-seeking if problems begin to re-emerge later in life. This need is underlined by the finding that one group of individuals from the clinic sample achieved resilience for 15 years and then relapsed.

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APPENDIX 1

Detailed definitions of outcome measurements.

Physical illness. Physical diseases related to alcohol or drug use were identified using discharge diagnoses reported according to International Classification of Diseases, (ICD) criteria: ICD8 from 1969 to 1986, ICD9 from 1987 to 1996, and ICD10 from 1997 to 2002. The following illnesses were included (ICD-codes in brackets): sexual transmitted diseases (ICD10=A50-A64, N70-N73, B16-B19, B20-B24; ICD9=090-099, 614-616, 0702-0709, 042-044; ICD8=090-099, 612-614, 6160-6161, 620, 622, 070), neoplasms (ICD10=C00-D48; ICD9=140-239; ICD8=140-239), cardiovascular diseases (ICD10=I00-I99 with exception of I42.6; ICD9=390-459 with exception of 4255; ICD8=390-458, 7824), digestive diseases (ICD10=K20-K92 with exception of K29.2 and K86.0; ICD9=530-579 with exception of 5710-5713 and 5353; ICD8=530-577 with exception of 5710), unintentional injuries (ICD10=V01-X59, Y40-Y86, Y88-Y89; ICD9=E800-E949; ICD8=E800-E946), and intentional injuries (ICD10=X60-Y09, Y35, Y870-Y871; ICD9=E950-E978; ICD8=E950-E978).

Mental illness. Mental disorder was coded as present if participants had at least one in-patient admission to a psychiatric ward with a discharge diagnosis of: schizophrenia, schizotypal and delusional disorders (ICD10=F20-F29; ICD9=295, 297-298 with exception of 2980-2981; ICD8=295, 297-299 with exception of 2980-2981), mood disorders (ICD10=F30-F39; ICD9=296, 2980-2981, 3011, 311; ICD8=296, 2980-2981, 3011), neurotic, stress-related, and somatoform disorders (ICD10=F40-F48; ICD9=300, 306, 308-309; ICD8=300, 305-307 with exception of 3060-3067), eating disorders (ICD10=F50; ICD9=3071, 3075; ICD8=3065), personality disorders (ICD10=F60-F62; ICD9=301 with exception of 3011; ICD8=301 with exception of 3011).

Substance misuse. Substance use disorders were coded as present if participants had an in-patient admission with a discharge diagnosis of substance dependence syndrome or harmful use (ICD10=F10.1-F10.2, F11.1-F11.2, F12.1-F12.2, F13.1-F13.2, F14.1-F14.2, F15.1-F15.2, F16.1-F16.2, F18.1-F18.2, F19.1-F19.2; ICD9=303, 3040-3046, 3048-3049, 3050, 3059; ICD8=303, 3040-3049). Further, a substance induced condition was coded as present if participants had an in-patient admission for a alcohol induced condition including: pseudo-cushing's syndrome (ICD10=E24.4; ICD9 and ICD8 codes not referable), mental and behavioural disorders due to alcohol (ICD10=F10 with exception of F10.0-F10.2; ICD9=291; ICD8=291), degeneration of nervous system due to alcohol (ICD10=G31.2, ICD9 and ICD8 codes not referable), alcoholic polyneuropathy (ICD10=G62.1; ICD9=3575; ICD8 codes not referable), alcoholic myopathy (ICD10=G72.1; ICD9 and ICD8 codes not referable), alcoholic cardiomyopathy (ICD10=I42.6; ICD9=4255; ICD8 codes not referable), alcoholic gastritis (ICD10=K29.2; ICD9=5353; ICD8 codes not referable), alcoholic liver disease (ICD10=K70; ICD9=5710-5713; ICD8=5710), alcohol induced chronic pancreatitis (ICD10=K86.0; ICD9 and ICD8 codes not referable), maternal care for (suspected) damage to fetus from alcohol (ICD10=O35.4; ICD9 and ICD8 codes not referable), acute intoxication (ICD10=F10.0; ICD9 and ICD8 codes not referable), toxic effect of alcohol (ICD10=T51; ICD9=980; ICD8=980), alcohol rehabilitation (ICD10=Z50.2; ICD9 and ICD8 codes not referable), alcohol abuse counselling and surveillance (ICD10=Z71.4; ICD9 and ICD8 codes not referable); or if participants had an in-patient admission for a drug induced condition including: mental and behavioural disorders

due to use of opoids, cannabinoids, sedatives or hypnotics, cocaine, other stimulants, hallucinogens, volatile solvents, multiple drug use and use of other psychoactive substances (ICD10=F11-F16, F18-F19 with exceptions of F11.0-F11.2, F12.0-F12.2, F13.0-F13.2, F14.0-F14.2, F15.0-F15.2, F16.0-F16.2, F18.0-F18.2, F19.0-F19.2; ICD9=292; ICD8=2943), maternal care for (suspected) damage to fetus by drugs (ICD10=O35.5; ICD9 and ICD8 codes not referable), acute intoxication of drugs (ICD10=F11.0, F12.0, F13.0, F14.0, F15.0, F16.0, F18.0, F19.0; ICD9 and ICD8 codes not referable), poisoning by narcotics and psychodysleptics (ICD10=T40; ICD9=9650, 9685, 9696, 9697; ICD8=9650, 9679, 969, 9709, 971), psychostimulants with abuse potential (ICD10=T43.6; ICD9 and ICD8 codes not referable), and drug rehabilitation (ICD10=Z50.3; ICD9 and ICD8 codes not referable). Moreover, an alcohol and drug related crimes were defined as: 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 offences involving doping substances.