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Karolinska Institutet, Stockholm, Sweden

# ADOLESCENT ALCOHOL USE: IMPLICATIONS FOR PREVENTION

Anna-Karin Danielsson



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## ABSTRACT

**Background** Alcohol use, especially heavy episodic drinking, at an early age has been associated with various problems (e.g. risky sexual behaviours, health problems, depression, and heavy alcohol consumption at a later age). Thus, a better understanding of the risk and protective factors that influence adolescent alcohol use is crucial to developing effective prevention strategies. The aim of this thesis is to examine the importance of risk and protective factors in the development of heavy episodic drinking and subsequent problems for adolescent boys and girls. In addition, the prevention paradox (most alcohol-related problems occur in the 90 % of the population with lowest alcohol consumption) was examined among adolescents in Sweden and Europe.

**Methods** Data from three different questionnaire studies were analysed: (1) a longitudinal cohort study with 1222 adolescents from Stockholm, aged 13 to 19 years, (2) a cross-sectional study with 3000 adolescents aged 15 years and 17 years from random samples of school classes throughout the whole of Sweden, and (3) a cross-sectional study (the European School Survey Project on Alcohol and Other Drugs, ESPAD) performed in 35 countries among students who turned 16 during the year of the data collection. Twenty-three countries with 38 370 alcohol-consuming adolescents were included.

**Results** Smoking and peer alcohol use were strongly associated with heavy drinking among both boys and girls, both cross-sectionally and longitudinally. Some gender differences were found; parental provision of alcohol in the 7th grade increased the odds for heavy alcohol use in girls two years later, and truancy was associated with later heavy alcohol use in boys. For boys, heavy episodic drinking at age 13 was one of the most distinct predictors of later heavy episodic drinking. For girls, secure bonds to parents lowered the risk for heavy episodic drinking, even if the girls had friends who drank alcohol, money to spend, or parents who offered them alcohol. For boys whose parents offered them alcohol, parental monitoring had a protective effect. Also, we found that adolescents on a consistent high alcohol use trajectory during early adolescence had higher levels of heavy episodic drinking and alcohol-related problems at age 19. Furthermore, the prevention paradox was valid for adolescent boys and girls in Sweden and in most European countries; despite differences in annual alcohol consumption, levels of heavy episodic drinking, and reported problems, the heavy episodic drinkers in the bottom 90% consumer group accounted for a majority of all reported problems.

**Conclusions** Effective population strategies may have large potential to reduce risk drinking and the overall problem level. A comprehensive prevention strategy should nevertheless also include efforts to reach adolescent high consumers. Furthermore, our results lend support to prevention initiatives to strengthen the parent–child relationship, to focus on adolescents' ability to resist peer pressure, and to limit parental provision of alcohol.

## LIST OF PUBLICATIONS

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## LIST OF ABBREVIATIONS

CAN	Centralförbundet för Alkohol och Narkotikaupplysning [Swedish Council for Information on Alcohol and other Drugs]
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
ESPAD	European School Survey Project on Alcohol and Other Drugs
HED	Heavy Episodic Drinking
IPPA	Inventory of Parent and Peer Attachment
IOM	Isle of Man
SES	Socio-economic Status
SNAO	The Swedish National Audit Office [Riksrevisionsverket]



# 1 INTRODUCTION

Adolescence for many is a time characterized by the onset and escalation of alcohol use (Duncan, Duncan, & Strycker, 2006) and experimentation with alcohol is a normative behaviour. Alcohol use at an early age has been associated with various problems (e.g. risky sexual behavior, health problems, and depression) (Arata, Stafford, & Tims, 2003). Also, it is well known that adolescents' alcohol drinking patterns can predict heavy alcohol consumption and alcohol abuse at a later age (e.g. Andersen et al., 2003; Bonomo et al., 2004; Hill et al., 2000; Pape & Hammer, 1996; Pitkänen, Lyrra & Pulkkinen, 2005; Poikolainen et al., 2001). Thus, adolescent alcohol use is a major issue in both adolescent and adult health and of great concern to society. A better understanding of the various risk and protective factors that influence adolescent alcohol use is crucial in developing initiatives for health promotion and effective prevention strategies, at both the individual and societal levels.

In the present thesis the importance of several posited risk and protective factors for heavy episodic drinking in early adolescence is explored in relation to specific drinking trajectories or subgroups of alcohol consumers. Furthermore, alcohol-related problems in relation to different drinking patterns and to different drinking cultures are examined. A specific focus will be on whether boys and girls differ with regard to the examined factors, developmental pathways, and problems.

## 1.1 THEORETICAL FRAMEWORK AND DEFINITIONS

Adolescence is characterized by cognitive as well as biological and social change (Steinberg, 2005). Children and adolescents develop in interaction with the surrounding society, parents, friends etc. It is therefore important to take a holistic perspective and study how the individual function in different areas and in relation to others (Cicchetti, 1993; Magnusson, 1997; Sameroff, 1995).

*The social development model* (Catalano & Hawkins, 1996) incorporates elements from control theory, which stresses the importance of bonds between individuals and society that restrain people from deviating or going against the norms, and social learning theories, which emphasize that people's tendency to learn from one another, via observation, imitation, and modelling (if people observe positive, desired outcomes from a behavior, then they are more likely to model, imitate, and adopt that behavior themselves). The social development model states that substance use and delinquency are learned behaviors resulting from exposure to multiple risk factors associated with problems within the individual, family, peers, school and community (Hawkins, Catalano & Miller, 1992).

*Problem behaviour theory* (Jessor & Jessor, 1977) is a conceptual framework that is also derived from control and social learning theories. As originally formulated, the theoretical framework included three major systems of explanatory variables: the perceived-environment system, the personality system, and the behaviour system. Each system is composed of variables that serve either as risk factors for engaging in

problem behaviour or as protective factors against involvement in problem behaviour. The overall level of disposition for problem behaviour, across all three systems reflects, on the one hand, the balance between risk and protection and, on the other hand, the degree of psychosocial conventionality-unconventionality characterizing each adolescent (Jessor, 1991; Jessor et al., 1995).

The aim of identifying risk and protective factors is to promote more effective prevention initiatives, i.e. prevention science and health promotion are based on the assumption that there are identifiable factors that precede public health problems and therefore should be the focus of preventive measures. In this thesis the terms ‘risk’ and ‘protective factor’ are used in the same way as in many other studies on alcohol and drug use and criminality (in Sweden e.g. Stattin, Romelsjö & Stenbacka, 1997; Stenbacka, 2000; Romelsjö et al., 1992). *Risk factors* include elements that increase the risk of negative development (Rutter, 1987; Eklund & af Klinteberg, 2003), while *protective factors* include those that facilitate positive development (Antonovsky, 1991), especially when there is a risk of negative progression (Rutter, 1987).

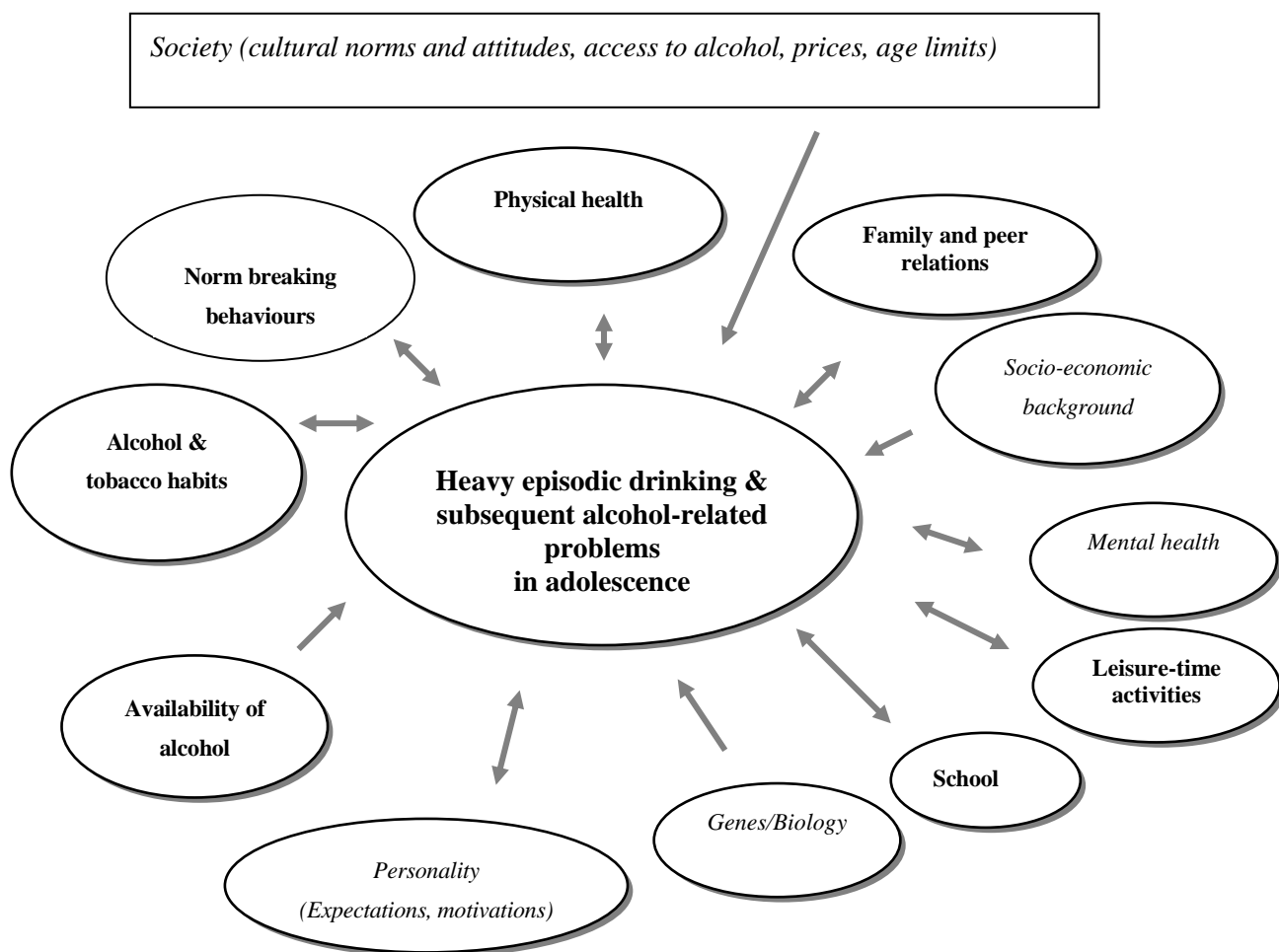
Previous studies of substance use among adolescents (e.g., Hawkins, Catalano & Miller, 1992; Petraitis, Flay, & Miller, 1995) have shown that many underlying and concurrent factors need to be considered. Accordingly, our choice of certain risk and protective factors was guided by a multiple risk and protective factor approach. This means that we presupposed that factors from different domains (e.g., individual factors, relationship factors and community/societal factors) must be examined in order to understand how risk and protective factors operate in relation to heavy episodic drinking in adolescent girls and boys. Our main focus in this thesis is on individual and relationship factors (family and friends), although societal factors (e.g. access to alcohol and school environment) are also included. Furthermore, *heavy episodic drinking* and *binge drinking* are used synonymously in this thesis to describe drinking a certain amount of alcohol in a certain amount of time; ‘six cans of medium-strength beer (3.5% alcohol by volume), or four cans of normal beer (more than 3.5% alcohol by volume), or four large bottles of strong cider, or a bottle of wine, or half a bottle of spirits on the same occasion’ (Studies I-III), or ‘five or more drinks on the same occasion’ (Study IV).

Risk and protective factors can act as *correlates* (be associated with); *factors* (be predictive, requiring longitudinal data), or *causal factors* (be correlated and precedent, and when changed cause a change in outcome) (Murray, Farrington & Eisner, 2009). Examining both longitudinal and cross-sectional data, we use the terms ‘risk factors’, ‘protective factors’, and ‘predictors’.

*Prevention* of alcohol-related harm among adolescents can take place at the individual, group, and societal levels and two different, but not mutually exclusive, approaches can be applied: a high-risk strategy and a population strategy (Boyd, Howard & Zucker, 1995; Gmel et al., 2001; Norström, 1995; Skog, 1999; Skog, 2006). A high-risk strategy aims to reduce consumption and problems through targeted interventions in a small group of individuals who are at increased risk. A population strategy, on the other hand, aims to reduce general consumption and overall problems through interventions based on the ‘prevention paradox’ of most alcohol-related problems occurring in low to

moderate, rather than heavy, drinkers. Although heavy drinkers have a higher individual risk of adverse outcomes, low-risk drinkers account for most of the problems simply because they are much more numerous (Rose, 1981). In our studies, alcohol-related problems refer to problems (e.g. arguments; accidents; injuries; poor relationship with friends and parents; lower achievement at school; unwanted sex; being robbed, driving a vehicle under the influence of alcohol) experienced in relation to and attributed to own alcohol use.

**Figure 1.** Model for studies of factors (risk and/or protective) influencing heavy episodic drinking in adolescence (Factors examined in this thesis are marked with **boldface roman type**).



## 1.2 ADOLESCENT ALCOHOL USE, SUBSEQUENT PROBLEMS AND THE PREVENTION PARADOX

Research shows that over 80% of Europe's 15- to 16-year-olds are alcohol consumers and alcohol is by far the most commonly used drug among adolescents (Hibell et al., 2009). The level of heavy episodic drinking among European adolescents has shown a small but continuous increase over the last 12 years, mostly due to increasing rates reported by girls in many countries (Hibell et al., 2009). Still, important differences exist regarding adolescent drinking and drunkenness; for example adolescents in the Nordic countries and the UK typically drink more but on fewer occasions than adolescents in the southern (wine-producing) countries, who drink more frequently, but at lower levels (Hibell et al., 2009). Girls in Sweden, Finland, Norway, and the UK tend to drink at the same level and get drunk as often as boys, while boys in France, Greece, and Italy are more likely than girls in those countries to report heavy drinking (Hibell et al., 2009).

Studies from the USA and many European countries show that adolescent girls are beginning to approach or even exceed adolescent boys' levels of heavy alcohol use (Cotto et al., 2010; Johnston et al., 2006; Kuntsche, Rehm & Gmel, 2004). Similar observations have been made in Sweden (The Swedish Council for Information on Alcohol and Other Drugs [CAN], CAN, 2010). Alcohol consumption in Swedish adolescents has generally followed the same development as that in the adult population (Leifman, 2000). Alcohol consumption among 15- to 16-year-olds increased strongly in the second half of the 1990s, but has been falling in the 2000s (CAN, 2010). However, the recent decline in consumption is greater among boys than girls. While in the 1990s boys in the 9th grade drank approximately twice as much alcohol as girls, today the difference is negligible. Also, while heavy episodic drinking has somewhat diminished among boys in Sweden since the year 2000, this reduction is not as evident in girls; today, frequent heavy episodic drinking is equally common among 15- to 16-year-old girls and boys (CAN, 2010).

Individuals, however, differ in their development of alcohol consumption (Babor & Caetano, 2006). Theories of *subgrouping* (Moffit, 1993; Moffit & Caspi, 2001) are built on the assumption and knowledge that not all adolescents who drink and drink heavily during adolescence continue to do so as adults. Studies have identified different drinking trajectories marking out different subgroups of alcohol consumers among adolescents. Some adolescents are abstainers, some merely experiment occasionally with alcohol, some show an early high and stable consumption, and others demonstrate a sudden increase in alcohol use during the adolescent years (e.g. Windle, Mun & Windle, 2004). Adolescent substance (including alcohol) use trajectory membership has been associated with adjustment problems, binge drinking and alcohol misuse in early and later adulthood, (Cable & Sacker, 2008; Chassin, Pitts & Prost, 2002; Lynne-Landsman, Bradshaw & Ialongo, 2010). Additionally, longitudinal research has shown that adolescent alcohol consumption is a key risk factor for future illicit drug use and drug dependence (Adalbjarnardottir & Rafnsson, 2002; Boden, Fergusson & Horwood, 2006), as well as future criminality (Odgers et al., 2008).

Research has also demonstrated relationships between higher levels of alcohol use and higher levels of alcohol-related problems (e.g. hangovers, problems with parents, friends, work, and school) (Duncan et al., 1997; Gruenewald et al., 2010), between extreme drinking increased risk of injury (Mundt, Zakletskaia, & Fleming, 2009), and between problem alcohol use and subsequent violent victimization (e.g. being stabbed, injured) for both boys and girls (Thomson et al., 2008). Also, delinquency, both violent, and non-violent, has been associated with high alcohol consumption and drunkenness among both boys and girls (Eklund & af Klinteberg, 2009). Even among adolescents with a moderate prevalence of heavy drinking, alcohol-related problems (e.g. drunk driving, hangovers, and school problems) are relatively common (Reboussin et al., 2006). Furthermore, it has been reported that adolescents who accelerate faster in their use during adolescence have higher rates of alcohol-related problems as young adults than do those who increase their drinking less rapidly. In addition, moderate and heavy drinking trajectories among adolescent girls have been related to higher rates of negative consequences (Dauber et al., 2009; Marti, Stice & Springer, 2009). Also, 'heavy-multiple-context' drinkers (i.e. those drinking heavily and frequently in all social contexts) have been reported to experience the most negative consequences (e.g. trouble with the police, not doing homework, being embarrassed) (Stewart & Power, 2002). A study examining alcohol-related problems among European adolescents on a national level found a strong correlation between frequent drunkenness and frequency of problems, more pronounced among girls than among boys (Andersson & Hibell, 2007). This study also showed a clear relationship between countries reporting high volumes of alcohol consumption and high incidence of problems. Countries scoring high on both included Denmark, Ireland, Isle of Man, and the UK, while countries that were low on both consumption and subsequent problems were mostly in the Mediterranean area (e.g. Cyprus, Greece, France, and Italy).

We have, however, only limited knowledge about whether some adolescent alcohol consumption patterns and/or trajectories have stronger links to later negative consequences other than alcohol consumption per se, for example arguments, fights, accidents/injuries, poor relationship with friends/parents/teachers, low achievement at school, and unwanted and/or unprotected sex. Adolescents with different alcohol use behaviors might need different approaches to prevention (Bartlett, Holditch-Davis & Belyea, 2005; Bartlett et al., 2006). To our knowledge, there is only one prior study examining and supporting the validity of the prevention paradox among adolescents attending college (Weitzman and Nelson, 2004).

### **1.3 RISK AND PROTECTIVE FACTORS ASSOCIATED WITH (HEAVY) ALCOHOL USE (TRAJECTORIES)**

The protection/risk model has been shown to account for substantial variance in adolescent problem behaviours, health behaviours, and prosocial behaviours. It has been suggested that the number of risk factors may be of greater importance for adolescent alcohol use than the number of protective factors (Getz & Bray, 2005; Kliewer & Murrelle, 2007), that cumulative risk in early childhood predicts problems in adolescence (Appleyard et al., 2005), and also that protective factors may moderate

the effects of risk differentially across gender (Griffin et al., 2000). Also, risk and protective factors have been found to interact, and the presence of protective factors has been shown to attenuate risk, thus lowering the odds for drunkenness and problems with alcohol (Kliewer & Murrelle, 2007). Nevertheless, it is not clear whether these factors operate similarly or differently in boys and girls. Below are presented identified risk and protective factors associated with heavy alcohol in adolescence.

### **1.3.1 Genetic, (neuro)biological, and personality factors**

Research has demonstrated that certain individuals may have a genetic predisposition to develop addictions; studies have shown that genetic factors account for between 50 % and 70 % of the variance in alcohol abuse/dependence, and these factors are of equal importance for men and women (Agrawal & Lynskey, 2008 for a review). A genetic risk for problematic drinking has been reported in a study of children of alcoholics (Slutske et al., 2008). It has also been suggested that this association may be explained by additional parental antisocial disorder; that is, adolescents with antisocial parents have more behavioural problems (e.g. attentional aggressive, disruptive) themselves (Barnow et al., 2007), and this increases the risk for adolescent alcohol use (Barnow et al., 2002; Eklund & af Klinteberg, 2003; Hawkins, Catalano & Miller, 1992). Also, the genetic risk for alcohol use has been found to correlate with friends' alcohol use, highlighting the complex interactions of genetic and environmental factors in explaining adolescent alcohol consumption (Fowler et al., 2007).

However, evidence for lower heritability in favour of shared environment as risk factors for adolescent alcohol use has been reported in several studies (Agrawal & Lynskey, 2008). Most of the variance in drinking initiation has been explained by shared environmental effects (i.e. family environment), whereas the importance of genetic effects is greater once adolescents have initiated drinking (Rhee et al., 2003).

Findings also indicate that certain neurobiological factors, as well as biochemical indicators of biological vulnerability, play a role in developing risky alcohol use and antisocial behaviours (Eklund, Alm & af Klinteberg, 2005; Schulte, Ramo & Brown, 2009 for a review). It has been argued that certain brain functions and structures are extra sensitive towards external influences during adolescence, particularly the dopamine system and the 'reward system of the brain' (Bava & Tapert, 2010 for a review).

Risk-taking in general is particularly prominent during adolescence and many of the problems associated with advanced alcohol use may be manifestations of the adolescent propensity to take risks (Leigh, 1999). Children or adolescents with conduct problems (e.g. fighting, bullying, truancy, burglary, lying, cruelty to people and/or animals), hyperactivity, impulsivity, aggressiveness, or 'sensation seeking' are particularly inclined to risk behaviours and risky alcohol use (Eklund & af Klinteberg, 2005; Hawkins, Catalano & Miller, 1992). These patterns of behaviour are often observed much earlier than different manifestations of alcohol use and psychosocial problems (Dubow, Boxer & Huesmann, 2008; Moffit & Caspi, 2001; Niemäla et al., 2006). In addition, research shows that 60 % of adolescents with substance use, abuse or

dependence may have a co-morbid diagnosis (e.g. conduct disorder or depression) (Armstrong & Costello, 2002 for a review). Results regarding possible sex differences in risk-taking and other possible predictive behaviours, however, are mixed.

Adolescents with early heavy episodic drinking have been characterized by antisocial behaviour and, for boys, high levels of externalizing behaviour (Chassin, Pitts & Prost, 2002). At the same time, this group (especially boys) show less depression than any other group. These lower levels were not, however, maintained into emerging adulthood. Furthermore, externalizing behaviors (e.g. restlessness, truancy, lying, lack of punctuality) in adolescence (age 13 years) have been associated with alcohol abuse in adulthood (age 53 years) (Colman et al., 2009).

It has also been reported that both internalizing (depression) and externalizing symptoms (e.g. delinquency and school misbehaviour) symptoms distinguish 'normative' drinking girls (abstainers and experimenters) from 'problem' drinking girls (moderate and heavy drinkers) (Dauber et al., 2009). Negative affect (i.e. depressed mood, low self-esteem, low perceived chances of success in life, and hopelessness) has been linked to later alcohol use and alcohol disorders for both boys and girls (Englund et al., 2008; Griffin et al., 2004; Mason, Hitch & Spoth, 2009; Pirkle & Richter, 2006). However, it seems that delinquency may exhibit somewhat larger effects on girls' heavy drinking than depression (Dauber et al., 2009; Marti, Stice & Springer, 2009). Also, while trajectories of depression seem to decline across transition to young adulthood for both boys and girls, the likelihood of moving from lower to higher binge drinking, smoking and illicit drug use trajectories increases (Needham, 2007).

### **1.3.2 Other individual factors**

#### *1.3.2.1 Early onset*

Many studies have linked an early alcohol debut to heavy alcohol use in adolescence as well as in early adulthood and middle age (Flory et al., 2004; Grant, Stinson & Harford, 2001; Pitkänen, Lyrra & Pulkkinen, 2005; Reboussin et al., 2006). Others have demonstrated the importance of feeling drunk at the initiation of alcohol use in predicting problem drinking (Warner & White, 2003). It has been shown that drinking at age 14 can predict problematic alcohol habits for both boys and girls in late adolescence when controlled for smoking cigarettes, smoking marijuana and having friends who drink and get drunk (Reboussin et al., 2006), and in early middle age, when controlled for familiar (e.g. parenting practices, parental alcohol and smoking habits) and behavioural factors (e.g. aggressiveness, low self-control and anxiety) (Pitkänen et al., 2008). In contrast, it has been shown that early drinking onset did not predict alcohol dependence in adulthood after controlling for parental characteristics, family environment and externalizing symptoms (King & Chassin, 2007). Early onset and intoxication debut (< 14 years) have been associated with parental drinking and having less family support (Hellandsjø- Bu et al., 2002). Similarly, it has also been demonstrated that a good relationship with parents can function as an important protection; that is, adolescents with a late onset and a high-quality relationship with their parents had lower levels of alcohol use and alcohol-related problems than other groups when compared over time (Kuntsche, van der Vorst & Engels, 2009).

Other studies have reported that early alcohol onset, rather than being the cause of alcohol abuse or dependence, was preceded by aggressive, impulsive, or hyperactive symptoms in boys and girls, and suggest that other underlying mechanisms or pathological behaviours may cause both early onset and later abuse or dependence (McGue et al., 2001). In addition, conduct disorder have been identified as the most potent predictor of early alcohol initiation (Sartor et al., 2006). At the same time, it has been demonstrated that alcohol intake and heavy drinking can be predicted simply by examining earlier reports on drinking and smoking, when controlled for trait anxiety and personality styles (i.e. underlying personality factors) (Poikolainen et al., 2001). A recent study examining the relative importance of age at first drink, genetic factors, externalizing symptoms, parental alcohol use, psychosocial adversity, and negative life events for hazardous drinking in young adults concluded that age of onset constitutes an independent predictor, and is in fact, the strongest predictor of heavy consumption (Buchmann et al., 2009).

#### *1.3.2.2 Smoking cigarettes*

Recent figures in Sweden show that, despite large governmental initiatives for prevention, the number of adolescents who smoke cigarettes has remained stable; 28 % of the girls and 21 % of the boys in the 9th grade are smokers (CAN, 2010).

Cigarette smoking has been identified as one of the most important predictors of heavy drinking when compared with factors, such as parental alcohol problems, low self-esteem and lack of social support (Poikolainen et al., 2001). Previous studies have linked adolescent cigarette smoking to progression not only to later smoking (Needham, 2007) but also to high-risk drinking for both boys and girls (Bonomo et al., 2004; Bucholz, Heath & Madden, 2000; D'Amico et al., 2001), and adolescent consistent binge drinkers have been found to start using other substances (e.g. cigarettes, marijuana) at younger ages (D'Amico et al., 2001). Also, early adolescent smoking has been found to predict multiple drug use, low academic achievement, dropping out of school, and early pregnancies in later adolescence (Ellickson, Tucker & Kleins, 2001) and adolescent smoking trajectories have been associated with poorer functioning in young adulthood, i.e. heavy drinking, smoking and lower education attainment (Mun, Windle & Schainker, 2008).

Concurrent drinking and smoking trajectories have also been identified (Jackson, Sher & Wood, 2000; Jackson, Sher & Schulenberg, 2008). Risk factors, such as delinquency, sensation seeking, and the expectation of positive reinforcement from alcohol use all contributed to this co-morbidity to some degree, while religiosity was a prominent protective factor (Jackson, Sher & Schulenberg, 2008). Additionally, parental smoking has been linked to adolescent smoking (Chen et al., 2006), and family history of excessive drinking has been associated with belonging to co-morbid trajectory groups for both boys and girls (Jackson, Sher & Wood, 2000). In contrast, less parental smoking, more family monitoring and supervision, and stronger family bonding have been associated with a lower risk for daily smoking initiation (Hill et al., 2005; Joun, Ensminger & Sydnor, 2002).



The converse relationship has also been reported; prior alcohol use has been found to predict both initiation and persistence of tobacco use (Jackson et al., 2001; Jackson, Sher & Wood, 2000), while persistence in drinking was found to be predicted by prior smoking (Jackson et al., 2001). Thus, alcohol and tobacco use are closely connected in adolescents and continue so into early adulthood. In fact, it has been shown that light drinkers are least likely to smoke, whereas chronic heavy drinkers are most likely both to smoke while drinking, and to be chronic smokers (Jackson, Sher & Wood, 2000).

### *1.3.2.3 Socio-economic status (SES) & money to spend*

Previous studies have found that social background characteristics (e.g. low parental education and income and single-parent household) are related to adolescent drinking habits (Bergmark & Andersson, 1999; Persson, Hansson & Råstam, 1994).

Furthermore, higher prevalence of alcohol use and drunkenness has been reported among adolescent girls and boys living in single-parent families (Barrett & Turner, 2006; Lintonen et al., 2000). It has been suggested that this may in part be explained by a higher rate of deviant peers among those adolescents (Barrett & Turner, 2006) and that high exposure to substance-using peers may have a great effect on adolescent alcohol and smoking habits independent of family constellation (Eitle, 2005).

In contrast, it has also been demonstrated that living in a single-household had no effect on adolescent binge drinking, but rather that having a father who was currently unemployed had (Lundborg, 2002). At the same time, others have reported that having unemployed parent has no effect on adolescent heavy episode drinking (Stafström, Östergren & Larsson, 2005). It has been suggested that adolescents with high-risk behaviours (e.g. smoking and binge drinking) come more often from low-education families and lower income areas (Petridou et al., 1997). However, it has also been shown that parental SES had no longitudinal effect on hazardous alcohol consumption, but that limited hazardous alcohol habits in adolescence and early adulthood were associated with low parental SES (Wennberg, Andersson & Bohman, 2002).

Higher levels of alcohol use and heavy drinking have been linked to higher parent education (Merline, Jager & Schulenberg, 2008) and living in high-income areas (Branting & Romelsjö, 1998; Song et al., 2009). Studies have reported an association between fathers' occupation and adolescent alcohol consumption; i.e. adolescents having fathers belonging to the lowest occupational group had twice the odds of being large consumers compared to adolescents with fathers in the highest occupational group (Droomers et al., 2003). This was partly explained by a higher prevalence of familial alcohol problems and lower parental attachment in the lowest occupational group. Research has also shown higher drinking frequencies in late adolescence and early adulthood to be related to higher SES of the family of origin, whereas higher problem drinking is related socio-economic status (Pitkänen et al., 2008). Thus, research regarding socioeconomic status and alcohol use among adolescents is somewhat inconclusive and some researchers have concluded that there seems to be little consistent evidence to support the association between lower childhood SES and later misuse of alcohol (Wiles et al., 2007 for a review).

Previous studies have also associated adolescents' weekly allowance with drunkenness, i.e. the more money available to spend, the higher the risk for drunkenness (Lintonen et al., 2000), the more alcohol consumed (Conolly et al., 1992) and the more frequent bouts of heavy episodic drinking (Stafström, Östergren & Larsson, 2005). The amount of available spending money has been associated with adolescent alcohol use and tobacco use (smoking cigarettes) (McLellan et al., 1999; Vitoria et al., 2006). In fact, it has been shown that the level of allowance may separate alcohol-consuming adolescent from non-consumers (Chen et al., 2008) and receiving more spending money from parents has been shown longitudinally to predict transition from normative to high-risk drinking (Power et al., 2005).

#### *1.3.2.4 School factors: Truancy & Bullying*

School misbehaviour in adolescence has been associated with higher probabilities of heavy drinking in adulthood (Muthen & Muthen, 2000). Poor school success and truancy during adolescence have been linked to concurrent drinking habits in girls and to alcohol consumption in early middle age for both men and women (Best et al., 2006; Pitkänen et al., 2008). It has been shown that drinking as a strategy to avoid social rejection and to be part of a group can be a strong predictor of bullying and fighting (Kuntsche et al., 2007a), and bullying victimization has been linked to substance use in both males and females (Luk, Wang & Simons-Morten, 2010). Substance use (including alcohol) has been more strongly associated with aggression (bullying), whereas depressive affect has been more strongly associated with victimization (being bullied) (Carlyle & Steinman, 2007). Also, it has been reported that poor school success and the absence or limitations of educational plans are associated with externalizing symptoms, such as bullying and heavy alcohol use (Laukkanen et al., 2002). Among adolescents in outpatient substance abuse treatment, early onset of substance use has been linked to bullying, aggressive behaviours and cruelty to people (Gordon, Kinlock & Battjes, 2004).

Furthermore, truancy has been found to predict heavy drinking not only in adolescence but also in adulthood (Maggs, Patrick & Feinstein, 2008). Longitudinal analyses have demonstrated that low school achievement and lower grades increase the risk of very heavy drinking groups and future alcohol problems in boys (Wennberg, Andersson & Bohman, 2002; Windle, Mun & Windle, 2004) and low school cohesion has been linked to heavy episodic drinking among girls (Springer et al., 2006). School misbehaviours such as skipping classes and cheating and negative experiences in school have been associated with adolescent alcohol use (Case, 2007; Li, Feigelman & Stanton, 2000; Ludden and Eccles, 2007). In contrast, academic accomplishment has been inversely related to risky behaviours such as binge drinking and smoking (Petridou et al., 1997; Piko & Kovács, 2009), and being engaged in school, classroom participating in classroom activities and discussion, and having a stronger sense of belonging in the school seem to have a protective effect against adolescent alcohol use (Napoli, Marsiglia & Kulis, 2003; Simons-Morton, 2004; Morrison et al., 2002). Also, teacher empathy, i.e. students feeling that their teachers care about them, has been negatively associated with binge drinking (Guilamo-Ramos et al., 2005).

On a community or societal level, attending a school with a high level of alcohol use and frequent binge drinking has been found to predict alcohol use and binge drinking for the individual (Svensson, 2010), whereas attending a supportive school may serve as a protective factor against adolescent alcohol use (Simons-Morton, 2004).

#### *1.3.2.5 Health status*

Heavy episodic drinking has been associated with somatic complications and complaints (Stolle, Sack & Thomasius, 2009 for a review). Adolescents with poor health or somatic symptoms (headache, backache, insomnia, tiredness and stomach ache) are more likely to be alcohol consumers or severe alcohol consumers than those without such problems (Boman, Andersson & Romelsjö, 1993; Lindberg, Nilsson & Bremberg, 1992). Physical complaints have been related to adolescent alcohol use; the more physical ailments reported, the greater the likelihood of alcohol, tobacco and/or cannabis use (Kirkcaldy et al., 2004). Also, somatic symptoms have been found to separate non-alcohol users from users, i.e. somatic complaints increased the odds almost threefold for being a current drinker (Chen et al., 2008). Results among US adolescent girls have shown that not only do somatic complaints co-occur (i.e. headache, stomach pain and morning fatigue), they are also strongly associated with heavy episodic drinking and smoking cigarettes (Ghandour et al., 2004). Others have pointed to the fact that headaches and abdominal pain seem to be more prevalent among adolescent alcohol and drug patients than among matched controls (Mertens et al., 2007), and alcohol-abusing adolescents have been found to report more physical symptoms, for example weight loss, headaches and eczema, than do controls (Arria et al., 1995).

Whether somatic health problems precede alcohol use or poor health is a consequence of alcohol consumption remain an unanswered question. One cross-sectional study showed that feelings of inner restlessness, difficulties in falling asleep, headaches, stomachaches and nervousness were rather common complaints among primary (pre-adolescent) school children, in whom alcohol and nicotine use were non-existent behaviours (Häfner & Schmidt-Lachenmann, 2008).

#### *1.3.2.6 Leisure time – youth recreation centres*

An active social life outside the home during late childhood, including for example, visits to youth centres, has been linked to an increased risk for advanced alcohol habits in adolescence (Bergmark & Andersson, 1999). Participation in structured leisure-time activities has been linked to lower levels of antisocial behaviours, whereas participation in activities with low structure has been related to high levels of antisocial behaviours including alcohol use (Mahoney & Stattin, 2000).

It has been suggested that antisocial adolescents with poor relationships with parents and school are more likely to visit unstructured youth recreation centres and also that involvement in such centres increases the risk of antisocial behavior, including alcohol use even more (Mahoney, Stattin & Lord, 2004). Thus, adolescent boys were found to have adjustment problems prior to their involvements in centres, but when these problems were controlled for, the attendees had significantly higher rates of criminal arrests later on than did non-visitors (Mahoney, Stattin & Magnusson, 2001). Also,

adolescent girls who have many friends outside of school and/or a boyfriend and attend youth centres are later over-represented with norm-breaking behaviours (Persson, Kerr & Stattin, 2004), and a relationship between girls' after-school destinations (e.g. 'hanging out') and their use of alcohol has been found (Schinke, Fang & Cole, 2008). It seems that increased unsupervised time in adolescence is followed by increased risk behaviour (e.g. alcohol use) in both boys and girls (Borawski et al., 2003). Nonetheless, it has also been noted that increased antisocial behaviour as a consequence of participating at youth recreation centres may be the result of adjusting to the higher levels of norm-breaking in many antisocial peers present at the centres (Mahoney, Stattin & Lord, 2004; Persson, Kerr & Stattin, 2004).

### **1.3.3 Relational factors**

#### *1.3.3.1 Family*

Parental strategies, including modelling, limiting availability, monitoring, relationship and communication, have been associated with delays in adolescent alcohol initiation and reduced levels of later drinking (Ryan, Jorm & Lubman, 2010 for a review). Emotional ties to family and others and high levels of communication and self-disclosure to parents have been shown to be inversely related to adolescent alcohol use (Guilamo-Ramos et al., 2005; Hawkins, Catalano & Miller, 1992; Ryan, Miller-Loessi & Nieri, 2007), as has high parental monitoring (Kliewer & Murrelle, 2007). In fact, relatively moderate levels of parental control and supervision seem to be optimal and related to lower levels of heavy episodic drinking (Getz & Bray, 2005; Guilamo-Ramos et al., 2005) and parental monitoring and having a secure attachment may also lower the risk for alcohol use and binge drinking in adolescents with alcohol-using peers (Bahr, Hoffman & Yang, 2005) or older siblings (Gossrau-Breen, Kuntsche & Gmel, 2010). Spending time with family, e.g. regularly attending family dinner, has been found to delay girls' initiation to alcohol use (Fisher et al., 2007). In contrast, low parental attachment has been found to predict involvement with friends who use alcohol and other drugs, which in turn predicts later adolescent alcohol and drug use (Henry, 2008).

Little is known, however, about possible gender differences in early alcohol use. Girls report more parental monitoring and parental knowledge of their friends and whereabouts than boys (Li, Feigelman & Stanton, 2000; Mahoney, Stattin & Lord, 2004; Okulicz-Kozaryn, 2010). Correlations between low parental support, poor attachment and girls heavy drinking have been reported (Amaro et al., 2001; Springer et al, 2006), and it has been suggested that alcohol use is more closely related to family relations in girls than in boys (Yea, Chiang & Huang, 2006). Trust established between adolescent girls and their parents can be a strong deterrent for risky behaviours, but appear to have little effect on the behaviour of adolescent boys (Borawski, et al., 2003). However, it has also been demonstrated that anxiety in the mother-adolescent relationship may predict boys', rather than girls', progression into problem drinking (Power et al., 2005). Furthermore, it has been shown that girls' problem behaviours including alcohol use may elicit poor parenting, and externalizing symptoms and substance abuse symptoms have been found to predict future decreases in perceived parental support and control (Huh, Wade & Stice, 2006).

Previous studies have also demonstrated that parents' alcohol use is related to their children's alcohol use (Brook et al., 2010; Duncan, Duncan & Strycker, 2006), and early heavy binge-drinking adolescents have been characterized by parental alcoholism (Chassin, Pitts & Prost, 2002). Drinking and, for girls, smoking in early adolescents has been found to be preceded by parental alcohol and tobacco use and, for girls, poor parenting (Pitkänen et al., 2008). Excessive drinking in the family has also been found to be more important in adolescent alcohol use and drunkenness than family structure (single-parents) (Kuntsche & Kuendig, 2006). Parental history of alcohol problems has been reported to predict adolescent girls' transition into dependent drinking (Bucholz, Heath & Madden, 2000). In a longitudinal study parental drinking was found to predict more late adolescent and early adulthood heavy drinking at all ages (age 18, 22, 26 and 35) for both sexes (Merline, Jager & Schulenberg, 2008). In contrast, it has been reported that parents giving guidance, setting strict rules, or disapproving of alcohol can prevent adolescents' alcohol use (Li, Duncan & Hops, 2001; Miller & Plant, 2009; Van der Vorst et al., 2009), and that youths who perceive their parents to strongly disapprove of substance use were more likely to abstain from or limit heavy drinking (Martino, Ellicson & McCaffrey, 2009). In fact, it has been shown that parental disapproval may have a protective effect on adolescent heavy drinking even in the presence of stable high-drinking peers (Martino, Ellicson & McCaffrey, 2009).

Parents have been identified as one of the primary sources of alcohol for 12- to 13-year-olds (Hearst et al., 2007). Adolescents whose parents offer them alcohol have been found to drink more and get drunk more often than other adolescents (Haeggman, Romelsjö & Branting, 2001; Persson, Hansson & Råstam, 1994). At the same time, other research reports somewhat ambiguous results. In a cross-sectional study parental provision of alcohol was reported as a protective factor against excessive alcohol use (Foley et al., 2004), whereas a longitudinal study showed it to be a risk factor and a strong predictor of increases in alcohol use (Komro et al., 2007). One longitudinal study found that high-school girls who were allowed to drink at home (at meals or with friends) reported more heavy drinking in college than girls not allowed to drink at all, and those allowed to drink at home with friends reported the heaviest drinking (Livingstone et al., 2010).

### *1.3.3.2 Peers*

Adolescence is a time when peer orientation tends to increase and adolescents move their focus away from their families and towards their friends (Piko, 2001). Thus, the choice of friends and those friends' patterns of alcohol use are very important. It has been shown that family factors may be more salient in relation to alcohol use among younger adolescents (age 11 to 12), and peer and school factors may be more important among older adolescents (age 17 to 18) (Cleveland et al., 2008). At the same time, parents have been shown to influence their children's choices of for example friends, also in early adulthood and this, in turn has been linked to their teens' drinking behaviours (Abar & Turrisi, 2008).

Peer alcohol use has proven to be by far the strongest predictor of regular drinking and heavy alcohol use among adolescents, compared with family and psychosocial factors (Getz & Bray, 2005) and parental drinking (Scholte et al., 2008). Spending more

evenings out with peers, having friends who get drunk, and feeling pressure to drink have all been associated with greater odds of heavy episodic drinking (Patrick & Schulenberg, 2010). Early heavy binge-drinking adolescents have been characterized by peer drinking (Chassin, Pitts & Prost, 2002). Peer encouragement has been related to increases in alcohol use between the ages of 9 and 16 (Duncan, Duncan & Strycker, 2006) and associations between best friends' drinking and heavy-drinking trajectories have been reported (Van der Vorst et al., 2009). It has been demonstrated that youths who had a high and stable association with peer drinkers were more likely to be stable heavy drinkers themselves (Bot et al., 2005; Martino, Ellickson & McCaffrey, 2009). Peer involvement in antisocial behaviour has been identified as a strong predictor for adolescent transition from being an abstainer to starting drinking (Power et al., 2005).

It has been suggested that alcohol use may be more strongly influenced by peer norms and peer relationships among girls than among boys (Callas, Flynn & Worden, 2004; Yea, Chiang & Huang, 2006). Additionally, adolescents scoring low on peer-pressure resistance are more likely to belong to an early-onset trajectory and have higher risk of anti social personality symptoms, arrests, and alcohol dependence in early adulthood (Flory et al., 2004). Also, peer-pressure may be more closely associated with girls' alcohol and drug use than with boys' (Barber, Bolitho & Bertrand, 1999) and alcohol prevention programmes with higher rates of success for girls regarding teach social resistance skills and reducing negative social influences (Kumpfer, Smith & Summerhays, 2008).

Heavy drinkers search for and choose drinking peer and longitudinal research has linked the degree of adolescent's alcohol and cigarette use to their choice of friends with higher alcohol and cigarette use (Urberg et al., 2003). At the same time adolescents are influenced by their peers and may change and adopt their friends' healthy behaviours as easily as their risky behaviours: high-quality friendships and alcohol use habits of those friends have been found to influence adolescent alcohol consumption (Urberg et al., 2003).

#### **1.3.4 Social factors**

Access to alcohol has been found to increase the odds for adolescent heavy episodic drinking, drunkenness and belonging to a higher consumption trajectory group (Brännström, Sjöström & Andréasson, 2007; Casswell, Pledger & Pratap, 2002; Patrick & Schulenberg, 2010; Weitzman, Chen & Subramanian, 2005) and studies have demonstrated that restricting access to alcohol has an effect not only on heavy drinking episodes but also alcohol-related admissions to emergency departments, especially among 10- to 15-year-olds (Gmel & Wicki, 2010). Also, areas where retail sales of alcohol are restricted to monopolies have been associated with lower adolescent alcohol consumption, less binge drinking, and fewer alcohol-impaired driving deaths compared to non-monopoly areas (Miller et al., 2006).

Community protective factors including the local context, laws, norms and perceived availability of alcohol and drugs have been associated with current and lifetime alcohol, cigarette and marijuana use (Hawkins, Van Horn & Arthur, 2004), particularly in younger ages (>15 years) (Cleveland et al., 2008). That is, adolescents reporting higher

community protection (i.e. limited access and distinct laws and norms concerning alcohol) had lower odds of being alcohol, cigarette and marijuana consumers. However, it has also been shown that adolescents with high levels of individual risk (e.g. sensation-seeking and rebelliousness) may benefit less from community protective factors, suggesting that the protective effects are strongest among adolescents with low individual risk (Cleveland et al., 2010). Research has also linked living in an unstable neighbourhood, where residents move in and out on a frequent basis, during childhood to the development of late adolescent alcohol-use disorder (Buu et al., 2009).

Prevention initiatives at the societal/community level have been demonstrated to have a large potential to reduce the overall level of problems related to alcohol use (Babor et al., 2010). Mean consumption and heavy episodic drinking has both been shown to be negatively associated with the price of alcohol, i.e. higher prices result in lower drinking levels (Abel, 1998). Additionally, higher alcohol prices and taxes have been shown to reduce alcohol-related mortality, traffic accident deaths, sexually transmitted diseases, violence, and crime (Wagenaar, Tobler & Komro, 2010). Thus, it has been suggested that reduction in alcohol consumption and alcohol-related harm may be achieved by controlling both the price and the availability, including opening hours and legal buying age, of alcohol (Babor et al., 2010).

## 1.4 SUMMARY OF CURRENT KNOWLEDGE & RELEVANCE OF THE PRESENT RESEARCH

Although several risk and protective factors have been identified for alcohol consumption and heavy episodic drinking among adolescents (as presented above), there is less knowledge about risk and protective factors at younger ages (<15 years), and it is also unclear whether gender differences exist. To our knowledge, no previous study has examined and controlled for all those risk and protective factors simultaneously. Hence we do not know whether smoking or parental provision of alcohol are risk factors when the effects of having friends who drink or money to spend are controlled for, or whether having an early alcohol debut is a better predictor of heavy episodic drinking than bullying and truancy. In addition, our knowledge is limited about the possible effects of protective factors, including parental monitoring, secure attachments, and school engagement, in the presence of the risk factors mentioned above.

Thus, the connections or interactions between risk and protective factors, gender and heavy episodic drinking are still indistinct and far from explained (Farrington & Welsh, 2007). Notably, the emphasis in previous research has often been on risk factors rather than protective factors, on college students rather than middle school students, and on boys rather than girls (e.g. Farrington & Welsh, 2007). Also, the majority of the previous studies were conducted in the USA (Kuntsche, Rehm & Gmel, 2004). A recent review underlines the importance of assessing the risk and protective factors associated with alcohol consumption in different cultures and subcultures (EMCDDA, 2009).

In Sweden only a small number of studies have focused in particular on identifying risk and protective factors for adolescent alcohol use, (Bergmark & Andersson, 1999; Brännström, Sjöström & Andréasson, 2007; El-Khoury, Sundell & Strandberg, 2005; Persson, Hansson & Råstam, 1994; Stafström, Östergren & Larsson, 2005). Most of the studies have been cross-sectional and only a couple of them have considered possible gender differences. In general, few studies have attempted to identify specific risk and protective factors for girls compared to boys and as a result many of the prevention programmes of today may fail to recognize possible gender differences (National Center on Addiction and Substance Abuse, 2003).

Furthermore, although adolescents are often the prime group for prevention efforts, to our knowledge, there is only one prior study examining the validity of the prevention paradox among adolescents (Weitzman and Nelson, 2004). In order better to tailor prevention efforts aimed at adolescents, we need to identify precursors to adolescent alcohol use in Sweden today and to examine whether most of the alcohol-related problems among adolescents can be attributed to the vast majority of adolescent drinkers, supporting general population prevention efforts, or to high-risk drinkers, supporting instead more targeted interventions aimed at individuals.



## **2 AIM**

The main aim of this thesis is to examine the importance of risk and protective factors in the development of heavy episodic drinking and subsequent problems for adolescent boys and girls. In addition the prevention paradox among adolescents will be examined. Throughout the thesis a specific focus will be on whether boys and girls differ with regards to the developmental pathways stated below and, if so, what possible practical implications those differences may have.

### **2.1 SPECIFIC OBJECTIVES**

1. To identify risk and protective factors for heavy episodic drinking at different ages.
2. To identify different trajectories for alcohol use and subsequent problems.
3. To examine the prevention paradox among adolescents, i.e. whether most alcohol-related problems occur in low to moderate rather than heavy drinkers.
4. To examine the prevention paradox in relation to adolescents in different countries and drinking cultures.

### 3 MATERIALS & METHODS

This thesis is based on four different data sets that are described in more detail below. All studies have been approved by the Research Ethics Committee at the Karolinska Institute, DNR 00-196; 2006/242-32 and 2009/1857-31 (advisory statement).

Data	Study/Paper	Participants	N	Age of participants	Years of data collection
Longitudinal cohort study	I , II , III	All 7th grade students in all 18 schools in 6 districts in Stockholm	1222	13-18	2001-2003 and 2006
Cross-sectional study (two samples)	III	Random samples of school classes in the whole of Sweden	3091	15 & 17	2008
Cross-sectional study	IV	Random samples of school classes in 23 European countries	38 370	16	2007

#### 3.1 LONGITUDINAL COHORT STUDY (STUDIES I-III)

##### *Participants*

Data were from a longitudinal cohort study that began with 1,923 adolescent participants. The study population included all 7th grade students in 2001 (aged 13-14), with follow-up in 2002, 2003 and 2006 (aged 18-19), in all 18 schools and 79 classes in 6 out of 18 districts in Stockholm, Sweden (Romelsjö et al, 2003). The districts chosen included low-, middle-, and high-income socio-demographic areas within the city.

Parental written consent was mandatory for student participation, and 96 % of the parents approved participation prior to first data collection for an initial enrolment of 1847 students. Response rates to the surveys were relatively high (T1 = 88 % of the students, T2 = 87 % and T3 = 82%). In total, 64 % of the students (644 girls and 578 boys) participated in all of the first three data collections. At age 19 substantially fewer participated (n=539). While roughly the same group of youths responded between 2001 and 2003, only a minority of these responded in 2006. Between 2001 and 2003, the questionnaires were collected in school, during class, but in 2006, because the students no longer went to the same schools, the questionnaires were sent instead sent to the pupils' home addresses. This probably contributed to the relatively low response rate.

##### *Procedures*

The student questionnaire was administered by Statistics Sweden during class, and the great majority answered it after being informed (verbally and in writing) about voluntary participation and confidentiality. Students were informed that names and

civic registration numbers would be removed and replaced with a number and that no individual student could be identified or recognized. For absent students and students who moved or changed school during the study period, the questionnaire was sent to their home address. The questionnaires, which had been specially developed for this study, contained about 125 questions that were similar over the first three surveys. In 2006 questions about depression, anxiety and personality were added. Many of the questions (e.g. parental provision of alcohol, school, parental monitoring, time spent with family, and attachment) had been tested in various pilot and regular studies (Grosin, 2004; Greenberg, Siegal, & Leitch, 1983, Mahoney & Stattin, 2000; Greitz & Svensson, 2005). The questions about alcohol consumption have demonstrated good reliability in test-retests (Hibell et al., 1997) and also in tests of inconsistencies between questions (Hibell, 2009).

### **3.2 CROSS SECTIONAL STUDY, SWEDEN (STUDY III)**

#### *Participants*

Data were drawn from two surveys, each comprising over 3,000 pupils, of random samples of school classes throughout Sweden of adolescents aged about 15 years and 17 years (CAN, 2008). The participation rates were over 82 %. Annual surveys about adolescent alcohol and drug use in Sweden have been conducted by CAN since 1972.

#### *Procedures*

Data from nationally representative schools and samples of students were collected by teachers in the schools. The students answered the questionnaires anonymously in the classroom (CAN, 2008). Students were asked not to sign their names and to put the questionnaires in envelopes after answering.

### **3.3 CROSS SECTIONAL STUDY, EUROPE (STUDY IV)**

#### *Participants*

We used data from the 2007 European School Survey Project on Alcohol and Other Drugs (ESPAD) performed in 35 countries among students who turned 16 during the year of the data collection. Twenty-three countries, with 38 370 alcohol-consuming adolescents (19 936 boys and 18 434 girls) who had replied to the questions about consumption, alcohol-related problems, and heavy episodic drinking (irrespective of the answers), were included in our study.

#### *Procedures*

Data from nationally representative samples of students were collected by teachers or research assistants in the schools. The students answered the questionnaires, which had been specially developed within the ESPAD project, anonymously in the classroom.

## 3.4 MEASURES

### 3.4.1 Outcome measures

*Heavy episodic drinking* (Studies I and II, independent variable in study III)

Heavy episodic drinking was assessed by asking, ‘How often do you drink six cans of medium-strength beer (3.5% alcohol by volume), or four cans of normal beer (more than 3.5% alcohol by volume), or four large bottles of strong cider, or a bottle of wine, or half a bottle of spirits on the same occasion?’.

In Study IV frequencies of drinking five or more drinks on the same occasion during the last 30 days were measured using category midpoints (answers ranging from never to  $\geq 40$  times).

*Annual alcohol consumption* (Study II; independent variable in studies III and IV)

This was based on a quantity-frequency measure transformed into litres of pure alcohol per year. It was assessed by asking, ‘How often do you drink beer, wine, and spirits?’.

In Study IV frequencies of drinking (‘On how many occasions during the last 12 months have you had any alcohol beverage to drink?’) were measured using category midpoints (answers ranged from never to  $\geq 40$  times) and volume consumed during the last drinking day (reported consumption of beer, wine, or spirits) were transformed into assumed consumption of centilitres of pure (100%) alcohol. Cider was not included in the measure of consumption, since it was an optional question in many of the countries. Questions about alcopops were also optional in some countries and thus excluded. In our sample, 89% reported zero consumption of cider and 86% zero consumption of alcopops.

*Alcohol related problems* (Studies II, III and IV)

The students were asked to report how often they had experienced a set of 16 (or in some years 15) different problems during the last 12 months (‘ever’ for one sample in study III), resulting from consumption of alcohol. These problems were arguments; fights; accidents; injuries; poor relationship with friends; poor relationship with parents; poor relationship with teachers; lower achievement at school; unwanted sex; unprotected sex, being robbed, losing money or other valuables; destroying clothes or other things; driving a vehicle under the influence; trouble with the police; and headache or feeling sick or hungover. Responses were scored 0 (never), 1 (once), and 2 (twice or more) for total scores of problem frequencies across all 16 (15) problem items ranging from 0 to 32 (0-30).

In Study IV frequencies of problems (physical fight, accident or injury, serious problems with parents or with friends, poor performance at school or work, victimization by robbery or theft, trouble with police, hospitalization or admittance to an emergency room, sexual intercourse without a condom, and sexual intercourse

regretted the next day) experienced in the last 12 months and attributed to own alcohol use were measured using category midpoints, and a summary index ranging from 0 to  $\geq 40$  times was created.

### **3.4.2 Risk factors (predictors) (Studies I and II)**

Based on the existing literature and focusing on variables amenable to preventive measures, our choice of risk and protective factors was as follows:

*Alcohol debut:* Question: How old were you the first time you drank spirits/wine/beer/cider? Answers were coded as  $< 13$  years = 1, and 13 years = 0.

*Parents' provision of alcohol:* Question: Have your parents ever offered you spirits/wine/beer/cider? Answers were coded as yes = 1 and no = 0.

*Alcohol accessibility* (Study II): Question: How easy or hard is it for you to get hold of spirits/wine/ beer/ cider? Easy/Very easy = 1 and others = 0.

*Proportion of friends who drink:* Question: How many of the friends you spend your spare time with drink alcohol? Answers were coded as at least half/a majority/everyone = 1 and some/none/do not know = 0.

*Smoking cigarettes:* Question: Do you smoke cigarettes? Answers were coded as yes = 1 and no = 0.

*Truancy and bullying:* Questions: Did you skip class last term? Did you bully other pupils in school last term? Answers were coded as yes = 1 and no = 0.

*Amount of money to spend per month:* Based on the median split, answers were coded as 300 Swedish kronor (SEK) (40 USD) or more = 1 and 0-299 SEK = 0.

*Health status* (Study II): Health status was measured with five questions about headache, backache, insomnia, tiredness and stomach-ache (Swanberg et al., 2002). The answers were coded as: a few days a week/every day = 2, one/a few days a month = 1, seldom/never = 0. Summing up the answers created an index with a range of 0-10, with 10 denoting the poorest health. Answers of 0-5 and 6-10 were coded as 0 and 1 respectively and dichotomized in the main index.

*Living with one parent* (Study II): Question: Do you live with both of your parents? Answers were coded as yes = 0 and no = 1.

### **3.4.3 Protective factors (predictors) (Studies I and II)**

*Time with family:* How much time do you spend with your parents at weekends, doing something (besides watching TV) together (Mahoney & Stattin, 2000)? Focusing on the adolescents spending most time with their families, answers were coded over 6 hours = 1 and 0-6 hours = 0.

*Relationship with parents and peers:* Questions were taken from the Inventory of Parent and Peer Attachment (IPPA) (Greenberg, Siegal, & Leitch, 1983). Attachment is synonymous with strong, secure emotional bonds to 'significant others', particularly the bond between parent and child. We used 29 questions (15 questions regarding attachment to parents and 14 regarding friends) from the IPPA, measuring attachment to parents and peers on three dimensions: communication, trust, and alienation. The questions were answered on a 5-point Likert scale (never/almost never =1, seldom =2, sometimes =3, often =4, and almost always/always =5). An index was created ranging from 0-75 for parents and 0-70 for peers, with 75 (70) indicating the most stable relationship). Focusing on the adolescents scoring 4-5 (= secure attachment), the parental attachment index was dichotomized into scores of 0-59 (=0) and 60-75 (=1), while the peer attachment index was grouped by scores of 0-55 (=0) and 56-70 (=1).

In Study II all answers were dichotomized to often/always = 1 and Never/Seldom/Sometimes = 0. An index of scores was created ranging from 0-15 (0-14 for peers), with 15 (14) representing the most stable relationships. The parental index was dichotomized to scores of 0-11 (=0) and 12-15 (=1), while the peer attachment index was dichotomized to 0-9 (=0) and 10-14 (=1).

*Parental monitoring:* The following five questions were asked: Do your parents know where you go when you are out with your friends? Do you need your parents' consent to stay out late on weeknights or weekend nights? If you are going out on Friday or Saturday night, do you need to inform your parents in advance of your whereabouts? Do your parents know what you spend your money on (Mahoney & Stattin, 2000)? The questions were answered on a 5-point Likert scale (never/almost never =1, seldom =2, sometimes =3 often =4, and almost always/always =5). Focusing on the adolescents with most answers scoring 4-5 (= high monitoring), the index was dichotomized into scores of 0-19 (=0) and 20-25 (=1).

In Study II all answers were coded often/always = 1 and never/seldom = 0. An index of total scores was created, ranging from 0-5, with 5 representing the highest parental monitoring. The index was dichotomized to those with scores of 0-4 (=0) and those with 5 (=1).

*School environment:* Thirteen statements were presented about the pedagogical and social conditions at school and students' opinions of school (Grosin, 1993), for example, 'I like being in school', 'The teachers really care about the pupils in our school', 'It is fun to learn new things in school', 'My teacher has interesting classes', 'The principal in our school is interested in the students and what we learn in school'. All answers were coded as completely agree (=4), partly agree (=3), partly disagree (=2), completely disagree (=1). Total scores were summarized in an index, which was then dichotomized into scores of 0-38 (=0) and 39-52 (=1).

In Study II all answers were coded as completely agree totally/partly agree = 1, and partly disagree/completely disagree = 0. Total scores were summed to create an index.

All indexes were tested with Cronbach's alpha for reliability (internal consistency), which ranged from 0.78 to 0.99. In Study II two indexes (health and parental monitoring) had Cronbach's alpha values below 0.7 and thus those results must be interpreted with caution.

### 3.5 STATISTICAL PROCEDURES

*Study I:* Analyses were based on adolescents participating in both surveys (2001 and 2003) and all were carried out separately for boys and girls. Frequency and  $\chi^2$  analyses of all the examined independent and dependent variables found no significant differences between the group of students who participated in both waves and the group of students who participated only in the first wave. All variables were cross-correlated to control variance overlap. The strongest correlation found in the data set was 0.59 (smoking and heavy episodic drinking in the 7th grade).

Univariate and multivariate logistic regressions, with 95% confidence intervals, were used to analyze the association between risk and protective factors in the 7th grade and heavy episodic drinking in the 7th and 9th grades. In the first round of analyses we controlled for all variables (independent and dependent) in their original formulations, that is, with all the possible answer categories left intact and found that the risk for heavy episodic drinking increased with each higher risk level, but the confidence intervals were often too wide to give reliable information. For this reason, the variables were dichotomized. The risk factors were divided into two categories, mainly yes = present and no = not present. Focusing on the adolescents reporting having the protective factors, the indexes (attachment, monitoring, and school) were dichotomized into one group reporting secure attachment; high parental monitoring and/or good school conditions) and another reporting the reverse.

Each of the risk and protective factors were then analyzed separately in relation to heavy episodic drinking in the 7th and the 9th grade. Next, all significant variables were entered simultaneously and examined in relation to heavy episodic drinking in a multivariate analysis. We also analysed the impact of number of risk and number of protective factors on heavy episodic drinking. In the last step, we used logistic regressions to analyse whether the impact of the protective factors differed depending on the presence of any particular risk factor.

*Study II:* A cluster analysis was performed on the three measurements of annual alcohol consumption (7th, 8th and 9th grade) using Wards method. The extraction of the number of cluster was based on a screen-plot of the "explained variance". The evaluation of the cluster analysis was done with the Sleipner computer program (Bergman & El Khouri, 1998).

Multinomial logistic regression analyses in SPSS were carried out, to calculate the odds of belonging to each of the four clusters. To explore all possible combinations of classes, all four clusters were used as reference categories in separate analyses. In analysis of gender, girls were the reference category. Finally, using  $\chi^2$  tests and one-way

ANOVA, the developmental patterns in grade 7-9 were analysed in relation to alcohol use, heavy episodic drinking and alcohol related problems at age 19.

*Study III:* Analyses were based on adolescents who had reported a debut age for beer, wine and/or liquor consumption, i.e. adolescents answering ‘never’ for all alcoholic beverages were removed from the analyses. All analyses were carried out separately for boys and girls. We used ANOVA and  $\chi^2$  analyses to examine possible gender differences. The proportions (%) of problems related to drinking measures were calculated. Finally, attributable proportions (AP) were calculated for problems according to the different drinking categories. AP, in this case the proportion of alcohol-related problems in a group that can be attributed to belonging to this group, is a measure of the public health impact of a factor, in this case alcohol use. The formula for AP, or population attributable risk percentage (PAR %), is:

$$\text{PAR\%} = [(\text{rate total population} - \text{rate unexposed}) / (\text{rate total population})] \times 100\% \text{ (Northridge, 1995).}$$

*Study IV:* Analyses were based on adolescents who had reported any consumption of beer, wine, or spirits in the last 12 months, i.e. adolescents answering ‘never’ for all alcoholic beverages were removed from the analyses. All analyses were carried out separately for boys and girls. We used ANOVA and  $\chi^2$  analyses to examine possible gender differences. Pearson product-moment correlation and Spearman’s rank correlation between annual alcohol consumption, heavy episodic drinking, and alcohol-related problems were calculated by country and overall. Proportions and mean levels of problems related to drinking were calculated. Four groups – the upper 10 % of drinkers by annual alcohol intake, with and without heavy episodic drinking during the last 30 days, and the bottom 90 % of drinkers, with and without heavy episodic drinking – were compared. Also, each separate problem was analysed in relation to yearly alcohol consumption and heavy episodic drinking.



## **4 RESULTS**

This thesis comprises four studies. The aims, research questions, results and conclusions from each study are described in the following pages.

### **4.1 STUDY I. HEAVY EPISODIC DRINKING IN EARLY ADOLESCENCE: GENDER-SPECIFIC RISK AND PROTECTIVE FACTORS**

#### **4.1.1 Aim**

To examine possible gender differences regarding risk and protective factors for heavy episodic drinking among 1222 7th grade students (aged 13) in Stockholm, Sweden, with follow-up 2 years later.

#### **4.1.2 Results**

In the 7th grade girls smoked more than boys, had more friends who drank alcohol, liked school to a less, reported higher levels of parental monitoring, more stable attachments to peers but less stable attachment to parents and spent more time with their parents. Boys reported lower onset age for alcohol, more bullying and were more likely to be heavy episodic drinkers in the 9th grade.

Logistic regression analyses showed that when analysed separately, almost all risk factors increased the risk of heavy episodic drinking for both boys and girls, cross-sectionally as well as over time; smoking and heavy episodic drinking in the 7th grade were associated with the highest odds for heavy episodic drinking two years later for both boys and girls. Conversely, high parental monitoring was the strongest protective factor against heavy drinking (reduced the odds) over time for both sexes.

However, when adjusted for the influence of all factors, we found some gender differences. Our multivariate analysis revealed that having friends who drink alcohol showed the strongest association with heavy episodic drinking for boys in the 7th grade (odds ratio [OR] = 4.54), while smoking was the strongest risk factor for girls (OR = 11.27). The strongest predictors for boys' heavy episodic drinking in the 9th grade were heavy episodic drinking (OR= 5.30) and smoking in the 7th grade (OR = 5.80), while drinking peers (OR = 2.47) and smoking (OR = 2.44) in the 7th grade showed the strongest association for girls. Furthermore, truancy was a risk factor for boys only, whereas parental provision of alcohol showed a significant effect only on girls' heavy episodic drinking.

None of the protective factors, except boys spending time with family on weekends, had a significant effect on heavy episodic drinking. However, high parental monitoring and having a secure attachment to parents was found to have a protective effect when specific risk factors were present.

### **4.1.3 Conclusions**

Peer drinking and smoking were strong predictors of heavy drinking in adolescent boys and girls, making these factors suitable for prevention initiatives. Girls and boys who smoke cigarettes, have drinking peers, and drink heavily should be given extra attention. Furthermore, our results lend support to prevention initiatives to strengthen the parent–child relation, strengthen adolescents’ abilities to resist peer pressure and, limit parental provision of alcohol to adolescents.

## **4.2 STUDY II. ADOLESCENT ALCOHOL USE TRAJECTORIES: PREDICTORS AND SUBSEQUENT PROBLEMS**

### **4.2.1 Aim**

This study was aimed at identifying different alcohol use trajectories in early adolescence. We also examined a broad range of factors in terms of their capacity to predict trajectory membership, and investigated the associations between the identified trajectories and subsequent alcohol use problems.

### **4.2.2 Results**

Analyses were based on data from 1201 adolescents who participated in the first three data collections and answered the alcohol consumption questions. There was high study attrition at age 19; the attrition group had higher levels of annual alcohol consumption and more often reported heavy episodic drinking in the 7th grade than the remaining participants.

Analyses revealed four developmental pathways: low, gradually increasing, high, and suddenly increasing consumption. While the proportion of boys and girls in trajectories 1 and 2 was about the same, trajectory 3 included more girls and trajectory 4 more boys.

The trajectories were also linked to various risk and protective factors. We found that the consistently high consumption trajectory, with a majority of girls, was characterized by easy access to alcohol, generous parental handling of alcohol, having many friends who drink, and smoking cigarettes. Individuals in this trajectory also had an insecure attachment to their parents, spent little time with their family on weekends, reported poor health status, and experienced low parental monitoring (data not shown).

Both ‘high consumers’ and ‘sudden increasers’ reported higher levels of alcohol consumption, heavy episodic drinking, and alcohol-related problems both at age 14–16 and at age 19. Smoking cigarettes predicted membership in the three highest alcohol consumption trajectories. Easy access to alcohol, visiting youth recreation centres, having friends who drink, and poorer health all predicted membership in the gradual increasers trajectory rather than in the low consumer/abstainer group. In contrast, adolescents who spent time with their family on weekends had lower likelihood of belonging to the alcohol-consuming trajectories. In addition, ‘high consumers’ were

more likely to have drinking peers than either ‘low consumers/abstainers’ or ‘gradual increasers’. Gender did not predict trajectory membership.

### **4.2.3 Conclusions**

The high consumers and sudden increasers in our study had considerably higher levels of heavy episodic drinking at all ages (14–19). Also, they reported more alcohol-related problems at ages 14–16 as well as 19. One implication of our results may be that young adolescents who smoke cigarettes, have friends who drink, report poor health, and/or visit a youth recreation centre should be given extra attention as they have an increased risk for future high alcohol use and subsequent problems. As expected, adolescents who spent time with their family on weekends had lower likelihood of belonging to the alcohol consuming trajectories, indicating that this had a protective impact.

Our results cannot answer the question of whether heavy drinkers search for drinking peers or are primarily influenced by their friends’ drinking. However, our results do show that as early as the 7th grade, about 94 % of the high consumers and 49 % of the gradual increasers reported that at least half of their friends drank alcohol (data not shown). In addition, the results cannot answer the question of whether girls turn to heavy episodic drinking as a way to deal with health-related or other problems, or whether poor health or other problems are a result of heavy episodic drinking. However, girls reporting poorer health in the 7th grade also had a significantly higher risk for heavy episodic drinking in the 9th grade (data not shown).

## **4.3 STUDY III. DOES THE PREVENTION PARADOX APPLY TO YOUNG PEOPLE?**

### **4.3.1 Aim**

To examine the extent to which the prevention paradox applies to the relationship between various drinking patterns and alcohol-related problems in adolescent boys and girls. Our research questions were:

- Is the prevention paradox valid for adolescent boys and girls
- at different ages?
- for different measures of drinking?
- for different kinds of alcohol-related problems?

### **4.3.2 Results**

Mean alcohol consumption, number of problems and proportion of heavy episodic drinkers increased with age (13-18 years). Generally, boys reported higher alcohol consumption and more heavy episodic drinking than girls. At the same time, girls reported a significantly higher average number of alcohol-related problems.

The bottom 90 % of consumers by annual intake accounted for a large majority of the alcohol-related problems among boys and girls at all ages. The share of problems accounted for by monthly heavy episodic drinkers increased with age. Heavy episodic drinkers, especially frequent heavy drinkers, had a higher mean number of problems at all ages than non-heavy episodic drinkers.

Attributable proportions, i.e. the proportion of alcohol related problems in a group that can be attributed to belonging to that group, ranged from 13 % to 37 % in the top 10% of alcohol consumers compared to from 9 % to 56 % in the bottom 90 % consumers with monthly heavy drinking.

### **4.3.3 Conclusions**

A majority of all alcohol-related problems were accounted for by the bottom 90 % of annual alcohol consumers, a support for the prevention paradox. A majority or a large share was accounted for by the heavy episodic drinkers in the bottom 90 % of consumers, which supports a 'second-order prevention paradox'. One contradiction lies in the fact that, most problems are associated with the rather large risk group of frequent heavy drinkers, who at the same time belong to the bottom 90 % of all consumers. This implies that effective population strategies, e.g. stronger enforcement of minimum legal age for alcohol purchases and limited availability to alcohol, probably have more potential to reduce risk drinking and the overall problems than strategies aimed at high-risk individuals. At the same time, however, a comprehensive prevention strategy should nevertheless also include efforts to reach adolescent high-consumers.

## **4.4 STUDY IV. ALCOHOL USE, HEAVY EPISODIC DRINKING, AND SUBSEQUENT PROBLEMS AMONG ADOLESCENTS IN 23 EUROPEAN COUNTRIES: DOES THE PREVENTION PARADOX APPLY?**

### **4.4.1 Aim**

To examine the prevention paradox in relation to alcohol consumption, heavy episodic drinking and alcohol-related problems among 38 370 alcohol consuming adolescent boys and girls in 23 European countries.

Our research questions were:

1. To what extent is the prevention paradox valid for different patterns of alcohol use?
2. How are different patterns of alcohol use associated with different reported problems?
3. To what extent are the findings the same or different in different countries?
4. For all of the above, are gender differences found?

### **4.4.2 Results**

The mean levels of consumption and alcohol-related problems varied largely between boys and girls and between different countries. In all countries, boys' alcohol consumption exceeded girls'. Also, boys reported a significantly higher average number of alcohol-related problems in a majority of the countries. With two exceptions (boys in Isle of Man [IOM] and Sweden), the bottom 90% of consumers by annual

intake accounted for a majority of the alcohol-related problems, ranging from 57% in Norway to 82% in Cyprus for boys and from 57% in Estonia to 78% in Lithuania and Romania for girls.

Boys reported a significantly higher frequency of heavy episodic drinking than girls in all countries except Iceland and Sweden, where the figures were comparable for girls and boys, and IOM, Norway, and the UK, where the figures were reversed; i.e. girls reported a higher frequency. The bottom 90% of alcohol consumers with monthly heavy episodic drinking accounted for a majority of the alcohol-related problems for boys in 17 countries and for girls in 12 countries, and for a substantial minority in the other countries.

The most commonly reported alcohol-related problems in the top 10% consumer group, over all countries, were physical fight and unprotected sex for boys, and unprotected sex and having performed poorly at school or work for girls. In most countries, the heavy episodic drinkers in the bottom 90% of consumers by annual intake accounted for a majority of all alcohol-related problems, irrespective of the severity of the problem.

#### **4.4.3 Conclusions**

The prevention paradox seems valid for adolescent boys and girls in Europe and for alcohol-related problems of varying severity. Despite large cultural differences in annual alcohol consumption, levels of heavy episodic drinking, and reported problems, we found that in general the heavy episodic drinkers in the bottom 90% group accounted for a majority of all reported problems, supporting population prevention strategies. This implies that population strategies (e.g. higher prices, enforced age limits, restricted availability to alcohol) may have the potential to reduce the overall level of alcohol-related problems. Mean alcohol consumption and heavy episodic drinking have both been shown to fall with increases in the price of alcohol. Additionally, higher prices for alcohol have been shown to reduce alcohol-related mortality, traffic crash deaths, sexually transmitted diseases, violence, crime, and alcohol-related admissions to emergency departments.

## **5 GENERAL DISCUSSION**

### **5.1 SUMMARY OF FINDINGS**

The specific focus throughout this thesis has been on alcohol use and heavy episodic drinking in early to middle adolescence among boys and girls and in relation to subsequent problems. Possible differences between boys' and girls' drinking patterns, risk and protective factors, alcohol-related problems, and other study measures have been of particular interest as have any practical implications those differences may have.

First, we identified specific individual, family, and peer factors as very important in relation to adolescent heavy drinking and alcohol use trajectories and found many similarities, and some notable differences, between boys and girls. Smoking and peer alcohol use were strongly associated with heavy drinking in both boys and girls, both cross-sectionally and longitudinally. Parental provision of alcohol in the 7th grade increased the odds of heavy alcohol use two years later only in girls and truancy was associated with later heavy alcohol use only in boys. We also found that having a secure attachment to parents and/or high parental monitoring had a protective effect for adolescents with risk factors and thus lowered the risk for heavy episodic drinking.

A second aspect highlighted by our results is that, for boys, heavy episodic drinking at age 13 is one of the most distinct predictors of heavy episodic drinking two years later. In addition, adolescents with a constant 'high' or 'sudden increase' alcohol use trajectory in early adolescence had higher levels of heavy episodic drinking and alcohol-related problems at age 19.

Third, we found that the prevention paradox seems valid for adolescent boys and girls in Sweden and in most European countries, as well as for alcohol-related problems of varying severity. That is, despite large cultural differences in annual alcohol consumption, levels of heavy episodic drinking, and reported problems, we found that in general the heavy episodic drinkers in the bottom 90 %, rather than the top 10 %, of drinkers accounted for a majority of all reported problems. Generally, boys reported higher alcohol consumption and a higher average number of alcohol-related problems in a majority of the countries. Boys reported a significantly higher frequency of heavy episodic drinking than girls in all countries except Iceland and Sweden, where the figures were comparable for girls and boys, and IOM, Norway, and the UK, where girls reported more frequent heavy episodic drinking.

### **5.2 IMPLICATIONS FOR PREVENTION**

#### **5.2.1 Population versus targeted interventions**

There are two essential models for prevention, which represent apparently opposing but actually complementary frameworks for policy development; high-risk strategies and population strategies (Norström, 1995; Skog, 1999; Skog, 2006; Gmel et al., 2001). On the one hand, some researchers posit that a substantial decrease in a population's mean

consumption will always be accompanied by a decrease in the prevalence of heavy drinkers (Babor et al., 2010). On the other hand, a repeated finding is that even at relatively lower levels of volume, many types of alcohol-related problems are associated with drinkers who at least intermittently report high episodic drinking (Skog, 1999; Gmel, 2001; Stockwell, 1996).

Our analyses among adolescents in Sweden and 22 other European countries show that the majority of problems may occur in relation to heavy drinking occasions, and since the number of subjects with occasions of heavy drinking is larger among low to moderate drinkers than among the much fewer heavy overall consumers, the ‘second-order prevention paradox’ seems applicable (Skog, 1999; Gmel, 2001). Hence, our results in studies III and IV imply that effective population strategies probably have more potential to reduce risk drinking and the *overall problem level* than high-risk strategies aimed at smaller groups. Furthermore, our results show that easy access to alcohol predicted membership in one of the three alcohol consumer groups, and access to alcohol (through parents or by other means) is a factor where intervention on a societal level would be possible.

Prevention science is built on the assumption that negative health outcomes such as alcohol abuse can be prevented by reducing risk factors and enhancing protective factors in individuals and their environments (Hawkins, Catalano & Arthur, 2002). Previous findings indicate that not only individuals but also communities differ in levels of risk and protection and that those differences are related to differences in substance use (Hawkins, Van Horn & Arthur, 2004). Thus the need to tailor community-wide prevention efforts, adapted to each community’s specific profile of risk and protection, has been stressed (Hawkins, Van Horn & Arthur, 2004).

Research has suggested that positive results, i.e. reducing alcohol consumption and alcohol-related harm, may be achieved by controlling the physical availability of alcoholic beverages, as well as prices, opening hours, and legal buying age (Babor et al., 2010). Mean consumption, as well as heavy episodic drinking may be affected by changes in prices; higher prices have been shown to lower drinking levels (Abel, 1998). Higher alcohol prices and taxes have also been shown to reduce alcohol-related mortality, traffic crash deaths, sexually transmitted diseases, violence, and crime (Wagenaar, Tobler & Komro, 2010). Restricting access to alcohol has also been found to reduce heavy drinking episodes and alcohol-related admissions to emergency department, especially among 10- to 15-year-olds (Gmel & Wicki, 2010).

However, as we showed in study IV, there are large cultural differences in alcohol consumption, levels of heavy episodic drinking, and reported problems among European adolescents, implying great variations in both individual risk and protection levels and in community risk and protection levels. This raises several more questions. First, should we focus efforts on general alcohol consumers or on heavy episodic drinkers? Second, can we assume that prevention initiatives can be implemented cross-culturally? And third, how can successful prevention initiatives from one country and drinking culture be translated to another country or drinking culture?

As previously described, the heavy episodic drinkers in our studies accounted for a large part of all the reported problems. Furthermore, we found that drinking more than five drinks at one occasion is not necessarily a behaviour that adolescents grow out of. Thus, a comprehensive prevention strategy should include not only population strategies, but also efforts to reach adolescent high-consumers, as those efforts may have immediate as well as far-reaching effects.

### **5.2.2 Successful prevention initiatives**

Prevention initiatives focused on heavy episodic drinking (e.g. increasing knowledge, teaching refusal skills, draw up policies at universities and colleges) have so far shown little effect (Oei & Morawska, 2004). However, a recent study showed that ‘natural mentoring relationships’ (e.g. with a teacher or other adult in school who cares about, listens to, and supports the adolescent) may have direct and indirect effects (i.e. increasing school attachment) that in turn may decrease heavy alcohol use (Black et al., 2010). Also, certain prevention programs (preferably aimed at the entire eligible population and focused on family and school) have been associated with a reduction in heavy consumption also at follow-up a few years later (Spoth, Greenberg & Turrisi, 2008 for a detailed review). Family interventions that typically include child monitoring, parent-child bonding, and targeting adolescents aged 10 to 15 years old seem to have considerable promise in reducing adolescent alcohol use (Spoth, Greenberg & Turrisi, 2008; Foxcroft et al., 2003 for reviews), but female-specific programmes focused on improving family (especially mother-daughter) relationships were found to be the only programmes with demonstrated long-term benefits (Foxcroft et al., 2003).

There is still a clear need to develop culturally specific interventions and to demonstrate the generalizability of the findings (Spoth, Greenberg & Turrisi, 2008). Only a few studies have examined cross-cultural predictors and negative outcomes of adolescent alcohol use, demonstrating relationships independent of country between risk factors such as peer alcohol use, lack of parental monitoring, dissatisfaction with parents and current heavy alcohol consumption (Kokkevi et al., 2007) and between the availability of alcohol and heavy alcohol consumption (Bjarnasson et al., 2003), thus indicating some generalizability between countries of certain risk factors for alcohol use. This also implies that, to some extent, prevention initiatives may be implemented cross-culturally. It has, however, also been shown that reports of alcohol-related adverse outcomes among young adults differ markedly between countries (Plant et al., 2009) and may be strongly affected by drinking culture, with respondents from ‘binge drinking’ cultures more likely than other respondents to attribute negative consequences to their alcohol use (Kuendig et al., 2008). The differences can partly be explained by different consumption habits (Hibell et al., 2009), but, as suggested by our results in study IV, may also be explained by cultural differences in attribution processes, i.e. different consequences are more or less acceptable in different countries (Kuendig et al., 2008). Furthermore, research has shown that adolescent attitudes towards traditional gender roles affect their drinking patterns, especially drinking to intoxication (Schulte, Ramo & Brown, 2009 for review), which may explain some of the differences we found between girls and between boys in different countries in study IV. One interpretation may be that it is more acceptable in the Nordic countries and the



UK than in the Mediterranean countries for adolescent girls to go out and ‘drink like a guy’. This implies that prevention strategies may be improved by including, emphasizing, or challenging prevailing culturally specific gender norms, for example stereotypes linking masculinity to drinking and intoxication (Schulte, Ramo & Brown, 2009).

A decrease in alcohol consumption and drinking to intoxication among Swedish adolescents has been noticed over the last years (CAN, 2010), suggesting that national prevention initiatives directed to adolescents and their parents (e.g. stressing availability of alcohol) may have been successful (Engdahl & Romelsjö, 2009). However, national and local alcohol and drug prevention work in Sweden was recently examined, but due to the lack of documentation and evaluation of the methods used, an association between prevention efforts and decreased consumption could not be established (The Swedish National Audit Office [SNAO], 2010). Local knowledge of alcohol and drug use in the community and the use of evidence-based methods were emphasized as crucial to developing effective local preventive measures. Considering that studies show controlling access to alcohol may be an effective way to prevent adolescent alcohol use, the fact that many communities instead focus their efforts on the provision of information was questioned (SNAO, 2010). Thus, further research is still needed on the impact of different preventive strategies for both alcohol habits and subsequent problems (Babor et al., 2010).

### **5.2.3 Gender-general versus gender-specific interventions**

The limited research on possible gender differences in predictors of adolescent alcohol use shows somewhat ambiguous results. A previous cross-sectional Swedish study concluded that the risk factors are similar for girls and boys, but that some exceptions concerning family communications may be associated only with boys’ alcohol consumption (El-Khoury, Sundell & Strandberg, 2005). Another Swedish longitudinal study highlighted the fact that, in general, adolescent girls may be more strongly influenced by social interaction than are boys (Bergmark & Andersson, 1999). Other findings indicate that family factors, such as attachment, communication, and supervision may have a slightly greater impact on girls’ use of substances (including alcohol) than on boys’ (Kumpfer, Alvarado & Whiteside, 2003). Hence, gender differences in risk and protective factors may lie more in the relative strength and impact of various known factors on one gender or the other, rather than in new, gender-specific factors.

Our findings suggest that prevention efforts should start early and include attempts both to limit risk factors (e.g., limiting access to alcohol and cigarettes, preventing truancy [especially among boys], and addressing [especially among girls] symptoms of poor health) and to enhance protective (relational) factors. In line with previous research (Kliewer & Murrelle, 2007) we found that the accumulation of risk increases the odds for current and later heavy episodic drinking. Thus, the more risk factors the adolescents’ face, the greater their odds for heavy episodic drinking. Similarly, we found that the more protective factors in the adolescents’ lives, the lower their odds for heavy drinking. A secure attachment to parents and/or high parental monitoring may also have a protective effect in adolescents with risk factors present. We showed that,

especially for girls, secure bonds to parents can in fact lower the risk for heavy episodic drinking even if the girls have friends who drink alcohol, money to spend, or parents who offer them alcohol. Thus, a strong parent-child relationship can act as a ‘buffer’ and parental provision of alcohol may not be *as great* a risk for adolescent girls who have a stable relationship with their parents.

For boys whose parents offer them alcohol, parental monitoring shows a greater likelihood of lowering their odds for both current and later heavy episodic drinking. Also, in line with previous research (Bahr, Hoffman & Yang, 2005), we found that for both boys and girls with drinking peers, parental monitoring had a protective effect on heavy episodic drinking. Our results are consistent with previous research illustrating stronger effects (however small) of parental attachment on alcohol consumption in girls rather than boys, and a stronger relation between parental monitoring and alcohol use in boys than in girls (Van der Vorst et al., 2006).

Thus it seems a promising way to prevent adolescent heavy drinking may be by focusing on parents with interventions that could, for example, encourage communication in the family. Consistent with previous research (Li, Feigelman & Stanton, 2000), we found that girls report more parental monitoring than boys, while boys may benefit from closer monitoring, having parents ask more consistently about their whereabouts, friends, what they spend their money on, etc. Working with parents during school meetings and encouraging them to adopt more restrictive attitudes toward adolescent alcohol use may be an effective way to reduce not only underage drinking, but also adolescent delinquency (Koutakis, Stattin, & Kerr, 2008). Research examining (primarily American) parenting programmes identified key features of interventions shown to reduce adolescent alcohol use: involving adolescents in family activities, maintaining good familial bonds, and managing conflicts in the family (Petrie, Bunn & Byrne, 2007). However, further research is needed to assess whether those findings are applicable in other countries. A recent Swedish thesis concluded that the, originally American, Strengthening Families prevention program (“Steg-för-Steg”) could be transported and culturally adapted to Swedish conditions, but at the same time it showed no effect on adolescent substance (alcohol and drugs) use (Skärstrand, 2010). Hence, further research is needed to assess whether positive findings in one country is applicable in other countries.

Another important target for prevention, based on our results, seems to be to focus on adolescents’ abilities to resist peer pressure and/or norms encouraging alcohol consumption. It has been shown that prevention programmes with higher rates of success for girls included teaching them social resistance skills, reducing negative social influences, and altering perceived social norms regarding alcohol and alcohol consumption (Kumpfer, Smith, and Summerhays, 2008). Also, higher resistance self-efficacy (for example resisting peer pressure to drink) has been linked to less frequent heavy drinking, making it a suitable area for prevention initiatives (Tucker, Ellickson & Klein, 2008).

As in previous studies (Simonsson et al., 2008; Wu et al., 2006), we found that girls tend to report poorer health than boys; girls reporting poorer health in the 7th grade also had a significantly higher risk for heavy episodic drinking in the 9th grade. Since 2004,

Sweden's national guidelines have stressed that every pupil should be offered structured counselling conversations about health, well-being, friends, family, etc., with a neutral adult professional (National Swedish Board of Health and Welfare, Socialstyrelsen, 2004). Hence, one way of identifying those girls at higher risk for heavy drinking could be through these health conversations, which are meant to take place in every Swedish school with pupils aged 6, 10, 13, and 16, with the objective of increasing children's and adolescents' awareness and knowledge of social and health issues, including the risks of using alcohol and other drugs.

#### **5.2.4 Summary**

The studies on the prevention paradox indicate that effective population strategies may have the potential to reduce risky drinking and the overall level of alcohol-related problems, but should also include efforts to reach adolescent heavy episodic drinkers. We have identified risk factors suitable for population strategies for the prevention of adolescent problem drinking, such as limiting access to alcohol and tobacco and encouraging schools to work actively against health problems in girls and truancy in boys. We have also found areas that may be more suitable for targeted interventions, such as improving adolescents' skills at resisting peer pressure. Our research also indicates that interventions focused on parents, aimed at improving their communication, attachment, and monitoring, may also be a promising method of preventing heavy drinking in adolescents.

### **5.3 STRENGTHS & LIMITATIONS**

This thesis may contribute to the scientific literature in various ways. It focuses on gender, examines relatively young adolescents, uses both a prospective design and a developmental perspective, and analyses several risk and protective factors, comparing their relative importance in early adolescent heavy episodic drinking.

Our studies also add to the literature on the prevention paradox, focusing not only on adolescents at different ages from different geographical areas in the same country, but also on adolescents in different countries, gender differences, and how the prevention paradox applies to a wide range of alcohol-related problems in relation to annual alcohol consumption and heavy episodic drinking.

#### **5.3.1 Generalizability**

Data from our longitudinal cohort study included all seventh grade students in all 18 schools and 79 classes in 6 out of 18 districts in Stockholm, Sweden (Romelsjö et al, 2003). The district chosen constituted different socio-demographic areas within the city, covering low-, middle-, and high income districts and were hence, in this respect representative of the entire city. However, data from areas with large number of immigrants is lacking, which is a clear limitation with our study.

Another obvious limitation of our studies is that we rely solely on self-reports. Anonymous self-reports are, however, generally considered reliable and valid if confidentiality is stressed (Brener, Billy & Grady, 2003 for a review; Campanelli, Dielman, & Shope, 1987).

A further limitation is the high attrition at age 19 (study II). Our missing data analysis showed that this probably led to an underestimation of the consumption level, the rate of heavy episodic drinking, and the level of alcohol-related problems in the different drinking trajectories at age 19. One implication could be that the alcohol-consuming adolescents in our study are in fact at even greater risk of future high alcohol consumption and alcohol-related problems than our results suggest. Data from earlier Swedish studies suggest that adolescent non-responders are more likely to be high consumers than those who respond (Andersson, Hibell, & Sandberg, 1999; Romelsjö & Branting, 2000), but this does not necessarily mean that risk and protective factors would be different among non-responders. The annual consumption and level of heavy episodic drinking in our Stockholm data is below the Swedish average from the same time period (CAN, 2003), indicating a possible underestimation of the consumption level and of heavy episodic drinking. The data from the annual examinations of alcohol and drug habits among Swedish and European adolescents, that were analysed in studies III and IV are considered reliable; the study population were from randomly selected schools all over Sweden and Europe; participation rates were high, the study populations in the different countries were close to or over the recommended number and the samples were representative (CAN, 2008; Hibell et al., 2009).

### **5.3.2 Validity and reliability**

A majority of the questions used (e.g. parental provision of alcohol, attitudes towards school, parental monitoring, time spent with family and attachment) have been tested in various pilot and regular studies (Grosin, 2004; Greenberg, Siegal, & Leitch, 1983, Mahoney & Stattin, 2000; Greitz & Svensson, 2005). The questions about alcohol consumption have demonstrated good reliability in test-retests (Hibell et al., 1997). Research has demonstrated that methods that inquire about frequency and volume for each separate alcoholic beverage, as in our studies, yield the most realistic values of intake (Feunekes et al., 1999). Our classification of annual alcohol consumption in study IV had some weaknesses. First, adolescents responded to questions about ‘the last day’ they used alcohol, but we have no way of knowing whether or not this was a typical episode of alcohol use. Second, multiplying the reported alcohol drunk on ‘the last day’ by ‘number of drinking occasions during the last year’ may have distorted the measure of total consumption if the reported ‘last day’ was atypical. However, it seems reasonable to assume that this distortion would not differ very much between boys and girls and between different countries. Furthermore, it is difficult to know whether heavy episodic drinking (drinking 5 or more drinks in a row) is understood in the same way in different countries with different alcohol cultures and varying understandings of what constitutes a ‘drink’.

Different cut-off points for heavy episodic drinking have sometimes been suggested for boys and girls (Wechler et al., 1995, NIAAA, 2004). We used the same measurement for both sexes in all of our studies and did, nevertheless, in many cases capture roughly the same proportion of heavy episodic drinkers among boys and girls. These statistics are troubling, since research demonstrates a greater vulnerability in girls than in boys to many of the health effects of alcohol (Schulte, Ramo & Brown, 2009 for a review). It would have been desirable to compare different cut-off points (e.g. 5 drinks for boys

and 4 drinks for girls) but with the heavy episodic drinking-question used in our studies this was unfortunately impossible. In Sweden one 'drink' (unit) corresponds to 10-12 grams of alcohol. Our measure of heavy episodic drinking, used in studies I and II (e.g. a bottle of wine or four cans of beer etc) equals '+ 6 drinks', thus making comparisons to other studies somewhat difficult and hard to interpret.

Our analyses only concern problems self-attributed to alcohol use. In a Swiss study on adolescents, self-attributed consequences among adolescents were compared with consequences without self-attribution and the number of alcohol-related consequences reported under the latter approach was larger (Gmel et al, 2010). Thus, in monitoring the overall burden of alcohol use, it is preferable that both attributed and non-attributed problems be examined. Also, to some extent, different questions about alcohol-related problems are used in study III and IV, making comparisons somewhat difficult. The choice to define the 'high-risk group' to the top 10% of annual alcohol consumers has its' limitations. This cut off limit may seem somewhat arbitrary and further analyses of the prevention paradox should compare different risk groups, based on different consumption habits as well as levels of risk and protective factors.

Our choice, classification, and dichotomization of risk and protective factors might also be questioned. In the included studies, the terms 'risk' and 'protective factor' were used in the same way as in many other studies on adolescent alcohol and drug use and criminality (e.g., Stattin, Romelsjö, & Stenbacka, 1997). Our choices were guided by the existing literature and based on the selection of factors that could be addressed through interventions on the individual, relational, and societal levels. Our focus was on adolescents who reported having the chosen risk and protective factors, rather than those who did not, hence the dichotomization and grouping of participants that was necessary to attain sufficient information. This seemed a satisfactory procedure, as the risk or protection of the factor changed with each higher level of the variables. Nonetheless, we are cautious in making use of the terms, and drawing conclusions about, "causal factors/mechanisms". Three major systems of explanatory variables are often included in studies of risk and protective factors: the perceived-environment system, the personality system, and the behaviour system (Jessor, 1991; Jessor et al., 1995). We do not, for example, have data on individual psychosocial factors, and hence, our studies do not include all possible factors important in adolescent alcohol use. One question is whether both the independent variables and the dependent variable can be explained by one or more factors earlier in life. Some research has shown that children who run a high risk of future (alcohol) problems can be identified at preschool or even earlier (Donovan, 2004; Kaplow et al., 2002; Olsson et al., 2000; Oxford et al., 2000). However, such information is in reality seldom available, and is also lacking in the present studies.

## **5.4 FUTURE DIRECTIONS**

This thesis highlights some important areas for future research.

First, further examinations concerning gender differences in relation to alcohol are needed. As noted by several researchers, there is little information on gender-sensitive

and gender-appropriate approaches to prevention (Kumpfer, Smith & Summerhays, 2008; Amaro et al., 2001; Guthrie & Flinchbaugh, 2001; Freshman & Leinwand, 2001). Today, many of the prevention programmes used in Sweden (e.g. Örebro Preventionsprogram, Komet, Prevention i Skolan) are being reevaluated and it is most relevant that possible gender-specific effects and symptoms should be considered.

Second, the connections and interactions between risk, protection, gender, age, and alcohol use are complex phenomena. As shown in the introduction, the results regarding risk and protection are somewhat ambiguous and dependent on the confounders examined. Factors interact, work as mediators, have buffering effects, and so on. Thus, without a holistic approach, covering all relevant areas, it is difficult to draw conclusions about the impact of individual factors. Furthermore, the impact of each risk and protective factor differs at different ages, demanding longitudinal research. Also, there are some indications that polarization in adolescent drinking is increasing, i.e. that the average annual consumption is decreasing while heavy episodic drinking is stable (CAN, 2010). Thus longitudinal research may gain from focusing on adolescents with different risk profiles and risk levels as a way also to identify protective mechanisms.

Third, future research should examine both societal and individual factors more closely. For example, as mentioned earlier, research has linked living during childhood in an unstable neighbourhood, where residents frequently move in and out, to the development of late adolescent alcohol-use disorder (Buu et al., 2009). The positive effects of cohesion to family, school and society have been demonstrated (e.g. Wu et al., 2007) and future research should examine the effects that feeling outside of the society, and perhaps representing different norms (e.g. ethnic and/or sexual), may have on alcohol consumption.

Fourth, adolescents within countries as well as between countries have different reasons for drinking and different expectations in relation to their drinking (Kuntsche et al., 2005; Kuntsche et al., 2007b). To fully understand adolescent drinking, these motivational and expectant factors also need to be examined.

Finally, evidence suggests that adolescent heavy alcohol use may be prevented through a combination of regulatory, early-intervention, and harm-reduction approaches (Toumbourou et al., 2007). Considering over 80 % of Europe's 15-to 16-year-olds are alcohol consumers one might ask if preventing any alcohol use is an attainable goal. Perhaps it would be more realistic to focus on diminishing heavy episodic drinking, especially since, on average, 59 % of the European boys and 50 % of the European girls report monthly heavy episodic drinking and a majority of the alcohol-related problems in our studies were found among the adolescents in the bottom 90 % of annual consumers who reported heavy drinking episodes. How this is to be done in the most effective way remains an unanswered question, even if this thesis may highlight some possible areas to focus on.

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