

From the Department of Public Health Sciences  
Division of Social Medicine  
Karolinska Institutet, Stockholm, Sweden

# **STUDIES IN YOUTH ALCOHOL CONSUMPTION AND PREVENTION**

Mats Hallgren



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## ABSTRACT

**Background:** Alcohol remains the ‘drug of choice’ for most young people and is responsible for a sizable proportion of deaths and injuries every year. In Sweden, total consumption and rates of heavy episodic drinking have reduced over the past ten years. At the same time, the number of adolescents admitted to hospital as a consequence of their drinking has risen. This unexpected trend warrants explanation with empirical research. The recent increase in serious alcohol-related harms also suggests there is more to learn about what works in prevention, including the effects of community-based approaches and targeted brief interventions.

**Objectives:** The thesis has two main objectives; first, to describe recent trends in alcohol consumption among Swedish youth, with a particular focus on polarisation effects (Study I). The second objective is to examine the effects of various alcohol prevention strategies targeting young people, and what can be learnt from these interventions (Studies II-IV).

**Methods:** Study I (polarized youth drinking) uses repeated cross-sectional self-report data from the Stockholm Student Survey to explore changes in alcohol consumption and risk factors associated with heavy drinking among year 9 and year 11 students in Stockholm between 2000 and 2010. Changes in the dispersion of consumption over time are reported. Study II also uses cross-sectional data to examine the effects of a comprehensive alcohol prevention trial targeting young people in 12 communities in Sweden between 2003 and 2007. Studies III and IV assess the effectiveness of a brief health education program on consumption and attitudes towards alcohol in high schools and the Swedish military, with assessments taken at 5 and 20 month follow-up. All participants were aged between 15 and 20 years.

**Results:** Findings indicate that a polarization in youth drinking is a likely explanation for the recent divergence between alcohol consumption and serious alcohol-related harms among youth. We found significant increases in the dispersion of consumption over time, indicating more heavy drinkers in the tail end of the drinking distribution. Most adolescent in Stockholm continue to drink less or abstain from alcohol completely, but a minority continue to drink more alcohol. Results concerning the relationship between heavy drinking and risk factors were inconclusive. We found no significant improvements in six trial communities compared to six control communities following a four year multi-component community intervention primarily targeting young people, although adults in the trial communities developed more restrictive attitudes towards the supply of alcohol. The *Prime for Life* brief health education program did not lead to significant improvements in alcohol use or attitudes towards alcohol in either high school students or military conscripts.

**Conclusion:** We suggest that ongoing social changes could be affecting young people in the form of greater disparities which are associated with a higher incidence of social problems generally, including heavy drinking. Communities can be mobilized to initiate the organizational changes necessary for effective alcohol prevention. However, for aggregate level effects on youth drinking, strategies with demonstrated effectiveness must be implemented consistently and given sufficient time to influence drinking habits. Brief health education strategies, such as *Prime for Life*, may help to improve short-term attitudes towards alcohol use, but are unlikely to result in sustained behaviour change.

## LIST OF PUBLICATIONS

- I. **Hallgren M**, Leifman H., & Andréasson S (2012). Drinking less but greater harms: could polarised drinking habits explain the divergence between consumption and harm among youth? *Alcohol and Alcoholism* (in press).
- II. **Hallgren M**, Leifman H, & Andréasson, S (2012) The Swedish six community alcohol and drug prevention trial: Key findings and lessons learnt. *Submitted Manuscript*.
- III. **Hallgren M**, Källmén H, Leifman H, Sjölund T, & Andréasson S. (2008) Evaluation of an alcohol risk reduction program (PRIME for Life) in young Swedish military conscripts. *Health Education*, 109(2):155-168.
- IV. **Hallgren M**, Sjölund T, Källmén H, & Andréasson S. (2010) Modifying alcohol consumption among Swedish high school students: an efficacy trial of an alcohol risk reduction program (PRIME for Life). *Health Education*, 111(3): 216-229.

These four papers will be referred to by their roman numerals (I-IV). All articles are reprinted with the publisher's permission.

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## LIST OF ABBREVIATIONS

AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood Alcohol Concentration
CAN	The Swedish Council for Information on Alcohol and Drugs
CV	Coefficient of Variation
DUI	Driving Under the Influence
ESPAD	European School Survey Project on Alcohol and other Drugs (ESPAD) study
MI	Motivational Interviewing
PFL	Prime for Life
RBS	Responsible Beverage Service
SET	Social and Emotional Training
SNIPH	Swedish National Institute for Public Health
STAD	Stockholm Prevents Alcohol and Drug Problems
WHO	World Health Organisation
ÖPP	Örebro Prevention Project



# 1 INTRODUCTION

## 1.1 YOUTH DRINKING IN CONTEXT

Why devote attention to youth drinking? Adolescents are consistently over-represented in alcohol-related harm statistics (WHO, 2011). Compared to other age groups, they are more likely to be harmed or seriously injured as a consequence of their drinking. It is also known that a sizable proportion of death and disability among youth is attributable to alcohol (Toumbourou et al., 2007). In addition to short-term negative outcomes, such as accidents and intoxicated aggression, evidence suggests that brain development may be adversely affected by alcohol (Lubman et al., 2007). The harmful effects that many young people experience arise partly from the *amount* of alcohol that they consume (consumption typically peaks in the early twenties), and from the *pattern* of drinking (heavy episodic drinking is more frequent among youth, and associated with serious acute harms). A recent World Health Organisation study found that out of 73 participating countries, hazardous and harmful drinking patterns, including drinking to intoxication, appear to be on the rise among adolescents (WHO, 2011). Although aggregate level data can hide important differences that exist between countries, this recent study highlights a concerning world-wide trend. The reasons for this increase are complex, but greater alcohol availability is a likely explanation. Another contributing factor could be the popularity of ‘alcopops’ or alcoholic carbonate drinks, which are associated with more problematic drinking patterns, earlier onset of drinking and drunkenness (Kraus et al., 2010).

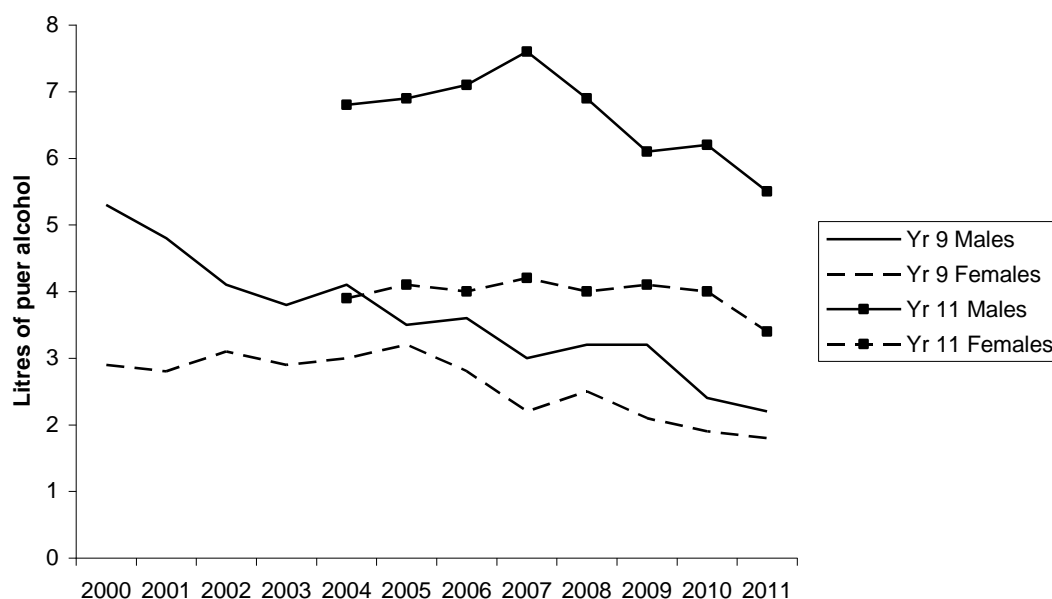
On the other hand, positive developments have also been noted. The ongoing *European School Survey Project on Alcohol and other Drugs (ESPAD) study*, indicates that the perceived risks associated with heavy drinking among European youth have increased, and that disapproval of binge drinking among upper secondary school students has also risen (Hibell et al., 2009). These are favourable shifts, but as will be discussed, changes in attitudes do not always translate into positive changes in behaviour. From a developmental perspective, early experiences with alcohol are known to increase the risk of later alcohol use disorders (Hingson et al., 2006, Kelly et al., 2011). In particular, the age of first drinking occasion is a strong predictor of alcohol-related problems in adulthood (Pitkanen et al., 2005, Poikolainen et al., 2001, Cable and Sacker, 2008). Adolescence is a period when parents and peers have a substantial influence on behaviour and several studies have shown that adolescents who socialise with heavy drinking peers, or whose parents routinely offer them alcohol, are more likely to develop problems associated with alcohol (Ary et al., 1993, Becker and Grilo, 2006, Cable and Sacker, 2008). Moreover, recent research indicates that heavy drinking during the teen years may contribute to the development of social and health inequalities in adulthood (Hill et al., 2000, Odgers et al., 2008, Viner and Taylor, 2007).

Across all age groups, alcohol is a causal factor in more than 60 major diseases and injuries and its consumption results in approximately 2.5 million deaths each year (WHO, 2011). About 4 per cent of all deaths worldwide are attributable to alcohol, where it is the leading risk factor in the world for deaths among young males. Four and a half per cent of the global burden of disease and injury is attributable to alcohol. A recent Swedish government report estimates that the economic cost of alcohol consumption in Sweden is around 66 billion SEK annually (SOU, 2011).

In sum, both the magnitude and frequency of alcohol-related harms among youth offer compelling reasons to better understand the nature of youth drinking and what can be done to prevent unnecessary injury and death. This thesis contributes to the field with recent data from the Swedish context.

### 1.1.1 Recent trends in Swedish youth alcohol consumption

The Swedish Council for Information on Alcohol and Drugs (CAN) has conducted annual public school surveys of alcohol consumption among year 9 students (aged 15-16 years) since 1971, and year 11 students (aged 18-19 years) since 2004. The anonymous self-report surveys measure the quantity and frequency of different types of alcohol, enabling the calculation of a yearly estimate of total consumption. As the survey is completed during class time, response rates have consistently been high. In 2011, for example, 4 632 year 9 students, and 3 596 year 11 student participated in the survey, with response rates of 83 and 81 per cent, respectively (Henriksson and Leifman, 2011). Fifty-five per cent of year 9 boys and 59 per cent of year 9 girls indicated they had drunk alcohol at least once during the previous 12 months. The figures for year 11 boys and girls were 83 and 84 per cent, respectively; the lowest rates that have been recorded for both age groups since the survey began. For year 9 students, consumption peaked in 2000 before reducing steadily until 2011. Data for year 11 students is only available from 2004, where we also see a steady decline in consumption over the past seven years, predominantly among males. These changes are illustrated in Figure 1, below.

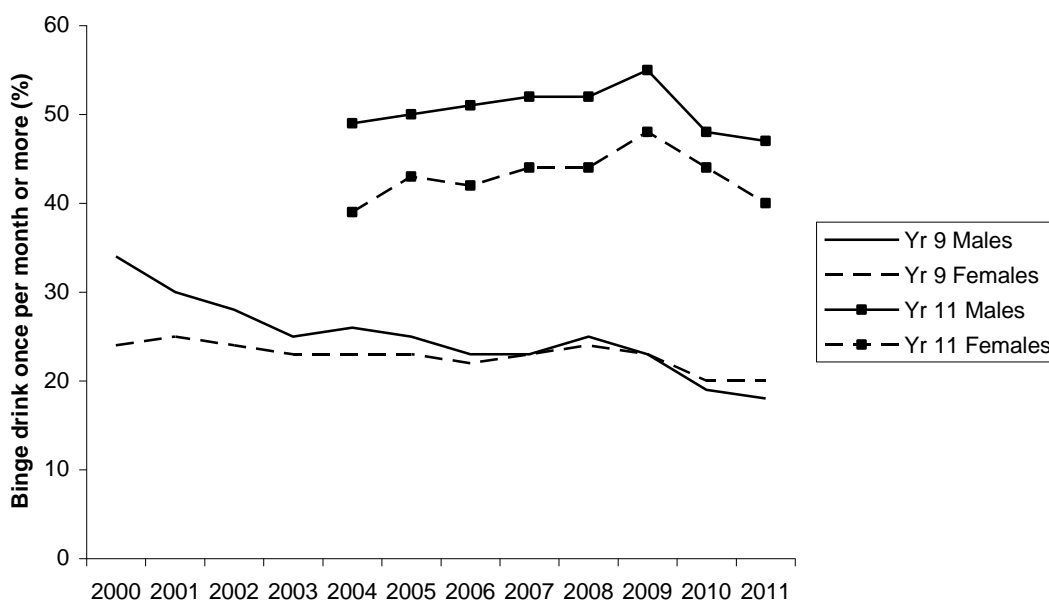


**Figure 1:** Per capita alcohol consumption among year 9 students (15-16 years) and year 11 students (aged 18-19 years) in Sweden, 2000-2011. **Source:** The Swedish Council for Information on Alcohol and Drugs (CAN). Drug Trends in Sweden, 2011. Report nr. 130, Stockholm 2012.

In 2011, the estimated per capita consumption for year 9 females was 1.8 liters of pure alcohol and 2.2 liters for boys; again, the lowest recorded levels since 1996 and 1988, respectively. Per capita consumption also reduced among year 11 boys from 6.8 liters in 2004 to 5.5 liters in 2011. The trend among year 11 females was more stable, dropping from 3.9 to 3.4 liters during the same period. The reduction in per capita consumption has been driven primarily by an increasing number of young people who abstain from alcohol completely. However, reductions are also seen when only the

alcohol consumers are examined, except among Year 11 females, where a small rise between 2004 and 2011 has been observed (Henriksson and Leifman, 2011).

Heavy episodic drinking, or binge drinking, is more prevalent among youth and tends to decline with age; a trend observed in most countries worldwide (WHO, 2011). Binge drinking has been a public health concern in Sweden for decades because it is a pattern of consumption strongly associated with acute harms, such as motor vehicle accidents, violence, and acute alcohol intoxication (Toumbourou et al., 2009, Rehm et al., 2009). Due to this association, recent trends in binge drinking are of great interest. Figure 2 illustrates the steady decline in heavy episodic drinking among Swedish youth over the past decade, a trend similar to the total consumption changes shown in Figure 1.



**Figure 2:** Percentage of young people who binge drink once per month or more, Sweden, 2000-2011. **Source:** The Swedish Council for Information on Alcohol and Drugs (CAN). Drug Trends in Sweden, 2011. Report nr. 130, Stockholm 2012.

Binge drinking among Year 11 females has increased slightly, although the trend has reversed over the past three years. For the first time since 1971, Year 9 males report binge drinking less frequently than Year 9 females. This is interesting to observe because across all age groups (and in most countries worldwide) males typically drink more alcohol than females (Babor et al., 2010).

In terms of beverage preferences, males in both school years continue to prefer strong beer and spirits, whereas females prefer blended drinks (now the preferred choice among Year 11 females) and spirits. Overall, males increasingly prefer to drink strong beer, and females increasingly prefer blended or mixed drinks. There has been a recent trend towards lower consumption of spirits among Year 11 males and females (Henriksson and Leifman, 2011).

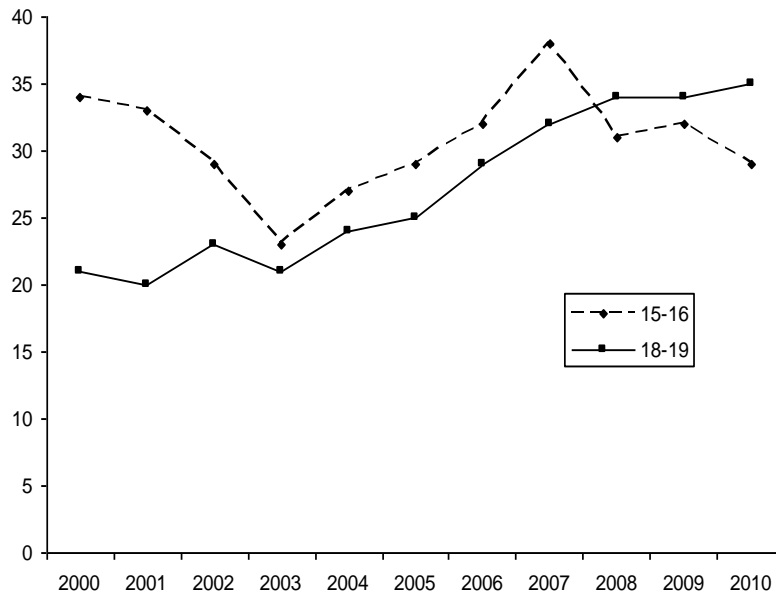
### **1.1.2 Recent trends in alcohol-related hospitalisations among Swedish youth**

Young people can experience a range of harmful consequences when they drink alcohol. One of the more serious outcomes is hospitalisation due to acute intoxication or alcohol poisoning, which in Sweden accounts for the majority of all alcohol-related hospital admissions involving young people (Valdatabasen., 2010).

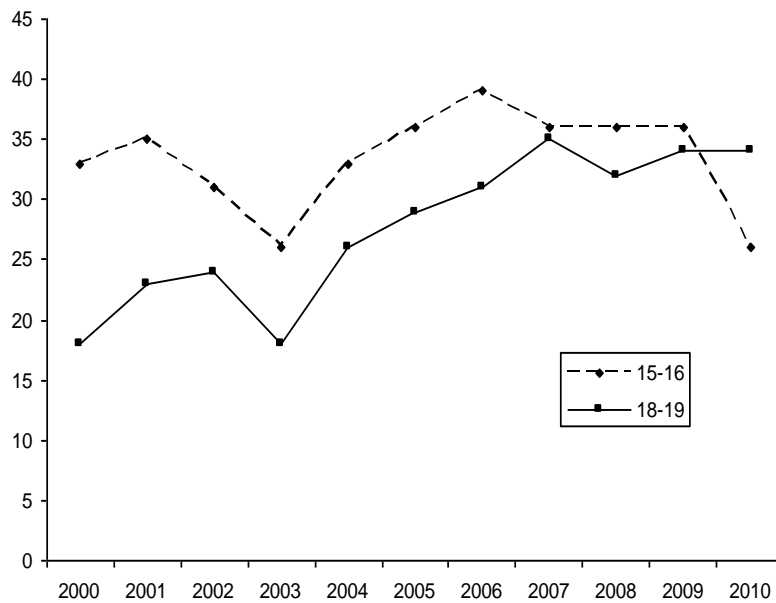
All public hospitals in Sweden are required to provide annual data on the number of people admitted to hospital with an alcohol-related diagnosis and this information is recorded by CAN. Between 2000 and 2010, the total number of youth aged 15-16 (year 9) and 18-19 (year 11) admitted to hospital with a primary or secondary alcohol-related diagnosis increased from 1,078 to 1,562; a real increase of 5.7 admissions per 10,000 youth. As shown in Figures 3 and 4, the rate of increase appears to be driven mainly by adolescents aged 18-19 years, who have recently overtaken their younger peers in terms of annual alcohol-related hospital admissions nationally.

The rise in admissions due to acute intoxication or poisoning has been particularly striking in Sweden's capital, Stockholm (Figures 5 and 6). Between 2000 and 2010, the number of admissions increased by 17 per cent among 15-16 year-olds, and 29 per cent among 18-19 year-olds (Ahacic and Thakker, 2010, Valdatabasen., 2010). These figures represent unique cases (as opposed to repeat admissions) per 10,000 inhabitants with a diagnosis of acute intoxication and/or alcohol poisoning upon admission. Compared to the national figures for Sweden, the main differences are firstly, a higher proportion of admissions in Stockholm, and secondly, a clear increase in admissions among 15-16 year olds. Nationally, the trend for 15-16 year old adolescents has been more stable over time, with a recent decline. The largest increase has been among females aged 18-19 years in Stockholm. These young women are the only group to show signs of increasing binge drinking, and a strong preference for mixed drinks with high alcohol content (CAN, 2011). The marked drop in all admissions seen in 2003 is most likely the result of a change in the admission recording procedures in one of the major hospitals that year. It should be noted that the higher hospital admission rate in Stockholm compared to the rest of Sweden could be due to underlying differences in drinking patterns between urban and rural adolescents, or equally, they may reflect differences in service access or treatment opportunities, which could be higher in the country's capital city.

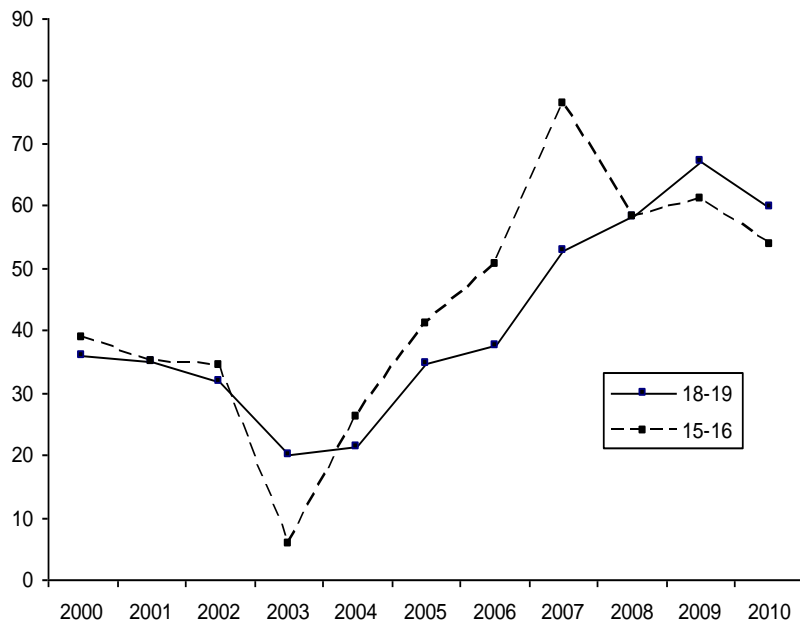
Together, this data shows a divergence between alcohol consumption, which has reduced over the past decade, and alcohol-related hospitalisations, which have risen – an unexpected trend that deserves explanation and provides the starting point for a detailed analysis of drinking trends in Study 1.



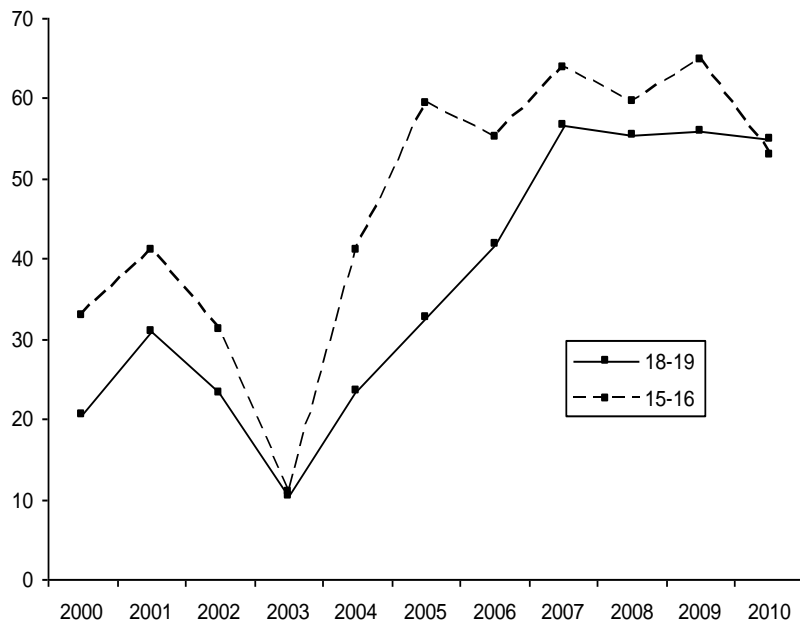
**Figure 3:** Number of males per 10,000 inhabitants aged 15-19 years admitted to hospital in Sweden with a primary or secondary alcohol- related diagnosis (acute alcohol intoxication or poisoning, ICD codes F100 or T51). **Source:** Socialstyrelsen, 2012



**Figure 4:** Number of females per 10,000 inhabitants aged 15-19 years admitted to hospital in Sweden with a primary or secondary alcohol- related diagnosis (acute alcohol intoxication or poisoning, ICD codes F100 or T51). **Source:** Socialstyrelsen, 2012



**Figure 5:** Number of males per 10,000 inhabitants aged 15-19 years admitted to hospital in Stockholm with a primary or secondary alcohol- related diagnosis (acute alcohol intoxication or poisoning, ICD codes F100 or T51). **Source:** Valdatabasen, 2012



**Figure 6:** Number of females per 10,000 inhabitants aged 15-19 years admitted to hospital in Stockholm with a primary or secondary alcohol- related diagnosis (acute alcohol intoxication or poisoning, ICD codes F100 or T51). **Source:** Valdatabasen, 2012

## **1.2 PREVENTING ALCOHOL-RELATED PROBLEMS IN THE COMMUNITY**

Early and popular views regarded ‘high-risk’ individuals as the main source of alcohol-related health problems. Education and information was the dominant prevention strategy, while the underlying social and community mechanisms responsible for alcohol-related harms were largely overlooked (Room, 1997, Gruenewald, 2011). There was a keen focus on alcoholism, and a widely held view that heavy problematic drinkers – those most visible in society – were the source of most alcohol-related harmful effects. This view stemmed from the Medical Model which has an individualistic perspective on the nature of addiction, and which dominated thinking until at least the 1960’s (Edwards, 1978). To change problematic drinking behaviour, one needed to modify the problematic individual responsible for the harmful alcohol use. In the 1960’s and 70’s alcohol researchers began to question this focus. It was noted that there was no threshold at which one suddenly became ‘a significant risk’ for alcohol-related problems and that there was some risk for harm at consumption levels below that associated with ‘alcoholism’ (Stockwell et al., 1997).

Recent prevention research and behaviour change theory has also shifted this perspective substantially (Birckmayer et al., 2004, Petraitis et al., 1995, Foxcroft and Tsertsvadze, 2011a). We now know, for example, that the greatest harms from alcohol arise not from a limited number of severely problematic drinkers, but from the larger group of heavy drinkers with less severe problems, a scenario referred to as the prevention paradox. (Kreitman, 1986). Most investigators agree that a highly effective way to reduce alcohol problems is to target whole populations; not only high-risk individuals.

Policies which regard alcohol as a public health issue and a subject for comprehensive regulation have been uncommon outside Sweden and the Nordic countries. Since 1995 when Sweden joined the European Union, however, there has been a decline in Swedish alcohol control policy, including those interventions which have the greatest potential for curtailing alcohol-related problems. Between 1995 and 2004, per capita consumption increased by around 30 per cent in Sweden, a development which prompted the adoption of a national alcohol action plan in 2000 (and revised in 2005). Among other things, a stronger emphasis was given to prevention work in local communities (the focus of Study II in this thesis).

The sections which follow summarise four topics that are central to Swedish alcohol prevention policy: (1) the relationship between consumption and alcohol-related harmful effects; (2) the systems approach to community prevention; (3) the evidence base for prevention, and lastly (4) the risk/protection model. As will be discussed, to some degree, the systems model and other prevention strategies based on risk and protection theory, overlap.

### **1.2.1 Relationships between drinking and harm: the total consumption model**

Studies from several countries demonstrate that alcohol consumption is very unevenly distributed in a population; most alcohol is drunk by a relatively small minority of drinkers (Babor et al., 2010, Norstrom and Ramstedt, 2005). There is also a strong relationship between the per capita alcohol consumption, the prevalence of heavy drinking, and alcohol-related problems. This relationship forms the basis of the total consumption model, which has been influential in Sweden. In their classic article *The population mean predicts the number of deviant individuals*, Rose and Day (1990) demonstrated that for various health risk indicators there is a strong association between the population mean and the prevalence of problems. They concluded that the “distributions of health related characteristics move up and down as a whole: the frequency of ‘cases’ can be understood only in the context of a population’s characteristics” (Rose and Day, 1990).

With respect to alcohol consumption, Ole-Jørgen Skog has argued that changes in per capita consumption tend to influence all levels of consumption concurrently, including heavy drinking (Skog, 1985). Consequently, when mean consumption increases or decreases, the proportion of heavy drinkers should change accordingly (Skog and Rossow, 2006); a phenomenon driven mainly by strong social influences on drinking behaviour within cultures. Consistent with Skog’s theory and the total consumption model, current Swedish alcohol policies aim to reduce population level drinking and associated harms through restrictions on the availability of alcohol through (among other things) a retail monopoly, age checks at the point of alcohol purchase, and regulations over trading hours. Historically, increases in alcohol availability in Sweden have been associated with increased per capita consumption, and more alcohol-related mortality and morbidity, which support the total consumption model (Holder, 2000b, Andreasson et al., 2006, Norstrom and Ramstedt, 2005). For example, increases in consumption and alcohol-related harms were observed shortly after Sweden joined the European Union in 1995 when traditional protections were eroded through increased cross-border trade and lower excise duties (Holder, 2000b).

While a relationship between total consumption, heavy drinking and alcohol-related harms has been observed, exceptions to this general association have been noted which may have consequences for Swedish alcohol policy. For example, a recent study examining changes in alcohol-related harms in northern and southern Sweden after increased alcohol imports from Denmark, failed to show a uniform increase in harms associated with more alcohol availability (Gustafsson and Ramstedt, 2011). Similarly, Study 1 in this thesis, *Drinking less but greater harm*, also highlights an exception to this relationship.

### **1.2.2 A framework for prevention: the Systems approach**

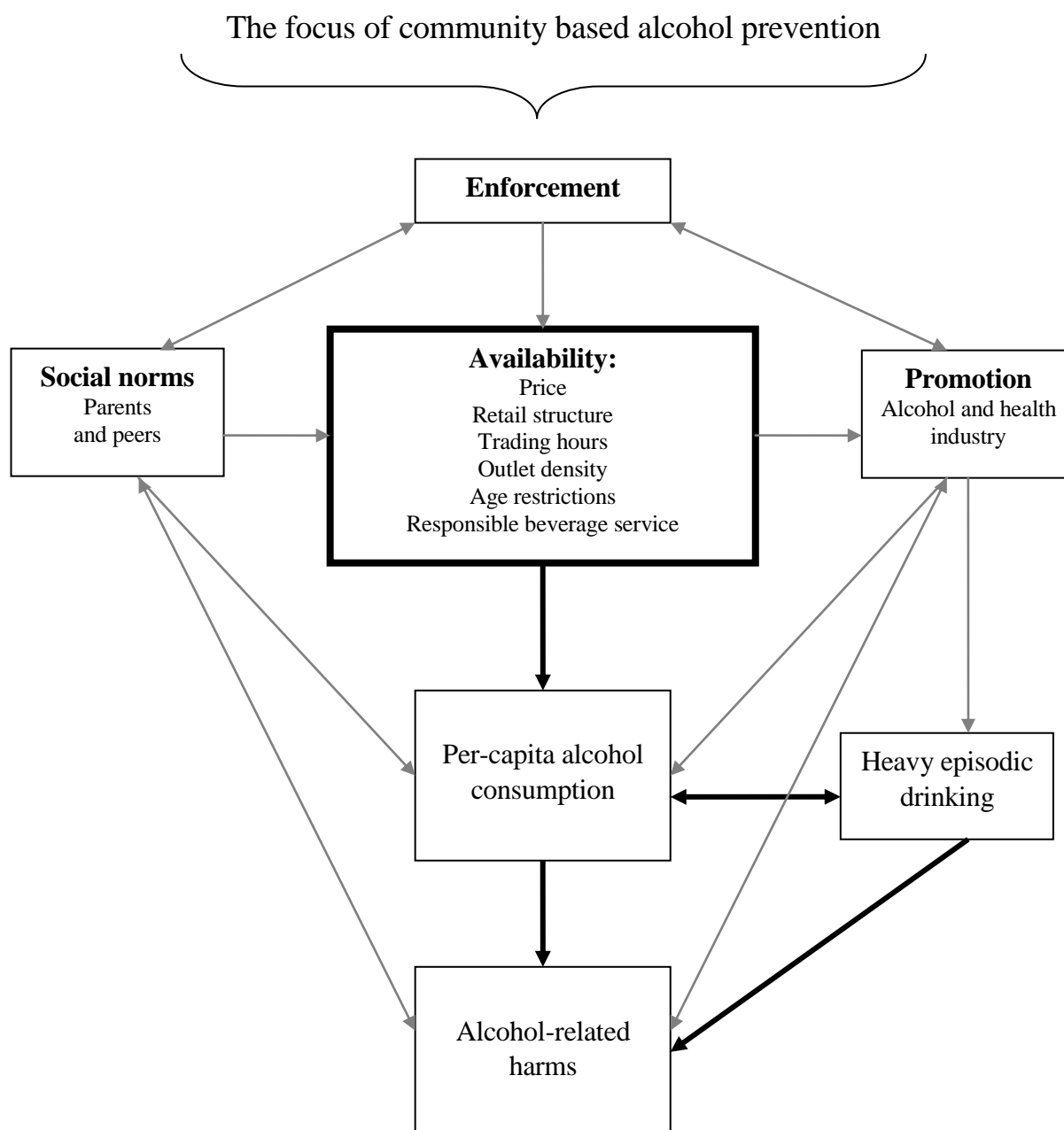
There are powerful advantages to population level prevention of alcohol problems. This type of prevention attempts to remove or modify the underlying cause of the problem and has considerable potential to bring about change due to the large number of individuals involved (Loxley et al., 2004). Harold Holder’s ‘systems’ model of community based alcohol prevention has been influential in Sweden, and guided the development of the *Swedish Six Community Alcohol and Drug Prevention Trial* (Study



II in this thesis). His theoretical model, described in *Alcohol and the Community: A systems approach to prevention* (Holder, 1997), regards the community and its multiple sub-systems as the main target for intervention efforts at the local level. All communities, he argues, consist of individuals and entities that influence each other in a 'socio-cultural-political-economic context' (Holder 1997, p. 12). To have maximum effect, prevention efforts need to be directed towards as many system-wide structures and processes as possible. Uni-dimensional strategies, such as education about the harmful effects of alcohol, are unlikely to be effective, unless other parts of the system are primed (or mobilised) to respond to such messages. Important sub-systems which can influence alcohol problems within a community include drinking patterns, alcohol availability, enforcement efforts, sanctions and social norms. An overarching aim of the systems approach is to achieve prevention rather than treatment of existing alcohol problems in the community.

To provide an example of the model's application, a local high school could be seen as a sub-system in which the behaviour of students is influenced by national alcohol regulations (availability, price, age-restrictions), the physical environment of local drinking establishments (location, crowding, noise), the behaviour of bar staff (responsible beverage service practices), public opinion regarding drunkenness (parental and peer influences), and the scrutiny of local police (enforcement). A systems approach to prevention aims to identify these underlying community-level risk factors, and to modify them in order to reduce problematic drinking. The systems model advocates the use of both supply measures, which limit access to alcohol, and demand measures, which reduce individual demand for alcohol. Many of these causal factors have a bi-directional influence, as shown in Figure 7, below. This model, adapted from Birchmayer and Holder et al (2004), illustrated the main areas targeted by alcohol prevention at the community level, namely: availability, enforcement, social norms and alcohol promotion. The model recognises the association between availability, per capita consumption and alcohol-related harms.

A community system perspective calls for approaches that go beyond education, screening, and other individually focussed programs, and instead attempts to change the environment (broadly defined) related to risky drinking behaviour. Holder and others have noted the importance of creating effective partnerships between researchers who develop science-based interventions, and practitioners who implement and sustain such interventions locally. This emphasis, and the need to modify risky drinking environments (as opposed to risky individuals), has been a central focus of successful prevention efforts in Australia, Canada and New Zealand recently (Livingston, 2008, Stockwell et al., 2011, Connor et al., 2011, Homel et al., 2004) The implementation of a systems approach largely involves legislative change and enforcement. Integrating research into the evaluation design can be costly, which possibly explains why only a small number of interventions based on this model have been implemented and evaluated worldwide.



**Figure 7:** Conceptual model of factors influencing alcohol consumption (Adapted from Birckmayer et al (2004))

### 1.2.3 Evidence from previous community projects

Support for community prevention based on the systems model - or variations of this model - has grown as a small but increasing number of trials have demonstrated positive effects. Four community prevention projects undertaken in different parts of the world are described below and a summary of recent trials is set out in Table 1. This is not an exhaustive list, but it does illustrate the main features of different prevention programs.

In the United States, a five year alcohol prevention project (the ‘Three Communities Trial’) was conducted between 1992 and 1996 to determine the effect of environmental prevention strategies on alcohol-related injury in three intervention communities (Holder et al., 2000). The interventions included community mobilisation, responsible beverage service, age checks, increased local enforcement of drink-driving laws, and zoning to limit access to alcohol. By the end of the trial, self-reported alcohol consumption had declined by 6 per cent; the frequency of having had ‘too much to drink’ reduced by 49 per cent; drink-driving reduced by 51 per cent; and night-time vehicle crashes declined by 10 per cent. In addition, assault injuries observed in emergency departments declined by 43 per cent in the intervention communities.

Also in the US, the Communities That Care project (2003-2007) aimed to reduce adolescent alcohol and drug use and delinquent behaviour communitywide (Hawkins et al., 2009). Twenty-four small towns in seven states were randomly assigned to control or the intervention condition. The participants were 4407 youths aged 10-14 years. The intervention involved the collection of epidemiological data to identify elevated risk factors and depressed protective factors in the community and the implementation of tested programs to address the community’s specific needs. Unlike the Three Communities Trial (Holder et al., 2000), this project did not focus exclusively on the prevention of alcohol use, but on reducing risk factors that predict early initiation and use among youth, in addition to other health-risking behaviours such as delinquency. Also unlike other prevention trials in the US (e.g., Project Northland, Communities Mobilising for Change on Alcohol), environmental risk factors such as venue opening hours, age-checks, and regulatory enforcement, were *not* targeted. Results indicated that alcohol use, cigarette smoking and delinquent behaviour were significantly lower in the trial communities than in the control areas for students in grades 3 through 8 at follow-up in 2007. Binge drinking during the last two weeks, and alcohol consumption during the last 30 days both reduced significantly during the project.

A community intervention project in the Northern Territory, Australia, aimed to reduce higher levels of alcohol-related harm to national levels using a range of strategies, including a levy on alcoholic beverages with more than 3 per cent alcohol to fund education, increased controls on alcohol availability, and expanded treatment and rehabilitation services (Chikritzhs et al., 2005). The intervention led to a significant preferential reduction in acute alcohol-related deaths and to a non-significant reduction in chronic, alcohol-related deaths in the Northern Territory compared to the control areas.

Finally in Trelleborg, southern Sweden, a three-year community intervention trial was conducted targeting youth drinking (Stafstrom et al., 2006). The interventions included the adoption of a community and school policy and action plan on alcohol and drug management; increased Police inspections of grocery and convenience stores where black market alcohol could potentially be sold; the introduction of an evidence based curriculum on alcohol and drugs in schools; information and support for parents, and the use of mass media to boost knowledge about alcohol related harms. Results from the trial were positive and included a 20 per cent decrease in the proportion of alcohol consumers (compared to a 5 and 1 per cent increase in two control areas, and a 5 per cent increase nationally). Similar trends for excessive drinking and heavy episodic drinking during the last month were also observed.

In a recent Cochrane report, David Foxcroft and collaborators identified and systematically reviewed 20 methodologically sound, multi-component alcohol prevention trials targeting young people (Foxcroft and Tsertsvadze, 2011a). Twelve of the 20 trials reported statistically significant effects across a range of outcomes in the short and long-term. Six trials, however, found no effects on youth alcohol consumption or related harms. The authors concluded that, overall, current evidence supports the effectiveness of some multi-component programs targeting young people, with effect sizes that are often small, but potentially important. The authors noted that more needs to be understood about the content and context effects of community trials. In other words, trials need to be evaluated in different contexts, and they should include a detailed description of the various program components, and (where possible) assessments of their relative impact on the outcomes measured (Foxcroft and Tsertsvadze, 2011a). Also relevant here is a recent Norwegian report which highlights the utility of mixed methods in the evaluation of community trials. The authors suggest that qualitative methods can greatly assist the interpretation of quantitative findings (Rossow and Baklien, 2011).

The programs listed in Table 1 include examples of recent successful community interventions to reduce alcohol consumption (e.g. Communities That Care; the Trelleborg Project), and programs that did *not* result in significant improvements during the intervention period (e.g. DANTE Victoria; Project Northland, Chicago), illustrating that not all community trials are successful. This also reinforces the importance of evaluation and the need to explain negative findings when they arise. As will be discussed in Study II, a myriad of factors can influence the success of community based interventions, including the extent to which local communities are actively engaged in the project, the choice of intervention strategies, the intervention ‘dose’ and fidelity (i.e. if the program was implemented as intended), the study design and evaluation method, and policy changes during the trial period.

**Table 1:** Examples of community trials incorporating elements of the systems approach to prevention

<b>Project</b>	<b>Objective</b>	<b>Location &amp; Design</b>	<b>Population</b>	<b>Interventions</b>	<b>Outcomes</b>
Alcohol: less is better project (Bagnardi et al., 2011)	To reduce community level alcohol consumption; and improve community attitudes towards alcohol use.	Italy, 1999-2006 Controlled intervention trial with pre-post intervention comparisons	Ten trial and eight matched control communities; in total 123,235 inhabitants (trial only)	<ul style="list-style-type: none"> <li>▪ Extensive community mobilisation</li> <li>▪ Educating and sensitising the population on alcohol problems via schools and within local communities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant reductions in self-reported alcohol consumption in the trial communities</li> </ul>
Dealing with Alcohol Related Problems in the Night-time Economy (DANTE) (Miller et al., 2011)	To reduce alcohol related emergency department admissions to hospital	Geelong, Australia, 2005-2009 Pre-post intervention study design	217,000 people living in the City of Geelong, Australia	<ul style="list-style-type: none"> <li>▪ Venue based prevention: ID scanners for age checks, police enforcement, local accords</li> <li>▪ Media: safer drinking promotions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Overall, the intervention was not associated with reduced alcohol related hospital admissions</li> </ul>
Communities That Care (Hawkins et al., 2009)	To reduce adolescent alcohol and drug use and delinquent behaviour communitywide	Seven states in the USA, 2003-2007 Randomised controlled trial	Forty-one communities within the seven states participated. A panel of 4407 fifth grade students was surveyed annually	<ul style="list-style-type: none"> <li>▪ School &amp; community based youth focussed programs</li> <li>▪ Family focussed programs</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant reduction in the incidence of alcohol and drug use among students in the trial communities only</li> </ul>
Project Northland Chicago: (Komro et al., 2008)	To reduce total and risky drinking among urban youth, including mediating risk factors	Chicago Randomised controlled trial	61 schools and surrounding areas (baseline), and 5698 students in grades 5-8	<ul style="list-style-type: none"> <li>▪ Classroom curricula</li> <li>▪ Parental involvement</li> <li>▪ Peer leadership</li> <li>▪ Youth extra-curricula activities</li> <li>▪ Community organising</li> </ul>	<ul style="list-style-type: none"> <li>▪ No significant changes in the intervention communities</li> <li>▪ A trend towards reduced alcohol access by youth</li> </ul>

Table 1 continued:

Project	Objective	Location & Design	Population	Interventions	Outcomes
The Trelleborg Project (Stafstrom et al., 2006)	To reduce harmful drinking patterns among adolescents, delaying age of first onset drinking, improving attitudes towards alcohol	Trelleborg, Sweden, 1999-2003 Pre-post intervention comparisons with national and regional drinking trends	39,000 adults and youth in the Trelleborg region	<ul style="list-style-type: none"> <li>▪ Police enforcement</li> <li>▪ School based curriculum</li> <li>▪ Parent information on youth drinking</li> <li>▪ Media interventions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Decreased harmful drinking behaviour post intervention</li> <li>▪ Increased abstinence rates</li> </ul>
Over serving at licensed premises in Stockholm (Wallin et al., 2005, Wallin et al., 2002)	To reduce alcohol service to intoxicated patrons To reduce violence in the project area, Stockholm	Stockholm, 1994-2000 Quasi-experimental design	Central Stockholm (~300,000 inhabitants), with Södermalm as comparison area (~100,000 inhabitants)	<ul style="list-style-type: none"> <li>▪ Community mobilisation</li> <li>▪ Responsible Beverage Service training</li> <li>▪ Enforcement</li> </ul>	<ul style="list-style-type: none"> <li>▪ Violent crimes decreased significantly by 29% in the intervention areas</li> </ul>
Communities Mobilising for Change on Alcohol (CMCA) (Wagenaar et al., 2000)	To implement policies and regulations aimed at reducing youth access to alcohol To improve the public health of the trail communities	Minnesota, Wisconsin, USA, 1993-1995 Group randomised trial	7 communities with an average population of 21,000 inhabitants 8 control sites	<ul style="list-style-type: none"> <li>▪ 2.5 year community organising initiative involving extensive mobilisation and media/information dissemination in the trial communities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Significant declines in the trial communities for DUI arrests among 18-20-year-olds</li> <li>▪ DUI arrests and disorderly conduct violations among 15-17-year-olds approached significance</li> </ul>
Three Communities Trial (Holder et al., 2000)	To reduce alcohol-related accidental injuries and deaths	California, USA, 1992-1996 Matched intervention and control group design	Three trial communities in northern and southern California with a population of approx. 100,000 each	Five components targeting: <ul style="list-style-type: none"> <li>▪ Local mobilisation</li> <li>▪ Responsible Beverage Service</li> <li>▪ Drinking and driving</li> <li>▪ Under age drinking</li> <li>▪ Access to alcohol</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reduction in night-time injury crashes by 56 per 100,000 adult population per year</li> <li>▪ Reduced drink-driving crashes by 67 per 100,000 adult population</li> </ul>

## 1.2.4 The evidence base: what works in alcohol prevention?

Any discussion about youth alcohol consumption must consider the evidence base for prevention. Fortunately, a great deal is known about what works in alcohol prevention, and much of this knowledge is summarised in the book *Alcohol: No Ordinary Commodity* (Babor et al., 2010). Recent and comprehensive reviews have also contributed to what is known about effective prevention (Foxcroft et al., 2011, Anderson et al., 2009a, Stockwell et al., 2003). Many of the strategies set out below target whole populations (for example, price and availability restrictions), while others target school aged youth (for example; peer resilience programs, school based education). There is ongoing discussion in the literature regarding what constitutes the optimal balance between targeted versus community-wide prevention. On balance, the consensus is that a *combination* of both population level strategies and targeted interventions for high-risk youth is likely to achieve the greatest benefit (Babor et al., 2010, Foxcroft and Tsertsvadze, 2011a, Toumbourou et al., 2007).

### 1.2.4.1 Availability

Most investigators agree that reducing alcohol availability across multiple domains (community, home, peers) is the most effective strategy to reduce harmful drinking and alcohol-related problems (Babor et al., 2010, Anderson et al., 2009a). Studies have also shown that greater access to alcohol increases the odds for adolescent binge drinking, drunkenness, and belonging to a higher consumption trajectory group (Danielsson et al., 2010, Patrick and Schulenberg, 2010). A recent study examining the relationship between alcohol control policies and adolescent alcohol use in 26 countries found that more stringent policies, particularly those affecting availability, were associated with lower prevalence and frequency of adolescent drinking and age of first alcohol use (Paschall et al., 2009).

Reducing access to alcohol can be achieved in several ways: reducing the density of alcohol outlets in the community (Stockwell et al., 2011), limiting trading hours (Rossow and Norstrom, 2012), age restrictions at the point of sale (Wagenaar and Toomey, 2002), and Responsible Beverage Service (RBS) practices (Wallin and Andreasson, 2004, Livingston, 2008). It can also be achieved through government control of alcohol distribution and sales. One form of government control is the retail monopoly system which exists in Sweden, 'Systembolaget'. A US study exploring associations between state retail alcohol monopolies, underage drinking and alcohol-impaired driving deaths, found that monopolies over both wine and spirits were associated with larger consumption reductions than monopolies over spirits only. Lower consumption rates, in turn, were associated with a 9.3 per cent lower alcohol-impaired driving death rate (Miller et al., 2006). Similarly, recent Swedish studies have demonstrated critical links between alcohol availability and alcohol-related mortality and morbidity (Andreasson et al., 2006, Norstrom et al., 2010).

### 1.2.4.2 Price

One of the most effective strategies for reducing consumption at the population level is through increasing alcohol prices. A recent review of 112 studies on the effects of alcohol tax affirmed that when alcohol taxes increase, drinking goes down – including problem drinking among adolescents (Wagenaar et al., 2009). Although price restrictions can have beneficial effects from a public health perspective, the strategy is not favored by most countries due to the detrimental impact of such policies on the highly competitive alcohol industry.

#### *1.2.4.3 Drinking environments*

In Sweden, the legal age for purchasing alcohol from bars, restaurants and clubs is 18 years. Many adolescents choose to drink alcohol in or near licensed venues, where ‘going out’ is seen as a rite of passage and where experimenting with alcohol is common. Recent prevention research has shown that drinking environments can influence drinking behaviour and associated violence (Graham and Homel, 2008, Foxcroft and Tsertsvadze, 2011a, Wallin et al., 2002). High-risk drinking venues characterised by over-crowding, poor staff training and patron discomfort have been linked to higher rates of alcohol-related problems (Homel et al., 2004). In Australia, Ross Homel and collaborators have identified several venue-level factors associated with harmful drinking (Homel et al., 2004, Graham and Homel, 2008). These include over-crowding, poorly trained staff, heavily intoxicated patrons, inadequate public transport, late closing hours, and ‘chap drink’ specials. In Sweden and elsewhere, several studies have demonstrated that modifying these risk factors can lead to significant reductions in alcohol related violence, with large cost-savings for the community (Graham et al., 2005, Wallin et al., 2002, Homel et al., 2004, Mansdotter et al., 2007).

#### *1.2.4.4 Drink-driving countermeasures*

Alcohol consumption is associated with a higher incidence of traffic accidents worldwide (Rehm et al., 2009). A recent New Zealand study found that the rate of road traffic injuries and the involvement of alcohol peaks during late adolescence, as does the proportion of all road traffic injuries that are caused by other people drinking (Connor and Casswell, 2009). Setting maximum blood alcohol concentrations for drivers and enforcing these with random breath testing can reduce alcohol-related motor-vehicle crashes by 20 per cent (WHO, 2011). Moreover, setting lower BACs for younger drivers can reduce alcohol-related crashes among this population by between 4 and 24 per cent (Shults et al., 2004).

#### *1.2.4.5 Alcohol promotion*

Research has shown that the level of alcohol advertising in a community is associated with alcohol-related problems, including road fatalities (Smith and Foxcroft, 2009). The strongest evidence for the association comes from longitudinal studies that have shown an effect of various forms of alcohol marketing on the initiation of youth drinking, and on riskier patterns of youth drinking (Anderson et al., 2009b). Historically, alcohol advertisements in Sweden have been prohibited. However, marketing is allowed for beverages identified as ‘class 1’ (for example, light beer), and since 2005, newspaper advertisements for alcohol were permitted under EU directives. Despite the finding that a general association exists between the level of advertising in a community and alcohol-related harms, a recent systematic review of advertising bans found inconclusive results, mainly due to methodological limitations (Booth et al., 2008). Other studies have emphasized the link between alcohol promotion and drinking levels among adolescents. A recent Australian study of 1113 adolescents aged 12-17 years found that exposure to alcohol advertisements was strongly associated with drinking patterns (Jones and Magee, 2011). Similarly, a recent review of prospective cohort studies suggests that there is an association between exposure to alcohol advertising or promotional activity and subsequent alcohol consumption in young people (Smith and Foxcroft, 2009).



#### 1.2.4.6 Information and education

The provision of information and education is important to raise awareness and impact on knowledge. It is also a popular strategy with parents, schools and governments. Young people typically initiate alcohol use while at school, and so there is obvious appeal in school-based alcohol education (the focus of Study IV). A recent program emphasizing a harm reduction approach to alcohol, found favorable changes in student attitudes, lower alcohol consumption, less frequent hazardous alcohol use, and fewer harms associated with drinking over a 32 month follow-up period (McBride et al., 2004). In general, however, extensive reviews of the literature find that education does not result in sustained behaviour change (Foxcroft et al., 2011, Foxcroft and Tsertsvadze, 2011b, Anderson et al., 2009a). Positive, short-term changes in attitudes or knowledge are common, but if long term behaviour change is the goal, education alone is insufficient. In an environment in which many competing messages are received by young people (and adults) in the form of advertising and social norms supporting drinking, the effects of brief education programs tend to lose their power of influence.

It should also be acknowledged that there is a clear relationship between harmful alcohol use and wider social factors, such as unemployment, low income and insecure housing (Wiles et al., 2007, Makela, 1999). The evidence base for the social determinants of harmful drinking is strong; consequently, policy makers need to plan and implement a wide range of interventions that acknowledge some of the social origins of risky behaviours at all levels (Loxley et al., 2004). A discussion about these factors is beyond the scope of this thesis. Interested readers are referred to the text *Social determinants of health* for further information (Marmot and Wilkinson, 1999).

#### 1.2.5 Risk and protection: the building blocks of prevention

The two previous sections describing what works in prevention, and the systems model, are both grounded on a firm understanding of risk and protection. Knowing which factors increase or decrease the likelihood that young people will drink alcohol in a hazardous way is the starting point for effective prevention. The risk/protection model has been shown to account for substantial variance in adolescent problem behaviours, including heavy drinking. Risk factors are prospective predictors that independently increase the likelihood that an individual or group will engage in adverse outcomes (Hawkins et al., 1992). Conversely, protective factors reduce the likelihood of harmful outcomes by attenuating risk, and promoting healthy behaviour.

A range of risk factors for hazardous alcohol use have been identified at the individual, social and the community level in Sweden and internationally (Hawkins et al., 2004, Becker and Grilo, 2006, Cleveland and Wiebe, 2003, Branstrom et al., 2008, Nation and Heflinger, 2006). Many of these studies are based on cross-sectional survey designs, where associations between the identified variables and alcohol consumption are presumed to infer a greater level of risk. Stronger assertions about the relationship between risk factors and alcohol use can be derived from prospective research designs, which aim to identify factors that *predict* subsequent alcohol use (Poikolainen et al., 2011, Merline et al., 2008, Poikolainen et al., 2001, Swendsen et al., 2009, Hemphill et al., 2011).

It has been shown that risk factors for hazardous alcohol use can vary depending on the social context (Hemphill et al., 2011), the level of drinking (Petraitis et al., 1995, Zufferey et al., 2007), gender and age (Danielsson et al., 2011, El-Khoury et al., 2005), and stage of alcohol use (Swendsen et al., 2009). It has also been suggested that the number of risk factors may be of greater importance than the number of protective factors (Getz and Bray, 2005), and that cumulative risk in early childhood predicts later substance use and other social problems (Appleyard et al., 2005). The extent to which risk factors are stable over time within the same population is debated in the literature and warrants further research (Merline et al., 2008).

Overall, however, there is a large degree of concordance regarding which individual, social, and community level factors place young people at increased risk of harm from alcohol. On the individual level, several studies have shown that early onset of alcohol use predicts later heavy drinking and dependence (Pitkanen et al., 2005, Danielsson et al., 2011, Hingson et al., 2006), although the extent to which these early experiences have a direct causal role in later alcohol use, as opposed to other confounding factors, is not clear. Parental behaviours and attitudes are also relevant. A recent prospective study in the US involving 21,117 people aged 18 to 35 years, found that level of parental drinking, individual risk taking, other drug use, and delinquency at age 18 years, all significantly predicted heavy drinking at age 35 (Merline et al., 2008). An Australian study of 10,879 Victorian youths aged 16-24 years found significant associations between high-risk drinking and male gender, high recreational spending money, poor living arrangements, family conflict and 'age at first drink'. Significant community-level correlates were also reported, including living in a rural area, and liquor outlet density (Livingston et al., 2008). A recent prospective cohort study in Finland involving 4431 people aged 15-69 years, and followed-up over a 16.3 year period, found that cigarette smoking and total alcohol intake were significantly associated with hospitalisation or death due to an alcohol specific condition (Poikolainen et al., 2011). School misconduct – in particular, bullying and truancy – have been associated with higher probabilities of heavy drinking in several studies (Fisher et al., 2007, Bryant et al., 2000). However, like many individual level risk factors, it is unclear whether school related problems *per se* are a cause of harmful alcohol use, or a symptom of some other underlying risk factor, such as poor parental relationships or anti-social personality traits (Bryant et al., 2000, Hampson et al., 2006).

The drinking behaviour and attitudes of significant others, especially parents and peers, have also been associated with hazardous drinking among adolescents. Using a multi-level approach, a study involving 7064 adolescents aged 10 to 12 years from 231 schools, found that the number of alcohol consuming peers predicted individual alcohol use (Kelly et al., 2012). Moreover, younger students showed a unique susceptibility to peripheral involvement with peer drinking networks (having one friend who consumed alcohol). Positive parental behaviour (monitoring, limiting alcohol availability, and supportive communication) tends to be associated with later onset of drinking and fewer alcohol related problems during adolescence (Ryan et al., 2010). Parents are a primary source of alcohol for younger adolescents, and it has been shown that parental provision of alcohol increases the risk of later hazardous drinking (Livingston et al., 2010a).

While most investigations have found consistent associations between the risk factors noted above and harmful drinking patterns, a minority of studies have failed to establish these links (Poikolainen et al., 2001), highlighting the socially and cultural specific nature of some risk factors.

Traditionally, the risk/protection model has focussed heavily on individual level factors and changing the behaviour of adolescents through psychosocial development and parental/peer support programs (Riesch et al., 2012, Bodin and Strandberg, 2011). Although there is strong theoretical support for these interventions, the mixed findings from effectiveness studies to date suggests that the risk/protection model should be conceived as something more diverse than a collection of individual, peer and parental risk factors for harmful alcohol use (Hawkins et al., 1992). A wider perspective is necessary – in particular, one which recognises the importance of alcohol supply mechanisms, such as availability, and environmental risk factors at the venue and neighbourhood level (Chuang et al., 2005, Homel et al., 2004, Wallin et al., 2002). This systems model of alcohol prevention takes into account individual level risks, but also the important underlying community level mechanisms that contribute to alcohol-related harmful effects (Holder, 1997).

### 1.3 SOME WORDS ON PROGRAM EVALUATION

Program evaluation provides a method to assess how well an intervention or strategy has worked and where improvements can be made. Rigorous evaluation of public health programs is necessary to ensure that limited resources are used to achieve the greatest possible health benefits. Three of the four papers in this thesis describe evaluations of prevention programs to reduce alcohol consumption and related harms among youth. The methodology and materials used are presented in detail under ‘Methods’. First, however, some issues regarding program evaluation in general should be mentioned.

Broadly speaking, there are three types of evaluation in public health sciences (Rootman et al., 2001). *Outcome* evaluations (also called *effect* studies) aim to assess the extent to which a program has achieved its stated objectives. Effect studies can be short or long-term, but always set out to answer the same fundamental question: has the program being evaluated achieved its stated goals? Whenever possible, outcomes should be assessed with valid and reliable measurements that align with the stated goals of the program. A distinction should be made here between *efficacy* studies, which aim to determine whether a program is capable of producing a desired effect under ideal circumstances, and *effectiveness* studies, which examine the ‘real life’ performance of a program or intervention – normally after initial efficacy has been established. *Process* evaluation is a related assessment, and aims to describe how the program has been implemented and the effect this process may have had on the outcomes measured. Process evaluations often use qualitative assessments, such as stakeholder interviews, to establish these connections. *Economic* evaluations, which are not discussed in this thesis, typically aim to assess the cost-effectiveness of programs (Wutzke et al., 2001).

In general, community prevention projects are complex, often involving various strategies and agencies. Evaluation of such complexity can often benefit from the use of mixed methods – that is, an approach involving both effect and process evaluation. Rossow and Baklien (2011) provide a good example of a recent Norwegian study using mixed methods to evaluate the effects of a community alcohol prevention trial.

The person or group chosen to evaluate a program may be regarded as equally important as the evaluation process itself. Frequently, public health interventions are evaluated by the same individuals who developed the program, which presents a potential conflict of interest. Holder (2010) recently noted that there are few published cases of successful replications of efficacious programs by independent researchers not

involved in the original program design and testing. In addition to the potential loss of objectivity, this scenario can encourage *post-hoc* outcome variable selection and reporting only outcomes which show positive or statistically significant results. In fact, a publication bias in prevention research favoring positive findings have been recognized (Francis, 2012, Holder, 2010, Joobar et al., 2012). In some cases, this bias has led to inaccurate conclusions about the effects of different interventions (Francis, 2012). Empirical replication has long been considered the final arbiter of phenomena in science, but replication is undermined when there is evidence for publication bias.

Objectivity in program evaluation is important, but it should not come at the expense of understanding a program's purpose. One way to formalise knowledge about a program is to construct an outline of the program's underlying theory. A good theoretical model articulates the assumed links and sequence of events between the program inputs and the desired outcomes. The intermediate program steps can then become a framework for the evaluation, which tracks developments to find out whether the assumed linkages occur.

#### **1.4 A BRIEF RATIONALE FOR THIS THESIS**

Alcohol remains the 'drug of choice' among Swedish youth, as it does in many other countries. Hazardous use of alcohol at an early age often sets young people on a trajectory resulting in poor school performance, difficult social relationships and other negative life events – all good reasons to act preventatively, and to better understand alcohol prevention methods.

A logical starting point is the epidemiological evidence. Per capita alcohol consumption among Swedish youth has fallen steadily over the past ten years but there have been concerning increases in serious alcohol related harms. The reasons for this increase are not fully understood and deserve greater attention. One possible explanation is that a sub-group of young people are drinking more alcohol than their peers over time or in ways that are causing more alcohol-related problems. Study I tests this explanation, by examining the so-called alcohol polarisation hypothesis.

Recent changes in youth drinking have been paralleled with wider socio-economic change in Sweden. Alcohol is now more readily available, prompting the adoption of new national alcohol action plans with a greater emphasis on local community prevention. To date, however, only a small number of comprehensive, community based programs have been reported in the literature. In Study II, we describe the key findings and lessons learnt from one of the largest community prevention trials in Sweden – the *Swedish Six Community Alcohol and Drug Prevention Trial*.

Finally, evidence suggests that limiting availability is a highly effective way to reduce alcohol-related problems, yet health education and information strategies remain popular with schools, parents and local governments, often at considerable expense. Some of these programs have undergone substantial revision in recent years, so their impact needs to be re-assessed in different contexts. Studies III and IV evaluate the effectiveness of the *Prime for Life* brief health education program in two settings; the military and in high schools.

## 2 AIMS

This research has two general aims: firstly, to describe recent trends in the alcohol consumption habits of Swedish youth, with a particular focus on polarisation effects, and secondly, to examine the effects of various alcohol prevention strategies targeting young people.

### 2.1 RESEARCH QUESTIONS

Four articles will address the following research questions.

#### Study I:

Could polarised youth drinking habits explain the recent divergence between alcohol consumption and alcohol-related harms among Swedish youth?

Are heavy drinking youth exposed to an increasing number of risk factors for harmful alcohol use over time, compared to their peers?

#### Study II:

What are the effects of a comprehensive community based alcohol prevention trial on youth alcohol consumption and alcohol-related harms?

#### Studies III and IV:

Can a health education program (Prime for Life) reduce youth alcohol consumption and improve attitudes and knowledge towards alcohol in the Swedish military (Study III) and among high school students (Study IV)?

### 2.2 THE 'RED THREAD'

What connects the four papers in this thesis? At the highest level, all four studies are concerned with youth alcohol consumption and prevention in the Swedish context, although the findings have implications which extend beyond Sweden. Study I begins with an epidemiological perspective on youth drinking, and presents recent data describing alcohol consumption trends over the past ten years in the country's capital, Stockholm. This study sets the scene for a detailed discussion in subsequent papers of ways to prevent alcohol related harms. In Study II, a broad perspective on prevention is taken with an evaluation of the Swedish Six Community Alcohol and Drug Prevention Trial (sometimes abbreviated to the *Six Community Trial*). Study II sets out the key findings and lessons learnt from the trial, with a focus on outcomes relevant to adolescents. Studies III and IV continue the prevention theme, but with a focus on the effectiveness of one particular prevention strategy; Prime for Life - a health education program delivered in the Swedish military and in high school settings.

The connections between the four Studies are set out in Figure 8.

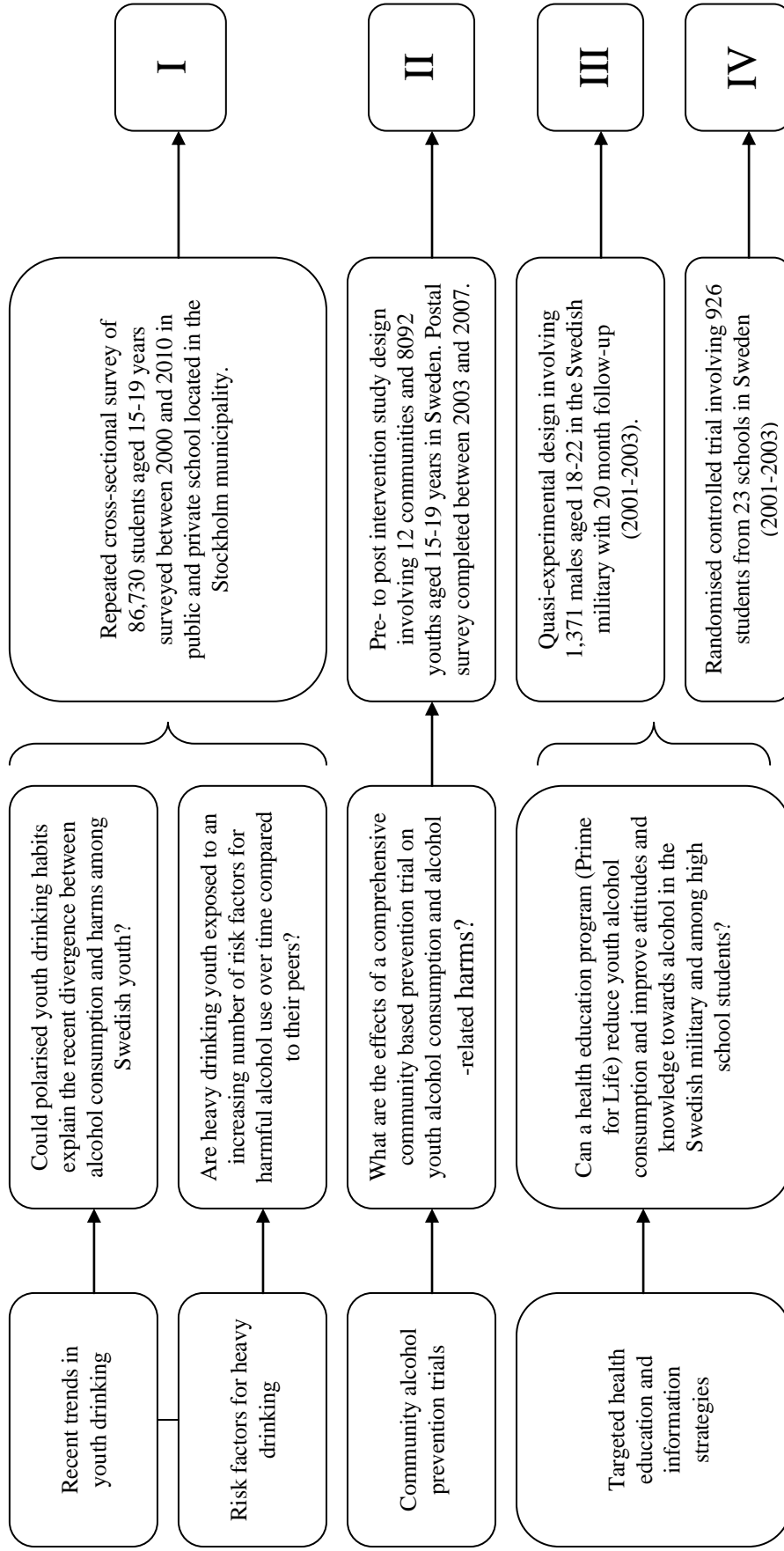


Figure 8: Overview of the research questions and study design

## 3 METHOD

### 3.1 STUDY 1: POLARISED YOUTH DRINKING

Study I explores recent trends in youth drinking and tests the alcohol polarisation hypothesis, which asserts that while most young people have reduced their consumption, a minority continue to drink more alcohol, possibly in response to accumulating individual and social risk factors for hazardous alcohol use.

#### 3.1.1 The Stockholm Student Survey

The alcohol consumption and risk factor data presented in Study I comes from the *Stockholm Student Survey*; a repeated cross-sectional self-report questionnaire completed every second year by high-school students in years 9 (aged 15-16 years) and year 11 (aged 18-19 years) in the Stockholm municipality. The anonymous survey is conducted during the spring period and is completed by students during class time. Students absent from school due to illness are posted a questionnaire to be completed at home and then returned via mail. The survey covers demographic information, alcohol and drug use (frequency, quantity and type), and various risk/protective factors for harmful alcohol use, including delinquency, psychosocial health, school performance and social support. The questionnaire is the largest youth alcohol and drug survey in Stockholm and is used by the Stockholm County Council to monitor important changes in health related behaviour. Participation in the survey is mandatory for all public schools, which comprise the majority of schools in Stockholm. Independent (fee paying) schools participate on a voluntarily basis.

##### 3.1.1.1 Participants

In 2000, 8,915 students from 76 schools participated in the survey. In 2010 the number had expanded to 15,746 students and 182 schools. Approximately equal numbers of males and females in both school years (9 and 11) participated in the study. As the questionnaires were completed during school time, response rates were high, averaging close to 80 per cent across the survey years. Non-responders were mainly students who were absent from school due to illness or other commitments.

Alcohol consumption during the past 12 months was assessed by 12 questionnaire items (frequency/quantity and type). Questions about the quantity of alcohol were answered on a 9 point scale; for example, ‘When you drink wine, approximately how much do you normally drink?’ with responses ranging from 1 (less than a glass <15 centilitres), to 9 (more than three bottles). The frequency scale followed a similar format. Per capita alcohol consumption (centilitres of pure alcohol) was determined by multiplying the quantity and frequency of reported consumption from each scale. Changes in binge drinking (also referred to as heavy episodic drinking) over time were assessed with a single question: ‘How often have you consumed the following amounts of alcohol during a single occasion?’: at least one bottle of wine, 5-6 shots of spirits, or 4 cans of strong beer (or 6 cans of medium strength beer). This measure has been used in annual alcohol surveys in Sweden since 1972. Estimates of the yearly frequency of

binge drinking were determined by converting statement response alternatives to numerical scores; for example, ‘a few times per year’ became three times per year, etc.

In addition to testing the *alcohol* polarisation hypothesis in Study I, we also set out to examine whether there was a polarisation in the total number of risk factors for harmful alcohol use over time. The goal was to determine whether or not the total number of risk factors had changed significantly over time in the entire population surveyed, compared to the heaviest drinkers. ‘Heavy drinkers’ were defined in this context as young people who consumed 20 litres of pure alcohol (or more) per year. We anticipated observing a reduction in the total number of risk factors among the majority of drinkers, but an increase among the heaviest drinkers between 2000 and 2010.

To test this idea empirically, thirteen risk factors for alcohol misuse were identified from the Stockholm Student Survey. As the survey changed slightly from year to year, with some risk factors dropping out and others coming in for the first time, we selected 13 risk factors that were present in each of the six surveys (2000, 2002, 2004, 2006, 2008 and 2010). The questionnaire was administered each year, but because the surveys needed to be merged into a single file, and this procedure involved considerable time, a decision was made to examine the risk factor data every second year. This analysis was time efficient, yet still provided an adequate picture of the changes that had occurred. We used a theory-driven approach to identify the 13 risk factors, focussing on the relevance and importance of factors noted in the international literature (Hawkins et al., 2004, Hawkins et al., 1992, Merline et al., 2008, Zufferey et al., 2007) and in recent Swedish studies (Branstrom et al., 2008, Danielsson et al., 2011, El-Khoury et al., 2005).

### **3.1.2 Statistical analyses**

Our main interest was to assess changes over time (2000 to 2010) in alcohol consumption and the total risk factor score. Changes in mean consumption and binge drinking were calculated for 6 years (2000, 202, 2004, 2006, 2008, and 2010). To assess changes in different levels of consumption over time, for males and females in both school years (9 and 11), alcohol consumption percentile ranks were calculated. This descriptive data shows how much alcohol young people were drinking each year, on average. Independent sample t-tests assessed the statistical significance of changes in consumption between 2000 and 2010 with Bonferroni adjustments for multiple comparisons. Changes in the distribution or ‘spread’ of the data were assessed with various measures including the standard deviation, coefficient of variation and homogeneity of variance (Leven’s test). Skewness and kurtosis were also assessed and reported. Skewed consumption data were log-transformed before performing parametric tests. Spearman’s non-parametric bivariate correlation tested the association between consumption and the total number of risk factors. SPSS version 20 was used for all analyses.



## **3.2 STUDY II: THE SWEDISH SIX COMMUNITY ALCOHOL AND DRUG PREVENTION TRIAL**

### **3.2.1 Brief project history**

Alcohol and drug availability in Sweden has increased over the past 15 years, and serious alcohol-related harms have risen among adolescents (CAN, 2011). These increases have led to a stronger focus on local communities and how they can be mobilised to reduce alcohol problems. As part of Sweden's national action plans to prevent alcohol and drug-related problems, the Alcohol Committee, the National Drug Policy Coordinator, and the Swedish National Institute of Public Health (SNIPH) initiated a development project in six communities. The aim of the project was to assist the municipalities in developing coordinated long-term prevention work using evidence based methods. Another important aim was to reduce harmful alcohol use and related harms, and to learn more about the processes involved when communities mobilise to increase prevention work at the local level.

Trial communities were encouraged to adopt prevention strategies with a strong evidence base. However, local communities were responsible for the final selection, which was seen as a compromise between evidence from the scientific literature and community priorities. Ultimately, most of the prevention strategies chosen involved youth related activities such as parental education and training, and school-based interventions. Some communities also targeted the restriction of alcohol through responsible beverage service programs. Training of primary care practitioners working with alcohol and drug issues was also adopted. Media advocacy was undertaken in an effort to improve community awareness of alcohol problems in the trial areas.

An invitation to participate in the project was sent out to all the municipalities in Sweden, and six were chosen to take part (Solna, Kalmar, Lund, Laholm, Kramfors, Umeå). The six trial communities were selected on the basis of their willingness and capacity to participate in the project by increasing alcohol and drug prevention efforts locally. Six demographically matched control communities were also selected for comparison purposes. The project was guided by a national steering committee and a project manager with responsibility for overall project coordination. Action groups in each trial community were responsible for implementing the chosen strategies locally. Work with the six trial communities commenced on 1<sup>st</sup> January 2003. The strategies were implemented over a four year period, with the first two years taken up primarily with planning and implementation activities. As most of the participating communities chose strategies targeting youth, Study II also focuses primarily on outcomes relevant to adolescents.

### **3.2.2 Study design and interventions**

Study II was primarily a pre to post intervention *effect* study, with cross-sectional data collected from questionnaire surveys conducted in the twelve communities. Data from a separate process evaluation, undertaken separately by the SNIPH, was used to help interpret the effect study findings (Karlsson, 2008). The main outcome variables of interest were: per capita alcohol consumption, binge drinking, adult attitudes towards

youth drinking, adolescent's perception of alcohol availability in the community, parent's willingness to offer alcohol to their children, and alcohol-related hospitalisations among 15-19 year olds, where national register data was used.

Seven key programs are described below with an indication of how widely each program was implemented during the trial period, The program 'dose' was assessed by asking each of the participating communities to complete a questionnaire regarding the type and number of programs implemented between 2003 and 2007. A complete program list is presented in Table 2.

**Table 2:** Specific programs included in the prevention work by the six trial communities

Method/Program	Kalmar	Kramfors	Laholm	Lund	Solna	Umeå
<b>School based programs</b>						
Motivational Interviewing for student health	X		X	X	X	
'Komet'	X <sup>1</sup>			X <sup>1</sup>		
Social and Emotional Training (SET)	X	X	X	X	X	X
<b>Programs for parents</b>						
Parental power	X				X <sup>2</sup>	X
Parental steps					X	X <sup>3</sup>
Komet for parents	X	X		X	X	
Step for step	X				X <sup>1</sup>	
Örebro Prevention Program	X		X	X	X	X
<b>Programs to reduce problems related to alcohol in bars and restaurants</b>						
Responsible beverage service (RBS)	X	X		X	X	X <sup>1</sup>
Responsible service of alcohol to students	X <sup>1</sup>			X		X <sup>1</sup>
Drugs in clubs	X					
<b>Measures to reduce the availability of alcohol and drugs</b>						
Inspirational lecture and training day <sup>1</sup>	X	X	X		X	X
Training day 2-3 <sup>4</sup>	X	X	X			
<b>Drink-driving strategies</b>						
Do not drink and drive campaign	X					
Variation of SMADIT <sup>5</sup>	X				X	X
<b>Interventions in primary care</b>						
Screening and counselling during pregnancy	X		X			X
Early detection/intervention and brief counselling					X <sup>1</sup>	X
<b>Mobilisation</b>	X	X	X	X	X	X

1:Very little scope/spread; for example a school-class, single group or patient

2:Only the inspirational method was used

3:Personnel trained in the method externally but as of 2006 had not performed their own training courses

4:Could only invite the trial communities Kalmas, Kramfors and Laholm

5. Samverkan mot alkohol och droger i trafiken (Interaction of alcohol and drugs with traffic)

### *Responsible beverage service (RBS)*

RBS is an effective method for reducing over-serving to intoxicated patrons and minors, and has been associated with reductions in violence (Wallin et al., 2005). Unfortunately, the widely known success of the program meant that it was

implemented in approximately equal numbers of bars and clubs in the trial and control communities. 'Participation' in the program meant that venue staff completed a two-day RBS training program at least once during the project period. Although the majority of licensed venues in the trial communities did not participate in RBS training, the proportion that did increased over time. In 2007, the participation rates were as follows: Laholm and Umeå (20%), Solna (71%), and Kramfors (55%). No data were available for Kalmar. Regulatory oversight is a key component of RBS and is associated with greater effectiveness. The number of compliance checks in the trial communities increased from 277 in 2004 to 367 in 2006. At the same time, the number of checks decreased in the control communities from 275 in 2003 to 125 in 2005 (data was not reported in 2006/7).

#### *Social and emotional training (SET)*

Since all children go to school, this is an obvious arena for health interventions. SET aims to develop adolescents' social skills so they are better equipped to make choices that reduce their exposure to alcohol and drugs. Specifically, SET teaches students self-control, social competence, empathy, motivation and self-awareness. Studies from the US have shown positive program effects including improved impulse control, social behaviour, increased ability to cope with anxiety and resolve inter-personal conflicts, and decreased criminal behaviour; including reduced drug use in schools (O'Donnell et al., 1995, Solomon et al., 1996). A recent Swedish study using a quasi-experimental, longitudinal design, found that the program had generally favorable effects on mental health (Kimber et al., 2008). Positive results were mediated through the promotion of self-image and well-being and by hindering aggressiveness, bullying, attention-seeking and alcohol use. There was, however, no differential effect on social skills. By 2007, SET had been implemented in 10% of schools in Umeå, 29% in Lund, 60% in Laholm, 64% in Solna and 51% of schools in Kalmar.

#### *Motivational interviewing (MI)*

MI is a prevention method that has been shown to help people change their lifestyles, including alcohol and drug use (McCambridge and Strang, 2004). Most studies to date have involved adults, but there is reason to believe the strategy also works with adolescents. In the trial communities, MI was integrated into school health services work, when students attend health examinations or request counselling. The method is applied in various problematic situations, such as when a student experiences social problems or truancy. By 2007, the proportion of student health personnel (nurses, psychologists and counsellors) who were trained in MI ranged from 2% of all schools in Lund, to 30% in Solna, 85% in Kalmar, and 100% in Laholm and Umeå.

#### *Örebro Prevention Project (ÖPP)*

ÖPP was developed by researchers at Örebro University in Sweden and targets parents with high school age children. The program aims to positively influence parents' attitudes to young people's drinking, and teaches parents how they can act to prevent alcohol misuse in young people. ÖPP was one of the more widely implemented strategies among the trial communities. In 2007, all schools in Kalmar and Laholm

were actively working with the program. In Umeå, 47% used the program, and in Solna and Lund, 64% and 69% of schools respectively had implemented ÖPP. Although the program showed initial promise, a recent evaluation failed to show any positive program effects (Bodin et al., 2011).

### *Komet for parents*

Children who display disruptive behaviours are at greater risk of developing anti-social problems, such as alcohol abuse, compared to children who are not disruptive. The parental support program 'Komet' was first developed in 2002 at the national Research and Development Unit in Stockholm. The program is intended for parents with children aged 3-12 years with disruptive behaviour or who have consistent problems establishing peer relationships, or difficulty concentrating at school. Results from a randomised trial showed that Komet increased parental competencies at four month follow-up, reduced children's problem behaviours and improved their social skills. The program was implemented in three communities between 2004 and 2007: Kalmar, Solna and Lund. The number of parents receiving the program varied between 5 (Kalmar, 2004) and 67 (Lund, 2006).

### *Availability*

Reducing the availability of alcohol is the most effective way to prevent alcohol-related harm (Babor et al., 2010, Anderson et al., 2009a), and all six trial municipalities were encouraged to work with availability measures. Regulations concerning trading hours apply nationally, and therefore influenced the trial and control communities equally. However, in the trial municipalities the police were given additional training in alcohol availability and enforcement measures. This included training in how to conduct on-site checks of alcohol sales to minors and intoxicated patrons, and to assess environmental measures associated with violence, such as over-crowding in licensed venues (Graham and Homel, 2008). The percentage of police officers trained in availability regulations in 2006-07 varied widely, from 10% in Solna, 35% in Umeå, and 75% in Laholm. The application of this knowledge by police, in terms of venue inspections at the local level, was not assessed.

### *Informing the local community*

Several studies highlight the beneficial effects of advocacy and information dissemination in reducing road traffic accidents and youth drunkenness (Clapp et al., 2005, Voas et al., 2002, Voas et al., 1997). Considerable efforts were made during the trial period to increase the number of media reports (mainly print media) describing alcohol-related problems and harms occurring at the local level in the trial municipalities. The aim was to increase the amount of information distributed in the trial communities around a particular topic, such as youth binge drinking. In practice, this frequently involved local communities working with journalists to ensure that particular issues were highlighted in the media. Every three months the total number of relevant print media articles was counted, and in January to March 2003, there were approximately 10 articles in the control communities compared to 65 articles in the trial

communities. Four years later in 2007, this number had increased to 75 (control) and 135 (trial) articles, respectively.

Underpinning these specific programs were sustained efforts to organize and mobilise community resources in ways that encouraged work towards the trial objectives. It was anticipated that the interventions would result in a number of intermediate and long term changes, including decreased heavy drinking, especially among youth. An intermediate goal was to initiate a shift in community attitudes towards the regulation and supply of alcohol to young people.

### **3.2.3 Prevention work in the control communities**

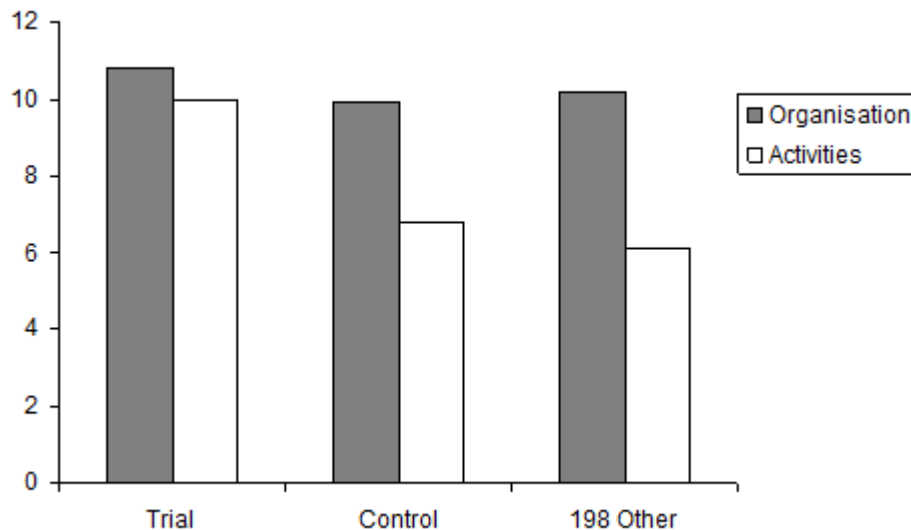
Alcohol prevention was also undertaken in the six control communities during the project - although on a measurably lower scale - and it was neither ethical nor practical to expect this work to cease completely. All of the control communities engaged to some extent in one or more of the methods available to the trial communities, described above. However, implementation of these prevention strategies did not commence until the final two years of the project; namely in 2005-06. When programs were implemented, it was typically with less frequency and organisation compared to the trial communities, as illustrated by the Prevention Index, below.

### **3.2.4 The prevention index**

To obtain an objective, overall assessment of the quality and quantity of prevention work undertaken by the twelve communities, a 'prevention index' was developed by the SNIPH. The index consists of two scales; an 'organisation' scale which includes 16 questions to assess how well the municipality's prevention work had been organised, and an 'activity' scale to assess the total number of prevention activities initiated during the previous twelve months (Study II reports data for 2006). The indices were based primarily on data collected through the SNIPH work development questionnaire, which is posted to all municipalities annually. The specific variables included in the prevention index are set out in Table 3. Differences between trial and control communities are illustrated in Figure 9, below.

**Table 3:** Variables included in the Prevention Index

<b>Organisation index variables</b>	<b>Activity index variables</b>
The municipality has a structured alcohol prevention program in place	Alcohol free activities are organized by the municipality
There is a clear implementation plan for the prevention policy involving key stakeholders	Information about alcohol related issues is distributed to parents residing in the municipality
The municipality has an explicit alcohol policy	School based parental programs targeting alcohol prevention (class 6-9).
An alcohol prevention policy is a pre-requisite for funding	Structured programs for ‘at-risk’ young children
The municipality has a policy regarding alcohol use in public places	Programs to support children of alcoholics
The municipality has a policy for alcohol preventive work in schools	Other activities to prevent the provision of alcohol to young people.
The municipality works with volunteer organisations (at least three) around alcohol prevention	Activities to help enforce minimum age limits for the sale of alcohol
The municipality works with other relevant authorities (at least three) around alcohol prevention	Activities to reduce alcohol related traffic incidents
The municipality works with the business community around alcohol prevention	Responsible alcohol service training
At least one person is employed (half time or full time) to work with alcohol/drug prevention	Screening and brief interventions in primary care
Alcohol prevention work is financed mainly by the municipality	Prevention programs are carried out in local schools in the municipality
A person is employed with responsibility for coordinating alcohol preventive work in the municipality	
Number of permanent liquor licences issued per 10,000 inhabitants	
Number of venues in the municipality with a liquor licence permitting trading after 1am	
The number of liquor licence compliance checks conducted in venues	
The number of compliance checks conducted in stores selling medium strength beer (3.5% alc volume or less)	
<b>Maximum 16 points</b>	<b>Maximum 11 points</b>



**Figure 9:** The prevention index used to assess differences between trial and control community prevention efforts (2006).

### 3.2.5 Measures

Changes in alcohol consumption and risk factors for harmful alcohol use were assessed by a self-report questionnaire mailed to residents within the twelve respective communities in May of each year (except 2005). This was the main data source used in Study II. Two stratified, unbound, random samples were drawn on the four measurement occasions; one for adults consisting of 7200 individuals aged 19-70 years, and one for adolescents consisting of approximately 4800 individuals aged 15-19 years. This meant that 1000 people (400 adolescents and 600 adults) were surveyed from each of the twelve communities. In total, 12,000 questionnaires per year, or 48,000 across the four year study period, were posted to residents.

The questionnaire included items concerning: alcohol consumption, binge drinking and drug use, demographic variables, a personality questionnaire, problems in relation to alcohol (youth), attitudes towards alcohol use (adults), truancy and delinquent behaviour (youth); relationships with parents and friends (youth), the school environment (youth); knowledge about alcohol prevention activities in the local community; safety and criminality in the local neighbourhood. The questionnaire items represent a combination of previously identified risk and protective factors for alcohol and drug use (Hawkins et al, 1992; El-Khoury et al, 2005).

Changes in youth's perceived availability of alcohol was assessed on a 4-point scale ranging from 1 (alcohol is very easy to access) to 4 (alcohol is very difficult to access). Seven questions determined how difficult or easy young people believed it was to access light beer, home-made alcoholic beverages, alcohol sold in the retail monopoly 'Systembolaget', and alcohol purchased from bars and clubs, parents and friends. Combining these scores derived a 'perceived availability of alcohol' total score. The self-report survey included one item to assess whether or not parents offered alcohol to their children. The 5-point scale ranged from 1 (my parents don't drink) to 5 (yes, I am often offered alcohol by my parents).

Changes in adults' attitudes towards the supply of alcohol to adolescents was assessed by averaging scores on four related items: 'Parents should not invite young people under 18 years to try alcohol', 'It is a serious crime to sell illegally imported alcohol to young people', 'It is acceptable to purchase alcohol for youth aged 18-19 years' and 'It is acceptable to purchase alcohol for youth under 18 years'. Each item was scored on a 5-point scale ranging from 'completely true/agree' to completely untrue/disagree'.

Alcohol-related hospitalisation data was collected from the National Board of Health and Welfare from 2002 to 2010. Data are presented for hospitalisations where the main reason for admission was an alcohol-related diagnosis (acute intoxication or poisoning).

### **3.2.6 Survey participants**

In total, 8092 questionnaires (42 per cent) were returned over the four year study period. Response rates for younger adolescents (aged 15-16 years) were generally lower, possibly because parental consent was required before the surveys were returned by mail. In 2007, 31 per cent of year 9 students responded, compared to 55 per cent of year 11 students.

A follow-up study was undertaken in late 2007 using a short version of the original questionnaire to compare differences between responders and non-responders. One thousand questionnaires were posted and 34.5% were returned. There were more alcohol abstainers among the non-responders (16.3% vs 2.0%); which might explain their decision not to participate in the survey. However, non-responders also reported binge drinking more frequently than the responders (14.0% vs 6.3%), and had been in contact with social services or the police for alcohol or drug-related problems more often during the previous 12 months (5.7% vs 3.8%). The two groups were comparable with respect to the age when first intoxicated, and other drug use.

### **3.2.7 Statistical analyses**

The main research question of interest in Study II was whether or not the trial communities had improved over time on key outcomes compared to the control communities. To answer this, group (trial/control) by time (year) interactions were assessed with Analysis of Variance (ANOVA). The important statistic was the ANOVA *interaction* effect. A main effect of 'group' indicates a significant difference between the intervention and control communities somewhere in the data, but only the interaction effect can answer the original research question; did the intervention have a positive effect on alcohol consumption and attitudes towards alcohol *over time*, compared to the control intervention? Changes in the proportion of youths who binge drink, and the proportion of parents who offer alcohol to their children were assessed with the non-parametric Kruskal Wallis *H* test.



### 3.3 PRIME FOR LIFE EVALUATION (STUDIES III AND IV)

#### 3.3.1 The intervention

The final two studies in this thesis evaluate the effects of a brief health education program named Prime for Life (PFL). The outcomes of interest include youth alcohol consumption, and attitudes and knowledge towards alcohol use in two settings: the Swedish military and in high schools. The theory and assumptions underlying the PFL program are described below.

PfL is a brief (typically one-two day) theory based prevention program that focuses on altering substance-use risk awareness and motivation for change. The program has been described by its developers, the Prevention Research Institute, as a ‘risk reduction model’, but essentially it is a health education and information strategy. PFL has been widely used in the USA, particularly for driving under the influence (DUI) offenses, but it has also been used with Swedish military conscripts (Study III) and in high-school settings (Study IV). Although the program was originally intended for use with ‘high risk’ alcohol users, the program has been modified for different populations and settings which are likely to include individuals who drink in risky or hazardous ways.

The program attempts to increase participants understanding of their own unique level of risk for the negative consequences of hazardous drinking by using timed presentations of both logical arguments and emotional experiences. This perception of risk, in turn, is believed to help motivate participants to reduce their consumption to less risky levels, and thereby avoid alcohol-related health problems (Beadnell et al., 2012). Information about alcohol and its effect is provided during the program, including the role of biological factors (such as family history and low response to alcohol) in the development of addictions. The Prevention Research Institute trains instructors to deliver the program in a designated sequence using detailed syllabi and check-sheets to self monitor adherence. The program places considerable emphasis on establishing collaboration with participants and uses an interactive approach, rather than didactic teacher-led style. Typically, PFL is administered over a two day period, although shorter one day versions are common. The U.S. “PRIME For Life under 21” version of the program was used in Study III and IV after it was translated into Swedish and modified with minor word changes and small adjustments to the content of some items to be consistent with Swedish cultural norms. However, the meaning of the items remained the same. The under 21 version of the program targets youth at-risk of alcohol-related harms.

The PFL program is based on the Lifestyle Risk Reduction model (Daugherty and Leukefield, 2003), and was influenced by several related health promotion and behaviour change theories. One of these, the Health-Belief model (Rosenstock, 1990), suggests that people are more likely to change their behaviour if they believe that doing so will result in the avoidance of a significant harm (for example, a motor-vehicle accident after drinking). Change is most likely when an individual believes they are *personally* vulnerable to a particular harm. The theories of Reasoned Action (Fishbein, 2008) and Planned Behaviour (Ajzen, 1991) suggest that a person's voluntary behavior is predicted by their attitude toward that behavior and how they believe other people

would view them if they performed a certain action. A person's attitude, combined with subjective norms, forms his/her behavioral intention, and the likelihood of change. Prime for Life's development was also influenced by the Transtheoretical model, also known as 'stages of change' theory (Prochaska and Velicer, 1997). This model recognises that people can be at different stages of readiness to change their health behaviour. The theory describes five main stages, from pre-contemplation (people here are generally unaware of the need to change), to contemplation of the benefits of change, preparation to act, action, and finally maintenance of the desired behaviour.

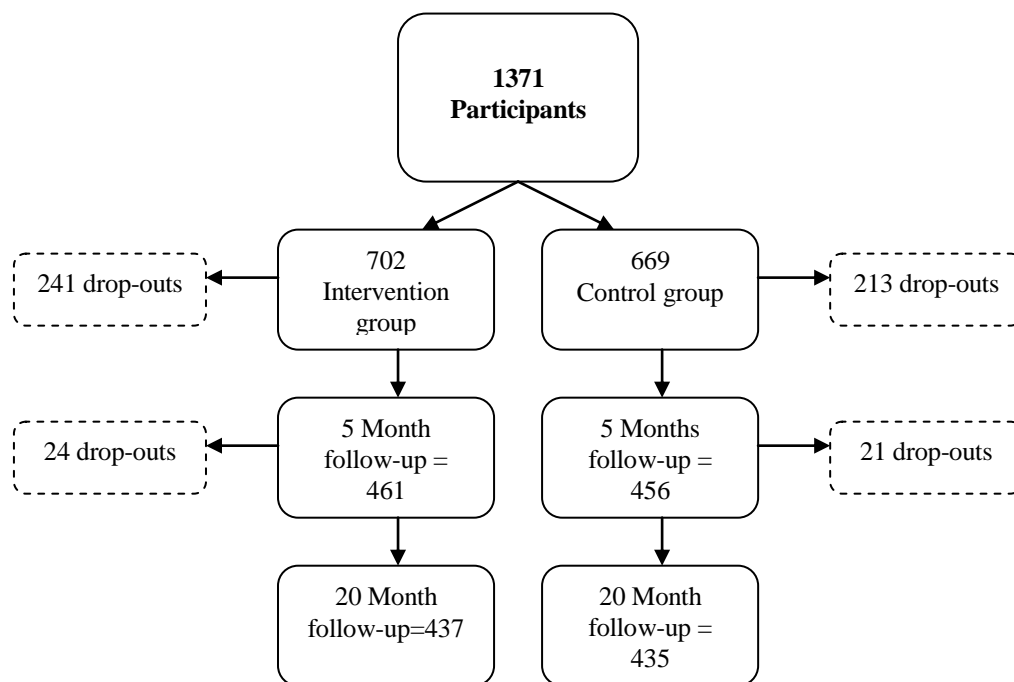
### **3.3.2 Military conscripts (Study III)**

Study III examined the effects of the Pfl program among young men in the Swedish military, with assessments taken at baseline, 5 month and 20 month follow-up. Data were collected from 2001 to 2003, with the intervention taking place from September 2001 to January 2002, shortly after the baseline assessment.

#### *3.3.2.1 Study design and participants*

This was a quasi-experimental design in which all participants were assigned to either a control or intervention group based on their military regimen. Ten regiments accepted an invitation to participate in the study, and all conscripts were encouraged to participate in the project as part of their military training. Participation was voluntary, however, and the conscripts could choose to withdraw at any time. To be included in the study, conscripts needed to be registered with one of the ten participating regiments at the beginning of the study. Originally, the design planned to be strictly randomised over the ten regiments. However, for practical reasons, three regiments had participants in both conditions, while four regiments provided conscripts to the intervention group, and three regiments to the control group only. Some regiments were assigned entirely to the intervention group because they had previously received the intervention and therefore could not be randomised. Recruitment to the study was made on site by officers who were in touch either directly with the researchers, or with their respective commander.

In total, 1371 male conscripts completed a baseline questionnaire. Of these, 702 conscripts received the Pfl intervention and 669 were assigned to the control group. About one-third of the participants dropped out of the study at 5 month follow-up because they chose not to participate beyond the baseline assessment, or because they had left the military. The recruitment sequence is illustrated in Figure 10. All participants were male and aged between 18 and 22 years.



**Figure 10:** Participation and drop-out rates – military conscript study

### 3.3.2.2 Measures

Alcohol consumption was measured by the first three questions in the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993), Swedish version (Bergman and Kallmen, 2002). Consumption was calculated by adding scores on the following items: ‘How often do you drink alcohol’, ‘How many glasses of alcohol do you drink on a typical drinking day?’ and ‘How often do you drink six or more glasses of alcohol during a single drinking session?’ Binge drinking was measured with the third AUDIT question assessed on a 5 alternative scale, ranging from “never” to “daily or almost daily”.

Knowledge about alcohol and attitudes towards alcohol consumption were measured using questionnaires developed by the project group. The 10 item knowledge questionnaire included statements with five alternative responses; strongly agree, agree, indifferent, disagree, and strongly disagree. The face validity of all items was cross-checked by a group of drug and alcohol experts within the STAD group (Stockholm Prevents Alcohol and Drug Problems) affiliated with the Karolinska Institute, Sweden. The questions were designed to reflect common alcohol issues, in addition to issues dealt with in the Pfl program. Examples of questions were “Only people with alcoholism in their family are at risk for developing alcoholism” (knowledge, 10 items), “A party is no fun if there isn’t alcohol available” (attitudes, 8 items) and “I’m planning to cut down on my drinking” (intentions, 3 items). After converting the questions to indexes, the range of possible points was 0-4 for each index, where *high* scores indicate more informed knowledge about alcohol problems and better attitudes towards alcohol use, with a greater intention to drink less.

### 3.3.3 Statistical analyses

A repeated measures analysis of co-variance (ANCOVA) was performed to explore changes in the dependent variables over time between the intervention and control groups. Baseline data was used as a covariate factor. Where main effects of group were found, post-hoc t-tests were used to see where the differences occurred (baseline, 5 or 20 month follow-up). An intervention effect is expressed as a group by time interaction. All analyses were conducted with SPSS version 18.

### 3.3.4 High school students (Study IV)

The aim of Study IV, like Study III, was to assess behaviour change following the Pfl intervention – this time, in a high school setting. Once again, changes in alcohol consumption, knowledge, attitudes and (specifically) intentions regarding alcohol use were investigated, as well as perceptions of risk for alcohol problems.

The program was implemented by trained instructors in each of the 23 schools involved in the study. During a 5-months period the instructors taught 24 courses, with each course requiring two days, or 10 hours (in two classes the course had to be compressed to one day). The curriculum was guided strictly by the program manual to minimise instruction variability.

#### 3.3.4.1 Measurements

Changes in alcohol consumption and heavy episodic drinking were assessed with the AUDIT questionnaire. The same questionnaire used in Study III was also used in Study IV to assess changes in adolescence attitudes and knowledge about alcohol, but with additional questions concerning the perceived risk for alcohol problems.

#### 3.3.4.2 Study design and participants

Study IV was a group randomized trial with Pfl used as the intervention. An age matched control group received no intervention. There were no other potentially confounding programs taking place at the time of the study. Individual students completed questionnaires administered before the intervention (baseline) and at 5 and 20 month follow-up.

All twenty-three public high schools in the Stockholm municipality participated in the study ( $n=926$  students). In Sweden, 'high school' includes students aged between approximately 18 and 19 years – the final two years of upper-secondary education. Only three students refused to take part in the survey, and a few survey forms were excluded due to incompleteness. The schools were stratified by location (inner city vs. suburban) and by their primary education profile (theoretical or vocational), and then randomized to either the Pfl intervention or control group.

At baseline, only students attending school were included, but at the first follow-up, absentees were sent forms by regular mail with two reminders. Postal questionnaires were also used for all subjects at the second follow-up, since by that time most had left school. In total, 79% of all participants were able to be followed through to 20 month follow-up. The retention rate over 20 months is shown in Table 4.

**Table 4:** Retention of participants over time, by condition and total number (high school study)

Condition	Baseline	Course evaluation	5 months follow-up	20 months follow-up
Intervention	501 (100%)	361 (72%)	435 (87%)	400 (80%)
Control	425 (100%)	n/a	383 (90%)	334 (79%)
Total	926 (100%)		818 (88%)	734 (79%)

### 3.3.5 Statistical analyses

Differences between conditions over time (group x time effects) were analysed with repeated measures Analysis of Variance (ANOVA), and differences between conditions (intervention vs control) were analysed with t-tests. If interaction effects were found, the significance of differences was tested with post hoc tests (Neumann-Kuhls). The statistical packages SPSS v. 12 and Statistica were used to run these analyses.

As the participants were clustered in pre-arranged groups (schools), the level of similarity among students needed to be taken into account in the analyses. To achieve this, the intra-class correlation coefficient (ICC) and the corresponding variance inflation factor (VIF) for each dependent variable was calculated. The F (and t) ratios were then corrected with the formula  $F/\sqrt{VIF}$ . The ICC represents the proportion of the total variability in the outcome that is attributable to the variable ‘school’. If attending the same school had the effect of making the students more alike, then the ICC will be large (approaching 1). Conversely, if the variable ‘school’ had little effect, the ICC should be low (closer to 0). As such, the ICC is a gauge of whether a contextual variable – in this case, school – had an effect on the outcome.

The relevant ICC’s and the corresponding Variance Inflation Factor (VIF) were calculated according to the general formulas for group dependency,  $ICC = (MS_{\text{between}} - MS_{\text{error}}) / (MS_{\text{between}} + (m - 1)MS_{\text{error}})$  and  $VIF = 1 + (m - 1) ICC$  (Murray and Hannan, 1990). Due to unequal school samples the mean school size was used as  $m$ . Both the ICC and VIF scores were calculated for each outcome variable. The ICC scores were generally low (below 0.1), indicating that the effect of ‘school’ on the sample was small. Similarly, the VIF factor was always below 10, indicating that the ‘likeness’ caused by attending the same school should not have influenced the results. The VIF and ICC scores are shown in Table 5.

**Table 5:** Mean number of participants per school (m), Intraclass Correlation Coefficient (ICC) and Variance Inflation Factor (VIF) scores for the primary outcomes measured at baseline

Measure	m	ICC	VIF
AUDIT 1	39.87	.0858	4.335
AUDIT 2	35.57	.0944	4.263
AUDIT 3	39.09	.0869	4.049
Risk for alcohol problems	39.48	.0424	2.632
Knowledge	40.09	.0053	1.207
Attitudes	40.09	.1224	5.785
Intentions	36.35	.0501	2.771
AUDIT score	34.09	.0808	3.674

### 3.4 ETHICAL CONSIDERATIONS

The four papers in this thesis were made possible because thousands of individuals volunteered to complete questionnaires, or because they participated in alcohol prevention programs. The surveys used include questions about drinking habits, general health, contact with social services and lifestyle issues. The author acknowledges the sensitive nature of this information, which has always been treated with strict confidentiality. Studies II-IV have all undergone an ethical review process conducted under the auspices of either the Karolinska Institute's research ethics committee, or Socialstyrelsen's ethics committee (Study II). These procedures have ensured that:

- Participation in each of the studies was entirely voluntary. No participants were coerced or persuaded to participate in any investigation reported here.
- All participants were free to withdraw from a study or program at any time, without needing to justify their reasons for doing so.
- No participants have been identified or named. All the questionnaire responses are anonymous, although information about the school or community that a person belongs to is represented in some data.
- All study data has been kept in a secure location, accessible only by members of the research group.

It should be noted that ethics approval was not sought for Study I (*Polarised youth drinking*) because the data used in this study was not originally intended for research purposes – instead, it was collected by the Stockholm City Council (funded by the Department of Education) and later used by the Karolinska Institute for research. It is important to note, therefore, that participation in this study was also voluntary, and that no individuals were identified during the survey process. Only aggregate level data is presented in the final paper.

## 4 RESULTS

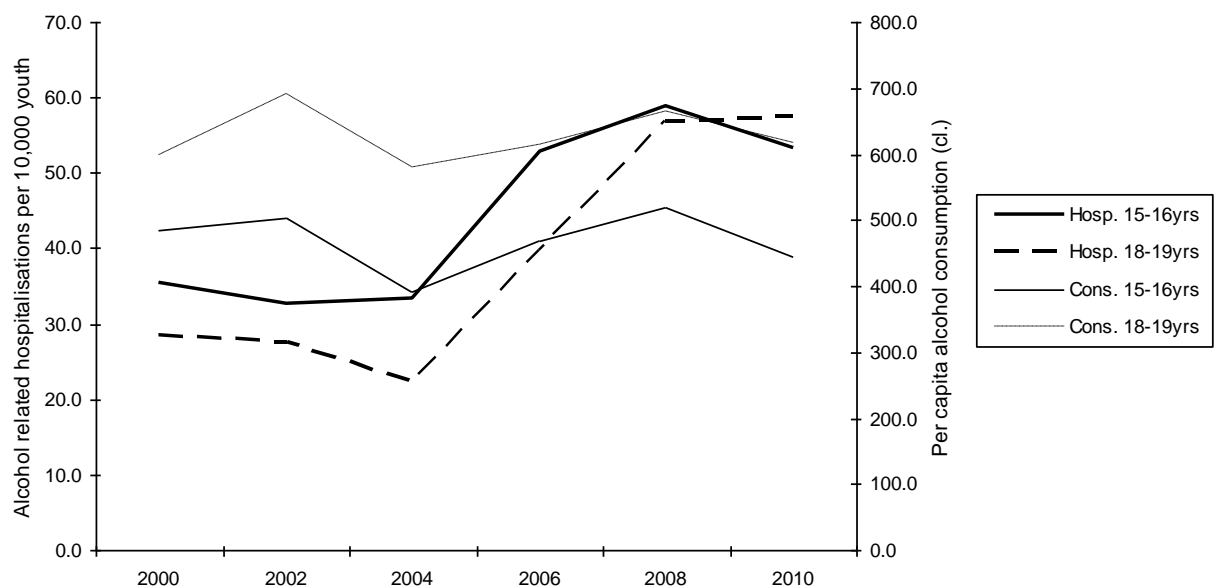
### 4.1 ARTICLE I – POLARIZED YOUTH DRINKING

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#### Could polarised youth drinking habits explain the recent divergence between consumption and alcohol-related harms among Swedish youth?

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In Study I we observed that the majority of adolescents in Stockholm are drinking less alcohol, or choose not to drink alcohol at all. Between 2000 and 2010 abstention rates rose by about 7% among year 9 students, and 16% among year 11 students, while per capita alcohol consumption reduced slightly. There was only one exception to this trend, with females aged 18-19 reporting a small increase in consumption over the past decade. Consistent with the changes in total consumption, the estimated yearly frequency of binge drinking – an important indicator of harm - also reduced (again, with the partial exception of year 11 females). Similar changes have been observed nationally, so the results are not limited to Stockholm. In contrast to these mostly positive drinking trends, there were steady *increases* in the number of young people admitted to hospital with a primary or secondary alcohol-related diagnosis, as shown in Figure 11, below.



**Figure 11:** Changes in per capita alcohol consumption and alcohol related hospitalisations among Stockholm youth aged 15-19 years. (Source: Socialstyrelsen, 2012)

We proposed that one possible explanation for these diverging trends could be a polarisation effect in youth drinking, where some young people are drinking considerably more alcohol over time, while the majority drinks less. This hypothesis was generally confirmed by the data, which shows that a sub-group of young people (those in the top 5-10% of the drinking distribution) are consuming more alcohol over time compared to their peers. The strength of this pattern varies somewhat by gender and age (school year), but overall the trend is clear (see Table 6).

**Table 6:** Changes in per capita alcohol consumption by percentile rank for year 9 males

Percentile	2000	2002	2004	2006	2008	2010	%change	Absolute change
1	0.53	0.54	0.48	0.48	0.48	0.26	-51	-0.27
5	1.92	1.92	1.08	0.91	1.05	1.04	-46	-0.88
10	4.82	6.09	2.52	2.08	2.85	2.08	-57	-2.74
25	29	37	12	12	21	14	-52	-15
50	205	206	97	105	136	109	-47	-96
75	716	737	429	558	573	542	-24	-174
90	1623	1715	1127	1640	1628	1382	-15	-241
91	1706	1874	1234	1778	1823	1537	-10	-169
92	1861	2079	1355	1945	1964	1697	-9	-165
93	2001	2287	1542	2181	2140	2041	2	40
94	2261	2478	1725	2443	2435	2430	7	169
95	2502	2713	1948	2657	2810	2852	14	349
96	3011	3069	2400	3192	3230	3333	11	321
97	3777	3798	3061	4014	4045	4292	14	515
98	4453	4924	4226	5089	5175	5128	15	674
99	5935	6779	5495	6532	7020	6942	17	1007
mean	618	659	452	576	601	569	-8	-49
median	205	206	97	105	136	107	-48	-98
SD	1108	1205	1042	1209	1249	1224		116
CV	179	183	231	209	207	217		38
Skewness	3.75	3.83	4.98	3.83	3.97	4.03		0.28
<i>St error Skew</i>	<i>0.06</i>	<i>0.05</i>	<i>0.04</i>	<i>0.05</i>	<i>0.05</i>	<i>0.05</i>		-0.01
Kurtosis	18.14	18.58	31.11	17.55	18.80	19.06		0.92
<i>St Error Kurt</i>	<i>0.11</i>	<i>0.11</i>	<i>0.08</i>	<i>0.11</i>	<i>0.11</i>	<i>0.11</i>		0
% abstainers	23	25	30	34	36	42	83	19

For brevity, data for year 9 males only is shown. Changes in the dispersion of the data are also clear; for example, both the SD and coefficient of variation (CV) increased in most groups between 2000 and 2010, as did the skewness and kurtosis. The statistical significance these increases in the dispersion of the consumption data were confirmed by Levene's test of the homogeneity of variance. Overall, the data indicates a widening of the drinking distribution, which supports the hypothesis that most adolescents are drinking less, while a sub-group of very heavy drinkers are consuming more alcohol over time.

The polarization trend was similar for other students surveyed, with two notable differences compared to the year 9 males, shown above. First, for year 11 females the polarisation effect emerged at about the 50th percentile, indicating that the group of heavy drinkers was considerably larger. Second, for year 9 females, there was a consistent reduction in consumption across *all* percentiles between 2000 and 2010, however, the reduction was smaller in the top end of the distribution; a pattern consistent with a polarisation effect.



### 4.1.1 Risk factors for harmful drinking

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#### Are heavy drinking youth exposed to an increasing number of risk factors for harmful alcohol use over time compared to their peers?

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Bivariate correlation analyses confirmed that the 13 risk factors chosen were significantly associated with higher alcohol consumption. In other words, as the number of risk factors increased, so did per capita consumption, and visa versa. Apart from this finding, the risk factor data is inconclusive due to the high variability in scores between years (Tables 7 and 8).

Replicating the methods used to analyse the consumption data (i.e., a percentile analysis with tests of data dispersion) failed to demonstrate a polarisation effect in the total number of risk factors for the total sample or the top 5 per cent of drinkers.

**Table 7:** Risk factors for harmful alcohol consumption (total sample)

Year	2000 n=6302	2002 n=6929	2004 n=6330	2006 n=7008	2008 n=7583	2010 n=8092
Mean	3.41	2.91	2.72	3.11	3.17	3.08
Median	3	3	2	3	3	3
SD	2.08	2.02	1.92	2.05	2.06	2

**Table 8:** Risk factors for harmful alcohol consumption (top 5% of drinkers)

Year	2000 n=78	2002 n=449	2004 n=737	2006 n=621	2008 n=587	2010 n=448
Mean	6	5.21	2.97	3.33	3.63	5.49
Median	6	5	3	3	3	5
SD	2.08	2.4	1.88	2	2.03	2.26

## 4.2 ARTICLE II – COMMUNITY BASED PREVENTION OF HAZARDOUS YOUTH DRINKING

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### **What are the effects of a comprehensive community based prevention trial on youth alcohol consumption and alcohol-related harms?**

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The six trial communities implemented a larger number of prevention programs than the six control communities. The prevention work carried out in the trial communities was also better organised and structured in comparison with the fragmented and varied work undertaken in the control areas.

The quantitative results, based mainly on cross-sectional surveys of the general population in the 12 communities, indicated few significant differences between the trial and control regions by 2007. Between 2003 and 2007, alcohol consumption reduced substantially among year 9 students (aged 15-16), but increased slightly among year 11 students (aged 18-19). When combined, there was an overall reduction in per capita consumption across the twelve communities, but there were no significant differences between trial and control regions. Heavy episodic drinking also reduced during the project period, but again, with no clear improvements in the trial communities over time, compared to the control communities.

One positive finding was that adults become more restrictive in their attitudes towards the availability and sale of alcohol, including the provision of alcohol to their own children. Significant improvements were found in both trial and control areas over time, but the tendency to offer alcohol to adolescents was somewhat stronger in the control communities.

#### **Other important results include:**

There were no significant differences between the trial and control communities on measures of youth's perceived availability of alcohol in the community (males year 9 ( $F_{3,738}=.011$ ,  $p=.998$ ), females year 9 ( $F_{3,995}=.687$ ,  $P=.560$ ), males year 11 ( $F_{3,1512}=.496$ ,  $P=.685$ ), females year 11 ( $F_{3,1989}=.237$ ,  $P=.871$ )).

Between 2003 and 2007, there was an increase in the proportion of young people admitted to hospital with a primary alcohol related diagnosis (ICD-10 codes f10, acute intoxication and T51, toxic effect of alcohol) but there was large variability between years and no statistically significant differences between intervention and control communities over time.

A separate study conducted by the Swedish National Institute for Public Health (data not shown), found no significant differences between trial and control communities with respect to over-serving of alcohol to intoxicated patrons, beverage service to minors, or the ability of minors to purchase medium strength beer from supermarkets (Kvillemo et al., 2008).

### 4.3 ARTICLE III – PRIME FOR LIFE CONSCRIPT STUDY

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#### Can the Prime for Life program reduce youth alcohol consumption and improve attitudes and knowledge towards alcohol among military conscripts?

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##### *Baseline analyses*

The responders drank significantly less alcohol at baseline, but the non-responders had a more restrictive attitude towards drinking with a stronger intention to drink *less*. No baseline differences were found on the Karolinska Personality Scale or the Knowledge questionnaire.

##### *Alcohol consumption (AUDIT-c)*

There was a significant main effect of time ( $F_{1,552} = 15,19$   $p < 0,000$ ), but no group by time interaction ( $F_{1,552} = 1,36$   $p < 0,24$ ), indicating that although consumption reduced in both groups by 20 months, the improvement was not significantly better in the experimental regimens compared to the control regimens. Changes in alcohol consumption among the high risk drinkers were also tested (AUDIT score=8+). A main effect of time was found ( $F_{2,307} = 31,31$   $p < 0,0001$ ), but no interaction effect ( $F_{2,307} = 0,443$   $p < 0,64$ ). There was a significant reduction in consumption from baseline to 5 and 20 month follow-up in *both* the intervention and control groups, but the effect sizes were small in all cases. There were no differences in consumption over the 20 months study period among the heaviest 10 per cent of alcohol consumers.

There was a significant main effect of time ( $F_{1,647} = 20,17$   $p < 0,0001$ ) but no interaction effect at 20 month follow-up on the binge drinking item ( $F_{1,647} = 0,14$ ,  $p < 0,70$ ). There was a small (Cohen's  $d = 0.01$ ) but statistically significant drop in binge drinking scores from baseline to 5 month follow-up in the intervention group only, but this improvement disappeared at 20 months follow-up.

##### *Attitudes and knowledge*

There were no significant group effects over time on the Attitude scale. Scores in both the intervention and control group improved significantly from baseline to 5 months, then decreased (worsened) to baseline levels in both group at 20 month follow-up. Due to low internal reliability, mean scores on the knowledge scale were not analysed. Changes on individual questionnaire items were examined but no consistent patterns were found.

##### *Personality*

There was a significant main effect of inhibition of aggression ( $F_{1137} = 10,42$   $p = 0,001$ ) and impulsivity ( $F_{1137} = 12,93$   $p < 0,001$ ) on the AUDIT-C score but no effect of Monotony Avoidance and no interaction between personality variables. Participants who scored high on 'inhibition of aggression' had a lower mean AUDIT-C than participants who scored low on this item (6.27 vs 6.72). Highly impulsive conscripts showed a higher AUDIT-C (6.79) than those low on impulsivity (6.30).

#### 4.4 ARTICLE IV - PRIME FOR LIFE HIGH SCHOOL STUDY

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##### **Can the Prime for Life program reduce youth alcohol consumption and improve attitudes and knowledge towards alcohol among high school students?**

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###### *Baseline analysis*

Ninety one per cent of the student participants were alcohol consumers at the baseline survey. Fifty-three per cent indicated that they typically drank between three and six standard units of alcohol per drinking occasion (where one standard unit contains about 10grams of alcohol), but 37 per cent consumed seven units or more. Inner city students drank alcohol more often than students in suburban areas ( $t(916) = 3.03, p = .002$ ) but the difference between theoretical and vocational students was not significant ( $t(916) = 1.16, p = .246$ ).

###### *Alcohol use*

The two conditions did not differ significantly on any of the four measures of alcohol use from baseline to 5 month follow-up. The overall quantity (units per occasion) of alcohol consumed, and the total AUDIT score were both lower at 5 month follow-up, but the differences were evenly distributed over the intervention and control group. Although not as strong, the trends which emerged at 5 months were maintained through to 20 months – neither group differed significantly on any measure of alcohol consumption. The frequency of consumption increased for all students ( $t_{\text{corr}}(710) = 13.16, p < .001$ ) from baseline to 20 month follow up, while the quantity declined ( $t_{\text{corr}}(621) = -8.48, p < .001$ ). There were no significant differences between the intervention and control groups on measures of risky consumption.

###### *Knowledge and attitudes*

The mean ‘knowledge’ score for Pfl participants increased significantly from baseline to 5 and 20 month follow-up. Student’s perception of risk for developing alcohol problems increased significantly in the intervention group only at 5 months, but the effect had diminished by 20 months. No other significant differences were found.

## 5 DISCUSSION

### 5.1 THE MAIN FINDINGS

This thesis has closely examined recent trends in Swedish youth alcohol consumption, and evaluated the effectiveness of prevention strategies to minimise alcohol-related harmful effects.

In Study I, we found evidence of polarised youth drinking habits. While most adolescents in Stockholm continue to drink less alcohol over time, a smaller group of young people are drinking substantially more alcohol than their peers. This finding was observed among males and females in years 9 and 11, although the strongest tendency was seen among year 9 boys. The total number of risk factors for harmful alcohol use was higher among the heaviest drinkers (those in the top 5 per cent of the drinking distribution), but there was no evidence of a polarisation effect in the total number of risk factors, as originally anticipated. With considerable variability between years, the risk factor data is inconclusive in this respect.

In Study II, findings from the *Swedish Six Community Alcohol and Drug Prevention Trial* were reported. The trial communities mobilised and increased their prevention activities to a greater extent than the control communities. However, by 2007 there were no significant improvements in the six trial communities compared to the control communities on any of the key outcomes measured, with the partial exception of adult attitudes towards the provision of alcohol to children, which improved more in the trial communities.

In Studies III and IV, the effectiveness of ‘Prime for Life’ – a brief health education intervention - was examined in two settings; among military conscripts (Study III) and high school students (Study IV). In the conscript study, alcohol consumption and high risk drinking both improved over the 20 month study period, but the improvements were approximately equal in both groups – no interaction effects were found. Attitudes towards alcohol also improved in both groups at 5 months, before returning to baseline levels by 20 months. Similar results were obtained in the high school study. There were no significant program effects on drinking behaviour. Improvements in knowledge and drinking risk perception were found in the intervention group only at 5 month follow-up, but only the improvements in knowledge about alcohol’s harmful effects were sustained at 20 months.

### 5.2 POLARISED YOUTH DRINKING

The starting point for Study I was the unexpected observation that alcohol-related hospitalisations among Stockholm youth had increased sharply over the past decade, while per-capita consumption had reduced. Previous studies have shown that increases in total consumption tend to be associated with roughly parallel increases in serious alcohol related harmful effects (Norstrom and Ramstedt, 2005), so the recent divergence between consumption and harm warrants explanation. Such analysis is also important because Swedish alcohol policies are based on a model which assumes a

strong association between consumption, heavy drinking and alcohol-related harms; an approach influenced by Skog's theory of the collectively of drinking and the so-called total consumption model (Skog, 1985). Skog's theory predicts that reductions in yearly consumption should influence all levels of drinking concurrently, including heavy drinking patterns which increase the risk of harmful effects. Current Swedish alcohol policy aims to reduce total consumption through restrictions over the availability of alcohol via a retail monopoly, purchasing age restrictions, responsible beverage service, trading regulations and enforcement.

The findings from Study I suggest that polarised youth drinking is a likely explanation for the recent divergence between consumption and alcohol-related harms among Stockholm youth. For most young people, consumption reduced between 2000 and 2010, while the heaviest consumers mostly increase their consumption during this period. The spread or dispersion of the consumption data increased over time in each of the four groups examined, indicating the presence of more heavy drinkers in the tail end of the distribution over time. Tests of the homogeneity of variance (Levene's test) confirmed that the increased dispersion in alcohol consumption was statistically significant. Examining the data with different cut-off's to exclude students who drank more than 30, 50 or 70 litres of pure alcohol per year (as opposed to 100 litres) produced the same basic trends, so the findings appear to be robust.

Although the anonymous self-report data used in Study I could not be connected to the Stockholm hospitalisation data, it appears likely that the heaviest alcohol consumers are responsible for the rise in alcohol-related hospitalisations seen recently. Adolescents in the top five per cent of the drinking distribution report consuming not only an increasing total volume of alcohol over time, but also a much higher frequency of yearly binge drinking; a pattern of consumption strongly linked to serious acute harms (Rehm et al., 1996, Rehm et al., 2008). Moreover, heavy episodic drinking accounts for a substantial proportion of all the alcohol consumed by the top 5 per cent of drinkers in the sample.

Of particular concern are females aged 18-19 years. These young women are the only group to report steady increases in both per capita consumption, and the estimated frequency of binge drinking between 2000 and 2010. Although 18-19 year old females consume less alcohol on average than their male counterparts, the proportion of males and females in this age group admitted to hospital in 2009-10 was similar. This suggests that the pattern of alcohol consumption and/or the type of alcohol that female adolescents drink may be responsible for a disproportionate number of adverse consequences. Recent reports show that females aged 18-19 years favour mixed drinks with a high alcohol content more than other adolescents in Stockholm (CAN, 2011). This is noteworthy because research suggests that the consumption of sweetened, high alcohol content beverages may be associated with more frequent alcohol-related problems, compared to the consumption of wine or beer (Kraus et al., 2010, Kisely et al., 2011). When differences in consumption and hospitalisation data for Sweden and Stockholm are compared, it is clear that adolescents in Stockholm drink more alcohol and present to hospital with serious alcohol-related problems more frequently than their peers (see Figures 3-6). For example, in 2009-10, the proportion of hospital admissions in Stockholm almost doubled the national figure. Another important difference is that

hospitalisations among 15-16 year olds have increased steadily over the past ten years in Stockholm, but have remained more stable in the national data. These differences could reflect different underlying drinking patterns between urban and rural adolescents. As noted in the Introduction, it is equally possible that the higher hospital admission rate in Stockholm reflects greater service access or different treatment practices in the capital city, where some cases of intoxication may be treated outside the hospital system, or not treated at all.

One unexpected finding from Study I was the absence of a risk factor polarisation effect. We originally hypothesised that polarised drinking habits could be driven by an increasing risk-factor burden among the heaviest drinkers. It was suggested that ongoing social and economic changes in Sweden could be affecting young people in the form of greater disparities, which are associated with a higher incidence of social problems generally, including heavy drinking. On a societal level, there have been shifts in the distribution of wealth in Sweden which have resulted in greater socio-economic inequalities (Klevmarken, 2006). Recent Swedish research examining changes in the living conditions of young people between 1994 and 2005, found a polarisation tendency on three central dimensions of welfare: employment, economic resources and health (Fritzell et al., 2007b, Fritzell et al., 2007a). Given these circumstances, it is plausible that adolescents who drink increasingly harmful amounts of alcohol are doing so because they are exposed to an increasing number of risk factors, both at the individual and community level. Some risk factors, such as greater alcohol availability, could be disproportionately affecting marginalised young people with fewer work and social opportunities. This possibility is supported by a recent Finnish study, which found that large reductions in the price of alcohol led to substantial increases in alcohol-related mortality, mainly among individuals from lower socio-economic backgrounds (Herttua et al., 2008).

The absence of a polarisation effect in the total number of risk factors could be attributable to qualitative differences between the extremely high and the more moderate drinkers. Young people who routinely drink to excess frequently also display social problems, which makes them a unique group in this respect (Zufferey et al., 2007). Consequently, the risk factors which influence the behaviour of most light to moderate drinkers may have a different effect on the behaviour of extreme drinkers or socially marginalised young people. This idea is supported by research which shows that risk factors for harmful alcohol use differ between community samples, where per capita consumption tends to be moderate and clinical samples, where the populations surveyed typically have co-morbid psycho-social problems (Becker and Grilo, 2006, Nation and Heflinger, 2006).

### **5.2.1 Implications**

Study I offers an important empirical observation which, to the author's knowledge, has not been shown previously. It demonstrates that a sub-group of young people in Sweden are drinking substantially more alcohol over time compared to their peers, and in ways that are likely resulting in greater alcohol-related harmful effects. This tendency has been observed elsewhere in the UK and Australia, so our findings have

implications that extend beyond Sweden's boundaries (Livingston et al., 2010b, Meier, 2010).

From a policy perspective, our data is an important reminder that changes in per capita consumption can hide shifts in the drinking habits of heavy alcohol consumers. Due to the general association between total consumption and alcohol-related harms, policy makers tend to focus heavily on yearly changes in per capita consumption. However, our findings suggest that policy decisions based on total consumption *alone* are insufficient and should be supplemented with data on the dispersion of drinking relative to per capita consumption so that high-risk drinking groups can be identified.

The results from Study I do *not* suggest that a complete shift away from the total consumption model is necessary. Indeed, there is considerable evidence that such an approach is justified. What may also be required, however, is greater attention towards emerging high-risk drinking groups in the community; that is, young people who are not responsive to system level policies which have a positive impact on the behaviour of most young drinkers. These could be marginalised young people with considerable social problems who are not influenced by traditional alcohol policies. Alternatively, they could also be adolescent from affluent backgrounds - further research is needed to identify these characteristics, which can then inform future prevention policies. .

### **5.3 COMMUNITY PREVENTION OF YOUTH ALCOHOL PROBLEMS**

In Study II, we reported key findings and lessons learnt from an evaluation of the *Swedish Six Community Alcohol and Drug Prevention Trial*. The main goal of the trial was to support 6 communities in the development and implementation of effective prevention strategies to reduce the harmful effects of alcohol and drugs. The trial targeted whole communities; however, in keeping with the main theme of this thesis, our focus was on youth alcohol-related outcomes.

The prevention of alcohol-related problems at the community level holds considerable promise. This type of prevention attempts to remove or modify the underlying mechanisms responsible for the problem, and has considerable potential for change due to the large number of people involved (Loxley et al., 2005). Once behavioural change has been achieved, it is likely to be self-sustaining because a new community norm has been established. In Sweden recently, a number of state-imposed protections against alcohol problems have been eroded due to EU membership and increased cross-border trade. Given these circumstances, the community emerges as the obvious setting for taking action against alcohol problems. Communities need to be supported in this task; action cannot simply be mandated, and long lasting change is most likely when the people who are affected are part of the change process. The complexity of how a community functions also needs to be recognised and harnessed. Here the systems perspective is a useful tool (Holder, 2000a). This model views the community as a complex system of interacting parts, which provides the context for all activities, including heavy drinking. Greatest change is likely to be achieved by operating at the level of the overall community system, so that the structures of the whole community are modified in ways that support safer drinking habits (Holder, 2009).



Given the multiple causes of alcohol problems, it makes intuitive sense to consider multi-component interventions that target entire communities and their various sub-systems, rather than single interventions directed towards high-risk groups alone. This was the broad strategy adopted during the Six Community Trial. Multi-component programs (i.e., combined school, community and family interventions) do not focus exclusively on the prevention of a single behaviour, such as hazardous drinking. Instead they typically have a psychosocial development orientation that is designed to impact on a range of health and lifestyle behaviours associated with problematic drinking. In theory, this approach has an advantage over alcohol-specific programs by impacting on a broader set of risk factors. As noted previously, however, research suggests that the most effective programs target community level mechanisms linked to harmful alcohol use. This includes the environmental context of selling and the distribution of alcohol, and the enforcement of regulations concerned with alcohol availability. In Study II, the six trial communities were encouraged to implement evidence based strategies, including prevention efforts addressing these underlying mechanisms.

The quantitative results indicated few clear improvements in the trial communities over the project period (2003-2007). Across all 12 communities, there was a tendency towards less alcohol consumption among adolescents, indicating that the interventions had not been particularly effective compared to the more limited prevention work undertaken in the control areas. Rates of binge drinking reduced, adolescent's self-reported access to alcohol through parents decreased, and adults appear to have developed more restrictive attitudes towards the supply of alcohol to young people. Each of these positive changes occurred in approximately equal proportions in both the trial and control communities, with one notable exception – the proportion of adolescents offered alcohol by their parents reduced more in the trial communities over time. Rates of alcohol related hospitalisations increased during the trial period but with no significant differences between the trial and control areas.

### **5.3.1 Lessons learnt: possible explanations for the absence of positive program effects**

There are several possible explanations for the general absence of program effects found in Study II. One likely explanation concerns **the selection of prevention strategies**. The trial was theory driven, but substantially modified by local political and practical constraints. Participating communities needed to fulfil a number of criteria, including an explicit requirement to work with evidence-based prevention, meaning that any proposed prevention activities should be supported by scientific evidence of effectiveness. Although the national project steering committee recommended the use of evidence based strategies, in particular those targeting the availability of alcohol, few of the implemented programs had any documented effect on substance use (Anderson et al., 2009a, Foxcroft and Tsertsvadze, 2011a). Some of the programs have shown promising indications of *efficacy* in controlled investigations (Kimber and Sandell, 2009, McCambridge and Strang, 2004), but few had demonstrated evidence of effectiveness in large scale community studies. It was not until the final year of the project (2007) that a firm decision was made to persuade the trial municipalities to work primarily with measures to restrict availability. Arguably, had this decision been made earlier, the trial might have had a greater impact. Related to this point is **the**

**trial's follow-up period.** The management of the project, which included the formulation of project goals and the selection of programs, was part of a negotiation process that took time. As the first two years of the project were mainly spent planning, mobilising, and organising training activities, it is possible that the evaluation period was not long enough for the prevention activities to have a measurable effect.

As has been the case in other community prevention trials (Baklien et al., 2007), **program fidelity and coverage** were not – and could not be – systematically observed for all programs in all communities, and several programs were received by a small proportion of the potential target audience. The Prevention Index shows that a greater volume of prevention activities were undertaken in the trial communities *overall* compared to the control areas, but still, broader program coverage may have been necessary to see population level effects. The varied coverage of some programs illustrates their complexity and shows that they require extensive training and technical support to an extent that average communities were not prepared to pay for.

During the four year project period, **the control communities were also engaged in prevention activities** which in some respects were similar to the work carried out in the trial municipalities, although with less coordinated emphasis. For example, all of the control communities worked with Responsible Beverage Service to some degree, and several implemented youth alcohol prevention activities in schools. Most municipalities in Sweden have their own alcohol prevention policies, and it was neither ethical nor practical to expect this ongoing prevention work to cease during the trial period. However, the prevention efforts in the trial communities were measurably better organized and supported, and a larger number of programs were implemented during the project (Karlsson, 2008).

The trial was undertaken during a period when **substantial changes in alcohol availability occurred** within the EU and Sweden: Alcohol became more widely available in general, partly due to trade agreements within and between EU member states; changes which could have offset the impact of the prevention work to some degree. As alcohol consumption reduced across all twelve communities, the possibility of **spill-over effects**, where other communities are influenced by the work undertaken in the trial areas, cannot be excluded entirely. However, as the trial and control communities were not adjoining each other physically, this explanation appears less likely.

The positive finding that adults became more restrictive in their attitudes towards the supply of alcohol to minors, and that adults in the trial communities in particular appear less willing to offer alcohol to young people, suggests that the prevention work may have had some beneficial effects. Whether or not these positive changes have persisted over time should be monitored in future studies.

### **5.3.2 Comparisons with other prevention trials**

The overall absence of positive findings from the Six Community Trial may not be surprising given there are few examples of well-executed community prevention projects internationally which have achieved population effectiveness. A selection of

trials reporting positive findings were discussed in the Introduction, and include the Three Communities Trial (Holder et al., 2000), Communities That Care (Hawkins et al., 2009), the Trelleborg Project (Stafstrom et al., 2006), and the Australian 'Living with Alcohol project' (Chikritzhs et al., 2005). These projects demonstrate the potential effectiveness of community prevention when strategies are chosen carefully and implemented under the right circumstances. Equally, however, several prevention trials have failed to demonstrate positive effects. In a recent Cochrane report, David Foxcroft and collaborators systematically reviewed 20 methodologically sound, multi-component alcohol prevention trials targeting young people (Foxcroft and Tsertsvadze, 2011a). Twelve of the 20 trials reported statistically significant effects across a range of outcomes in the short and long-term. Six trials, however, found no effects on youth alcohol consumption or related harms.

The Foxcroft review suggests that the benefits of multi-component trials can be substantial, but they are not guaranteed. A recent Finnish prevention project called 'PAKKA' aimed to reduce alcohol availability among youths under 18 years of age (Holmila et al., 2010). The interventions consisted of law enforcement, community coalitions and community mobilisation; an approach that addresses several sub-systems connected with alcohol problems. Effects were measured in a quasi-experimental research setting with a matched control area before (2004) and after (2007) the interventions. The results indicated that age-limit controls had improved, and young people reported that it had become more difficult to obtain alcohol - but these changes occurred in equal proportions in the intervention and control areas. The results were partly explained by increased surveillance and spill-over effects into control communities (Holmila et al., 2010).

Similarly, a recent Norwegian prevention project with interventions and goals very similar to the Swedish Six Community trial also failed to demonstrate positive program effects (Baklien et al., 2007). Six local communities were included in the project and were given additional funding and professional advice for the selection and implementation of multiple prevention activities. Like the Swedish trial, however, the interventions chosen by local communities had little evidence of effectiveness on population drinking. These included parental programs, motivational interviewing, school-based education, parent training, and anti-bullying strategies. Responsible beverage service programs were also implemented in several communities. A mixed methods effect/process study revealed almost no positive pre-post intervention improvements in the trial communities compared to the control communities, including assessments of adolescent alcohol use (Baklien et al., 2007, Rossow and Baklien, 2011, Rossow et al., 2011). In their detailed consideration of the results, the authors concluded that several factors contributed to the outcome, including the selection of ineffective interventions, delays in implementation, poor program fidelity and coverage, and the selection of varied programs between trial communities (Rossow and Baklien, 2011).

Effective prevention policy relies on a strong evidence base. For this reason, it would obviously be helpful to know which programs and trial characteristics are associated with the best outcomes. To date, this has been difficult to determine with certainty, in part due to the paucity of well designed prevention trials reported in the literature, but also because of the many and varied strategies that have been implemented and evaluated. It has also been suggested that a reporting bias exists in community

prevention research favouring the publication of trials demonstrating positive effects (Ahmed et al., 2012, Holder, 2010). In their recent review, Foxcroft and colleagues (2011) concluded that more needs to be known about how the content and context of multi-component prevention trials influences program success, and the extent to which programs are transferable to different settings. That said, a great deal is known about what works in prevention science. As noted in the Introduction, one of the most effective methods involves the regulation of alcohol's availability through controls over retail sales and distribution. Some of these methods are difficult or impossible to regulate locally; for example, the price of alcohol or the minimum purchasing age. This fact may have contributed to the absence of positive findings in the Six Community trial. On the other hand, access to alcohol can be limited locally through responsible beverage service practices; age-checks, and regulatory inspections to ensure that venues comply with alcohol service regulations. Most of the trial communities ultimately chose not to work with these strategies.

### 5.3.3 Implications

World trade agreements stimulating cross-border alcohol sales make it increasingly difficult for a single national policy to achieve all of its prevention goals. Similarly, a state retail monopoly is no longer sufficient to achieve low levels of per capita youth consumption - prevention measures which take into account local circumstances are also necessary.

The Six Community Trial demonstrates that local municipalities *can* be mobilised to implement alcohol prevention initiatives. The total number of prevention activities and their degree of organisation were greater in the trial communities, which may have contributed to the more restrictive adult attitudes assessed at follow-up. Study II also suggests that prevention strategies that rely heavily on individual or parental risk amelioration are unlikely to effect aggregate youth drinking. Furthermore, most of these programs are costly to implement compared to availability restrictions which normally only require legislative change to take effect.

It is clear that the prevention process takes time: despite the favourable circumstances that prevailed in the test municipalities, it took 2-3 years for the concrete work to get under way. This fact should be considered when planning future trials so that evaluations occur after the implemented programs have had an opportunity to take hold. Gaining acceptance for different prevention methods requires considerable advocacy and efforts to bring together researchers and practitioners. Achieving this takes time and can be facilitated by encouraging local communities to get involved in the prevention work (Holder, 2009).

Alcohol problems involving young people are also local issues involving police, families, schools and social services - it is natural to support and empower local communities to take the necessary action to reduce these problems. Such action has the greatest opportunity to work when it is appropriately planned, supported and based on current prevention science (Babor et al., 2010). Finally, the trial has also shown that prevention programs with sound efficacy need to be tested in community effectiveness trials before being disseminated.

## 5.4 'PRIME FOR LIFE' & BRIEF EDUCATION PROGRAMS

Continuing the prevention theme established in Study II, Studies III and IV assessed the effectiveness of a widely used prevention method – brief health education. The *Prime for Life* program was evaluated in two settings where young people and high risk drinking are common: the military and high school. The program has been described by the Prevention Research Institute as a 'risk reduction model' for individuals who typically make high risk alcohol and drug choices (PRI, 2006). This may be true; but Pfl falls into the category of 'health education' with the aim of secondary prevention of alcohol-related problems. The evaluation of programs such as Pfl is relevant due to their ongoing popularity with governments, schools and communities, despite reviews indicating mainly poor outcomes (Foxcroft and Tsertsvadze, 2011b, Anderson et al., 2009a, Babor et al., 2010). Although the program has been implemented in the United States for many years, these are the first two peer reviewed studies of the Pfl program.

Health education is a broad term encompassing programs and strategies that specifically aim to raise awareness of the potential dangers of hazardous alcohol use. It includes media campaigns, social marketing initiatives and warning labels on alcohol, low-risk drinking guidelines and programs in schools, universities or workplaces. Education can function as a primary prevention strategy, where it aims to prevent the *onset* of hazardous drinking, or as a secondary prevention strategy, where it aims to prevent the *re-occurrence* of hazardous drinking.

The scope and form of youth alcohol education tends to be influenced by the prevailing ideology around substance use. Increasingly, a harm-minimisation approach is emphasised rather than complete abstinence, which has dominated health education in the US for many years. It has been argued that strategies are most likely to succeed when they are theory driven, involve active participation, and when the presentation style is interactive rather than didactic (DiClemente, 2003).

The Pfl program represents an advance over many health education programs because it meets these three criteria. Built partly on stages of change theory (Prochaska and Velicer, 1997) and the health-belief model (Rosenstock, 1990), the program attempts to identify where young people are up to in their readiness to make safer drinking choices, and encourages them to identify their own unique level of risk for harmful drinking. Doing so, it is argued, builds a stronger link between the participants understanding of their own personal risk for harmful alcohol-related consequences, which in turn encourages safer alcohol choices (PRI, 2006).

Studies III and IV indicated few positive program effects following the intervention. Among military conscripts, alcohol consumption reduced significantly at 5 months and 20 month follow-up in both the intervention and control groups. Similarly, non-significant reductions in both groups were seen in the high-school study, indicating that factors beyond the intervention were responsible for the improvement in drinking. Improvements among the 'high risk' alcohol consumers were observed (AUDIT score 8+), but again with no differences between trial and control participants. Short term improvements in attitudes were found in both investigations, but these positive changes were not sustained at 20 months. In the high-school study, significant improvements in knowledge were reported; however, as the knowledge questionnaire had poor parametric properties, these results may not be valid.

The reduction in alcohol consumption seen among most participants in the intervention and control groups should be explained. In Study III, the baseline questionnaire was completed shortly after conscripts joined the military. It is possible that baseline consumption scores were temporarily elevated as joining the military often results in new social contacts and increased heavy drinking (Fisher et al., 2000, Kao et al., 2000). The reduction in consumption at 5 month follow-up may represent a return to more typical drinking levels once the conscripts had settled into their new work routines. The same explanation cannot apply to high school students, where an increase in consumption over time might be expected due to greater access to alcohol when students approach 20 years of age (the legal purchasing age from Sweden's retail alcohol monopoly). An alternative explanation for the reduced consumption seen in Study IV is that *participation* in the study, rather than the intervention per se, influenced the drinking behaviour of all participants – a so-called Hawthorne effect (O'Sullivan et al., 2004). Simply being involved in the study may have encouraged discussions among students and conscripts about alcohol's negative effects, which could have influenced their drinking. Another possible explanation is that the program content or delivery failed to convince the participants that they were *personally* at risk of harm from their alcohol use. According to the Health-Belief model, establishing this connection is a necessary precursor for behaviour change (Rosenstock, 1990). The theories of Reasoned Action (Fishbein, 2008) and Planned Behaviour (Ajzen, 1991) suggest that information and better knowledge are pre-requisites for behaviour change, but this will only occur if the behaviour is under perceived control. It is conceivable that the peer pressure to drink alcohol during this period was so great that the young participants felt they had 'less than normal' control over their drinking.

Another important explanation for the absence of program effects concerns exposure to other messages. PFL is a brief intervention lasting only one or two days, but exposure to alcohol promotion in the community and the influence of peer drinking behaviour is ongoing and likely to be more powerful than a brief health education message, however well conceived. Whichever explanation is correct, the conclusion is the same; participation in the program did not significantly reduce alcohol consumption in the intervention group compared to the control group as intended. This finding applies to both the entire sample studied and the high-risk drinkers who scored 8+ on the AUDIT questionnaire. The latter finding is relevant because the Prevention Research Institute claim that the PFL program was originally designed for high risk drinkers only. Our findings suggest that the program is largely ineffective for both high risk and 'moderate' young drinkers in the settings described above.

The results from Studies III and IV are consistent with previous research which provides little support for alcohol education programs targeting adolescents (Foxcroft and Tsertsvadze, 2011b, Foxcroft et al., 2003). Certainly, the provision of information and education is important to raise awareness and impart knowledge. However, in an environment in which many competing messages are received by young people in the form of marketing and social norms supporting drinking, and in which alcohol is easily accessible, programs such as Prime for Life are highly unlikely to elicit positive behaviour change. Several systemic reviews have assessed school based education and concluded that classroom-based education is not an effective intervention to reduce alcohol-related harm (Foxcroft and Tsertsvadze, 2011b, Anderson et al., 2009a, Ritter

and Cameron, 2005). Although some evidence suggests a positive effect on increased knowledge about alcohol, which was also observed in Study IV, and in some cases improved alcohol-related attitudes, evidence for a sustained effect on behaviour is scarce.

An example of a school based education program that resulted in short-term reductions in alcohol consumption and related harms is the School Health and Alcohol Harm Reduction Project (SHAHRP) conducted in Western Australia (McBride et al., 2004). The program had a goal of harm minimisation and was an evidence-based classroom program (29 skill based activities) conducted over two years. Students who participated in the SHAHRP program had safer attitudes towards alcohol use, consumed significantly less alcohol at 20 month follow-up, were less likely to drink to harmful or hazardous levels and experienced less harm associated with their own use of alcohol than students who participated in other alcohol education. However, unlike the Pfl program which takes only two days to implement, the SHAHRP program was more comprehensive; classes were spread out over two years, which provides a more consistent message. Despite this, the positive reductions in consumption seen at 20 months began to converge to baseline levels at 32 month follow-up (McBride et al., 2004).

Following the publication of Studies III and IV, a third evaluation of Pfl was published in *Accident Analysis and Prevention* (Beadnell et al., 2012). The study was conducted by the Prevention Research Institute, which developed the Pfl program. In total 522 individuals convicted of driving under the influence and other drug offences were assigned to either the Pfl intervention or a standard two-day alcohol and drug education course that was *not* based on motivational techniques. Results indicated significant improvements in the Pfl group on measures of understanding tolerance, perceived risk for addiction, problem recognition and program satisfaction. All outcomes were assessed upon completion of the Pfl program. Importantly, changes in alcohol use and alcohol-related harms were not reported in this study.

In a letter to the Editor of *Addiction*, Professor David Foxcroft, the author of numerous Cochrane reviews, suggests it is likely that the effect of school-based prevention (which includes alcohol education) is either nil or small (Foxcroft, 2006). He also notes that even if the effect of school-based prevention is small, showing as little as 1-2% benefit over controls, then it would probably still be a cost-effective intervention and therefore desirable. The challenge for future studies will be to clearly demonstrate this benefit.

#### **5.4.1 Implications**

Studies III and IV do not support the use of the *Prime for Life* program in either a high-school or military setting. In the author's view, these results do not indicate that all alcohol education programs should be abandoned. Instead, brief health education programs should be seen as *one* component of a larger suite of primary prevention initiatives targeting the supply of alcohol and the underlying environmental mechanisms responsible for the initiation and maintenance of hazardous alcohol use. Programs such as Pfl are typically expensive to operate because they involve extensive training, so our findings may help policy makers decide where to allocate limited

resources. Strategies which consistently demonstrate effectiveness deserve priority and several of these strategies have been described in previous sections of this thesis. They including taxation measures based on alcohol content, availability restrictions affecting retail trading hours and outlet density, age restrictions, and venue level changes to make drinking environments safer. Responsible beverage service practices and drink-driving countermeasures can also have a positive impact on drinking. There is some evidence to support the use of psychosocial and developmental strategies for adolescents, but program effects appear to vary greatly between studies. As other investigators have recommended, a re-framing of alcohol education's main purpose may be necessary, so that it is seen mainly as a public awareness builder, rather than a behaviour change tool (Giesbrecht, 2007).



## **5.5 STRENGTHS AND CONTRIBUTION**

Study I contributes to existing research by offering an empirical confirmation of the drinking polarisation hypothesis in the Swedish context. Our data suggests that a sub-group of young people in Sweden are drinking more alcohol over time compared to their peers, possibly resulting in more alcohol-related hospitalisations. The relevance of this finding extends beyond Sweden to countries where a similar divergence between consumption and harm has also been observed (for example, the UK and Australia). Response rates from the Stockholm Student survey were consistently high, as were the number of participants, helping to ensure the data is representative.

Effective alcohol prevention is built on research demonstrating what works and – equally important - what doesn't work in different contexts. Relatively few community-based, multi-component interventions have been conducted world-wide. Study II presents key findings from one of the largest community trials conducted in Sweden to date. Although the findings are mainly negative, the lessons learnt from this trial are important and will help inform the development of more effective community interventions in the future.

Studies III and IV are the first peer-reviewed assessments of a widely used education strategy to minimise risky drinking. They provide important evidence that the Prime for Life program is ineffective when used in a high school and military setting in Sweden. The 20 month follow-up period and the large number of participants were strengths. The study design enabled changes in consumption and attitudes towards alcohol to be monitored over time, rather than simply measuring changes immediately after the intervention, as reported by Beadnell et al (2012) recently.

## **5.6 LIMITATIONS & METHODOLOGICAL ISSUES**

All four studies in this thesis are based on self reports, and the limitations of this data are well known. Respondents tend to under-report the amount of alcohol they consume, particularly at high levels (Northcote and Livingston, 2011), which may lead to an under-estimate of the actual level of consumption. However, our reliance on self-report data does not invalidate our findings. Anonymous self-reports are generally valid, provided confidentiality is stressed, which it was in each of these studies (Campanelli et al., 1987).

In Study I the Stockholm Student survey was expanded after the year 2000 to include additional risk and protective factors. Some of these new factors (e.g., number of heavy drinking friends, social support, etc) are relevant, but were not included in the analyses because they were absent from the 2000 survey; and therefore could not be cross-matched with the 2010 data. Using a theory-driven approach to select the risk factors, as opposed to a statistical approach, enabled us to see whether there had been a change over time in the same thirteen risk factors, both in the total sample and among the heaviest drinkers. This approach may result in a different number and/or collection of risk factors, compared to a statistical approach driven by logistic regression modeling. Finally, as the questionnaires in Study I were anonymous, it was not possible to follow-up non-responders to compare them with the survey participants.

Study II reported changes in alcohol use at the aggregate level. Reducing harmful alcohol consumption was certainly one of the main long-term objectives of the Six Community Trial, however, other positive program effects may have occurred that were not captured by the aggregate analyses. Important changes in the organization of local communities and their acceptance of evidence based prevention, for example, will never be captured by broad assessments of alcohol use or related harms. Furthermore, many of the interventions chosen targeted specific groups (such as pregnant mothers); strategies that are unlikely to impact aggregate assessments of alcohol consumption.

Response rates from the Six Community Trial were low, especially among year 9 students, however, the participants' drinking habits appear similar to national consumption trends (CAN, 2011). Differences between trial and control communities were assessed with Analysis of Variance, which assumes independent selection of cases. Multi-level modeling, an extension of multiple-regression is a more appropriate analytical method for hierarchically structured or nested data. However, the general absence of significant interaction effects using ANOVA brings into question the necessity of multi-level analysis; a methodology which makes it more difficult to obtain significant program effects.

As military conscription was not compulsory when Study III was undertaken, it is possible that the participants are not representative of young Swedish males. If this were true, then characteristics particular to the study population could have influenced the findings, and this possibility was not tested. Another limitation of Study III concerns the study design. As it was not possible to randomise all participants from the ten regiments, it is possible that the control and intervention groups were not matched on important characteristics which could have influence the results. However, with regard to drinking it was shown that baseline alcohol consumption was similar over the participating regiments.

A weakness of Study IV concerns the questionable parametric properties of the knowledge scale. This questionnaire was developed by an expert alcohol and drug research group at STAD (Stockholm Prevents Alcohol and Drug Problems). Pilot testing indicated high face validity and expert opinions were used to validate the content. However, it could be argued that these results should have been removed from Study IV entirely. By randomising schools, we reduced the risk of contamination between conditions, but participants and teachers from different schools occasionally interacted in non-school settings. Finally, as Study IV used schools in the Stockholm area, the results cannot be generalised to the rest of Sweden, although the similarities between regions are usually regarded as larger than the differences.

## **5.7 FUTURE RESEARCH**

Study I opens a series of important research questions which could be answered using the Stockholm Student survey data: Who are the increasingly heavy drinkers in this population and what are their personal and social characteristics? Why are these adolescents drinking more alcohol over time, while their peers continue to drink less? Assuming current Swedish alcohol policies are partly responsible for the decline in per

capita consumption, why haven't these policies influenced the behaviour of the heavy drinking sub-group reported in Study I?

Ideally, these questions should be answered by linking consumption and hospitalisation data, although a great deal could be learnt from further analyses of the Stockholm Student survey alone. What may also be necessary is analysis of risk factors over time at community and societal levels, including measures of income and social inequality, which have widened in Sweden. These analyses should be combined with a theory of how societal increases in inequality are linked to individual-level risks for hazardous alcohol use and the mechanisms involved.

The increase in alcohol-related hospitalisations seen in Stockholm most likely reflects a genuine increase in the proportion of young people being harmed by excessive drinking. However, it is conceivable that other factors could also influence these statistics, including administrative changes to the way that admissions are recorded, or the behaviour of police towards drunken youths. Greater Police scrutiny of youth drinking could result in more referrals to hospital. This possibility should be explored in future studies. The higher rates of alcohol-related hospital admissions in Stockholm compared to the rest of Sweden should also be explained.

A great deal is known about what works in prevention, yet a prevailing issue concerns the use of universal versus targeted strategies and the optimal balance between these. Community prevention is sometimes highly effective, yet the 'black box' of multi-component trials remains a mystery to some extent. The relative impact of different program components needs to be disentangled in future trials to address this important question. Context issues also need more attention – that is, to what extent are programs transferable between countries or regions within a single country? We also need to learn more about the minimum program 'dose' required to achieve optimal effects. To address these questions, future community trials may need to be designed so that interventions are introduced sequentially over time, enabling the impact of each program component to be assessed.

## 6 CONCLUSIONS

Recent data shows that Swedish adolescents drink less alcohol today than they did ten years ago. The reduction is attributable to increasing alcohol abstention rates, but also to a real reduction in consumption among young drinkers. At the same time, the proportion of adolescents admitted to hospital as a consequence of their drinking has risen sharply in Stockholm. Findings from this thesis indicate that polarised youth drinking habits are a likely explanation for this trend, where a sub-group of young people are drinking considerably more alcohol than their peers over time. For now, we need to know more about these heavy drinking adolescents and the various factors or mechanisms that are maintaining their high levels of alcohol consumption. We suggest that ongoing social changes in Sweden could be affecting young people in the form of greater disparities which are associated with a higher incidence of social problems generally, including heavy drinking.

Community level prevention of alcohol problems holds considerable promise and the systems approach offers a framework which takes into account the multiple causes of hazardous alcohol use. Communities need to be supported to bring about change - action cannot simply be mandated, and long-lasting change is more likely when the people who are affected are part of the change process. Community trials involve close collaborations between researchers and practitioners – a partnership that is critical for achieving positive outcomes. Successful community prevention relies on the selection and implementation of evidence based strategies, particularly those which affect the supply and availability of alcohol to young people, and the environments in which they drink. Projects which rely heavily on reducing the demand for alcohol through brief education programs, such as Prime for Life, are unlikely to change aggregate level consumption or have an impact on alcohol-related harms.

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