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Alcohol Use and Stress in University Freshmen

A Comparative Intervention Study of Two Universities

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Akademisk avhandling

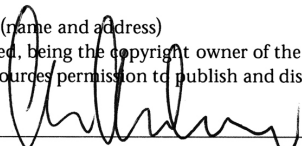
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vid Lunds Universitet, för avläggande av doktorexamen i medicinsk vetenskap
i ämnet psykiatri, kommer att offentligen försvaras i Aulan, Clinical Research
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Abstract <p>Starting university is associated with major academic, personal and social opportunities. For many people, university entrance is also associated with increased stress and alcohol consumption. At the start of the autumn term 2002, all students entering educational programmes at two comparable middle-sized Swedish universities were invited to participate in a comparative intervention study. This included both primary and secondary interventions targeting hazardous drinking and stress. The overall aim was to improve alcohol habits and stress patterns in university freshmen at an intervention university in comparison with a control university.</p> <p>A total of 2,032 (72%) freshmen responded to the baseline assessment. Half of them scored above traditional AUDIT cut-off levels for hazardous alcohol use. Factors associated with hazardous use were age below 26, male gender, family history of alcohol problems, and not being in a serious relationship. The Arnetz and Hasson Stress Questionnaire was evaluated and used to study a selection of freshmen at high risk of stress. It was easy to use and offered sufficient internal consistency and construct validity. In the freshman year, 517 students (25%) dropped out from university education. A multivariate analysis established that high stress and university setting was associated with dropout from university studies, while symptoms of depression and anxiety as well as hazardous drinking were not.</p> <p>Outcome was analysed in students remaining at university at one-year follow-up. The primary interventions offered to freshmen at the intervention university reduced alcohol expectancies and mental symptoms compared with freshmen at the control university. Secondary stress interventions were effective in reducing mental symptoms and alcohol expectancies. Secondary alcohol interventions were effective in reducing AUDIT scores, alcohol expectancies, estimated blood alcohol concentrations, as well as stress and mental symptoms.</p> <p>In conclusion, both primary and secondary alcohol and stress interventions have one-year effects in university freshmen and could be used in university settings.</p>		
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Alcohol Use and Stress in University Freshmen

A Comparative Intervention Study of Two Universities

Claes Andersson

**Clinical Alcohol Research,
Malmö, Sweden
2009**



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ORIGINAL PAPERS

The thesis is based on the following papers, which will be referred to in the text by their Roman numerals.

- I Andersson C, Johnsson KO, Berglund M, Öjehagen A
Alcohol involvement in Swedish university freshmen related to gender, age, serious relationship and family history of alcohol problems
Alcohol and Alcoholism 42(5), 448-455, 2007
- II Andersson C, Johnsson KO, Berglund M, Öjehagen A
Measurement properties of the Arnetz & Hasson stress questionnaire in Swedish university freshmen
Scandinavian Journal of Public Health (Jan 5), 2009 [Epub ahead of print]
- III Andersson C, Johnsson KO, Berglund M, Öjehagen A
Stress and hazardous alcohol use: Associations to early dropout from university
Scandinavian Journal of Public Health, Pending revision
- IV Andersson C, Johnsson KO, Berglund M, Öjehagen A
Intervention for hazardous alcohol use and high level of stress in university freshmen. A comparison between an intervention and a control university
Submitted

INTRODUCTION

Alcohol consumption increased in Sweden during the 1990s. One of the main reasons was Sweden's entry into the European Union, offering borderless opportunities for both individuals and goods, which presented major challenges to a traditionally protective alcohol policy (SOU, 2005). Increased levels of alcohol consumption are associated with increased risk of both immediate and long-term negative health consequences. In most individuals, alcohol consumption peaks in the early twenties.

In the same period another major change occurred in that the educational system expanded, offering more individuals the opportunity to study at universities and university colleges. In a short period the number of students more than doubled and, at the start of the 2000s, about half of all young adults entered higher educations before the age of twenty-five (Fransson, 2002).

Due to the general increase in alcohol consumption, and the simultaneous increase in numbers of students, the importance of university as an arena for alcohol interventions increased. About that time, hazardous drinking was observed in US universities, and research reports showed that hazardous drinking in students could be reduced (Kivlahan et al., 1990; Baer et al., 1992).

Starting university is associated with major academic, personal and social opportunities. This is also an adventurous period as these opportunities are often associated with increased stress. There is a well-established association between stress and alcohol consumption, and several studies show that both stress and alcohol consumption increase during transition to university.

Alcohol Use

Alcohol is a psychoactive drug that has effects on both cognitions and affects, and is commonly used around the world (WHO, 2009). Alcohol consumption fulfils an important cultural and symbolic function in most societies, and it is estimated that 80-90% of the European population consumes alcohol from time to time (Babor et al., 2004). The term alcohol consumption describes the frequency and the quantity of alcohol consumed over a given time. Frequency is often defined as the number of days or occasions during a specific time interval when alcohol is consumed. Quantity is the amount consumed on each drinking occasion. In Sweden and other countries it is often measured as number of 'standard drinks' defined as 12 g of alcohol (Bergman and Källmén, 2002).

Alcohol consumption is associated with both positive and negative consequences (Park and Grant, 2005). Alcohol consumption is the fourth most common reason for disability-adjusted life years (DALYs) lost in Western Europe (WHO, 2004). Alcohol is involved in immediate negative consequences, such as traffic accidents, falls, fires, sport and leisure injuries, rapes, suicides, homicides, violent treatment of children and other injuries. Alcohol is also related to a number of long-term consequences such as several cancer forms, cirrhosis of the liver, pancreatitis and high blood pressure (Room et al., 2005). Women are more vulnerable to alcohol than men, depending on physiological and hormonal differences. Women also reach higher blood alcohol concentrations through the same amount of alcohol due to lower concentration of body water compared to men. Immediate consequences dominate amongst young people, and long-term consequences are more applicable to older people (Andréasson and Allebeck, 2005).

The World Health Organization (WHO, 2009) defines moderate drinking as a pattern of alcohol consumption that has no or only few negative consequences. Social drinking may be moderate but, as it is dependent on the customs in the cultural setting where the drinking occurs, it may also be associated with negative consequences as mentioned above.

Hazardous drinking is a pattern of alcohol consumption that increases the risk of harmful consequences (Saunders et al., 1993). The cut-off between moderate and hazardous drinking is defined as drinking that exceeds weekly consumption of 14 standard drinks in men and 9 standard drinks in women. Of primary concern is also binge drinking, which is consumption of ≥ 5 standard drinks for men and ≥ 4 standard drinks for women on the same occasion (Andréasson and Allebeck, 2005). Epidemiological data shows that exceeding the daily drinking limit is associated with higher risks of developing alcohol use disorders than exceeding the weekly limits (Dawson et al., 2005a).

Alcohol use disorders

Harmful use and alcohol abuse are patterns of drinking that result in consequences, and are defined as disorders in the International Classification of Diseases (ICD-10) and the Diagnostic and Statistical Manual Disorders (DSM-IV) respectively. Harmful use is diagnosed in the ICD-10 if there is evidence that alcohol use contributes to physical or psychological harm, which may lead to disability/adverse consequences. The nature of the harm should be specified and clearly identifiable, and the pattern of use must persist for at least one month or occur repeatedly within a 12-month period, and symptoms must not meet criteria for other mental or behavioural disorders related to alcohol in the same time period with the exception of acute intoxication. Alcohol abuse is diagnosed in

DSM-IV if criteria for alcohol dependence are not met and use of alcohol within a 12-month period has resulted in fulfilment of at least one of four criteria: recurrent failure to fulfil major obligations, recurrent alcohol use in situations that are physically hazardous, recurrent alcohol-related legal problems, continued use despite persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.

The ICD-10 and DSM-IV define alcohol dependence in a similar way with the exception of the number of criteria available. Both systems include criteria on increased tolerance, withdrawal symptoms, impaired control, neglected alternative activities, a great deal of time spent in alcohol-related activities and continued use despite problems. ICD-10 also includes strong craving to drink alcohol. In the ICD-10, dependence is diagnosed if three or more criteria occur together for at least one month, or occur repeatedly, within a 12-month period. In the DSM-IV, dependence is diagnosed if three or more criteria occur at any time in the same 12-month period.

Alcohol screening

Screening tests are evaluative instruments used to identify individuals at risk of hazardous alcohol use or alcohol use disorders. The sensitivity of a screening test describes its ability to identify the majority of individuals with hazardous alcohol use or alcohol use disorders. The specificity of the test describes its ability to exclude all other individuals. Both biological markers and self-reports are used as screening tests. Common biological markers are breath, urine or blood concentrations. These are often used in clinical contexts but are difficult to administer in large research samples (Rosman and Lieber, 1992). Self-reports are easy to use, relatively inexpensive, and the most common screening test in both research and clinical settings (Babor and Del Boca, 1992).

Stress

Stress is a normal reaction and a natural part of everyday life. It may be experienced as both a positive force that improves health and performance and as an interfering factor that reduces health and performance. Hans Selye, founder of the stress concept, defined stress as the body's non-specific response (stress response) to a demand (stressor) placed on it (Everly and Lating, 2006).

Morse (1998) divided stressors into three categories: physical, psychological and social stressors. Physical stressors are external or environmental agents that may be damaging but generally are avoidable. Social stressors or life events are often

unplanned events that result from interaction with the environment.

Psychological stressors represent strong emotions that often are self-induced or generated by physical or social stressors. According to Morse (1998), a stressor may be present, but if the individual does not respond to it, he/she will not become stressed. Social and psychological stressors become stressors by the cognitive interpretation of an event, while physiological stressors require no cognitive evaluation in order to trigger the stress response.

According to Gelder et al. (2006), the stress response is the reaction to stress and consists of three components. First, there is a physiological response that is accompanied by an emotional response. The central physiological components, described by Everly and Lating (2002), are located in the hypothalamus and the brain stem, and they receive external and internal input. In order to maintain equilibrium, appropriate responses are initiated in the neural, endocrine and immune system. Adjustments made in the nervous system (ANS), i.e. the body's control system, are considered to be of specific importance. Its two subsystems, the parasympathetic nervous system (PSNS) and the sympathetic nervous system (SNS), regulate the balance between activity and relaxation. The emotional response that accompanies the physiological response described by Gelder et al (2006) is either an anxious response, with autonomic arousal, that generally is associated with events that pose a threat, or a depressive response, with reduced physical activity, and that is usually related to events that involve separation or loss. The second features of the stress response described by Gelder et al. (2006) are coping strategies aiming to reduce the physiological and emotional response to a stressor. According to Davis and Brantley (2004) coping strategies include adaptive coping strategies, i.e. problem solving, emotion-reducing strategies and positive re-examination of a problem, as well as maladaptive coping strategies that reduce the emotional response in the short term but lead to greater difficulties in the long term. As an example, and considering the relationship to alcohol, use of alcohol to reduce an emotional response or to reduce awareness of stressful circumstances is considered to be a maladaptive coping strategy. Finally, defence mechanisms as described by Gelder et al. (2006) are considered to be unconscious responses to external or internal stressors. In response to stressful circumstances, the most frequent mechanisms are repression, denial, displacement, projection and regression.

Stress disorders

If the stress response becomes excessively chronic or intense, different physical and psychiatric disorders may result. In a review on stress, Everly and Lating (2002) report that stomach disorders, cardiovascular disorders, migraine and headache, asthma, allergies, skin problems and mental disorders commonly are

related to stress. The WHO estimates that poor mental health, including stress, will be the second leading cause of disability by the year 2020 (Wilkinson and Marmot, 2003; WHO, 2004). According to the International Classification of Diseases (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) acute stress is a reaction or a disorder considered to be an immediate and brief response to sudden intense stressors in an individual who does not have another psychiatric disorder. The post-traumatic stress disorder refers to a prolonged and abnormal response to exceptionally intense circumstances. Adjustment disorders represent a more gradual and prolonged response and start as a consequence of acute or continued stress.

As described above, it is common that a stressor results in an anxious or depressive emotional response. There is considerable overlap and interaction between stress and depression and anxiety (Andersson and Hope, 2008). The main components of anxiety are psychological apprehension, muscular tension, autonomic arousal and avoidance of danger. Anxiety becomes abnormal when its severity is out of proportion to the threat of danger or when it outlasts the threat. If so, it is defined as an anxiety disorder in the ICD-10 and DSM-IV. The clinical presentations of depressed states vary, and can be subdivided in a number of different ways according to severity. Central features are poor mood, lack of enjoyment and pleasure, negative thinking and reduced energy, all of which lead to decreased social and occupational functioning. According to the ICD-10 and DSM-IV, depression is an abnormal disorder when it is out of proportion or is unduly prolonged.

Assessment of stress

In stress research new measurement techniques are commonly developed (Edwards and Burnard, 2003). Everly and Lating (2002) divided different techniques into two broad categories, measuring either the stressor or the stress response. Different questionnaires measure the occurrence of stressful life events ranging from daily hassles to major traumatic events. Biochemical or physiological measures may be used to measure the physiological stress response, while different questionnaires are used to measure the emotional stress response as well as different coping strategies and defence mechanisms. Biochemical or physiological measures are rather objective but are difficult to interpret, e.g. a low cortisol level may indicate either relaxation or exhaustion (Hasson, 2005). Several questionnaires are limited by their length and excessive response burden (Everly and Lating, 2002; Noble, 2002). In a review of different measurement techniques, Noble (2002) concludes that a thorough, stress-oriented, face-to-face medical interview currently is the best way to diagnose stress.

Alcohol and Stress

Probably the most influential theory on the relationship between stress and alcohol is the tension reduction hypothesis, where it is assumed that individuals drink alcohol for its stress-reducing properties and that alcohol consumption reduces stress (Sayette, 1999).

Sher et al. (2007) clarified that, under certain conditions, most individuals will drink alcohol in response to stress, though drinking in response to stress is dependent on several factors such as possible genetic determinants and usual drinking habits (Phorecky, 1991). Both social and problem drinkers commonly report that they expect alcohol to reduce stress (Leigh, 1989). These alcohol expectancies refer to individual beliefs about positive or negative outcome effects of consuming alcohol (Del Boca et al., 2002; Ham and Hope, 2003). Another finding is that alcohol consumers report drinking to cope with negative emotions (Ham and Hope, 2003). A recent epidemiological study based on almost 30,000 past-year drinkers established a consistent positive relationship between the number of past-year stressors experienced and heavy drinking. It was also found that stress did not result in a higher frequency of drinking, but in greater quantities when alcohol was consumed (Dawson et al., 2005d).

According to Sher et al. (2007), it is more uncertain whether alcohol has a stress response dampening effect (SRD). Furthermore, it is not only the pharmacological effects of alcohol, but also a variety of individual and situational factors that determine this effect. Sayette (1999) reviewed different individual and situational factors and found that possible moderators could be family history of alcoholism, gender, low self-control, high self-consciousness, and different cognitive deficits such as minimal brain dysfunction. It was also found that SRD effects exist only when drinking occurs in the presence of something that distracts the drinker from distress, which is referred to as the attention-allocation model. The SRD effect is also more likely when alcohol is consumed before the stressor occurs than afterwards, which is referred to as the appraisal-disruption model.

University Education

Higher education has expanded in all countries in the Organisation for Economic Co-operation and Development (OECD, 2008). The number of individuals achieving a higher education degree is considered to be of major importance. In addition to a fundamental contribution to personal development, education is considered to improve health and increase economic productivity. An OECD

review on the productivity benefits in developed countries estimates that the return from each extra year of schooling is 5-15% (Temple, 2001).

In Sweden, there has also been a major expansion. Between 1990 and 2001, the Swedish Government doubled the number of students in order to restructure society to a new high-competence economy (Fransson, 2002). There are currently 61 institutions of higher education, and the state-run part comprises 36 institutions, of which 14 are universities. The allocation of resources to these institutions depends on results in qualifications awarded. University studies have been divided into undergraduate education, postgraduate education and research. All studies are divided into courses, and a programme consists of courses within a specific subject area. The academic year is divided into two terms, with the autumn term running from the end of August until the middle of January, and the spring term beginning in the middle of January and ending in early June.

In Sweden the total cost of university and university colleges (including research) is about SEK 47 billion, representing about one percent of the Gross Domestic Product (GDP), or approximately SEK 75,000 per student and year (SCB, 2008).

University students

About half of all young adults in Sweden and most other western countries enter university (OECD, 2008). When this study started in autumn 2002, there were about 329,000 students in higher education (60% women) in Sweden. At the beginning of the autumn term, 105,100 people applied for higher education course, and 58,200 were offered places (57% women). During that academic year the proportion of those beginning before the age of 25 was 46 percent. The median age among freshmen students in Sweden was just under 23 years, which was the highest in the OECD countries, where the median age was about 20 years of age (HSV, 2003)

According to Levinson (1986), life course is a continual process characterised by transitions between different phases, where each phase makes its distinct contribution to the whole. In most theoretical models, developmental transitions are viewed as causally preceding risk behaviour (Schulenberg and Maggs, 2002). Transition to university and the years at university may be defined as a distinct phase regardless of the age at which university is started. However, as the majority of students enter university in their early twenties, it is important to discuss the characteristics of this specific age period. The period from the late teens through the twenties, with the focus on ages 18-25, has been referred to as emerging adulthood (Arnett, 2000). During this period, individuals have left the dependency of childhood and adolescence, but have not entered the

responsibilities that are normative in adulthood. According to Arnett (2000), life at this time is characterised by frequent change and exploration of possible life directions. Emerging adulthood is also distinguished by relative independence from social roles and from normative expectations.

Emerging adulthood is a risk period for several psychiatric disorders. The incidence of mental disorders peaks in late adolescence and emerging adulthood, the most prevalent being anxiety disorders, mood disorders, and substance use disorders (Kessler et al., 2005; Castaneda et al., 2008). A recent epidemiological study established that 50% in the 19-25 age group reported a psychiatric disorder, including substance use disorders, during the past year (Blanco et al., 2008). Overall mental health did not differ between students and non-students, except that alcohol use disorder was more prevalent among university students. Bipolar disorders as well as drug use disorders and nicotine dependence were less common among students.

Dropout from university

Thirty percent of university students leave without completing their degree courses (OECD, 2008). Besides substantial costs to the public purse, dropout is considered to be inefficiency in the system as well as an unnecessary waste of talent and potential (York and Thomas, 2003). Mean dropout level between the first and the second year at Swedish universities is around about 35 percent, but the figures vary from year to year. There are considerable differences between universities and in one given year the official dropout rates may vary from 0 to 87 percent (HSV, 2003). The first term is found to be the most crucial period in determining dropout from university (Murai and Nakayama, 2008).

Wintre et al. (2006) used the concept of emerging adulthood to analyse dropout from university studies by interviewing 119 students who had not graduated within seven years from a large Canadian university. The reasons for leaving were more often related to mobility, exploration, career paths and other characteristics of emerging adulthood than to negative university experiences. Furthermore, many former students completed their degrees elsewhere, decreasing the previously reported dropout rate from 42.1% to 22.5%.

Early dropout is often explained by emotional and social factors (Murai and Nakayama, 2008; Pritchard and Wilson, 2003; Dyson and Renk, 2006). McMichael and Hetzel (1975) found that dropout from university during the first year is preceded by poor mental health, life-stress, and loneliness, while dropout during the second year is strongly associated with first-year academic failure and mental illness.

Martinez et al. (2008) found that heavy drinking did not predict dropout after controlling for pre-college predictors of academic success. However, when controlling for students' past-month attendance at various types of events, heavy drinking was found to predict dropout. Aertgeerts and Buntinx (2002) found that, out of 3.6% of Belgian students fulfilling the alcohol dependence criteria in the Composite International Diagnostic Interview (CIDI) and meeting criteria of alcohol dependence, 62,5% failed in the first year, compared to 50% among students who did not report these drinking problems.

Alcohol involvement in university students

Alcohol involvement is consistently found to peak in emerging adulthood, i.e. 18-25 years (Johnston et al., 1996; Muthén and Muthén, 2000; Kuntsche et al., 2004). In comparison to non-students, alcohol involvement in university students is found to be lower during the years preceding and following university education (Johnston et al., 2002; Muthén and Muthén, 2000). University students show large variations in alcohol involvement and only a subset exhibits heavy drinking consistently during the time period (Schulenberg et al., 1996). Heavy drinking during the university years is found to predict alcohol dependence or abuse 10 years after university studies (O'Neill et al., 2001).

The university environment has been defined as an atmosphere in which heavy drinking is encouraged and is perceived as normative and positive behaviour (Ham and Hope, 2003). Based on a literature review, Borsari and Carey (2006) argue that alcohol is part of the university culture and that freshmen expect to experience the freedom to use alcohol when coming to university. In addition, alcohol-related attitudes of peer friendships are vital as raw models for socialisation opportunities, when testing and refining a new psychological identity (Borsari and Carey, 2006). Studies have also found that students generally overestimate the consumption of peers, which results in misconceptions about their individual drinking habits (Perkins et al., 1999).

There are variations within universities. Alcohol involvement is higher in larger social settings, and in social living arrangements (McCabe et al., 2005). Differences have also been established between universities. Higher drinking levels are found at universities where accommodation is situated on a campus (Presley et al., 2002), and in universities where alcohol is easily available on campus (Dowdall and Wechsler, 2002). Sundbom (2003) examined alcohol involvement in eight Swedish universities and found greater drinking rates in larger universities compared to smaller universities, and in older universities compared to newer universities. These differences were explained by the accessibility of student bars at the larger universities. Bullock (2004) investigated alcohol involvement in four

Swedish universities and found that alcohol involvement was higher at the more southerly situated universities compared to the more northerly universities.

In an extensive review of literature concerning college students and problematic drinking, Ham and Hope (2003) conclude that the way environment impacts drinking at college is influenced by several individual factors, including personality style, coping mechanisms and thought processes. In the following section, the influences of gender, serious relationships, alcohol expectancies and a family history of alcohol problems are briefly reviewed.

Similar to the gender differences in the general population, all indices of alcohol involvement, with the exception of alcohol dependence, are higher in males compared to women at universities (Bullock, 2004; Wechsler et al., 2000; Johnston et al., 2007; Knight et al., 2002). Since most students are young and not involved in serious relationships, peer relationships are most important for stability, intimacy and support (Borsari and Carey, 2006). Studies report that transition to marriage is an important factor reducing alcohol involvement during the years following university studies (Curran et al., 1998; Leonard and Mudar, 2003).

Several studies report that positive alcohol expectancies are related to heavy drinking, and also to more positive and negative alcohol-related consequences in both men and women (Evans and Dunn, 1995; Park and Grant, 2005; Park and Levinson, 2002). A recent study by Read and O'Connor (2006) suggests that beliefs concerning the effects of heavy drinking may be an active mechanism underlying drinking behaviour.

A positive family history of alcohol problems has been shown to be a risk factor for problem drinking and the development of future alcohol problems (Goldman et al., 2005). A review of university students found an association between alcohol consumption and a positive family history of alcohol problems in some studies, but not in others (Baer, 2002). Possible methodological explanations for these differences were discussed, such as definitions that were too broad when measuring family environments, and that children of alcoholics may not consume higher levels of alcohol but they more frequently report alcohol-related problems.

Excessive drinking in university students has been associated with different consequences ranging from increased risky sexual behaviour to aggressive injuries, blackouts and hangovers (Wechsler, 2002). Bullock (2004) found that the 43% of all current drinkers had experienced harm related to alcohol use in the past 12 months. Harm was related to physical health (26%), financial situation (25%), studies and work (9%), family life and relationships (8%), and friendships and social life (6%).

Stress in university students

Transition to university is a major life event associated with social and educational opportunities but, for many students, it is also a period associated with increased levels of stress. Several studies report higher rates of stress and psychiatric symptoms including anxiety and depression in university freshmen compared to students in later stages of educational programmes (Fisher and Hood, 1987; Adlaf et al., 2001; Andrews and Wilding, 2004; Wong et al., 2006).

According to Towbes and Cohen (1996), university entrance is associated with specific developmental tasks including achieving emotional independency from family, choosing a career, preparing for commitment to a relationship and family life, and developing a moral system. This requires the student to establish new roles and to modify old ones, which may result in chronic stress and lead to distress. Jackson and Finney (2002) investigated the importance of specific university-related stressors in different areas, including achievement of educational goals, establishment of new relationships, finances, sexual relations and deviant behaviour. It was found that negative experiences in peer relationships were the most important predictor of stress, and that younger students were more vulnerable than older students. These findings were explained by freshmen being dependent on peer relationships in order to adjust to university life and formation of new contacts being associated with increased stress. Furthermore, younger students probably do not have the necessary psychological resources, maturity and experiences, and therefore adopt ineffective coping strategies when faced with stressful situations.

According to a review by Borsari and Carey (2006), the quality of peer relationships is vital for successful adaptation to college. The authors also report that stable, intimate and supportive relationships consistently are associated with lower levels of psychological problems including stress and depression. Since students often are young and have not yet established serious relationships, same-sex friendships were regarded as most stable.

There are several studies discussing stress and psychiatric problems in medical students. A Swedish study of medical students (Jönsson and Öjehagen, 2006) found that female students reported more stress and mental symptoms compared to male students. Midtgaard et al. (2008) followed a population of Norwegian medical students during the first, third and sixth year of training. In the freshman year, 15% reported lifetime prevalence of mental health problems, 31% reported mental health problems during the first three years, and 14% reported mental health problems during the last three years of training. Predictors of problems during the first three years were previous mental health problems, type of personality, perceived medical school stress and negative life events. Fifty-four percent of the students had not sought professional help during the first three years of medical training.

Stress and alcohol in university students

Ham and Hope (2003) reviewed studies on the association between alcohol consumption and stress in university students. The studies mainly supported a relationship between alcohol involvement and stress, but results differed between studies, and some studies did not find such an association. It was suggested that the relationship between alcohol consumption and stress probably is moderated by individual coping motives, coping skills, self-efficacy and tension-reduction expectancies.

Perkins (1999) followed a large number of university students to examine stress-motivated drinking as a contributor to alcohol problems during university and post-university. Moving from university was associated with a decrease in alcohol consumption and related problems. However, drinking for stress reduction increased and was associated with negative alcohol consequences.

Weitzman (2004) analysed epidemiological data on university students and found that poor mental health and depression was associated with drinking-related harm and alcohol abuse. Dawson et al. (2005b) found that drinkers, both non-students and students, were at greater risk of negative mood, anxiety and personality disorders when compared to non-drinkers. However, the association was stronger in non-students, and in university students the association was found only in students classified with alcohol dependence. Cranford et al. (2009) found that excessive drinking was positively related to a generalised anxiety disorder, but negatively correlated to major depression. It was also found that, among students with both excessive drinking and mental health problems, 67% perceived a need for mental health services but only 38% received those services in the previous year.

Alcohol intervention programmes

About twenty years ago, Alan Marlatt and colleagues at the University of Washington in Seattle introduced a structured multi-component program targeting college drinking. The Alcohol Skills Training Program (ASTP) (Fromme et al., 1994) aimed to reduce harmful consumption by using a non-confrontational approach and included cognitive skills and motivational techniques. The eight-session ASTP programme proved to be effective and reduced alcohol consumption and alcohol-related problems in comparison to controls in follow-ups up to two years after intervention (Kivlahan et al., 1990; Baer et al., 1992). The Brief Alcohol Screening and Intervention for College Students (BASICS) derives from the ASTP and comprises two sessions (Dimeff et al., 1999). It reduced both alcohol-related problems and alcohol consumption two years after intervention (Marlatt et al., 1998) and alcohol-related problems up to four years after intervention (Baer et al., 2001).

In 2002, the task force of the National Advisory Council of Alcohol Abuse and Alcoholism (NIAAA) published review papers of the evidence on interventions in university student settings. The initiative was called “A Call To Action – changing the culture of drinking at US colleges”. Recommendations were given for both individual programmes and population strategies. As part of this initiative, Larimer and Cronce (2002; 2007) published two systematic reviews of 60 studies of individual programmes targeting college drinking . They found good support for brief motivational interventions, which are a combination of reflective empathetic listening and specific techniques for change, often including individualised feedback on drinking habits and the risks associated with drinking. Good support was also found for interventions giving only feedback, often including a normative component. This feedback can be given in several different ways, i.e. in person, by post or via computer, with the same results. Some support was found for the skills-based interventions that focus on giving students behavioural skills to monitor and moderate their own drinking, and normative re-education interventions that aim to change alcohol consumption through discussing student norms. There is also strong evidence that multi-component interventions have effects, especially when they include motivational techniques. The components most effective in this approach are personalised normative feedback, eBAC training and discussion of protective behaviour. All these components are included in the Brief Alcohol Screening and Intervention for College Students (BASICS) (Dimeff et al., 1999).

Carey et al. (2007) published a meta-analytic review of 64 studies, and Larimer and Cronce included 40 of these studies, identifying different characteristics that moderate alcohol-related problems. In short-term follow up (4-13 weeks), interventions were more successful if more females were included in the intervention group, if interventions were delivered on an individual and in-person basis, and if motivational interviewing techniques, normative feedback, and feedback on expectancies/motivates including a decisional balance exercise were used. Interventions were less successful if they were directed towards heavy drinkers or at-risk groups, if the intervention was delivered by computer or post, or if the intervention included an expectancy challenge or skills training. It was also found that few interventions affect alcohol consumption after 6 months, while reduction in alcohol-related problems had longer-term effects and was found in long-term follow-ups (27-195 weeks).

In a recent meta-analysis of 14 studies, Riper et al. (2009) investigated the effectiveness of personalised feedback. It was found that single-session personalised feedback without therapeutic guidance reduced alcohol consumption with effect sizes in the small-to-moderate range ($d=0.22$, 95% CI 0.16-0.29).

Stress intervention programmes

There is less research into specific stress intervention programmes in university students than into alcohol intervention programmes. The results to date are best summarised in a review by Shapiro and colleagues in 2000. The authors reviewed different stress management programmes in medical education between 1966 and 1999. They found 600 articles discussing the importance of addressing the stress of medical education, but only 24 studies reported intervention programmes. Twenty of these studies reported that the stress-management programme was helpful, both psychologically and/or physiologically, and that participants were in favour of the programmes. However, most studies were based on small samples involving volunteers. Only seven studies included a control group, and only four studies assessed the participants beyond the end of the intervention. It was concluded that more rigorous study designs and better specificity of outcome measures were needed (Shapiro et al., 2000).

Stress programmes for hazardous drinking

As an alternative solution to the use of alcohol to reduce stress, the Alcohol Skills Training Programme (ASTP) included one session on relaxation techniques and lifestyle balance (Fromme et al., 1994). Rohsenow et al. (1985) used a stress management programme as a prevention programme for heavy drinking in male university students. A decrease in daily drinking was established after 2.5 months but not after 5.5 months. Among heavy drinkers with high stress at baseline, no stress reduction could be found after 2.5 months. Murphy et al. (1986) assigned heavy-drinking male students to either a relaxation programme or weekly running, or to a control group. The weekly running group was the only group that reduced their alcohol consumption compared to the no-treatment control condition. To our knowledge these studies are the only studies reporting alcohol-related variables of a stress intervention programme in university students.

Previous local research development and/ as background for the present study

During the past century, the Clinical Alcohol Research group at Lund University has performed several studies on students at the university. These studies include interventions in student bars (Johnsson and Berglund, 2003), in freshmen at the Faculty of Engineering (Johnsson et al., 2006), in university halls of residence (Ståhlbrandt et al., 2007), and in students whose parents have alcohol problems (Hansson et al., 2006; 2007). These studies have been inspired by the work of the Marlatt group and the interventions are mainly based on a similar multi-component approach.

Based on these previous experiences, and using similar methods to those recommended by NIAAA in “A Call To Action”, a new research project aiming to change the drinking culture at an entire university was initiated. This initiative also included a stress intervention programme. The original ASTP programme included relaxation techniques to teach students with hazardous drinking alternative coping strategies to alcohol use. However, in the present research project, stress interventions were introduced as a separate programme, offering students experiencing high levels of stress good coping strategies, including sensible use of alcohol. In addition, a training programme for servers at student bars (Johnsson and Berglund, 2003) and an intervention programme for adult children of alcoholics (Hansson et al., 2006; 2007) was introduced during the study period. The research programme was introduced in autumn 2002 and was called “Laying the foundations for favourable drinking patterns and stress management. A prevention programme for 18-25-year-olds”.

AIMS OF THE PRESENT STUDY

The basic idea of the present study was to evaluate a total package of alcohol and stress interventions including both general primary prevention components and high-risk secondary components.

The general aim of the study was to improve alcohol habits and stress patterns in Swedish university freshmen at an intervention university in comparison with a control university.

Specific aims to examine were:

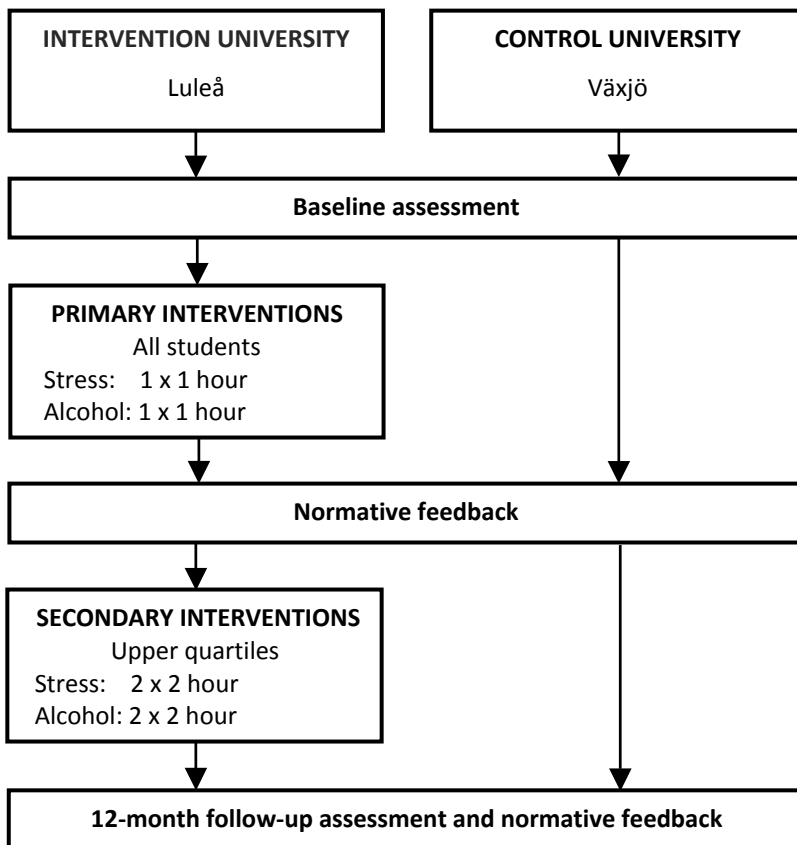
- Alcohol involvement in relation to gender, age, serious relationship and first-degree heredity of alcohol problems in Swedish university freshmen
- The measurement properties of the Arnetz and Hasson seven-item stress questionnaire to use in a sample of high-risk freshmen for a stress and alcohol intervention research project
- The influence of stress and hazardous alcohol use as well as related variables on first-year dropout from university studies,
- The one-year outcome of both primary and secondary interventions of one alcohol programme and one stress intervention programme at an intervention university in comparison with a control university

MATERIALS AND METHODS

Design of the study

Out of 14 state-run Swedish universities, two universities were selected to participate in a comparative research project. The basic design was to offer an extensive programme including both primary and secondary interventions for hazardous alcohol use and high levels of stress to freshmen at an intervention university, and to compare the outcome after one year to a corresponding group at a control university where freshmen were only offered minimal interventions, i.e. normative feedback. Additional follow-ups were made 24 months and 36 months after interventions, but are not discussed in this thesis.

Figure 1. Study design.



Setting

Luleå University of Technology in the north and Växjö University in the south of Sweden represent two recently founded universities with similar characteristics and curriculum. The universities are about the same size and both are situated outside the city centres, where halls of residence, university departments and social facilities for students are concentrated into a compact area. Comparable proportions of students are engaged in different educational programmes that are offered in a variety of disciplines including technology, economics, health, social sciences, education and the humanities.

Sample

All freshmen that had been accepted onto a university course exceeding three years in length and located at the main campus location at Luleå University of Technology and Växjö University in autumn 2002 were invited to participate in the research project. This represents about 80 percent of all freshmen entering these universities.

Preparations

At both universities, the student health managers were recruited as local project managers. Approval was obtained from the vice-chancellors and presidents of student organisations. At both universities, all university staff and students, especially students engaged in introduction activities, were informed about the project.

In the beginning of August, written information about the project, signed by the project manager, the president of the student organisation, and the head of each university, was sent to the freshmen at both universities that had been accepted onto a university course. Freshmen that required more information were recommended to phone the project manager at Lund University.

Enrolment

During the first weeks at university, by the end of August, all educational programmes were scheduled for baseline assessments. At the intervention university, all freshmen were scheduled to separate enrolment meetings including

primary intervention meetings in one of the main lecture halls on the campus area. Only about 20% of all freshmen attended these enrolment/primary intervention meetings, since these had not been entered in all timetables as was planned. Therefore additional enrolments were made by visits to subsequent lectures. These classroom enrolments did not include primary interventions. At the control university, all enrolments were scheduled at the regular introduction meetings or in the first available lecture. Prior to the baseline assessments, all freshmen were given both oral and written information about the study, and their signature on the questionnaire confirmed acceptance.

Primary interventions

Directly after the scheduled baseline assessment, freshmen at the intervention university were offered a primary prevention programme for hazardous alcohol consumption (1 x 1 hour) and stress management (1 x 1 hour). Trained instructors led the manual-based lectures and the content was based on the alcohol and stress interventions described below.

Normative feedback

A few weeks after the baseline assessment, enrolled freshmen at both universities were posted a short written normative feedback on their individual baseline results on the AUDIT and the instruments measuring estimated blood alcohol concentration and stress. Results were described in writing and in a diagram showing their own position in relation to quartiles of gender and university-specific referents. In this feedback, freshmen with the highest scores, i.e. highest quartile, were given a short recommendation to consider changing drinking patterns and/or coping with stress. At the intervention university this recommendation also included information about and a recommendation to participate in forthcoming secondary stress and/or alcohol interventions.

Secondary interventions

Two trained research assistants called each freshman with the highest scores at the intervention university, i.e. within upper quartile, to book them onto secondary alcohol and/or stress interventions. These calls were non-confrontational, and only a few freshmen rejected participation.

Secondary interventions started one month after baseline assessment at the intervention university and continued until spring 2003. Both secondary alcohol and stress intervention programmes included a 2 x 2-hour evening or lunchtime meeting in the campus area. Trained instructors led the manual-based meetings. Group interventions were used to encourage discussions, as well as for practical and economic reasons. The meetings consisted of a maximum of eight freshmen of mixed gender, and lunch or refreshments were served free at the meetings. The stress and alcohol interventions were conducted during the same period of time, and students with high scores for both alcohol and stress were allowed to participate in both interventions.

Freshmen that had been invited onto the secondary interventions, but who did not attend the meetings, were sent a short written booklet of the material of the alcohol and/or stress intervention programmes by the end of the spring term 2003.

Alcohol programme

The alcohol intervention programme is based on BASICS (Dimeff et al., 2009) and was prepared as an instruction manual at our department in Lund for reducing hazardous alcohol use. Firstly, basic information about alcohol was given, such as how alcohol habits are established and how the body reacts to alcohol. The facts and myths of alcohol and intoxication were discussed. Alcohol advertisements were shown and the underlying message was discussed. Cognitive behavioural skills training was woven into the programme to provide strategies for reducing risk and encouraging maintenance of behavioural changes. As an example, participants were given hands-on information about how to plan a party that limits excessive drunkenness by learning how to estimate blood alcohol concentrations (eBAC), and about the factors influencing this. The students were also encouraged to discuss different party situations in order to identify and avoid negative situations and experiences. As a hands-on help in this, the students were given drinking calendars.

Stress programme

Arja Bäckström, a psychologist working at the student health care centre at Lund University, developed the stress intervention programme. The programme had been used for regular group interventions for several years. The experiences from these interventions were positive, but no formal evaluation had been performed before this research project. The programme was transformed into an instruction manual by the author of this thesis, Claes Andersson, and Agneta Öjehagen. The aim of the programme is to provide information about stress as a natural reaction

to tension and how it is possible to manage stress by using different kinds of coping techniques. Basic information was given about physiological and psychological reactions to stress. The need for regular recovery was emphasised. Cognitive behavioural skills training was used to provide strategies for multiple coping techniques including relaxation training, time management, nutrition and exercise, assertiveness training, and problem solving, and to provide strategies for reducing risks and encouraging maintenance of behavioural changes.

Follow-up assessment

A follow-up questionnaire was posted to all students one year after the initial assessment, including the same items as the initial questionnaire. If the student did not respond, one written reminder was sent followed by a phone call in which the student was given the opportunity to respond to the questionnaire orally.

Statistical power

The aim of this study was to analyse outcome differences of secondary interventions for alcohol and stress between high-risk groups at the intervention university and the control university, as well as outcome differences of the primary alcohol and stress interventions between the total populations at each university. Primary outcome measures were the AUDIT and the Arnetz and Hasson Stress Questionnaire. The secondary alcohol intervention was assumed to influence alcohol consumption with a standardised effect size of 0.37 according to a meta-analysis by Berglund et al. (SOU, 2005). With a significance level of 5% and a power of 80%, a total of 120 subjects need to be included in each group in order to document differences. This calculation is based on randomised procedures and it is difficult to estimate the reduction in power due to the comparative design in this study. It is assumed that the same number needed to be included in the secondary stress interventions.

Ethics

No compensation was given to participants for responding to baseline and follow-up questionnaires. The Research Ethics Committees of Lund University (for Växjö University) and Umeå University (for Luleå University of Technology) approved the study.

Instruments

Several instruments were required to measure areas of interest in this study. The instruments should be able to detect individuals in need of risk group interventions and have the sensitivity to capture changes over time. Finally, the complete questionnaire needed to be short to allow administration of the large sample and to reduce the response burden on subjects included in the study. Primary alcohol outcome measure was the AUDIT and the Arnetz and Hasson Stress Questionnaire was the primary outcome for stress. Secondary outcomes were AEQ-18, eBAC and SCL-8D.

AUDIT

The AUDIT was used as the primary alcohol outcome measure. The Alcohol Use Disorders Identification Test (AUDIT) is a screening questionnaire that consists of 10 items each giving 0-4 points so the maximum score is 40. The items cover three domains: “alcohol consumption” (items 1-3), “signs of alcohol dependence” (item 4-6) and “alcohol-related harm” (item 7-10) (Rist et al., 2009). A “standard drink” is defined as 12 g of 100 percent alcohol/day (Babor et al., 2001). In the psychometric evaluation of the Swedish translation of the instrument, the Cronbach alpha coefficient of the total AUDIT score has been calculated to 0.82 (Bergman and Källmén, 2002), and in this study the internal consistency score was 0.80.

When the AUDIT was designed ≥ 8 points was considered as the standard cut-off point for positive screens in both men and women (Babor et al., 1989; Saunders et al., 1993). Due to lower sensitivity and higher specificity in women compared with men, the recommended cut-off point was later lowered to ≥ 6 in women. Usually, ≥ 8 for men and ≥ 6 for women are considered as positive screens (Reinert and Allen, 2002; 2007). Recently NIAAA (2005) lowered their recommendations to ≥ 4 for women.

In clinical management, persons who score in the low positive range (8-15) are recommended a brief intervention. In addition, individuals in the intermediate range (16-19) should receive regular monitoring, while those in the high range (20-40) should be given diagnostic assessment and treatment (Room et al., 2005).

AEQ-18

The AEQ-18 was used as a secondary alcohol outcome measure. The Alcohol Expectancy Questionnaire (AEQ) (Brown et al., 1987) is an empirically derived self-reporting form assessing various anticipated positive experiences associated with

alcohol use. AEQ originally consisted of 90 items with 6 subscales, but in this study is reduced to 18 items, three items each of the six dimensions, assessing the same domains of alcohol reinforcement expectancies. Each item is answered with a “yes” or “no”. The minimum score is 0 and the maximum score is 18 points. This version has been translated and developed for educational purposes at our department where it has been used for about ten years. In this study the Cronbach alpha coefficient of the shortened Alcohol Expectancy Questionnaire was calculated to 0.75 for the total scale, while the internal consistency was not sufficient on all individual scales. Consequently all analysis is made on the total scale. The results for five items have been used in a comparison with five matching items on a short version of the Comprehensive Effects of Alcohol Questionnaire (CEoA) (Fromme et al., 1993) that was used in a sample of US freshmen. The results showed that overall expectancies were similar between US and Swedish freshmen (Ståhlbrandt et al., 2008).

eBAC

The estimated Blood Alcohol Concentration (eBAC) was used as a secondary outcome. It is a self-assessment questionnaire where the individuals are asked to remember their last pleasant drinking occasion (number of standard drinks, time interval over which they were consumed, gender and weight). The method for estimating eBAC was obtained from the National Highway Traffic Safety Administration, US Department of Transportation (1994). In this study, the students were asked to remember their last pleasant drinking occasion and record their alcohol consumption at that occasion. This approach was considered to measure a typical optimal drinking occasion, rather than one of peak consumption.

The Arnetz and Hasson Stress Questionnaire

The Arnetz and Hasson stress questionnaire was used as the primary outcome measure of stress. Bengt Arnetz and Dan Hasson at Uppsala University in Sweden developed the questionnaire as a public web-based tool for regular individual assessments (www.pql.se). The questionnaire was constructed by basically sampling different aspects of stress from existing publications. The most relevant areas were found to be current health status, ability to sleep, ability to concentrate, global stress level, energy, life control and social life. The questionnaire comprises seven Visual Analogue Scales (VAS), one for each area. Since the questionnaire consists of seven scales, the minimum score for the entire questionnaire is zero points, while the maximum score is 700 points. The Cronbach alpha coefficient for the complete scale was 0.79.

The measurement properties of the full questionnaire had not been evaluated previously. Therefore this study also includes an evaluation of the measurement properties focusing on the internal consistency, i.e. the extent to which items in the scale are correlated (homogeneity) thus measuring the same concept, the construct validity, i.e. the extent to which the results on the scale is consistent with previous results, and the administrative demands of the questionnaire (Paper II). This analysis is based on the baseline results of the present paper.

SCL-8D

The SCL-D is used as a secondary outcome. The instrument has been developed and evaluated by Fink and co-workers (1995), and includes a total of eight symptoms of anxiety and depression. SCL-8D was originally derived from the anxiety and depression subscales of the Hopkins Symptoms Checklist (SCL-90) (Derogates et al., 1973). For each item, respondents are asked to respond with a “yes” or “no” to whether they have experienced any of the given symptoms during the past week, which differs to the original scale where a Likert scale is used. The minimum score on the SCL-8D is 0 and the maximum score is 8 points. In this study the internal consistency score was 0.77.

Additional items

The freshmen were asked whether parents, siblings, grandparents, aunts/uncles, or other close relatives or partner has or ever had a drinking problem. This question was derived from the Brief Drinker Profile (Miller and Marlatt, 1987), and in this study a positive family history of alcohol problems was defined as first-degree relatives – parents and/or siblings. The freshmen were also asked whether they were in a serious relationship (i.e. “going steady” or married). This question was answered with either a “yes” or a “no”. Finally, the freshmen were also asked about their gender and age.

The official university register (LADOK)

The response rate at baseline was calculated by comparing the number of freshmen answering the questionnaire in relation to the total number of freshmen registered in the official university records at each university at the beginning of the autumn term 2002. Among participating freshmen, dropout from university studies was defined by comparing the numbers of freshmen registered in the official university register when entering university with those remaining twelve months later. Students moving to other courses at the same university

were defined as students remaining at university. Unfortunately, it was not possible to collect records of transfer to other universities.

Statistics

Paper I - Alcohol involvement in university freshmen

Scale reliability was analysed using Cronbach alpha. Spearman rank correlations were used to calculate the correlation between results of different instruments. A Chi-square test was used to analyse differences in proportions. Comparisons of ratings between subgroups were carried out with Mann-Whitney and Kruskal-Wallis non-parametric tests. ANOVA analysis of variance was used to adjust for age differences when analysing the effects of heredity and serious relationship. A multiple logistic regression analysis was performed to gain more understanding of the influence of age, alcohol expectancies, eBAC, heredity and serious relationships on AUDIT scores. The likelihood ratio test, used when two-way interaction terms were included in the logistic regression model, tested effect measure modification by gender. A *P*-value of < 0.05 was regarded as statistically significant. The software used for the statistical analysis was SPSS 11.5 for Windows.

Paper II - Measurement properties of the Arnetz and Hasson Stress Questionnaire

Scale reliability analyses were performed with Cronbach alpha. Principal component varimax analyses were used for an exploratory factor analysis with an eigen value of 1. The Chi-square test was used to analyse differences in proportions. A multiple logistic regression analysis was performed to gain more understanding of the influence of gender, age, serious relationship, symptoms of anxiety and depression on stress scores. A *P*-value of < 0.05 was regarded as statistically significant. The software used for statistical analysis was SPSS 14.0 for Windows.

Paper III - Stress and hazardous alcohol use in relation to early dropout from university

Students who dropped out from university were compared in terms of mean differences in baseline scores on all measures with those remaining at university 12 months after university entrance. A Chi-square test was used to analyse

differences in proportions. The Mann-Whitney non-parametric test was used to compute differences between ratings. A multiple logistic regression analysis was performed with dropout from university as the dependent variable and baseline data as the independent variables. A P -value of < 0.05 was regarded as statistically significant. The software used for statistical analysis was SPSS 14.0 for Windows.

Paper IV - Outcome of interventions for hazardous alcohol use and stress

A Chi-square test was used to analyse differences in proportions. The Mann-Whitney non-parametric test was used to compute differences between ratings. Differences after one year were calculated as ANCOVAs according to Altman (1990). The one-year outcome was the dependent outcome, intervention or control was regarded as the fixed variable, and the baseline score was analysed as a covariate. All tests were two-tailed. A P -value of < 0.05 was regarded as statistically significant. The software used for statistical analysis was SPSS 14.0 for Windows.

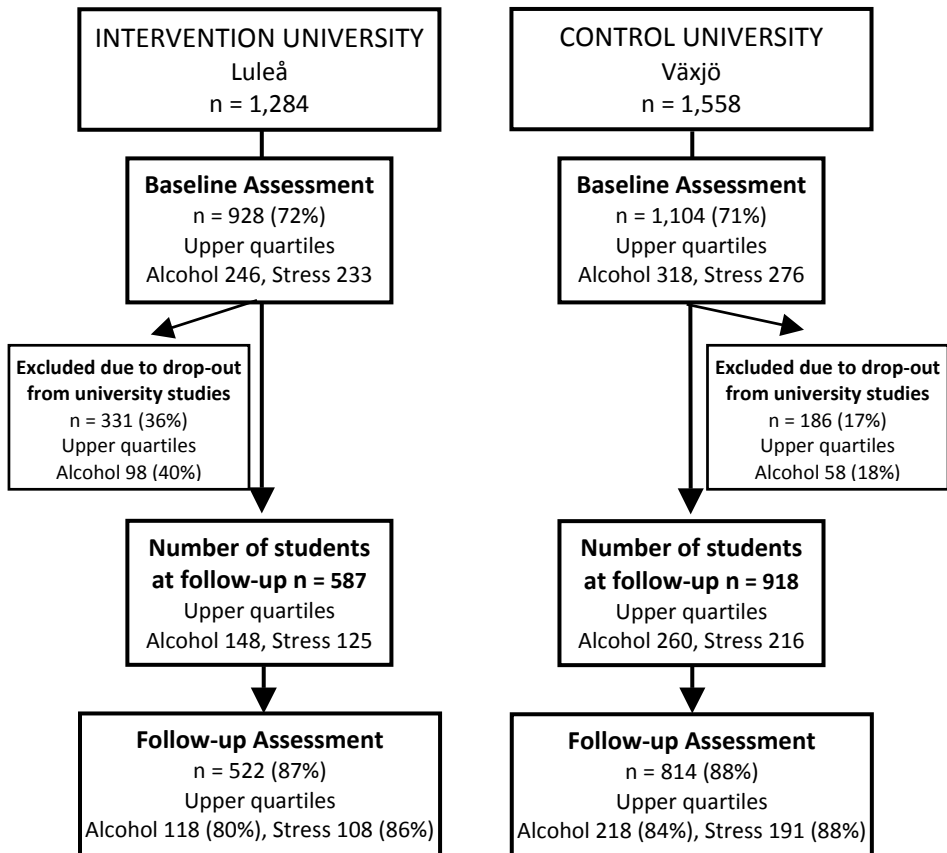
RESULTS

Population

A total of 2,032 out of 2,840 (72%) responded to the baseline assessment. More women than men participated (75% vs. 68%, $P = 0.000$). The mean age of all freshmen entering university education was 23.6 ± 5.5 years. Participants were younger than non-participants (23.5 ± 5.4 vs. 24.6 ± 6.3 , $P = 0.000$).

As shown in *Figure 2*, there were no differences in response rates between the two universities at baseline. Dropout from university studies during the freshman year was higher at the intervention university compared to the control university. Freshmen that dropped out from university studies were excluded from the follow-up analysis. In students remaining at university, there were no differences in response rate at follow-up between the intervention and control university.

Figure 2. Population at baseline and at follow up



Comparison in baseline data between the universities (*Table 1*) shows that men at Växjö University (control university) were younger than men at Luleå University of Technology (intervention university). Men at Växjö University also had higher AUDIT scores than men in Luleå. Both men and women at Växjö University reported higher Alcohol Expectancies compared with freshmen at Luleå.

Table 1 - Comparison between Luleå Technical University and Växjö University in men and women at baseline (n=2,032)

	Men			Women		
	Luleå n=489	Växjö n=448	P-value	Luleå n=439	Växjö n=656	P-value
Age	22.6±4.7	22.7±4.3	0.031	24.1±5.8	24.3±6.2	0.893
First degree heredity n(%)	42(9)	45(11)	0.499	61(14)	91(14)	1.000
In a serious relationship n(%)	189(37)	174(39)	0.686	278(63)	387(58)	0.165
Total score AUDIT (0-40) (mean+SD)	8.2±4.7	9.5±5.1	0.000	5.8±3.8	6.2±4.2	0.151
Alcohol expectancies (0-18) (mean+SD)	7.3±3.3	8.0±3.3	0.001	5.8±3.0	6.6±3.3	0.000
Estimated blood alcohol concentration (mean+SD)	0.082±0.067	0.092±0.076	0.081	0.075±0.061	0.076±0.063	0.871
Stress (0-700) (mean+SD)	221.1±102.6	228.4±105.8	0.213	243.1±114.2	241.2±117.6	0.861
SCL-8D (0-8) (mean+SD)	2.0±1.9	2.3±2.2	0.178	3.0±2.2	3.2±2.3	0.258

A Chi-square test was used to analyse differences in proportions. Comparisons of ratings were carried out with Mann-Whitney non-parametric tests.

Alcohol involvement in university freshmen (Paper I)

Alcohol involvement was analysed in the total study population of 2,032 university freshmen. As expected, men have higher AUDIT scores than women (8.8±4.9 vs. 6.0±4.0, $P = 0.000$). These AUDIT scores showed a considerable risk level for alcohol habits as 56% of the men and 49% of the women scored above the traditional cut-off levels (men ≥ 8 , women ≥ 6).

AUDIT scores was also analysed in relation to two-year age categories (18-19, 20-21, 22-23, 24-25, 26-27, 28-29 and above 30 years of age). Men had higher scores than women in all age categories. In men, the highest AUDIT score was found in the 24-25 age groups (10.5±5.4), while the highest AUDIT score in women was found in 22-23 year of age (7.1±4.3).

Thirty-eight percent of the men and 61 percent of the women were in a serious relationship. These students are older compared with others, and this applies to

both men (24.1 \pm 3.3 vs. 21.8 \pm 5.7, $P = 0.000$) and women (25.6 \pm 4.2 vs. 22.2 \pm 6.6, $P = 0.000$).

Nine percent of male and 14% of female freshmen are first-degree relatives to parents or siblings with alcohol problems. These students are older compared with others in both men (24.8 \pm 5.6 vs. 22.5 \pm 4.3, $P = 0.000$) and women (26.1 \pm 6.5 vs. 23.9 \pm 5.9, $P = 0.000$).

A multiple logistic regression analysis was performed to investigate the association between scoring above the traditional AUDIT cut-off levels (men ≥ 8 , women ≥ 6) as a dependent variable, and the following independent variables: gender, in emerging adulthood (18-25 years), high alcohol expectancies, and high eBAC, being a first-degree relative to someone with alcohol problems and not in a serious relationship. This was calculated for the total cohort and for men and women separately. All independent variables were associated with an increased risk of scoring above the traditional cut-off levels (see *Table 2*).

Table 2 - Logistic regression analyses showing factors associated (odds ratio, 95% CI) with traditional cut-off levels (men ≥ 8 , women ≥ 6) in the AUDIT

	Men (≥ 8)			Women (≥ 6)			Total ($\geq 8/\geq 6$)		
	OR	95% CI	P-value	OR	95% CI	P-value	OR	95% CI	P-value
Emerging adulthood (18-25 years)	1.61	1.02-2.54	0.042	1.96	1.36-2.81	<0.001	1.84	1.39-2.45	<0.001
High alcohol expectancies	1.31	1.24-1.39	<0.001	1.30	1.23-1.37	<0.001	1.30	1.25-1.35	<0.001
High estimated blood alcohol concentration	1.015	1.012-1.018	<0.001	1.018	1.015-1.021	<0.001	1.016	1.014-1.019	<0.001
Heredity	1.75	1.00-3.05	0.049	1.28	0.83-1.99	0.265	1.48	1.05-2.08	0.025
Not in a serious relationship	1.40	1.01-1.93	0.043	2.23*	1.62-3.05	<0.001	1.77	1.42-2.22	<0.001
Gender	-	-	-	-	-	-	1.34	1.07-1.68	0.010

* Significant effect measure modification by gender (P -value for interaction = 0.04). No other interaction with gender was found significant (P -value ≥ 0.13).

Measurement properties of the Arnetz and Hasson Stress Questionnaire (Paper II)

The measurement properties for the stress scale were analysed in the total population of 2,032 freshmen. The response rate for the stress questionnaire was high, and in total 14,184 out of 14,224 (97.7%) of the individual items was answered.

The Cronbach's alpha coefficient for the total scale was 0.79. The varimax rotation factor analysis, using an eigen value of 1, resulted in one factor that covered all items with factor scores of 0.5 and over. This factor explained 46% of the variance.

Women had higher stress scores than men (243±111 vs. 224±104, $P = 0.002$). Subjects scoring in the highest quartile, ≥ 318 in women and ≥ 288 in men, on the stress scale were compared in terms of background variables and scores on the SCL-8D scale with the proportions in the low stress group. As shown in *Table 3*, there was a higher proportion of emerging adults, i.e. below 26 years, and subjects with high scores on SCL-8D in the high-stress group compared with the low-stress group. In the high-stress group the proportion of freshmen living in a serious relationship was lower compared with the low-stress group.

Table 3 - Comparison between subjects scoring in the highest quartile of the stress scale (high) and the others (low) in terms of background variables and scores on the SCL-8D scale

	Stress levels		P-value
	High (n=509)	Low (n=1,523)	
Men	234 (46.0 %)	703 (46.2 %)	0.942
Age below 26 yrs	423 (83.1 %)	1181 (77.5 %)	0.005
Luleå	233 (45.8 %)	695 (45.6 %)	0.956
In a relationship	224 (44.0 %)	798 (52.4 %)	0.001
SCL-8D (highest quartile)	316 (62.1 %)	319 (20.9 %)	0.000

Differences between proportions were tested using the Chi-square test.

A multiple logistic regression analysis was performed with the background variables and SCL-8D as independent variables and the stress variable (high vs. low) as the dependent variable. *Table 4* shows that mental symptoms, living outside a serious relationship, and female gender were associated with high stress.

Table 4 - Logistic regression analysis with high stress as dependent variable and background variables and SCL-8D scores as independent variables

	High stress		
	OR	95% CI	P-value
Women	1.35	1.07-1.69	0.010
No relationship	1.40	1.10-1.75	0.005
Low age (18-25 yrs)	1.04	0.77-1.39	0.808
SCL-8D (highest quartile)	6.32	5.06-7.90	0.000

Stress and hazardous alcohol use in relation to early dropout from university (Paper III)

As shown in *Figure 2*, 331 (36%) freshmen at the intervention university and 186 (17%) at the control university dropped out from university studies within 12 months of starting a university course. *Table 5* shows a comparison between the total dropout group (n=517) and those remaining at university. In addition to greater dropout from the intervention university, it was also found that men at both universities more often dropped out than women, and that students who dropped out had higher stress scores and reported more mental symptoms compared to those remaining at university.

Table 5 - Comparisons between students dropping out and those remaining at university in relation to university, gender, age, AUDIT scores, alcohol expectancies, estimated Blood Alcohol Concentration, stress score and mental symptoms. Chi-Square (gender and university) and Mann-Whitney test (mean \pm SD)

	Dropping-out (n=517)	Remaining (n=1515)	P-value
Luleå/Växjö	331/186	597/918	0.000
Men/Women	266/251	671/844	0.005
Age	22.9 (4.5)	23.7 (5.7)	0.158
eBAC	0.084 (0.069)	0.080 (0.067)	0.335
AEQ	6.9 (3.3)	6.9 (3.3)	0.839
AUDIT	7.6 (4.9)	7.2 (4.6)	0.150
Stress	252 (120)	228 (107)	0.000
SCL-8D	2.9 (2.3)	2.6 (2.2)	0.029

Differences between proportions were tested using the Chi-square test. Comparisons of ratings were carried out with Mann-Whitney non-parametric tests.

In *Table 6*, a multiple logistic regression analysis showed that only stress and studying at the northern intervention university (Luleå University of Technology) were associated with dropout from university studies. An additional analysis, using a statistical interaction term (Luleå * high stress) established that high stress scores were not explained by university setting (OR 1.2, 95% CI 0.7-2.0, $P = 0.498$).

Table 6 - Logistic regression analysis showing associations (odds ratio, 95% CI) with dropout from university as the dependent variable, and university, high stress, gender, high levels of mental symptoms, high AUDIT scores, age, high levels of estimated Blood Alcohol Concentration and high scores on alcohol expectancies as independent variables

	Dropout from university within 12 months		
	OR	95% CI	P-VALUE
Luleå	2.748	2.226-3.392	0.000
High Stress	1.543	1.205-1.975	0.001
Men	1.172	0.949-1.446	0.140
High SCL-8D	1.172	0.922-1.490	0.194
High AUDIT	1.114	0.870-1.426	0.392
Young adulthood (18-25 yrs)	1.102	0.841-1.444	0.480
High eBAC	1.070	0.836-1.369	0.590
High AEQ	1.053	0.829-1.337	0.671

Outcome of interventions for hazardous alcohol use and stress (Paper IV)

Outcome analysis includes students remaining at university at follow-up, as shown in *Figure 2*. *Primary alcohol and stress interventions* were offered to all students at the intervention university as part of the introduction of a general intervention program (*Figure 2*). Though there are no exact figures, it is estimated that about 20 percent of all freshmen participated in primary intervention lectures. Students at the intervention university reported a more positive change in mental symptoms and alcohol expectancies, while changes did not differ in AUDIT scores, estimated blood alcohol concentrations or stress in comparison to freshmen at the control university at follow up (*Table 7*).

Table 7 - One-year outcome values in the total population at the intervention university (Luleå) compared to the control university (Växjö)

		Luleå	Växjö	Difference between means (95% CI)	P-value	
Total population	n	522	814			
	eBAC	Change score	-0.010(0.063)	-0.010(0.068)	0.000(-0.007 to 0.008)	0.788
		ANCOVA			-0.003(-0.009 to 0.003)	0.281
	AEQ	Change score	-0.9(2.6)	-0.9(2.7)	-0.0(-0.3 to 0.3)	0.890
		ANCOVA			-0.3(-0.6 to 0.0)	0.037
	AUDIT	Change score	-0.4(3.0)	-0.5(3.6)	0.0(-0.3 to 0.4)	0.524
		ANCOVA			-0.2(-0.5 to 0.1)	0.184
	Stress	Change score	-8.2(116.6)	-4.4(116.3)	-3.8(-16.6 to 9.0)	0.826
		ANCOVA			-7.9(-19.2 to 3.3)	0.168
	SCL-8D	Change score	-0.3(2.2)	0.3(2.2)	-0.0(-0.3 to 0.2)	0.779
		ANCOVA			-0.2(-0.5 to -0.0)	0.025

The *secondary alcohol interventions* offered to freshmen with high initial scores for AUDIT (Figure 2) were associated with a more positive change in AUDIT, as well as in alcohol expectancies, blood alcohol concentrations, stress and mental symptoms in comparison to the corresponding group at the control university (Table 8). More students left the high AUDIT group, i.e. upper quartile, at the intervention university compared to the control university (55% vs. 42%, $P = 0.022$). In the secondary alcohol intervention group, 50 (42%) students had participated in the group sessions while the remaining students were posted a short booklet of the course material. There was only a tendency towards a more positive change in AUDIT scores in those participating in the intervention compared to those only receiving the booklet (-1.2 95% CI -2.6, 0.1, $P = 0,072$).

Table 8 - One-year outcome values in the secondary alcohol intervention group (Luleå) compared to the corresponding high-risk group at the control university (Växjö)

		Luleå	Växjö	Difference between means (95% CI)	P-value	
High AUDIT	n	118	218			
	eBAC	Change score	-0.031(0.080)	-0.018(0.080)	-0.013(-0.031 to 0.005)	0.169
		ANCOVA			-0.016(-0.031 to -0.002)	0.029
	AEQ	Change score	-1.6(3.0)	-0.9(2.9)	-0.7(-1.3 to -0.0)	0.043
		ANCOVA			-0.9(-1.5 to -0.2)	0.008
	AUDIT	Change score	-2.8(3.8)	-2.1(4.5)	-0.7(-1.6 to 0.2)	0.053
		ANCOVA			-1.1(-2.0 to -0.2)	0.017
	Stress	Change score	-33.2(117.4)	-3.3(118.0)	-30.0(-56.4 to -3.5)	0.012
		ANCOVA			-29.3(-52.2 to -6.3)	0.013
	SCL-8D	Change score	-0.9(2.3)	-0.2(2.5)	-0.7(-1.2 to -0.2)	0.038
		ANCOVA			-0.8(-1.3 to -0.4)	0.000

The *secondary stress interventions* offered to freshmen with high initial scores for stress (Figure 2) were associated with further decrease in mental symptoms and alcohol expectancies, but not for stress, AUDIT scores and blood alcohol concentrations in comparison to the corresponding group at the control university (Table 9). There was no difference between those 54 (50%) students that participated in the stress group sessions and students who did not attend these lectures but who received a short booklet of the material.

Table 9 - One-year outcome values in the secondary stress intervention group (Luleå) compared to the corresponding high-risk group at the control university (Växjö)

		Luleå	Växjö	Difference between means (95% CI)	P-value	
High Stress	n	108	191			
	eBAC	Change score	-0.011(0.065)	-0.015(0.075)	0.009(-0.014 to 0.020)	0.639
		ANCOVA			-0.003(-0.016 to 0.011)	0.713
	AEQ	Change score	-1.1(2.8)	-0.5(3.0)	-0.6(-1.3 to 0.1)	0.079
		ANCOVA			-0.7(-1.4 to -0.1)	0.028
	AUDIT	Change score	-0.8(3.4)	-0.3(3.8)	-0.4(-1.3 to 0.4)	0.488
		ANCOVA			-0.6(-1.4 to 0.2)	0.112
	Stress	Change score	-94.0(118.6)	-84.1(111.0)	-9.9(-37.4 to 17.6)	0.468
		ANCOVA			-12.1(-38.4 to 14.2)	0.367
	SCL-8D	Change score	-0.9(2.6)	-0.6(2.3)	-0.3(-0.9 to 0.3)	0.444
		ANCOVA			-0.5(-1.1 to -0.0)	0.042

GENERAL DISCUSSION

University setting

Our intention was to select two universities as similar as possible. The universities selected represented two out of totally 14 state-run universities in Sweden. Freshmen involved in the study corresponded to about 9% of all freshmen entering Swedish universities in autumn 2002. Mean age and gender proportions corresponded to national data about freshmen (HSV, 2003). Dropout figures presented in this study are not specific to these universities. The mean 12-month dropout rate from Swedish university educational programmes is about 35% and many freshmen register without actually starting their courses (HSV, 2003).

Luleå and Växjö universities have many similarities. Both universities are recently-founded institutions of higher education with similar characteristics and curriculum. The universities are about the same size and both are situated outside city centres, where halls of residence, university departments and social facilities for students are concentrated in a compact area. Comparable proportions of students are engaged in different educational programmes in a variety of disciplines including technology, economics, health, social sciences, education and the humanities. However, during the study some differences were discovered.

Before the start of the present study, some differences were known about alcohol involvement between Swedish universities. Sundbom (2003) had reported greater drinking rates in larger universities compared to smaller universities, and in older universities compared to newer universities. These differences were explained by established drinking cultures in the old universities and by the accessibility of student bars at the large universities. After our study began, Bullock (2004) reported differences between the northern and southern parts of Sweden. It was found that students at one northern university (Umeå) reported less binge drinking (OR 0.69, 95% CI 0.58-0.81) than three universities in the south (Lund, Växjö and Kalmar). It was also found that prevalence of weekly drinking was lower at the northern university (OR 0.67, 95% CI 0.52-0.86) compared to the smallest university as reference (Kalmar). There was no difference in weekly drinking between Kalmar and Växjö (OR 1.23, 95% CI 0.94-1.60) while weekly consumption was higher in Lund (OR 1.61 95% CI 1.28-2.02) compared to Kalmar.

In the present study, alcohol involvement also was found to be lower at the northern university compared to the southern university at baseline (see Table 1). This difference between the two universities in our study is likely to be explained by the same north-south variation as discovered in Bullock's study. Probably this

initial difference in selection characteristics affects internal validity, but these differences are adjusted for in the statistical analyses.

There was no information on differences in dropout from university studies between the two universities when the study was initiated. During the freshman year, 36% of the participants at the intervention university dropped out from university compared to 17% of the participants at the control university. After adjusting for stress level and alcohol involvement it was established that studying at the northern intervention university was a separate factor influencing first-year dropout that did not interact with stress and alcohol drinking. In recent years the university system has expanded, with more severe competition between the universities. Luleå probably has suffered more than Växjö because of its northern location. This probably affects internal validity, and the differences are adjusted for in the statistical analyses.

Establishing contact

The basic idea of the present design was to evaluate a total programme for risky alcohol consumption and high stress. During implementation, contacts had been established with older students at the intervention university to gain their support for the project (Borsari and Carey, 2006).

A key factor in reducing freshmen's expectations of alcohol use at university was to inform students about the project before university entrance. Written information about the project, signed by the project manager, the president of the student organisation and the head of each university, was sent to all freshmen at both universities about one month before university entrance. This probably enhanced participation in the project at both universities.

At both universities, all initial data was collected face-to-face. This procedure had been used in similar settings previously (Johnsson and Berglund, 2006) and is well known to result in high response rates, making it possible to clear up important misunderstandings if necessary (Burkell, 2003). The acceptance of the study was probably improved by offering all freshmen feedback in response to their participation. Different incentives are known to improve response rates (Rendell et al., 2007). It is possible that this also affected the high follow-up rates at both the intervention and control university (87% and 88%). The general impression of the initial contact was that most freshmen were positive to the project, had an interest in the topic and thought their participation was important in bringing about change.

Representativity

This study includes all freshmen entering a university programme exceeding three years and situated at the main campus area at two Swedish universities.

Freshmen included in the study represented about 80% of all freshmen entering these universities in autumn 2002. The total response rate was 72% at baseline. In the original BASICS study, Marlatt et al. (1998) sent screening questionnaires to all freshmen entering Washington University in Seattle. Out of 4,000 questionnaires, only 2,179 (54%) answers were received. Thus the response rate in this study could be regarded as satisfactory. Virtually all freshmen that were contacted in different settings during the enrolment process accepted participation. In total only 63 (3%) persons refused, which must be regarded as a good figure. Analyses based on a comparison to available data from the official university records showed that more women than men participated, and that participants were younger than non-participants.

A total of 88% students remaining at university responded to the follow-up assessments, with very similar figures between the intervention and the control university in the total population (87% vs. 88%) as well as in the established high-risk groups for alcohol (80% vs. 84%) and stress (86% vs. 88%). A review of different intervention programmes in college students, which mostly contain smaller samples, found retention rates ranging from 72% to 97% (SOU, 2005). Another review by Carey et al. (2007) found a mean retention rate of 75% in a review of 62 studies in university settings. A review specifically targeting 12-month retention rates in brief alcohol interventions in general practice report variations ranging from 44% to 83% (Edwards and Rollnick, 1997). Differences in studies are referred to sample size, study procedure and follow-up length (Morrison et al., 1997). Our follow-up results therefore could be regarded as satisfactory.

Measurements

The aim of the questionnaire was to identify individuals with high levels of alcohol involvement and stress. It should also reflect the interaction between alcohol and stress, and be short in order to reduce response burden. It should also be able to measure changes in order to be used in the follow-up procedure.

Well-established instruments were used to measure alcohol involvement. The Alcohol Use Disorders Identification Test (AUDIT) is the most commonly used measure in literature about college drinking and it is acknowledged for its ability to detect high-risk drinking in different college settings, including university freshmen (Devos-Comby and Lange, 2008; Kokotailo, 2004; Clements, 1998;

Aertgerts et al., 2000; Johnsson and Berglund, 2006). We also considered an abbreviated version of the AUDIT, only including the first three items measuring consumption (AUDIT-C). This measure has been shown to detect at risk or heavy drinking (Bush et al., 1998; Dawson et al., 2005c). However, a recent review concludes that the full AUDIT may be superior for identifying unhealthy alcohol use in adults in some settings (Kriston et al., 2008). In addition, in order to capture the complexity of alcohol involvement, we consider it important not only to measure consumption, but also signs of harmful use and dependency (Rist et al., 2009). It has also been shown that intervention effects on consumption diminish over time, while the reduction in alcohol-related problems takes longer to appear and continues into long-term follow-ups (Carey et al., 2007).

There is an ongoing discussion on the specificity of the AUDIT (Reinert and Allen, 2002; 2007). Traditionally, the cut-off levels for positive screens are ≥ 8 in men and ≥ 6 in women, but lowered to ≥ 5 for women in the most recent recommendation (Reinert and Allen, 2002; 2007). In this study, the cut-off level was gender- and university-specific, and secondary interventions were offered to the 25 percent (quartile) of the students with the highest scores on the AUDIT. We consider this to be the best possible procedure, since 56% of all men and 49% of all women otherwise would have been selected for secondary interventions using traditional cut-off levels. We found it impossible to offer secondary group interventions to such a large group at the intervention university. Tailored cut-off levels according to age and drinking culture have also been recommended in other studies (von der Pahlen et al., 2008; Reinert and Allen, 2007).

Positive alcohol expectancies are related to heavy drinking, and are related to both more positive and more negative alcohol-related consequences, both in males and females (Evans and Dunn, 1995; Park and Grant, 2005; Park and Levinson, 2002). We used an abbreviated version of the Alcohol Expectancy Questionnaire (Brown et al., 1987). AEQ originally consisted of 90 items with six subscales, but was here reduced to 18 items, three items each of the six dimensions, assessing the same domains of positive alcohol expectancies. The Chronbach's alpha was calculated to 0.75, which is satisfactory. The results for five items have been used in a comparison with five matching items of a short version of the Comprehensive Effects of Alcohol Questionnaire, CEoA, (Fromme et al., 1993) that was used in a sample of US freshmen. The results showed that overall expectancies were similar amongst US and Swedish freshmen (Ståhlbrandt et al., 2008). This short version does not enable analysis of each of the six dimensions because Chronbach's alpha is low, which limits analysis since the separate domains moderate alcohol involvement differently in individuals (Ham and Hope, 2003). One limitation of AEQ is that it does not measure negative expectancies. Negative expectancies have been found to account for most of the

variance of frequency of consumption, while positive expectancies account for most of the variance of quantity consumed per session (Lee et al., 1999). However, positive expectancies have been found to better predict drinking among respondents under 35 years of age than older ones (Leigh and Stacy, 2004), which supports using the AEQ in university settings.

The Estimated Blood Alcohol Concentration is a retrospective self-reporting measure of the estimated blood alcohol concentration, calculated by gender, body weight, hour of drinking and number of standard drinks consumed (NHTSA, 1994). The freshmen were asked to report on their last “pleasant drinking occasion”, which is considered to measure a typical situation without negative consequences. This procedure probably results in lower scores than if the report had concerned a “peak occasion”. A pleasant drinking occasion might also be judged pleasant by other factors than the amount of consumed alcohol.

We wanted to use a short instrument to measure stress and decided to use the Arnetz and Hasson Stress Questionnaire. This questionnaire included only seven items and had been constructed by sampling different aspects of stress from existing publications. It was used as a short public Web-based tool for regular individual assessments. Since the psychometric properties of the total questionnaire had not been published (Hasson and Arnetz, 2005), we decided to evaluate the full questionnaire on the existing material. This evaluation found that the questionnaire was easy to use and offered sufficient internal consistency and construct validity. It has also been used in a population of medical students, which further strengthens the validity of the instrument (Jönsson and Öjehagen, 2006).

In a systematic review of stress and stress management (Edwards and Burnard, 2003), it is concluded that development of new measures is common in stress research. The situation is further complicated because different dimensions of stress are measured by different instruments, and because several instruments are limited by their length and excessive response burden (Everly and Lating, 2002).

The questionnaire still has some limitations, the most important being that results, even if statistically significant, cannot be translated to a clinically practical application. The overall large number of different measures reported in stress research makes comparisons between studies difficult. It is important to form a common platform to improve future research. This study showed that the measurement properties of the Arnetz and Hasson Stress Questionnaire were satisfactory, and that it could possibly be used as such a platform.

Anxiety and depression were measured by the SCL-8D, which has been validated in primary public care settings in a Nordic multicentre investigation (Fink et al., 1995). The items included in the questionnaire were derived from the SCL-90

(Derogatis, 1974), but the SCL-8D does not use a Likert scale, with defined steps as the SCL-90. This means that the intensity of each area cannot be analysed. The SCL-8D has been used in an analysis of stress in medical students in Sweden (Jönsson and Öjehagen, 2006) and in a comparison with US freshmen data including the same items (Ståhlbrandt et al., 2008), which further strengthens the use of the questionnaire.

Statistical considerations

This study examines the one-year outcome of both primary and secondary interventions at an intervention university in comparison to a control university. This comparative group design made the study sensitive to factors, other than the intervention programmes, that might explain the differences at follow-up (i.e. internal validity).

Trochim (2006) argues that the aim of every research design is to structure all major parts of the research in a way that holds the project together, and that the decision on what really is a strong design therefore is dependent on the project itself. In our previous projects, we had used different randomised experimental designs, which are considered strong in terms of eliminating threats to internal validity, depending on the aim of each study. This project differs from our previous approaches as it was designed as an overall implementation of several different programmes in order to change drinking patterns and stress management.

In the present study we felt it would not be possible to use randomised controlled designs, both individually and cluster randomised. One of the reasons for this was that it would not be possible for students in a control group at the same university not to be influenced by the implementation of the study, i.e. students often share accommodation, student bars and other social activities.

Limitations

The differences in gender and age proportions between students responding and not responding to the baseline assessment somewhat limit the generalisability of this study. However, these differences are not very precise since they were calculated in comparison to official university records of all students accepted onto a university educational programme.

Participation in the primary alcohol and stress interventions was rather low. The reason for the 20 percent participation rate was that these enrolment/primary prevention meetings were not fixed in all timetables at the intervention

university. However, the outcome in the total population at the intervention university perhaps could be viewed as part of the total package of interventions delivered at the intervention university and not only as results of these lectures.

Forty-two percent participated in the secondary alcohol programme and 50 percent in the secondary stress programme. The procedure to call each participant in order to issue personal invitations to these interventions, as well as the procedure of distributing a short booklet describing the interventions, reduced the possibility of interpreting the outcome of the secondary interventions. As well as primary interventions, the general intervention programme at the intervention university, including a beverage service programme and a programme for adult children of alcoholics, might also have affected subjects in the secondary intervention programmes. No outcome difference was found between participants and non-participants, i.e. those who received booklets, in the secondary intervention groups. Equal efficiency has previously been established in subjects participating in treatment and subjects receiving written material (Sobell et al., 2002).

This study has no pure control group since all freshmen at both universities received written normative feedback on their baseline results. The decision to provide all freshmen with feedback was originally chosen for ethical reasons and because the methodology, at that time, was not considered to have such an important influence on both alcohol and mental distress as proven in more recent studies (Levis and Neighbors, 2006; Geisner et al., 2006). It is assumed that the effect of the written normative feedback was equal at both universities.

Main findings

Alcohol involvement among university freshmen

The level of alcohol involvement measured with the Alcohol Use Disorders Identification Test (AUDIT) was found to be high among both male and female freshmen, and corresponds to previous studies in university freshmen (Clements, 1998; Aertgerts et al., 2000; Johansson and Berglund, 2006). According to given recommendations, about half of all freshmen should be given a brief intervention for harmful or hazardous use (Room et al., 2005). Though this is an issue of discussion, it has recently been suggested that AUDIT cut-off scores should be tailored according to age, gender and drinking culture (von der Pahlen et al., 2005; Reinert and Allen, 2007). In correspondence with previous findings in university students, the probability of scoring above traditional cut-off levels was associated with male gender (Knight et al., 2002), high alcohol expectancies (Ham

and Hope, 2003), and high levels of estimated blood alcohol concentrations (Ståhlbrandt et al., 2007).

It was also found that first-degree heredity of alcohol problems increased the probability of scoring above the levels where interventions traditionally are recommended for harmful or hazardous use. Generally, a positive history of alcoholism is recognised as an important risk factor for the development of problematic drinking. However, findings in college student populations are inconsistent about whether a positive history of alcohol problems increases alcohol involvement at college (Baer, 2002; Capone and Wood, 2008).

Freshmen not involved in a serious relationship also had an increased probability of hazardous drinking. This applied to both men and women regardless of age. These findings are new since lower alcohol involvement has previously only been associated with marriage (Curran et al., 1998; Leonard and Mudar, 2003). The term “serious relationship” covers both relationship and marriage, and was used because the mean age among freshmen in Sweden is about 23 years while the mean age of first marriage is above 30 years of age.

Measurement properties of the Arnetz and Hasson Stress Questionnaire

In this study, the Arnetz and Hasson Stress Questionnaire proved very suitable for measuring stress in a large sample of university freshmen. The questionnaire proved easy to understand and respond to, as shown by the limited amount of missing data, and was also simply to administrate. These experiences are of importance since the aim of the instrument was to separate those with high stress from those with low stress, and to longitudinally detect individual effects for interventions.

An exploratory factor analysis showed a factor solution supporting the homogeneity of the scale. The Chronbach’s alpha score of the total scale was within the proposed criterion for positive ratings, which also indicated that the scale was internally consistent.

In correspondence with previous findings, the probability of high stress scores was associated with female gender (Jönsson and Öjehagen, 2006), emerging adulthood (Richwood and d’Espaignet, 1996), and living outside a serious relationship (Due et al., 1999). These findings confirmed the construct validity of the scale.

Stress and university setting was associated with dropout from university studies

Both high stress and entrance to the northern university had an impact on dropout from university studies during the first 12 months. The influence of stress was found at both universities, and did not interact with dropout related to studies at the northern university. The results for stress correspond to findings suggesting a relationship between transitional stress and dropout from university studies (McMichael and Hetzel, 1975; Dyson and Renk, 2006; Murai and Nakayama, 2008).

When controlling for stress, no association was found between dropout and symptoms of anxiety and depression. However, these symptoms might contribute to dropout rates in later stages of educational programmes. It is well known that dropout rates differ between different institutions of higher education (HSV, 2003). In this study, the northern location of the intervention university probably caused additional transitional difficulties specific to freshmen entering the intervention university, which influenced the higher dropout rates there.

This study found no association between hazardous alcohol use and first year dropout, which has been found in some previous studies (Aertgeerts and Buntinx, 2002; Martinez et al., 2008). However, there are important differences between the present and previous studies, the most important one being that previous studies did not control stress.

The effects of interventions for hazardous alcohol use and high levels of stress

All interventions were part of an introduction to a total package of alcohol and stress interventions, aiming to evaluate improvement of alcohol habits and stress patterns at an intervention university in comparison with a control university.

Primary interventions

After one year, there was no reduction in AUDIT scores and stress scores at the intervention university compared to the control university. One aspect to consider is that all students were given written normative feedback known to be effective in reducing hazardous drinking. However, reduction in alcohol expectancies and mental symptoms was higher at the intervention university compared to the control university, which could be secondary effects of the interventions. This result corresponded to a recent review of primary intervention for alcohol misuse in young people, where Foxcroft et al. (2008) concluded that, after more than one

year, only 12 studies showed partly effective results, while 19 studies found no evidence of intervention effects, even though several previously had reported short-term effects.

Secondary alcohol interventions

The secondary alcohol intervention offered to high-risk freshmen at the intervention university was associated with greater reduction in AUDIT, as well as in alcohol expectancies and estimated blood alcohol concentrations than at the control university. This effectiveness of multi-component interventions in reducing harmful or hazardous alcohol use is consistent with results from US research (Larimer and Cronce, 2007) and one previous Swedish study by Ståhlbrand et al. (2007).

One new finding was that the secondary alcohol interventions were associated with a reduction in stress and mental symptoms in comparison to the high-risk group at the control university. To our knowledge, this kind of outcome has not been presented in previous studies using BASICS or any other method of alcohol intervention in university students. The result probably reflects an intervention effect since alcohol can cause signs and symptoms of depression and anxiety (Anthenelli and Schuckit, 1992). Furthermore, improvement might be related to reduction of alcohol-related problems associated with levels of stress and depression (Camatta and Nagoshi, 1995).

Secondary stress interventions

Stress reduction was considerable in both the intervention and control group (*Table 9*, $P = 0.000$ in both groups), which possibly could be explained by a short-term increase in stress during transition to university that, for most students, decreased during the first year at university (Fisher and Hood, 1987). However, the secondary stress intervention did not result in reduced stress compared to the control group, which may depend on the stress measurement used in this study, which includes common areas associated with stress, or may be because the intervention had no effect on stress. However, the secondary stress intervention was associated with improved mental health in the intervention group. Anxiety and depression are considered to be a consequence of chronic or frequently occurring stress (Everly and Lating, 2002). This is an important finding since 12-month evaluations on stress interventions have not previously been performed (Shapiro et al., 2000).

The secondary stress intervention programme reduced alcohol expectancies more than at the control university, but not AUDIT scores and estimated blood alcohol

concentrations. This is an important finding as few previous articles report results in alcohol-related variables of a stress intervention programme (Rohsenow et al., 1985; Murphy et al., 1986). According to Ham and Hope (2003), people often drink to cope with stress and negative effects, and both positive alcohol expectancies as well as mood enhancement and/or tension reduction motives have been associated with heavy drinking in university students. Consequently, interventions may reduce their expectancies of alcohol offering alternative strategies for coping with stress. This result corresponds to those of Geisner et al. (2007), who reported no major effects on drinking or related problems but reductions in perception of drinking norms compared to a control group in a brief intervention sent by post for alcohol use as an adjunct to a brief treatment for college students with depression symptoms. Reduced alcohol expectancies are an important effect after 12 months compared to previous stress interventions, which have only brought short-term benefits (Rohsenow et al., 1985; Murphy et al., 1986).

GENERAL CONCLUSIONS

This study reveals a high level of alcohol involvement in Swedish university freshmen. Half of all university freshmen score above traditional cut-off levels for harmful or hazardous alcohol use. Factors associated with hazardous or harmful use were emerging adulthood (18-25 years), male gender, family history of alcohol problems, and not being in a serious relationship.

The Arnetz and Hasson Stress Questionnaire was easy to use and offers sufficient internal consistency and construct validity. The questionnaire still has limitations, the most important being that different levels of scores has not yet been validated, and that results, even if statistically significant, cannot be translated to a clinical application.

Dropout from university studies during the freshmen year was associated with high levels of stress but not alcohol use. It was also associated with starting at the northern university. The stress associated with the start of university studies should be addressed.

In this study, primary alcohol and stress interventions were effective in reducing both alcohol- and stress-related variables after one year. Secondary stress interventions were effective in reducing mental symptoms and alcohol expectancies. Secondary alcohol interventions were effective in reducing AUDIT scores, alcohol expectancies, estimated blood alcohol concentrations, as well as stress and mental symptoms.

FUTURE RESEARCH

The secondary intervention programmes, including normative feedback at the intervention university, were more effective than the normative feedbacks given to freshmen at the control university. However, the outcome did not differ between individuals participating in the in-person secondary intervention groups and those receiving a written booklet of the programme. A future research area is further development of booklets, which may offer possibilities to give interventions to students not reached by alternative methods.

It was found that stress was an important factor contributing to dropout from university studies during the freshman year. It would therefore be valuable to develop and evaluate an introduction programme aimed at reducing stress during transition to university.

This study resulted in new questions on the association between alcohol and stress. It is unclear why the secondary alcohol interventions resulted in secondary effects in both stress and mental symptoms in comparison to the control group, while the stress programme did not reduce stress but did impact mental symptoms and alcohol expectancies. Different mechanisms are probably influential in subjects with high AUDIT scores and high stress scores. Mediators could be drinking consequences, alcohol expectancies, drinking motives, coping style and personality (Ham and Hope, 2003), factors that are not in detail investigated in this study.

Although it was not analysed in this thesis, the present study includes data on two additional assessments of alcohol and stress over the next two years. That will permit further investigations of whether effects of primary and secondary interventions continue during subsequent years, as well as whether the development of alcohol involvement and mental health contributes to dropout from university studies during later stages of university education. Schulenberg et al. (1996) identified different drinking trajectories during the university years and found large variations in how alcohol use developed in different individuals over time. However, since this relationship probably is influenced by stress (Perkins, 1999), it would be interesting to perform a similar trajectory analysis both for alcohol consumption and stress. To my knowledge there is no previous study investigating the association between alcohol and stress by using trajectory analysis.

Use of mobile telephones is widespread amongst university students. Therefore new technologies such as Interactive Voice Response (IVR), where a central computer is used to perform automated telephone interviews, could make it

possible to learn more detailed information about the interaction between stress and alcohol in daily life.

The special feature about stress is that stress is a natural part of daily life and the clinical significance in terms of negative health consequences only occurs if high levels of stress continue over a long period of time. It would therefore be valuable to use this short stress questionnaire to assess stress on a daily basis and in relation to health consequences by using the same technology as mentioned above. To perform daily IVR assessments on stress, a short stress questionnaire like the one used in this study is necessary.

CLINICAL IMPLICATIONS

Alcohol use is sometimes referred to as being part of the university culture (Ham and Hope, 2003; Borsari and Carey, 2006). In this study, about half of the university freshmen scored above the levels traditionally referred to as hazardous use with intervention recommended in the general population. Certainly many freshmen will modify their drinking behaviour naturally. However, since hazardous alcohol use at university is associated with both immediate negative consequences (Wechsler, 2002; Bullock, 2004), as well as long-term negative consequences (O'Neill et al., 2001), it is important for universities and students to be active in changing the drinking culture.

Like several other studies in university students, we found that most students accept evaluations of their drinking patterns and find interest in receiving feedback on their results (Johnsson and Berglund, 2006; Ståhlbrandt et al., 2007). Therefore, screening and feedback could be recommended. In this study, screening made it possible to identify individuals and groups with hazardous alcohol use and high levels of stress. The cut-off level for secondary interventions was defined by the drinking culture and the level of stress at each university and not on the clinical cut-off defined by the instrument. At universities, such a normative procedure is also reasonable.

When universities decide on intervention methodologies, it is important to use techniques that are validated in research. For instance, Larimer and Cronce (2002; 2007) found that information/knowledge programmes are not effective. Multi-component alcohol intervention programmes, such as the programme used in this study, show promising results (Larimer and Cronce, 2002; 2007). In Sweden, the present programme has proved effective in a previous study by Ståhlbrandt et al (2007) as well as in the present study. Therefore it could be recommended in Swedish universities.

A psychologist at the Student Health Care at Lund University, Arja Bäckström, developed the stress intervention programme used in this study. It had been used in clinical settings and the impression was that students benefited from participation. When the programme was evaluated in this study, secondary interventions reduced mental symptoms and alcohol expectancies. Considering the long-term follow up, this is a promising result compared to previous studies in the area. Therefore it could be recommended in Swedish universities. This also emphasises the importance of evaluating effective interventions that are developed in clinical settings.

A family history of alcohol problems has been shown to be a risk factor for problem drinking and the development of future alcohol problems (Goldman et al., 2005). In this study, this group scored above the traditional AUDIT cut-off level for interventions. Intervention programmes have been developed for adult children of alcoholics at university (Hansson et al., 2006; 2007), and it is important that these can be offered to students.

This study found that high stress levels at university entrance were associated with dropout from university studies. This result emphasises the need to offer programmes to introduce freshmen to university life. It was also found that dropout was associated with entrance to the northern university. This university should evaluate this result and to design specific actions.

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POPULÄRVETENSKAPLIG SAMMANFATTNING (SUMMARY IN SWEDISH)

Alkoholkonsumtionen ökade kraftigt, ca 30%, i Sverige under senare delen av 1990-talet. Hög konsumtion av alkohol är kopplat till ökad frekvens av skador, en ökad risk för ohälsa och utveckling av alkoholberoende. Under samma period mer än fördubblades antalet studenter vid svenska universitet och högskolor och i början av 2000-talet påbörjade närmare hälften av alla unga vuxna en högre utbildning innan 25 års ålder. Denna period i livet är den tid då alkoholkonsumtionen traditionellt är som högst.

Genom den ökade alkoholkonsumtionen i samhället och att allt fler studenter börjar högre utbildning, ökade universitetens betydelse som en alkoholpreventiv arena. Ungefär samtidigt hade riskfyllda konsumtionsvanor uppmärksammats hos studenter vid amerikanska universitet och forskningsstudier hade visat att det finns en möjlighet att påverka riskfyllda alkoholvanor hos studenter.

Att påbörja en universitets- eller högskoleutbildning innebär en möjlighet till personlig utveckling, men också en källa till stress. Det finns ett väl etablerat samband mellan alkohol och stress och i samband med studiestarten upplever många en ökad stress och en ökad konsumtion av alkohol.

Det övergripande syftet med den aktuella studien var att reducera riskfyllda alkoholvanor och hög stressnivå hos nyantagna programstudenter genom att introducera och utvärdera förebyggande program på ett interventionsuniversitet (Luleå tekniska universitet). Effekten av insatserna jämfördes med utvecklingen i motsvarande grupp studenter vid ett kontrolluniversitet (Växjö universitet). Samtliga studenter som påbörjade ett utbildningsprogram i Luleå och Växjö höstterminen 2002 inbjöds att medverka i forskningsstudien. En enkät, som innehöll frågor om alkoholvanor, stress och psykiskt mående, besvarades av 2.032 studenter (72 % av samtliga) i samband med introduktionen.

Alla nya studenter i Luleå inbjöds dessutom att ta del av ett förebyggande program för alkohol (1 x 1 timme) och ett förebyggande program för stress (1 x 1 timme). Under höstterminen inbjöds också de 25 % i Luleå som hade mest riskfyllda alkoholvanor till ett fördjupande alkoholprogram (2 x 2 timmar). På samma sätt inbjöds de med högst stress att medverka i ett stressprogram (2 x 2 timmar). I Luleå introducerades även en utbildning för ansvarsfylld alkoholserving och ett program för studenter med erfarenhet av att växa upp som anhörig till föräldrar med alkoholproblem, vilka inte utvärderats i denna studie.

Avhandlingen består av fyra delarbeten.

I det första arbetet undersöktes alkoholvanorna hos studenterna vid båda universiteten. Det konstaterades att ungefär hälften, både män och kvinnor, hade riskfyllda alkoholvanor. Yngre studenter (under 26 år) hade riskfyllda alkoholvanor i högre utsträckning än äldre studenter. Vidare kunde ett samband visas mellan riskfyllda alkoholvanor och att växa upp med föräldrar och syskon med alkoholproblem och mellan riskfyllda alkoholvanor och att inte leva i en fast relation.

I det andra delarbetet utvärderas det instrument som använts för att mäta stress hos studenterna. Reliabilitet är ett mått på ett tests precision och beräknades med Cronbachs alpha, som visar hur väl frågorna i testet förklarar ett överordnat begrepp, i detta fall stress. Alpha anges som ett tal mellan 0 och 1, och för stressskalan låg alpha på 0.79, vilket innebär att testets egenskaper var tillfredsställande. Därefter undersöktes de faktorer som hade ett samband med hög stress på testet, där hög stress definierades som att tillhöra de 25 % av studenterna med högst poäng på skalan. Det framkom att psykiska symptom, att inte leva i en fast relation, samt att vara kvinna, var för sig hade ett samband med hög stress. Dessa faktorer har även tidigare visat samband med hög stress, vilket stärker testets tillförlitlighet.

Ett år efter att studien påbörjats hade ett betydande antal studenter avbrutit utbildningen och fler avbröt utbildningen i Luleå än i Växjö. I det tredje arbetet undersöktes vilka faktorer som hade ett samband med avbruten universitetsutbildning. Det visade sig att stress vid båda universiteten och studier vid Luleå tekniska universitet oberoende av varandra hade ett samband med studieavbrott. Däremot hade inte symptom på ångest och depression eller riskfyllda alkoholvanor något samband med studieavbrott.

I det fjärde delarbetet följdes resultaten av preventionsinsatserna upp hos samtliga studenter som var kvar på universiteten. Det visade sig att interventionerna i Luleå hade varit framgångsrika på flera olika sätt. Den totala populationen i Luleå hade minskat sina förväntningar på alkohol och symptom på depression och ångest jämfört med studenterna i Växjö. Studenter med initialt riskfyllda alkoholvanor, som bjudits in till ett fördjupande alkoholprogram, hade minskat sina riskfyllda alkoholvanor mer än studenter med initialt riskfyllda alkoholvanor vid kontrolluniversitetet. Samma minskning återfanns även på de övriga instrumenten (positiva förväntningar på alkohol, självrapporterad blodpromillekoncentration, stress och symptom på ångest/depression). Studenterna med initialt hög stressnivå, som inbjudits att medverka i ett fördjupande stressprogram, hade minskat sina förväntningar på alkohol och

symptom på ångest och depression men inte på stress, i jämförelse med studenter med initialt hög stressnivå vid kontrolluniversitetet.

Detta är en stor studie, som visar att riskfylld alkoholkonsumtion är vanligt hos studenter vid två svenska universitet och att många studenter som avbryter sin utbildning upplever stress. Studien är betydelsefull, då den visar att det är möjligt att minska riskfyllda alkoholvanor hos studenter genom att använda det förebyggande program som använts i forskningsstudien. Studien visar också effekter på ett stressinterventionsprogram för studenter, vilket få tidigare studier har gjort.

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