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Effectiveness of school-based alcohol preventive interventions for adolescents

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A dissertation for the degree of Philosophiae Doctor – 2015



[wait]



Foto forside: Colourbox

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Summary

Early onset of alcohol consumption and early drunkenness, in particular, represent a risk factor for adolescents. Policy-makers and school professionals prioritize preventive alcohol interventions in schools. At the same time, the effectiveness of such interventions has been questioned. The major aim of this dissertation was to evaluate the effectiveness of school-based alcohol preventive programs for adolescents. A key to preventing alcohol use is to explore factors associated with early drinking behavior. The first study examined risk and protective factors associated with early onset of drinking, both of which are important when planning prevention efforts in addition to investigate the prevalence of early drinking and identifying determinants predicting early drinking onset among adolescents. The second study, based on a quasi-experimental design including a comparison group, with a pre-test, post-test and one-year follow-up, attempted to evaluate the effectiveness of the intervention, “Unge & Rus” [Youth & Alcohol]. This intervention is aimed at postponing alcohol debut, with a focus on adolescents’ attitudes and behavior in relation to alcohol use. The baseline sample consisted of 41 junior high schools, including students ($N = 1,574$), parents ($N = 1,166$) and teachers ($N = 105$). The intervention was evaluated according to its own goals as defined by the program owner, Knowledge Center for Drugs in North (KoRus). With the exception of increased alcohol-related knowledge among students in the intervention group, as compared to those of the control group, the results showed no significant differences in measured outcomes between the intervention and control groups at one-year follow-up. Finally, in the third study, a meta-analysis was conducted in order to estimate the general effectiveness of universal school-based interventions in preventing alcohol consumption. A total of 28 studies with high-quality designs were included in the analysis. Results varied significantly and showed small effects on adolescent alcohol consumption.

List of papers

- I. Adolfsen, F., **Strøm, H. K.**, Martinussen M., Natvig, H., Eisemann, M., Handegård, B. H., & Kuposov, R. (2014). Early drinking onset: a study of prevalence and determinants among 13-years old adolescents in Norway. *Scandinavian Journal of Psychology*, *55*, 505-512. doi: 10.1111/sjop.12151.

- II. **Strøm, H. K.**, Adolfsen, F., Handegård, B. H., Natvig, H., Eisemann, M., Martinussen, M., & Kuposov, R. A. (2014). Preventing alcohol use with a universal school-based intervention: results from an effectiveness study. *Submitted*.

- III. **Strøm, H. K.**, Adolfsen, F., Fossum, S., Kaiser, S., & Martinussen, M. (2014). Effectiveness of preventive alcohol interventions for adolescents: A meta-analysis of randomized controlled trials. *Substance Abuse Treatment, Prevention, and Policy*, *9*, 1-11, doi: 10.1186/1747-597X-9-48.

Abbreviations

AEQ-A: Alcohol Expectancy Questionnaire for Adolescents

AOE: Alcohol Outcome Expectancy

APA: American Psychological Association

EMCDDA: European Monitor Centre for Drugs and Drug Addiction

ESPAD: European School Survey Project on Alcohol and Other Drugs

HBSC: Health Behavior in School-Aged Children

HRS: Highly role-specified

KoRus: Knowledge Center for Drugs

LRS: Less role-specified

NOVA: Norwegian Social Research Institute

NCLB: No Child Left Behind Act

PBC: Perceived Behavioral Control

PBL: Problem-Based Learning

TPB: Theory of Planned Behavior

RCT: Randomized Controlled Trials

WHO: World Health Organization

Introduction

Alcohol is by far the most common drug among adolescents in Europe (Hibell et al., 2012). In general, adolescents are at risk for various problems as they navigate through cognitive as well as biological and social changes (Steinberg, 2008). For many, adolescence is additionally a time characterized by the onset and escalation of alcohol use, during which young people perceive alcohol consumption as an accepted behavior (Pavis, Cunningham-Burley, & Amos, 1997). The number of adolescents using alcohol has been decreasing in Europe, but the quantity of alcohol consumed on each drinking occasion has increased (Hibell et al., 2012). It is, therefore, clear that comprehensive prevention programs are needed throughout adolescence.

Prevalence of alcohol consumption among adolescents in Norway

The European School Survey Project on Alcohol and Other Drugs (ESPAD) reported Norwegian adolescents as representing the group with lowest alcohol consumption among 15 and 16-year-olds in Europe. In Norway, about 60% of 15 and 16-year-old students have consumed alcohol at least once during their lifetime. Compared with other European countries, Norwegian students have a relatively low rate of past year's alcohol use (60%) as compared to the European average of 87% (range 56-98%) (Hibell et al., 2012). The ESPAD survey reported that nearly six in ten students had consumed at least one glass of alcohol and 12% had been drunk at the age 13 or younger, with the same rate in almost all countries. The Norwegian Social Research Institute (NOVA) conducts annual school-based cross-surveys of Norwegian adolescents between 13 and 16 years of age, called Ungdata. Their latest report showed that 14% of junior high school students ($N = 63,201$) had been drunk during the last year. The amount of students reporting drunkenness in 8th grade was 3%, and increased to 25% by 10th grade (NOVA, 2014). Ungdata additionally reported that more adolescents from

rural districts and small communities have been intoxicated by alcohol. The prevalence of alcohol consumption has been found to be significantly higher among ethnic Norwegian adolescents than it is among immigrant adolescents from the Middle East, Asia and Africa (Abebe, Hafstad, Brunborg, Kumar, & Lien, 2014).

The gender differences are generally found to be small. In the ESPAD survey conducted in 2011, the data for Norwegian adolescents in 10th grade showed that 36% of girls and 33% of boys had consumed alcoholic beverages during the past 30 days. The same rates were found in the Ungdata, with 23% of boys and 28% of girls in the 10th grade reporting drunkenness. The North Trøndelag Health Study, the Young-HUNT study (including 9,141 adolescents aged 13-19, with a 90% response rate), showed that gender differences were generally small. However, for the age group 13-15 years old, boys were more largely represented in a high alcohol consumption group (defined by 3 or more units per 14 days) than girls (boys 11% vs. girls 7%) (Strandheim, Holmen, Coombes, & Bentzen, 2009). Additionally, a Norwegian study including 3,500 young adolescents between 12 and 18 years of age revealed that 25% had been drinking alcohol at the age of 13, but that early alcohol debut was a male phenomenon (Hellandsjø Bu, Watten, Foxcroft, Ingebrigtsen, & Relling, 2002). The same study also reported that, among those who had consumed alcohol before the age of 14 ($N = 816$), 50% had been intoxicated (Hellandsjø Bu et al., 2002).

Risk and protective factors for early onset of alcohol drinking

Risk factors include elements that increase the risk of negative development, whereas protective factors include elements that facilitate positive development. The US National Research Council and Institute of Medicine (2009) defined a risk factor as “a characteristic at the biological, psychological, family, or community or cultural level that precedes and is

associated with a higher likelihood of problem outcomes”. Many studies have reported associations between early alcohol debut and alcohol dependence with related problems later in life (Belcher & Shinitzky, 1998; Flory, Lynam, Milich, Leukefeld, & Clayton, 2004; Hingson, Heeren, & Winter, 2006; Maggs, Patrick, & Feinstein, 2008; Pitkanen, Lyyra, & Pulkkinen, 2005; Zeigler et al., 2005). The age of first alcohol use has been found to be highly predictive of high alcohol consumption and problem drinking in adulthood (Bonomo, Bowes, Coffey, Carlin, & Patton, 2004; Pedersen & Aas, 1995; Pedersen & Skrondal, 1998; Pitkanen et al., 2005). Associations between early onset of drinking and development of alcohol dependence later in life have been observed after controlling for genetic factors (Hingson & White, 2014). Those who experience the onset of alcohol consumption before the age of 13 are also more likely to experience frequent intoxication (Hingson et al., 2006). A recent finding by Kuntsche and colleagues (2013), from the Health Behavior in School-aged Children (HBSC) cross-national survey among 45,000 adolescents from 38 different countries, was that it is not early onset of drinking but early drunkenness that represents a risk factor in association with problem behavior such as smoking, use of cannabis, injury, fighting and poor school performance. Longitudinal studies have also shown that adolescent alcohol consumption is a major risk factor for future drug use (Boden, Fergusson, & Horwood, 2006). Adolescent cigarette smoking has been found to be a strong predictor for early alcohol use (Torabi, Bailey, & Majd-Jabbari, 1993). In addition, early-onset marijuana users have more frequently been found to experience early onset of alcohol use (Flory et al., 2004). Evidence suggests that there are several other risk factors associated with alcohol abuse by adolescents (Newbury-Birch et al., 2009). Early-onset drinking increases the risk of being involved in unintentional injury after drinking (Hingson & Zha, 2009). Young people who drink alcohol are more likely to be both perpetrators and victims of violence (Newburn & Shiner, 2001).

Early drinkers are also more likely to report unprotected sex and teenage pregnancy (Luster & Small, 1994; Stueve & O'Donnell, 2005).

Several risk factors for early alcohol consumption can be explained by individual and social factors. The literature is unclear as to whether early alcohol drinking leads to harmful consequences, per se, or if early drinking is more likely to occur in adolescents who are at risk due to other personal, familial or social factors (Newbury-Birch et al., 2009; Rossow, 2006). Studies on poor mental health as a risk factor for early onset of alcohol consumption show mixed results. A 21-year longitudinal study of a birth cohort in New Zealand found a significantly increased risk of later alcohol abuse and alcohol dependence among 14 and 16-year-old adolescents with depression (Fergusson & Woodward, 2002). On the other hand, adolescents participating in a national survey of mental health and well-being in Australia did not appear to be at increased risk for early alcohol use (Sawyer et al., 2001).

Factors identified as predicting early onset of alcohol consumption are sensation seeking, high positive alcohol expectancies, poor self-image, poor school performance and under- or over-controlling parents (Belcher & Shinitzky, 1998; Flory et al., 2004). Peers' alcohol use emerged as a strong predictor of adolescent use and abuse of alcohol (Hawkins et al., 1997). Peer group affiliation may lower the cueing for early alcohol use or act as a way a modeling for non-use (Skidmore, Juhasz, & Zucker, 2011). Research shows that young adolescents have very low resistance to peer influence when it comes to drinking alcohol (Kelly et al., 2012; Pavis et al., 1997), which is more so among girls than it is among boys (Callas, Flynn, & Worden, 2004; Kumpfer, Smith, & Summerhays, 2008). A Danish study further showed that peer groups constitute the predominant context for teenage drinking (Jørgensen, Curtis, Christensen, & Grønbaek, 2007). Findings from a longitudinal study conducted in the United

States showed that easy household access to alcohol was associated with more frequent alcohol use (Resnick et al., 1997). Determinants found for early alcohol debut among Norwegian adolescents include frequency of friends' and father's drinking behavior, single parent family and low family support (Hellandsjø Bu et al., 2002).

Protective factors may be defined as “a characteristics at the biological, psychological, family, or community (including peers and culture) level that are associated with a lower likelihood of problem outcomes or that reduce the negative impact of a risk factor on problem outcomes” (National Research Council and Institute of Medicine, 2009). Positive self-esteem, self-concept, behavioral control, assertiveness, social competence and academic achievement are found to promote resistance to alcohol and drug use (Belcher & Shinitzky, 1998; Wills, Vaccaro, & McNamara, 1992). Supportive and responsible parenting is also regarded as a protective factor for later initiation of alcohol consumption (Koopmans, van Doornen, & Boomsma, 1997; Skidmore et al., 2011). The fostering of school connectedness has been found to be a strong protective factor against alcohol use (Centers for Disease Control and Prevention, 2009). A high level of connectedness to family members and school is associated with less frequent alcohol use (Resnick et al., 1997). Research has also shown that positive parent-child relationships during the child's adolescent years are a protective factor against greater quantity of consumption and harmful drinking (Maggs et al., 2008), along with religious affiliation or high levels of importance placed on religion (Newbury-Birch et al., 2009; Resnick et al., 1997). Baer (2002) found that students who were more religious, and more committed to traditional values, drink less than students with no religious affiliations. Alcohol is forbidden in many Islamic countries, and recent research shows that Muslims in Norway have a significantly lower risk of binge drinking ($OR = 0.34$, 95% CI 0.23-0.52) as compared to ethnic Norwegian adolescents (Abebe et al., 2014). A Norwegian study

exploring the ethno-cultural factors on substance use among indigenous Sami found that stronger ethnic identity contributed to less substance use among adolescents aged 15-19 years (Spein, Sexton, & Kvernmo, 2007). Studies on alcohol use among adolescents participating in organized sports activities have shown differential findings. One Norwegian study found that participation in organized sports represents an important factor in delaying alcohol debut (Hellandsjø Bu et al., 2002). Another Norwegian study reported that those adolescents who participated in organized sports and team sports had a greater increase in alcohol intoxication than those who did not participate in any sport (Wichstrøm & Wichstrøm, 2009).

Alcohol prevention

Prevention science seeks to prevent psychological and physical ailment and to promote overall health and well-being through the application of evidence-based practices on both the individual and systemic levels (Romano, 2015). The purpose of alcohol prevention is to intervene early enough to prevent alcohol-related problems. Due to the fact that alcohol consumption tends to begin during the teen years, the development of effective interventions is regarded as the first important step towards health improvement. The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) classifies prevention strategies by categorizing the known level of vulnerability for developing alcohol use problems rather than distinguishing whether or not people are actually using alcohol or to what degree (The European Monitoring Centre for Drugs and Drug Addiction, 2014). This classification of prevention strategies was developed by Mrazek and Haggerty (1994). They identified three complementary categories of prevention: universal prevention, selective prevention and indicated prevention.

Universal prevention refers to preventive interventions that offer value to an entire group or population (e.g., school, local community), whereby each member is considered to benefit from the program regardless of differing vulnerabilities. The aim of a universal alcohol prevention is usually to deter or delay the onset of drinking or to reduce alcohol consumption by providing all individuals with the necessary information and skills to prevent alcohol use (Foxcroft & Tsertsvadze, 2011).

Selective interventions targets high-risk groups whose danger of developing problematic alcohol use is above average. Selective prevention could take the form of an after-school program for adolescents with known risk factors. Indicated preventions target individuals who display early signs of alcohol and drug use, and they aim to specifically address such individuals with appropriate interventions (Barry & Jenkins, 2007). Evidence emerging from a meta-analysis of prevention program evaluations suggests that selective and indicated interventions are modestly more effective in reducing alcohol use than universal programs and that they also yield greater cost-benefit ratios (Shamblen & Derzon, 2009). Indicated and selective programs are additionally found to be most appropriate when targeting older adolescents with a variety of risky behaviors in addition to alcohol abuse (Botvin & Griffin, 2007).

Interventions that focus on lowering consumption among the entire population reduce alcohol-related harm to a greater extent than those that merely target individuals with high consumption levels and alcohol-related problems (Saunders, Anderson, & Rey, 2011). This refers to the preventive paradox (Kreitman, 1986), which states that the majority of alcohol-related injuries occurs not in the heaviest drinkers but in those whose consumption is at lower levels. The argument for preventive strategies aimed at entire populations is that there are

more people with a lower level of alcohol consumption, suggesting that universal programs are also effective for high-risk adolescents who are nested within the general population (Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003; Griffin, Botvin, Nichols, & Doyle, 2003). Empirical support for the prevention paradox has been found in a study with samples from Norway and Sweden, showing that the majority of acute alcohol problems were among the low-risk drinkers who represented 90% of the sample (Rossow & Romelsjö, 2006).

Universal prevention of alcohol consumption among adolescents includes a variety of strategies. It has been suggested that the most effective strategies in reducing alcohol consumption and alcohol-related harm at the societal level are those that involve structural changes; i.e., by controlling the price and availability of alcohol (Babor et al., 2010; Rossow, Storvoll, Baklien, & Pape, 2011). Furthermore, at the community level, alcohol policy plans support inspection of grocery stores in relation to opening hours and the legal purchasing age (Stafstrom & Ostergren, 2008). The Norwegian authorities have set an age limit of 18 years old for purchasing, serving or distributing alcohol up to 22 volume percentage.

The most common prevention initiatives to address under-age drinking in European countries involve school-based approaches (Anderson & Baumberg, 2006). Schools are considered appropriate arenas for implementing universal prevention programs for several reasons: most individuals begin using alcohol during their school years; school programs reach almost all young people; and schools can implement a broad range of educational and disciplinary policies (Rey & Saltz, 2011). Delaying the onset of alcohol consumption may reduce the risk of harmful drinking for a young person. Interventions should, therefore, focus on preventive measures that are based on identifiable factors associated with early alcohol drinking and, above all, adolescent drunkenness with its obvious potential for harm. It has also been

suggested that alcohol prevention programs should include elements that provide information on the adverse effects of alcohol on the human body, as such elements have been found to delay alcohol debut (Hellandsjø Bu et al., 2002). A Norwegian study following a sample population over a period of six years found that the age of alcohol debut had an effect on future alcohol consumption and estimated that, if adolescents have a 10% delay in their alcohol debut, it could lead to a 35% decrease in subsequent expected alcohol consumption (Pedersen & Skrondal, 1998). Additionally, a systematic review ($K = 6$) found that long-term primary school-based alcohol prevention programs, utilizing comprehensive program content, resulted in a mean reduction of 12 days' alcohol use per month among adolescents (aged 10-15) with risk behavior (Lemstra et al., 2010). The interventions found to be most effective are those that target both risk and protective factors at the individual, family and community levels, while also having a design that falls within the framework of relevant psychosocial theories regarding alcohol use (Griffin & Botvin, 2010; Hawkins, Catalano, & Miller, 1992; Petraitis, Flay, & Miller, 1995).

Implications for alcohol prevention

Prevention programs that are well-designed and carefully implemented can be effective in preventing problems that adolescents face (e.g., alcohol use). Research findings support the use of harm reduction goals and classroom approaches in school-based interventions (McBride, Farrington, Midford, Meuleners, & Phillips, 2004). Educational programs should, therefore, provide information on the risk of alcohol use, the availability and effectiveness of advice and treatment in reducing harmful alcohol use, and evidence for effective alcohol policies (WHO, 2011).

Implementation of preventive interventions is generally not mandatory and may differ in both purpose and methods used. Hence, nine different principles for effective prevention programs have been identified using a review-of-reviews approach gleaned from interventions found to be effective (Nation et al., 2003). The principles identified are as follows:

1) Comprehensive school-based programs that include parents while also addressing the risk and protective factors (Hawkins et al., 1992). Research has indicated that the most effective universal prevention programs for reducing alcohol use among adolescents are comprehensive-based programs including anti-drug information, refusal skills, perceived behavioral control (PBC) and social skills training, in addition to involving parents and strengthening school connectedness (Lemstra et al., 2010; Tobler et al., 2000).

2) Programs that encompass various teaching methods. Successful substance abuse prevention programs are characterized by interactive processes. Program process matters more than the content or type of program. Programs engaging students and their environmental context are most likely to produce changes. Interactive programs that actively involve students (e.g., by using structured activities such as role-play) are found to be more effective than programs with a non-interactive approach (e.g., lectures) (Faggiano et al., 2005; Tobler et al., 2000). Findings regarding the effectiveness of peer-led education are mixed (Canning, Millward, Raj, & Warm, 2004). Evidence suggests that a peer-led intervention only increases effectiveness of programs that are already successful and that it is primarily the student delivering the intervention who tends to benefit most (Sumnall et al., 2006). However, a systematic review of school-based programs concluded that, overall, peer leaders were more effective than adult leaders (Mellanby, Rees, & Tripp, 2000).

3) The program dosage provided needs to be sufficient. Students need to be exposed to a sufficient dose of the intervention for it to have an effect. Program intensity may be measured

as the number of sessions or the duration of the total program (Nation et al., 2003). Previous research suggests that school-based prevention programs have a greater chance of long-term success if adolescents are exposed to some type of post-delivery of the program, such as booster sessions (Skara & Sussman, 2003). Meta-analytic results show that programs containing booster sessions are more likely to obtain effects (White & Pitts, 1998). However, few studies have provided a direct test of the effect of adding booster programs within an experimental or quasi-experimental design (Cuijpers, 2002).

4) The program should also be appropriately timed. For an intervention to have the best possible effect, the implementation should be properly timed in relation to the scope of the adolescent's life such that it will have maximum impact (Nation et al., 2003). When the aim is to prevent alcohol use, programs targeting adolescents in junior high school are found to be slightly more effective than those targeting adolescents at the elementary and high school levels (Gottfredson & Wilson, 2003).

5) It has been suggested that preventive programs should be culturally relevant (Nation et al., 2003). The relevance of a program, including cultural norms and beliefs, appears to be a primary concern in achieving positive outcomes.

6) A program should provide opportunities for positive relationships. The connection between students and their peers and parents has been emphasized as significant in preventing alcohol and drug use (National Institute for Health and Clinical Excellence, 2007). Research has demonstrated that social influence, including parents, family, peers, society and culture, is foremost among the causes attributed to alcohol use during adolescence (Baer, 2002; Borsari & Carey, 2001; Hawkins et al., 1992).

7) It is important to have well-trained staff. The implementation of preventive programs is enhanced when those who deliver the program, such as teachers, have received sufficient training, support and supervision (Dusenbury, Brannigan, Falco, & Hansen, 2003).

8) Outcome evaluations must be conducted to determine a program's effectiveness. The Society for Prevention Research has defined standards of evidence that require conduction of at least two evaluation trials of a program. The first evaluation has to test and prove the efficacy of a program under optimal conditions. The second evaluation has to test and prove the effectiveness under "real-world" conditions – before the program is tested and proven ready for dissemination (Flay et al., 2005).

9) The program should be theory-driven. For an intervention to be effective, it must take into account factors that determine human behavior. The causal mechanism should be stated by a clear theory (Flay et al., 2005). Furthermore, preventive alcohol programs need to have a scientific justification. Preventive programs based on empirically-tested theories have more often been shown to yield the desired behavioral changes that lead to prevention (Jané-Llopis & Barry, 2005; Nation et al., 2003).

Theoretical framework

The Theory of Planned Behavior (TPB) was designed to predict and explain human behavior in a specific context, such as adolescent alcohol drinking (see Figure 1). According to the TPB, alcohol use among adolescents is predicted by the intention to use alcohol, which, in turn, is predicted by attitudes towards alcohol, subjective norms related to alcohol, and perceived behavioral control (Fishbein & Ajzen, 2010). Intention may be defined as the instructions people give themselves to perform particular behaviors or to achieve certain goals (Sheeran, Milne, Webb, & Gollwitzer, 2005). Intention is an indication of the person's motivation and readiness to perform a behavior. Fishbein and Ajzen (2010) define attitude as "a latent disposition to respond with some degree of favorableness or unfavorableness to a psychological object". Alcohol-related attitudes among adolescents are a measure of how they evaluate alcohol use (Conner & Sparks, 2005). When assessing attitudes, the most interesting

one is the attitude a person has about carrying out his or her own actions (e.g., alcohol drinking). Subjective norms and descriptive norms may be considered as indicators of social pressure. Subjective norms are defined by Fishbein and Ajzen (2010) as an “individual’s perception that most people who are important to them think they should (or should not) perform a particular behavior”. Subjective norms refer to what is acceptable or permissible behavior in a group (Fishbein & Ajzen, 2010). Group norms have been operationalized as what members of a group think or perceive should be done (Conner & Sparks, 2005). Perceived Behavioral Control (PBC) represents the overall control an individual perceives him-/herself to have over the performance of his/her behavior (Conner & Sparks, 2005). PBC is defined by Fishbein and Ajzen (2010) as “the extent to which people believe that they are capable of performing a given behavior or attaining a certain goal”. The construct self-efficacy and PBC are treated synonymously and, according to Ajzen (1991), quite similar. Bandura defined self-efficacy as “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives” (Bandura, 1977a). A recent meta-analysis provides support for the utility of the TPB when applied to alcohol consumption among students aged 18-25 years old (Cooke, Dahdah, Norman, & French, 2014). Cooke and colleagues (2014) found that intentions had a large-sized relationship to alcohol consumption ($r = .54$), while self-efficacy had a medium-sized relationship to alcohol consumption ($r = .41$). In contrast, they found a negative relationship between PBC and alcohol consumption ($r = -.05$).

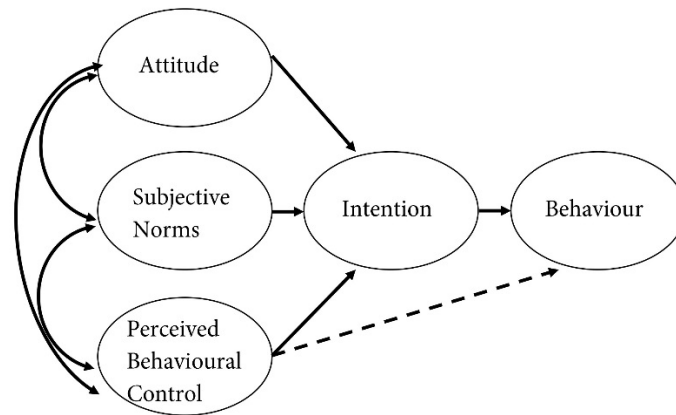


Figure 1. Theory of Planned Behavior (Fishbein & Ajzen, 2010).

The predictive validity of the TPB has also been empirically supported when applied to alcohol use among adolescents (Collins & Carey, 2007; Johnston & White, 2003; Kam, Matsunaga, Hecht, & Ndiaye, 2009; Marcoux & Shope, 1997; McMillan & Conner, 2003). For instance, Collins & Carey (2007) found that self-efficacy and attitudes, rather than subjective norms, significantly predicted the intention to drink and that intention predicted future drinking behavior among college students. Johnston and White (2003) tested the theory in predicting binge drinking among undergraduate students, also findings in support of the theory. Interventions that aim to prevent and reduce alcohol consumption among adolescents should, therefore, target attitudes, subjective norms and self-efficacy as a means to influencing intentions with the ultimate goal of reducing alcohol consumption (Cooke et al., 2014). However, criticism of the TPB theory has also been raised primarily in relation to its validity and to the lack of explanation for variability in behavior (Sniehotta, Presseau, & Araújo-Soares, 2013).

Social Learning Theory assumes that behavior is learned before it is performed and that learning is principally influenced by modeling through informative functions (Bandura,

1977b). Interventions that address the impact of social influence on drinking, by including drinking refusal skills and drinking moderation strategies, may be beneficial (Larimer & Cronce, 2007). Social Learning Theory posits that adolescents acquire their behavior and beliefs about alcohol from their role models, such as parents and close friends. Research has demonstrated that modeling is predictive of alcohol consumption among adolescents. Furthermore, a meta-analysis based on thirteen studies by Collins and Quigley (1999) found that modeling had a strong effect on alcohol consumption when comparing participants' alcohol consumption while in the presence of high, low or no consumption. Outcome expectancies are beliefs about the consequences of one's actions, which constitutes an important aspect of Social Cognitive Theory (Luszczynska & Schwarzer, 2005).

Alcohol Outcome Expectancy Theory proposes that drinking behavior is governed by expectations of the future positive or negative reinforcement outcomes associated with such behavior (Jones, Corbin, & Fromme, 2001). Positive alcohol expectancies are significant and are positively associated with drinking behavior, whereas the findings for negative alcohol expectancies are contrary (Jones et al., 2001). When it comes to aspects of drinking behavior, alcohol expectancies are found to be more strongly associated with the quantity of alcohol drinking than with the frequency of consumption (Fromme & D'Amico, 2000). Adolescents can develop alcohol expectancies well before they start to drink. Negative alcohol expectancies are usually more often reported among younger children, whereas positive alcohol expectancies increase with age (Miller, Smith, & Goldman, 1990). A longitudinal study conducted in Norway has provided support for the idea that pre-existing alcohol expectancies may be associated with subsequent alcohol use (Aas, Leigh, Anderssen, & Jakobsen, 1998). Consistent with social learning models, expectancies can be learned through direct and indirect experience from peers and through the media (Bandura, 1977a). Alcohol

outcome expectancies are significant predictors of adolescent alcohol use. Christiansen, Smith, Roehling, and Goldman (1989) discovered significant correlations at one-year longitudinal prediction of drinking, with findings of $r = .5$ for quantity and frequency of alcohol consumption. Self-reported alcohol use has been found to be significantly and positively associated with positive expectancies and inversely associated with negative expectancies (Brown, Christiansen, & Goldman, 1987; Christiansen & Goldman, 1983; Jones et al., 2001). The WHO has claimed that risky alcohol behavior starts developing at the age of 10 and peaks between 14 to 15 years of age (Currie et al., 2012). Aas (1995) suggested that prevention programs should target alcohol outcome expectancies before adolescents start drinking. Research findings have predicted that adolescents who begin drinking prior to age 13 are 3.16 times more likely to develop problematic alcohol use during their young adult years (King & Chassin, 2007). As the HBSC study showed, the earlier adolescents experience problematic alcohol use like drunkenness, the higher the subsequent level of problem behaviors can be (Kuntsche et al., 2013).

Implementation

Implementation refers to the actuality of putting a program or intervention into practice (Barry & Jenkins, 2007). Implementation is defined as a “specified set of activities designed to put into practice an activity or a program of known dimensions” (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005) and is, thus, a developmental process. Fixsen and colleagues (2005) suggested six discernible stages in the process of implementing evidence-based programs:

1. Exploration and adoption (assessment of the need for a preventive program and support for the program).

2. Program installation (structural support to initiate the program; e.g., funding, policy development, outcome expectations).
3. Initial implementation (integration of new learning, which requires change for further implementation of new practice).
4. Full operation (acceptance of the program as practice).
5. Innovation (learning more about the program itself and the conditions under which it is used with fidelity, thus providing positive effects).
6. Sustainability (long-term survival and continued effectiveness of the program).

Schools have become one of the most important settings for mental health prevention and promotion for young people. As most young people spend a large portion of their time at school, there are few other settings where such large numbers of adolescents may be reached. Schools are one of the primary contexts for providing preventive programs for alcohol and drugs (Rey & Saltz, 2011). However, there is a gap between what is found to be effective in prevention programs when delivered under optimal conditions, and what is done in practice when the programs are being delivered in schools. Studies evaluating intervention under ideal circumstances refer to efficacy trials, whereas studies evaluating a program under “real-world” conditions are labeled as effectiveness studies (Flay, 1986).

Implementation affects the outcomes of prevention programs (Durlak & DuPre, 2008). The quality of implementation is a measure of how well a program is integrated into practice in order to achieve the desired outcomes (Meyers, Durlak, & Wandersman, 2012). Programs with clear and explicit materials are likely to be better implemented (Payne, Gottfredson, & Gottfredson, 2006). The fidelity of the implementation refers to the degree to which teachers provide the program as intended by the program developers (Dusenbury et al., 2003). Fidelity

of implementation has generally been measured by five dimensions: 1) adherence to the program, 2) program dosage, 3) quality of program delivery, 4) responsiveness of the participants, and 5) program differentiation (Dane & Schneider, 1998). Adherence refers to measures of the extent to which implementation of particular activities and methods are consistent with the description provided by program developers. Program dosage reports on how much of the program the school used by number of hours or sessions. The quality of program delivery refers to the standardization in delivery of the program according to the methods and techniques described by the program developer. The responsiveness of the participants is measured in terms of how engaged and involved they are in the activities and content of the program. On the other hand, measures on program differentiation identify the program's uniqueness according to theory and components used, thus identifying the critical elements of effective programs (Dane & Schneider, 1998). In addition to these five dimensions, Durlak and DuPre (2008) suggested three more aspects of program fidelity assurance: 6) monitoring of the control group, 7) program reach, and 8) program modification. Monitoring the control group includes descriptions of the service they receive, e.g., concurrent interventions. The reach of the program refers to representativeness of the participants and the rate of involvement, whereas program modification refers to the changes made in the program during implementation (Durlak & DuPre, 2008). In a study that examined five domains of fidelity regarding school-based substance use prevention (adherence, exposure/dosage, quality of delivery, participant responsiveness and program differentiation), findings showed that adherence and program dosage/exposure constituted the two most important dimensions of fidelity in order to measure whether a program had been implemented as intended. In addition, both dimensions were significantly associated with the quality of delivery (Ennett et al., 2011). These findings were based on a random sample of US

public schools, in which the responding teachers ($N= 342$) provided 1 of 10 evidence-based universal substance use programs during the school year, 2004-05 (Ennett et al., 2011).

The primary methods of measuring implementation are through self-reports and observations (Durlak & DuPre, 2008). Teacher surveys at the end of a program are a common source of information on fidelity (Dusenbury et al., 2003). The fidelity of the implementation process provides a clear account of what was actually done during the delivery of a program. Fidelity of implementation has been associated with improved effectiveness of preventive programs (Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990; Wilhelmsen, Laberg, & Klepp, 1994). In a review of research on the influence of implementation on program outcomes, Durlak and DuPre (2008) found a positive relationship between the level of implementation and half of all program outcomes in 76% of the studies (45 of 59). The same review also presented strong support for the positive relationship between implementation and outcomes. By summarizing the findings from five different meta-analyses, including nearly 500 studies, the review showed that the mean effect size can be two to three times higher among carefully implemented programs (Durlak & DuPre, 2008).

The organizational capacity of a school has a major effect on the implementation quality of a program. Gottfredson and Gottfredson (2002), who investigated the quality of school-based prevention programs at 554 schools in the US, showed that only 61% of the prevention activities were provided on a regular basis and that, overall, there was room for improvement. Although their results indicated the quality of school-based prevention programs was low, they found that the majority of the variability in implementation was more often experienced within one type of program rather than occurring across program types. Nonetheless, their findings also identified factors related to how the quality of implementation may be improved,

including more local planning, expanded professional involvement in deciding which programs should be implemented, increased organizational support for teacher training, and greater standardization of program materials and methods (Gottfredson & Gottfredson, 2002). Schools that have supportive principals and are able to increase organizational capacity, thus allowing for greater integration of the program into normal school activities, can increase the implementation intensity of the preventive intervention (Durlak & DuPre, 2008; Payne et al., 2006).

To improve the practice of prevention programs in American school districts, the US Department of Education introduced a policy with a science-based approach, called `Principles of Effectiveness`, which eventually became known as the No Child Left Behind (NCLB) Act of 2001 ("No Child Left Behind Act ", 2001). The policy included four principles that required schools to: 1) base the preventive programs on data collected through needs assessments, 2) make measurable program goals and objectives, 3) choose evidence-based programs, and 4) evaluate their progress towards those goals and objectives.

The evaluation of the adoption of these principles showed that the majority of programs implemented were modified both by schools and by individual teachers (Hallfors & Godette, 2002). When programs are not implemented as intended, they are less likely to be effective. Adaptability and flexibility of programs are often seen as constituting a lack of implementation (Dusenbury et al., 2003). Furthermore, evaluation studies of these principles have identified such barriers as poor program training, low levels of funding, inadequate infrastructure and decentralized decision-making, all of which contribute to slow progress in the implementation of evidence-based prevention programs in schools (Hallfors & Godette, 2002; Simons-Rudolph et al., 2003). In addition, Botvin (2004) has suggested several other

potential barriers for poor implementation of school-based prevention programs, including limited resources, lack of time, lack of administrative support, lack of technical assistance and poor classroom management (Botvin, 2004). However, the contrary is equally objectionable, when programs are well implemented but nonetheless demonstrate a lack of effect (Elliott, 1997; Kanof, 2003), such as in the case of the most widely used school-based substance abuse prevention program in the U.S., Drug Abuse Resistance Education (DARE).

Evaluation of effectiveness

Evaluation of prevention program effectiveness is of the utmost importance (Belcher & Shinitzky, 1998). Evaluation research informs policymakers about program benefits and possible harmful effects (McCartney & Rosenthal, 2000). Assessment information is important not only for policymakers but also for school professionals and teachers who provide preventive programs in schools and have an interest in whether the changes they have made are making a difference for their students. Even the best theory-based interventions can nevertheless have no effect on adolescent alcohol use (Clark et al., 2010; Ringwalt, Ennett, & Holt, 1991). Preventive programs are most likely to be judged based on evaluation outcomes rather than other characteristics. The reason for this is that most school preventive programs have not undergone rigorous evaluation (Gottfredson & Gottfredson, 2002).

Assessments are often distinguished as either process or outcome evaluations (Gomby & Larson, 1992). The purpose of a process evaluation is to describe how the program was implemented and to examine the fidelity of the intervention. The purpose of an outcome evaluation is to determine whether the provided program led to the desired results. An evaluation process monitors outcomes to determine whether the intervention has any impact in relation to its objectives. An evaluation may be done by collecting evidence through an

assessment process during intervention implementation. Evidence is usually collected by tracking participants over time, after they have received an intervention, and subsequently comparing them with a group of similar individuals who did not receive the intervention. The evaluation determines whether the individuals who received the intervention report smaller rates of alcohol use, for example, than those who did not receive the intervention. In order to prove that the change has occurred among the target population, assessment is necessary to provide evidence that the intervention has been effective in achieving outcomes. Effectiveness refers to the extent to which the intended aim of the preventive initiative is actually reached in practice and to whether the intervention works among a broadly-defined population. Testing the effectiveness of a preventive program on the basis of “real-world” conditions allows for variation in both the implementation and the level of participation. Effectiveness studies that demonstrate a complete lack of change may, therefore, be a result of poor implementation (Glasgow, Lichtenstein, & Marcus, 2003).

Randomized controlled trials (RCT) are considered to be the gold standard in evaluating the effect of preventive interventions (Bonell et al., 2011; Shadish, Cook, & Campbell, 2002). In studies using RCT design, the participants are randomly assigned to either intervention or control conditions. By using an RCT design, the groups of participants are similar at pretest and the measured effects at posttest can be attributed to the implemented intervention. In some cases, it may be difficult to perform an RCT; e.g., in a school context where the intervention is already implemented. Another method that is widely used when the participants are not randomly assigned to conditions is the quasi-experimental design. The quasi-experimental design serves the same purpose as the RCT design, although it creates less compelling support for causal inferences (internal validity) (Shadish et al., 2002). Quasi-experimental design may involve different types of comparison groups, meaning that the

control group may differ from the intervention group and, in order to determine a valid estimate of the intervention effect, possible threats to the internal validity must be ruled out. The possibility of bias and confounding always exists within quasi-experimental studies (Babor et al., 2010). Nevertheless, studies using quasi-experimental designs still have considerable control over the assignment process in addition to the selection and scheduling of measures (Shadish et al., 2002). Many bullying programs, such as the Olweus Bullying Prevention Program, are typically evaluated using a quasi-experimental design, referred to as the longitudinal cohort design, which has been rated as an evidence-based prevention program by the national database for preventive efforts, Ungsinn.no (Drugli & Eng, 2014; Olweus & Limber, 2010).

Evaluation of preventive programs is necessary in order to determine a program's effectiveness, even when an intervention is evidence-based (Nation et al., 2003). The purpose of evidence-based practice is to promote effective practice and enhance public health by applying empirically-supported principles. The American Psychological Association's (APA) presidential task force (2006) defined evidence-based practice in psychology as "the integration of the best available research with clinical expertise in the context of patients' characteristics, culture, and preferences". An evidence-based intervention is a prevention program that has been proven to change the target problem in a positive direction (Barry & Jenkins, 2007). Evidence-based programs consist of common elements like a clear philosophy, a detailed structure and specific outcome components (Fixsen, Blase, Naoom, & Wallace, 2009). Evidence-based programs are usually tested as efficacy trials and subsequently tested through effectiveness studies. The study population for efficacy trials is often selected and includes more homogenous groups with more stringent inclusion criteria. On the contrary, the study population for effectiveness research is more heterogeneous and

the exclusion criteria are limited. Interventions that are evaluated through an efficacy study are more strictly enforced and standardized (e.g., timing, dosage), using experienced and trained program providers. Evaluation of the effectiveness of an intervention is applied with more flexibility and represents more usual program providers (Singal, Higgins, & Waljee, 2014). The estimated prevalence of evidence-based programs under use in US schools from 2005 to 2008 increased from 43% to 47% as a result of the NCLB Act of 2001 (Ringwalt et al., 2011).

Meta-analysis

Meta-analysis is a systematic review that generalizes data from available evidence by compiling and comparing the findings of different research studies (Borenstein, Hedges, Higgins, & Rothstein, 2009). This method applies only to quantitative research studies, reporting descriptive statistics that may be summarized across studies in terms of mean effect sizes. As opposed to narrative reviews, where it may be challenging to synthesize large amounts of data, meta-analysis uses statistical methods to summarize and compare studies included in the review (Borenstein et al., 2009). For both practical and conceptual reasons, findings included in a meta-analysis must result from comparable research designs (Lipsey & Wilson, 2000). In a meta-analysis, each study finding is represented in the form of an effect size, which is pooled across studies. Effect size is a way of quantifying the outcome of a study; e.g., in terms of standardized mean differences, correlations, or odds ratios. This method has considerably more power in evaluating the effectiveness of preventive programs than it does in assessing individual studies (Martinussen, 2010). The meta-analysis presents evaluation results in terms of a mean weighted effect size in addition to providing information about the variation between studies (Martinussen & Kroger, 2013). Significant variation

between studies may be explained by study characteristics, aspects of the samples or other variables that may be further explored in a moderator analysis.

When studies report continuous outcomes in terms of means and standard deviations for the intervention and the control group, respectively, the effect size is usually computed as a standardized mean difference; e.g., Hedges' g (Borenstein et al., 2009). The Hedges' g is computed as: $g = (M_1 - M_2) / SD_{pooled}$ where SD_{pooled} is

$$SD_{pooled} = \sqrt{\frac{(n_1 - 1)SD_1^2 + (n_2 - 1)SD_2^2}{n_1 + n_2 - 2}}$$

For interpretation purposes, Cohen (1988) has suggested that $g = 0.2$ is a small effect, $g = 0.5$ a medium effect and $g = 0.8$ a large effect (Hedges & Olkin, 1985).

When studies report categorical outcomes in terms of rates or proportions for two groups, the effect size is usually calculated as the odds ratio (OR). The OR can be calculated by using a 2×2 table (see Table 1), where the ratio of conditional odds constitutes the $OR = (a \times d) / (b \times c)$. When the value of OR is 1.00, it indicates no difference between groups, for example, in drinking. Whereas an $OR = 1.68$ represents a weak effect, an $OR = 3.47$ refers to a moderate effect and an $OR = 6.71$ demonstrates a strong effect. The OR is a symmetrical index where the inverse of the OR indicates the same strength of the association. The corresponding labels for $OR < 1$ are: $OR = 0.59$ means a weak effect, $OR = 0.29$ is a moderate effect, and $OR = 0.15$ represents a strong effect (Chen, Cohen, & Chen, 2010).

Table 1. Calculation of Odds Ratio

	Do drink	Do not drink
Intervention group	a	b
Control group	c	d

Meta-analysis calculations are generally based on one of two statistical models, either the fixed-effect model or the random-effects model. Under the fixed-effect model, all studies in the analysis share a common true effect which implies that all differences are due to sampling error. Under the random-effect model, it is assumed that the true effects are normally distributed and the effects may vary between studies (Borenstein et al., 2009). The random-effects models are most realistic when performing a meta-analysis that aims to summarize the effects of different interventions conducted in various contexts and with a variety of student samples. Thus, it is reasonable to assume that there are true differences between studies in addition to sampling error. The random-effects model was, therefore, used for the meta-analysis presented in paper 3 in this dissertation. To perform meta-analysis calculations in this study, the software, Comprehensive Meta-Analysis, was used due to its capability of handling a variety of effect sizes and large amounts of data (Borenstein, Hedges, Higgins, & Rothstein, 2005).

“Unge & Rus” [Youth & Alcohol]

The preventive program being evaluated, “Unge & Rus”, targets students in the 8th grade, aged 13-14, but also involves their parents and teachers. The aims of “Unge & Rus”, utilizing cooperation between the school and the home, are to allow students to develop knowledge about alcohol and the ability to think critically about its use, to strengthen attitudes that do not promote the use of alcohol, to reinforce the student’s ability to say no to alcohol, and to delay the first use of alcohol. “Unge & Rus” is owned and managed by the KoRus North.

Program content

The duration of “Unge & Rus” varies between 10-20 school classes of 45 minutes each, spread out over a period of 2-5 weeks. Teachers deliver the program after attending a one-day training seminar. A key element of the intervention is problem-based learning, where students work in groups using the internet with different themes related to alcohol. The program consists of five major themes:

1. Influence – the first component is a cultural and traditional theme, addressing the consequences of and alternatives to alcohol, with a focus on developing awareness of the influence of friends, family, community, and society.
2. Views on alcohol - the second component is to have students study norms for alcohol use, which aims to correct misconceptions among students that, for example, young people have a tendency to overestimate peer drinking and drug use.
3. Use of alcohol - the third component is designed to increase students’ knowledge about alcohol use by sharing facts on the physiological effects of alcohol on the body.
4. Dealing with peer pressure to drink - the fourth component of the intervention seeks to increase resistance skills and the ability to handle the pressure to drink.
5. Students’ point of view - the fifth component involves working with alcohol-related attitudes. Students share positive aspects of non-use and discuss how to remain non-users.

The primary program, which is implemented in the 8th grade, has a follow-up intervention for 9th grade students and a booster session in high school. The initial program, provided in 8th grade, aims at preventing and delaying the onset of drinking, with a focus on adolescents’ alcohol-related attitudes and behavior. The follow-up intervention in the 9th grade and the

booster session in high school are designed to reinforce the primary material. Additional goals are to prevent and reduce alcohol drinking in 9th grade and to prevent illegal substance use through the booster session in high school. The program arranges two meetings with parents and guardians, with the aims of increasing their competence in communicating with their adolescent about alcohol and augmenting their authority to set clear limits for their child. Program materials and delivery instructions are free of charge and are available at www.ungeogrus.no.

Implementation features

The theoretical foundations of “Unge & Rus” are based on a social cognitive rationale, focusing particularly on Planned Behavior Theory, Social Learning Theory and Alcohol Expectancy Theory. The theoretical strategy of the program suggests increasing social norms to abstain from drinking, strengthening attitudes against alcohol, boosting expectations of coping with peer pressure, reducing positive alcohol outcome expectancies and correcting the general misconceptions about alcohol use among peers (Wilhelmsen, 1997).

The educational strategy of “Unge & Rus” is Problem-Based Learning (PBL). In using PBL, students are more actively involved in the implementation of the program, which is an important factor in the process. With this approach, teachers serve more as supervisors while the students work in groups. Another educational strategy employed in this program is the use of peer leaders. Wilhelmsen (1997) assumed that peer leaders have the potential to communicate the program’s preventive aspects more suitably to the class than an adult program provider would. As part of the program, the students are invited to work out preventive topics and present the results to a chosen group (e.g., parents, younger students).

Teacher training is provided by KoRus North during a one-day workshop. This workshop presents the rationale for alcohol prevention, the program content, and previous evaluation results, as well as providing an opportunity to practice the skills necessary to implement the program effectively. Peer leaders serve as teachers' assistants and their training is ideally carried out during one single school-day prior to program initiation.

The program schedule is flexible such that it may be implemented within various types of curriculum; e.g., natural and social sciences as well as health-promoting subjects provided by the physical and health education departments. Implementation of the program has to be rooted in the school's administration. The heads of schools should be the initiators of the program and should make the necessary adjustments for practical and educational needs, in addition to incorporating the program into the curriculum.

Results from previous evaluations

“Unge & Rus” has been examined in a process evaluation (Steinkjer, 2008). Qualitative data was collected using observations of the implementation process and through group interviews, where teachers and students described the quality of the program and their participation in it. The process evaluation indicated a high variability in the implementation process between schools. It further stressed the organizational and structural adjustments needed to allow teachers the time to both attend training workshops and implement the program. The process evaluation concluded that approximately 75% of schools in Oslo had completely implemented the program.

The website of “Unge & Rus” has been evaluated by the Norwegian Centre for Integrated Care and Telemedicine (Trondsen, 2005). The assessment was based on a qualitative study collected in two 8th grade classes. Observations and interviews were conducted for the

purposes of data collection. Overall, teachers and students reported a positive impression of the program website, but they also reported a need for improvement when it came to practical training for teachers in the use of the website and modification of the language and content for students. The evaluation report concluded that the users wanted to continue with the net-based program, “Unge & Rus”.

“Unge & Rus” is a combination of two previous programs: “Ungdom og Alkohol” [Young and Alcohol], developed by Wilhelmsen (1994), and “Foreldresamarbeid” [Parents Working Together], developed by Henriksen (1999). The program, “Ungdom og Alkohol”, was examined in an RCT by randomly assigning twelve schools into two intervention groups and one control group. The two intervention groups were distinguished as having an implementation condition that was either highly role-specified (HRS) or less role-specified (LRS). Wilhelmsen (1997) described the HRS condition to be totally pre-planned by the researchers, including a higher quality of program implementation and refers therefore more to an efficacy evaluation of the program (Flay, 1986). The LRS condition involved collaboration between teachers and peer leaders, in order to adapt the prevention program guidelines, conducted under real-world conditions and refers therefore more to an effectiveness evaluation (Flay, 1986). When comparing the HRS condition with the control groups, the findings for the “Ungdom og Alkohol” program evaluation (performed by its developers) indicated that it was effective in reducing alcohol use and that it resulted in stronger norms, attitudes and intentions to abstain from drinking (Wilhelmsen et al., 1994). It is noteworthy that the evaluation study did not find any program effects for students in the LRS condition.

No effectiveness study has been conducted for “Foreldresamarbeid”. The parent component was tested in two junior high schools in the community of Bodø (Henriksen, 1999). Parent reports via questionnaires and interviews showed that the majority of the parents felt that the program had provided positive experiences and expressed confidence in the program’s ability to achieve its aims.

“Unge & Rus” has been developed as a new program by combining the programs, “Ungdom og Alkohol” and “Foreldresamarbeid”. No outcome evaluation of the current program has been conducted prior to the current study presented in paper 2.

Research objectives

The overall objective of this thesis was to evaluate the effectiveness of school-based alcohol preventive programs that seek to prevent and reduce alcohol consumption among adolescents.

Paper 1

The objectives of the first paper were to estimate the prevalence of early drinking among Norwegian adolescents, to identify factors correlated with early drinking, and to test models for predicting early onset of drinking.

Paper 2

The objective of the second paper was to evaluate the effectiveness of the school-based preventive program, “Unge & Rus”, by using a quasi-experimental design. The primary aim of the program is to prevent and delay the first use of alcohol. The secondary aims of the program are: to reinforce the ability to say no to alcohol, to strengthen attitudes against the use of alcohol, and to increase knowledge about alcohol and the ability to think critically about its use.

Paper 3

The objective of the last paper was to estimate the mean effect of school-based programs on adolescent alcohol consumption by conducting a meta-analysis of well-designed studies using meta-analytic techniques. Moderator analyses were performed to test if the effects varied between different school levels (elementary, junior high and high school) or according to program intensity as measured by the number of program sessions. Additionally, moderator analyses were conducted to test whether preventive programs had differential effect depending on age and gender.

Introduction to the W8 [wait] project

The W8 [wait] project was a longitudinal study evaluating the effectiveness of the preventive intervention, “Unge & Rus”. This research project was commissioned by the Norwegian Directorate of Health and assigned to The Regional Centre for Child and Youth Mental Health and Welfare at UiT the Arctic University of Norway in 2009. The W8 [wait] project team did not participate in the initiation, planning, development or implementation of “Unge & Rus”. The commissioned research was to evaluate the effectiveness of the program in Oslo, where it had been sanctioned for mandatory implementation in 2006. Several changes have been undertaken to revise and expand the previous intervention, “Ungdom og Alkohol”, but no effectiveness study of the current intervention, “Unge & Rus”, have been conducted. The name and profile for the research project evaluating “Unge & Rus” was: W8 [wait].

Methods in the W8 [wait] project

Data material in paper 1 and paper 2

The W8 [wait] project collected baseline data (T1) in January 2011, posttest data (T2) in May 2011, and data for the one-year follow-up (T3) in May 2012. The final data at two year follow-up (T4) was collected in May 2013. This dissertation was based on data from the baseline assessment (T1 in paper 1) and longitudinal data from baseline to one-year follow-up (including T1, T2 and T3 in paper 2). Data from the two year follow-up (T4) was not included in this thesis.

Sample and procedure in the W8 [wait] project

The sample in the W8 [wait] project was recruited from two neighboring municipalities in Norway, Oslo (intervention group) and Akershus (control group). Oslo has implemented “Unge & Rus” as a mandatory educational program in all of the 47 junior high schools. The

W8 [wait] project, therefore, used a longitudinal quasi-experimental control group design. Study invitations were sent out to 91 junior high schools from Oslo and Akershus, of which 41 principals accepted. All of the 8th grade teachers within the 41 schools received information about the W8 [wait] study by email. Teachers then verbally informed their students about the study and handed out packets of study-related information to take home with them. Each packet contained two separately directed information sheets, one for the students and the other including more details for their parents/guardians. The packets also contained a consent form to be signed and returned to the school in the event the student wished to participate in the study. The consent form required written approval from both the student and the parent/guardian in order for the student to participate in the study. However, the parent/guardians were able to participate regardless of their son/daughter's willingness to take part in the study. Members of the research team attended parent meetings at schools in the control group in order to provide additional information about both the W8 [wait] project and the "Unge & Rus" intervention implemented in Oslo.

Participants consisted of students, their parents/guardians and teachers. Students constituted the units of analysis used in this dissertation, supplemented with descriptive implementation data reported by teachers. The eligible sample among the 41 junior high schools consisted of 4,356 students, whereas the total number of students who agreed to participate in the study was 2,020. Of these students, 1,574 participated in the baseline assessment (presented in paper 1) along with 105 teachers. At the first posttest, 1,544 students and 47 teachers participated and, at the one-year follow-up study, 1,177 students and 40 teachers filled out the questionnaires (see paper 2 for a detailed flowchart of participants).

Data were collected by self-reported online questionnaires completed during school hours. The link to each questionnaire was sent to schools from the Education Agency in Oslo. In order to achieve the anonymous management of data, schools generated a number for each student based on alphabetic class list. By using the student number in combination with the schools' name, the resulting code made it possible to match individual questionnaires across follow-ups while protecting the participants' anonymity. During the data collection period, three newsletters were distributed. The first newsletter, with information about the project and some preliminary data on alcohol use among 8th grade students, was presented to teachers and parents. The second and third newsletters were sent out to increase motivation and prevent dropout from the W8 [wait] project. Those newsletters contained a summary of preliminary findings and student response rates along with information on minor rewards for project participation.

Measures

The following presents an overview of the measures used, while more detailed information is presented in each paper.

Demographics

In the first and the second paper, demographic variables included the adolescents' age at baseline, gender, family structure (e.g., living with two parents, one parent or other relatives), family financial status, religion (Christianity, Islam, other or no religion), friends, school performance, social life, and leisure activities.

Alcohol use

Examples of alcohol were provided in the questionnaire used for paper 1 and 2 (e.g., beer, wine, cider, alcopop, liqueur, whisky, champagne, and hooch/moonshine).

For paper 1, students were first asked whether they had ever consumed at least one glass of alcohol. Those who responded positively were asked follow-up questions about frequency of monthly alcohol use, frequency of alcohol inebriation for the period of the past three months, and drinking behavior among friends and/or siblings.

For paper 2, two items were used to assess adolescent alcohol use, adopted from Aas and Klepp (1992). The first question was, “*Have you ever had a glass of alcohol?*” The second question was, “*How often have you consumed alcohol during the past three months?*”

Intention to drink

Two questions assessed intention to consume alcohol. The first question was, “How likely is it that you are going to drink at least one glass of alcohol during the next three months?” The second question was, “How likely is it that you are going to get drunk during the next three months?” Response categories ranged from 1 = most likely to 5 = most unlikely.

Attitudes

Attitudes measured to what degree they found it acceptable for students of the same age to drink alcohol in various situations. Alcohol related attitudes were assessed using a scale that consisted of five items, the mean score of which was used in the analyses. A sample question was, “Do you find it acceptable for an 8th grader to drink a glass of alcohol without any adults present?” Response categories ranged from 1 = “no, totally wrong” to 7 = “yes, it’s ok”.

Subjective norms

Subjective norms were assessed by four questions about who would approve or disapprove of their alcohol drinking, e.g., “Would your friends like or dislike it if you had at least one glass

of alcohol?” Response categories ranged from 0 = “dislike it very much” to 4 = “like it very much”.

Perceived Behavior Control (PBC)

PBC measures the overall control the adolescent perceives him-/herself to have over his/her alcohol consumption (Conner & Sparks, 2005). PBC was measured by four items asking students to estimate the degree of PBC on a 7-point scale measured by questions such as, “If I am offered alcohol, I find it difficult/easy to say no thanks”. The response categories ranged from “Very difficult” (1) to “Very easy” (7).

Alcohol Outcome Expectancy (AOE)

The Alcohol Expectancy Questionnaire for Adolescents (AEQ-A) was based on a short and modified Norwegian version of the AEQ-A (Aas, 1993; Christiansen & Goldman, 1983). The eleven items were comprised of two subscales: the global positive effects and enhanced social behavior scales. The social positive scale included five items asking students to indicate their positive alcohol expectancies on a 7-point scale with items such as, “Many alcoholic drinks taste good” and “Parties become more fun when alcoholic beverages are consumed there”. The global positive scale included six items asking questions like, “It is easier to be with other peers when alcohol is consumed” and “Adolescents are more happy and comfortable when they consume alcohol”. The response categories for both subscales ranged from “strongly disagree” (1) to “strongly agree” (7).

Alcohol-related knowledge

Knowledge regarding alcohol was measured with three multiple choice items, each allowing four response alternatives (only one correct option). These questions were: “What is the age limit for buying beer and wine in Norway?”, “What does blood-alcohol concentration measure?” and “What is the name of the kind of alcohol used in beer, wine and spirits?”

Program dosage

With the purpose of assessing the dosage of program implementation, teachers from both the intervention and the control groups were asked: “Did you participate in the program training for “Unge & Rus” during the last two years?” and “Have you visited the website (www.ungeogrus.no)?” Teachers from the intervention group were additionally asked the following three items: “How many hours did you spend on “Unge & Rus” in your class?”, “How many weeks were spent on “Unge & Rus” in your class?” and “Was the peer leader training implemented at your school?” Teachers from the control group were asked: “Have you been working with any alcohol curriculums during the last two years in your class?”

Ethics

The W8 [wait] project was approved by the Regional Committee for Medical and Health Research Ethics of Northern Norway. An active consent was required to participate in the project, which means that the parents or their guardians had to provide signed approval to allow their child to respond to the questionnaires. Detailed written information was delivered to both guardians and students. The statements in the informed consent form emphasized that participation was voluntary and refusal to participate would not result in any negative consequences.

It was theoretically possible that the prevention program, “Unge & Rus”, could have caused adverse effects. However, based on the theoretical framework that incorporates methods and principles that are considered promising, in addition to the support of Wilhelmsen’s (1994) findings, such negative effects would most likely not occur. Some parents/guardians raised the issue of possible risks of asking 8th grade students questions about alcohol consumption. Their concerns were primarily surrounding the possibility of misconceptions among students

after reading the questionnaire; i.e. that they may overestimate their peers' alcohol use. According to a Norwegian survey including 85 junior and senior high schools ($N = 11,158$), the phenomenon of overestimating peers' alcohol use has been exaggerated (Pape, 2012). The incoming concerns were addressed by providing additional information. The questionnaire was previously tested in a pilot study ($N = 130$) conducted in Northern Norway (Jørgensen, Adolfsen, Martinussen, & Kuposov, 2009). The purpose of the pilot study was to test the questionnaire and examine whether or not students found any of the items difficult to understand. The most difficult question reported was the one measuring alcohol expectancies, where students were asked to rate the statement, "Several alcoholic drinks taste good", from "strongly disagree" (1) to "strongly agree" (7). The challenge with this question was related to those students that reported no experience with drinking alcohol and who, thus, could not really answer the question. That item is, however, a part of the Norwegian version of AEQ-A and could not be excluded from the scale intended to measure the expectancies for alcohol drinking among both those who have consumed alcohol and those who not (Aas, 1993). The control group received the standard curriculum on health education and was not deprived of any prevention program.

Introduction to the meta-analytic review

School-based prevention programs that aim to prevent the use of alcohol have been criticized for poor outcomes and low effect sizes (Babor et al., 2010). The overall aim of school-based alcohol prevention programs is generally to delay the onset of alcohol consumption, to reduce the frequency of drinking and the quantity of alcohol consumed. The purpose of this meta-analysis was to estimate the effectiveness of school-based alcohol preventive interventions on adolescent alcohol use and to examine the generalizability of the effect across different types of interventions and settings. In order to provide the best estimate of the effectiveness of preventive interventions targeting school-aged adolescents, only studies using randomized controlled designs, comparing an intervention group to a control group, were included.

Data material in paper 3

Paper 3 included data from 28 studies that had evaluated school-based prevention programs. To be included in the meta-analysis, the studies had to meet the following criteria. They needed to: use randomized controlled trial (RCT) design with a control group; assess alcohol use outcomes; and provide sufficient information to calculate between-group effect size estimates. In addition, the mean age of the participants had to be below 18 at pre-test and the studies had to be published in English between 1990 and August 2014.

Methods

Search strategies, inclusion and exclusion criteria are all explored in detail in paper 3. The following presents an overview.

Variables

The following variables were coded: year of publication, country, name of the intervention, sample size, mean age and age range for study participants, school level (elementary, junior high, and high school), gender distribution, aim of the intervention, duration of the

intervention (program intensity), components of the intervention, length of follow-ups (time points), booster sessions, attrition and alcohol use outcomes.

Alcohol use outcomes

Three outcome measures were coded for alcohol use: weekly drinking (7 days' alcohol use), monthly drinking (30 days' alcohol use) and lifetime alcohol drinking (e.g., Have you ever used alcohol?).

Studies addressing the categorical data reported the proportion of students that had been drinking within each outcome measure. Within each outcome measure, studies reporting continuous measures reported either the frequency of alcohol use (defined as the number of times alcohol was used weekly, monthly or ever) or the quantity of alcohol use (defined as the number of mean drinks weekly, monthly or ever).

Moderators

The term moderator is used in a meta-analysis to describe variables that may influence the mean effect sizes. Four different moderator analyses were conducted in order to explore true variation between studies. The first moderator analysis examined whether differences between studies could be explained by the different school levels that the programs were targeting. The second moderator analysis was conducted to test the effect of program intensity. The third moderator analysis examined age as a continuous variable. The fourth analysis explored whether gender was a possible moderator.

Summary of the papers

Summary of paper 1

Adolfson, F., **Strøm, H. K.**, Martinussen M., Natvig, H., Eisemann, M., Handegård, B. H., & Kuposov, R. (2014). Early drinking onset: A study of prevalence and determinants among 13-years old adolescents in Norway. *Scandinavian Journal of Psychology*, *55*, 505-512. doi: 10.1111/sjop.12151.

Objectives

Research on risk and protective factors associated with early drinking onset is crucial when planning prevention efforts. This study aimed to estimate the prevalence of alcohol consumption among Norwegian adolescents, to explore factors associated with early drinking, and to test models for predicting early drinking onset.

Statistics

Analyses were conducted using the Statistical Package for Social Sciences (SPSS 21). Generalized linear mixed models with a logit link function were employed to assess the association between drinking experience and various predictors. Both bivariate and multivariable analyses were conducted to assess the predictive value of the variables studied. Two multivariable models were tested. The first model included demographic variables and behavioral characteristics such as age, gender, religion, social life and school performance, family situation, family financial status, drinking peers and parental permissiveness. The second model included additional variables measuring intentions to use alcohol, alcohol outcome expectancies, alcohol attitudes and subjective norms.

Findings

The prevalence of alcohol drinking among Norwegian adolescents aged 13 showed that 24% percent of the participants in this study ($N = 1,550$) had consumed at least one glass of

alcohol, whereas 2% reported experience of drunkenness. The first model identified gender, religion and smoking as significant predictors of early alcohol consumption and correctly identified 29.1% of those having consumed alcohol at least once. When adding alcohol expectancies, attitudes, norms and intentions towards alcohol use, the percentage of correctly identified drinkers increased to 56.2%. Findings from this study support programs oriented towards psychosocial variables such as expectancies, attitudes, norms and intentions towards alcohol use.

Summary of paper 2

Strøm, H. K., Adolfsen, F., Handegård, B. H., Natvig, H., Eisemann, M., Martinussen, M., & Kuposov, R. A. (2014). Preventing alcohol use with a universal school-based intervention: Results from an effectiveness study. Submitted.

Objectives

The effectiveness of the preventive program, “Unge & Rus”, was examined in a longitudinal study using a quasi-experimental design with a control group. Assessment of effectiveness was measured according to the program’s defined purposes; namely, to develop knowledge about alcohol and the ability to think critically about its use, to strengthen attitudes against the use of alcohol, to reinforce the ability to say no to alcohol, and to delay the first use of alcohol. Participants were 8th grade students ($N = 1,574$) at baseline.

Statistics

Data were analyzed using the Statistical Package for Social Sciences (SPSS 21.0). To test whether the rate of change in the outcome measures differed between the intervention and comparison groups, multilevel analysis and generalized multilevel analyses were used. The multilevel analysis used full information maximum likelihood estimation. This method does not require an equal number of observations for all participants, such that respondents with missing observations could be included in the analysis (Hox, 2010). All continuous outcomes were in the form of scales created by calculating the mean scores across all individual items within each scale.

Findings

This study showed an overall lack of effectiveness for the intervention, according to the program’s defined objectives. The short-term effectiveness of “Unge & Rus”, measured after four months, showed no significant differences between groups on measured outcomes,

except for the measure of Alcohol Outcome Expectancy (AOE). Baseline rates were equal in both groups for all outcomes, apart from AOE. The control group had higher levels of AOE at baseline than the intervention group, and the control group also developed higher AOE after four months. Because the intervention group had significantly lower AOE after four months, this finding indicated a short-term effect. The assessment of overall long-term effectiveness of the “Unge & Rus” program showed that the development from baseline to one-year follow-up was not significantly different between the intervention and control groups, except for alcohol-related knowledge.

Summary of paper 3

Strøm, H. K., Adolfsen, F., Fossum, S., Kaiser, S., & Martinussen, M. (2014). Effectiveness of preventive alcohol interventions for adolescents: A meta-analysis of randomized controlled trials. *Substance Abuse Treatment, Prevention, and Policy*, 9, 1-11, doi: 10.1186/1747-597X-9-48.

Objectives

The purpose of this study was to assess the effectiveness of school-based prevention programs on alcohol use among adolescents by using meta-analytic techniques. Assessment of intervention effectiveness over time, and examination of whether the effect of the intervention differed according to the different school levels or the program intensity, was conducted in addition to testing differential effects on age and gender. In total, 28 randomized controlled studies were included, where 12 studies ($N = 16,279$) reported continuous outcomes (frequency of alcohol use and quantity of alcohol consumed) and 16 studies ($N = 23,010$) reported categorical data (proportion of students who drank alcohol).

Statistics

The meta-analyses were conducted using the Comprehensive Meta-Analysis Program version 2.2.057 (Borenstein et al., 2005). Descriptive data were analyzed using the Statistical Package for Social Sciences (SPSS 21.0). Two different effect-size statistics, standardized mean differences (Hedges' g) and odds ratios (OR), were used in the included studies. Hedges' g was calculated for continuous outcomes and OR for categorical outcomes. A random effects model was used for the meta-analysis calculations, as we assumed that the true effect could vary from study to study and that factors other than sampling error could contribute to the observed variation in effect sizes (e.g., study design, sample characteristics, and type of intervention). Various possible moderators were examined, including categorical variables (school level and program intensity) using a mixed-effects analysis, and continuous

moderators (age and proportion of boys) using meta-regression analyses. The heterogeneity test, Q , was used to test variation between studies.

Findings

The overall mean effect size, combining the quantity and frequency of alcohol use among studies reporting continuous outcomes, was small but significant ($\bar{g} = 0.22, p < .01$).

Furthermore, the mean effect size for the quantity of alcohol consumed was small and significant in favor of the intervention group ($\bar{g} = 0.29, p < .01$). On the contrary, the mean effect based on the frequency of alcohol use was not significant. The overall mean effect size of studies reporting categorical outcomes was not significant. The moderator analyses in this meta-analysis showed no significant effects between different school levels or between low, medium, and high intensity programs. The meta-regression did not reveal any significant findings for age or gender.

Discussion

The overall aim of this dissertation was to examine the effectiveness of school-based alcohol preventive interventions for adolescents. The first objective was to estimate the prevalence of early drinking among Norwegian adolescents and to identify factors associated with early consumption. Further objectives of this dissertation were to evaluate the effectiveness of “Unge & Rus”, as implemented in junior high schools in Oslo, and to estimate the mean effect of school-based interventions on adolescent alcohol use by performing a meta-analysis of previous studies. In general, there is great variability of alcohol use among adolescents. The prevalence of alcohol drinking is generally low among Norwegian adolescents as compared to adolescents from other European countries (Hibell et al., 2012). Nonetheless, it is disconcerting that a quarter of Norwegian adolescents at the age of 13 report onset of alcohol consumption. Several negative consequences of early alcohol drinking have been identified in previous studies (Flory et al., 2004; Hingson & Zha, 2009; Kuntsche et al., 2013; Luster & Small, 1994; Pitkanen et al., 2005), which has led to the development of a variety of preventive interventions for adolescents. The effectiveness of those interventions varies (Strøm, Adolfsen, Fossum, et al., 2014; Tobler et al., 2000) and should, therefore, be evaluated prior to widespread implementation.

In the first paper, prevalence and determinants of alcohol drinking among adolescents were investigated. Identifying risk and protective factors may facilitate the development of more effective prevention initiatives. The prevalence of adolescents in Oslo and Akershus who had consumed at least one glass of alcohol was estimated to be 24%, with a significantly higher rate among boys than among girls. Findings from previous research have suggested that adolescents with an early onset of alcohol drinking are more likely to use alcohol and have related problems as young adults (Stone, Becker, Huber, & Catalano, 2012). It should also be

noted that a connection between early onset of drinking and later alcohol use is mainly based on results from cross-sectional studies or studies with short-term follow-up (Pitkanen et al., 2005; Rossow, 2006). Findings from a 13-year Norwegian prospective study suggested that early onset of drinking behavior is not exclusively responsible for heavy drinking in adulthood (Rossow & Kuntsche, 2013), but is confounded by other factors such as conduct problems and observations of parental heavy drinking. Young people (aged 11-15) tend to drink less frequently and more intensively than adults (Newbury-Birch et al., 2009), which also emerged in the ESPAD survey for Norwegian adolescents (Hibell et al., 2012). We found that 2.1% of the 8th grade adolescents who participated in the W8 [wait] study reported inebriation from alcohol consumption, which represents a risk factor for problem behaviors (Kuntsche et al., 2013).

In the first study we found significantly more boys (29%) than girls (19%) had consumed at least one glass of alcohol in the 8th grade. Early alcohol use has also been found to be more common among boys than girls in other European studies (Koopmans et al., 1997), and heavy drinking and binge drinking are generally found to be more common among boys (Abebe et al., 2014; Kuntsche, Rehm, & Gmel, 2004). Our findings for 8th grade students are contrary to the tendencies found among older students, i.e., from 10th grade, where both the ESPAD survey for Norwegian adolescents and the national survey, Ungdata, showed that girls in 10th grade drank slightly more than boys (Hibell et al., 2012; NOVA, 2014). This might indicate different developmental trajectories between boys and girls in relation to alcohol drinking behavior.

Religious affiliation was found to be a protective factor for alcohol drinking. Our study, in line with previous research (Abebe et al., 2014), identified adolescents committed to Islam as

having a significantly higher age at onset of alcohol use than adolescents with other or no religious affiliations.

The strongest predictor of early drinking onset in our study was smoking (Adolfson et al., 2014). A possible explanation for this finding is that higher levels of sensation seeking behavior, in addition to social context factors, are common determinants for the motivation to use both alcohol and cigarettes among adolescents (Comeau, Stewart, & Loba, 2001). In addition, family and peer influence have also been found to be important factors in smoking behavior (Alexander, Piazza, Mekos, & Valente, 2001). A Dutch study on 12-16 year-old twins showed a strong association between smoking and alcohol use ($r = .61$), highlighting that alcohol and tobacco use are influenced by the same shared environmental features and associated with the same genetic risk factors (Koopmans et al., 1997).

The psychosocial variables, alcohol outcome expectancies, attitudes, intentions and social norms, were all found to be significantly associated with early onset drinking in the first study and significantly increased the identification of those who had consumed alcohol in the tested models. These findings expand the knowledge of the factors predicting alcohol drinking and give support to preventive programs built on theoretical frameworks that include psychosocial variables.

The second paper evaluated the effectiveness of the school-based preventive program, “Unge & Rus”, as implemented in junior-high schools in Oslo. This evaluation study was conducted as an effectiveness study under typical school-setting conditions such that, if there were positive results, they could be easily generalized to other schools. When programs like “Unge & Rus” are based on sound theory and evidence of previous effectiveness, there is a potential

for behavior change. This study found a short-term effect showing that the control group developed more positive alcohol outcome expectancies than the intervention group. However, no significant differences between the groups were detected for alcohol use, alcohol attitudes, perceived behavior control or alcohol-related knowledge measured after four months. It is noteworthy that the overall effects of the program showed no significant difference in the development between the intervention and control groups for alcohol use, alcohol attitudes, perceived behavior control or alcohol outcomes expectancies. The only effect detected at one-year follow-up was the number of students who answered correctly on knowledge regarding alcohol. Knowledge increased significantly more from baseline to one-year follow-up in the intervention group as compared to the control group.

The meta-analytic review for this dissertation showed that alcohol preventive programs vary significantly in their effectiveness in reducing alcohol use and postponing alcohol drinking. Two of the biggest barriers to school-based interventions are poor implementation and lack of program fidelity. The study evaluating “Unge & Rus” showed that teachers spent on average 17.9 hours ($SD = 8.6$) delivering the program, which is in line with program procedures. However, the relatively low attendance for program training (33% of the responding teachers $N = 47$) might have contributed to a lower quality of fidelity. A previously conducted process evaluation found high variability in the level of consistency with which teachers presented and delivered “Unge & Rus” in schools (Steinkjer, 2008). Dusenbury et al. (2003) revealed that when programs are implemented under real-world conditions, low program fidelity among teachers is common. The implementation quality of school-based prevention programs in typical school settings is generally found to be low. Based on a national US study including 3,691 school-based interventions, Gottfredson and Gottfredson (2002) found room for improvement in several of the fidelity dimensions of the program implementation (Dane &

Schneider, 1998). They suggested that higher levels of organizational and principal support, higher levels of standardization for program materials and program methods, more training and supervision of program providers, and better incorporation of program activities into the schools' standard activities will all improve the implementation quality of school-based programs (Gottfredson & Gottfredson, 2002).

Wilhelmsen and her colleagues (1994) demonstrated the effect of implementation quality in their study. According to the six stages of implementation suggested by Fixsen and his colleagues (2005), the "Unge & Rus" program was explored and adopted (stage 1) based on the development and program evaluation of its predecessor, "Ungdom og Alkohol". The program, "Ungdom og Alkohol", had a solid theoretical rationale and included activities that were well described (Wilhelmsen, 1997). Additionally, the evaluation of that program provided scientific evidence in support of it being put into practice (Wilhelmsen et al., 1994).

The decision to install "Unge & Rus" (stage 2) in schools was made after the Norwegian Directorate of Health and the Norwegian Directorate for Education and Training nominated a research group to evaluate school-based preventive programs. They provided a report called, "Forebyggende innsatser i skolen" [Preventive efforts in schools], in 2006, where "Unge & Rus" was recommended as a program with documented results based on the findings of the predecessor "Ungdom og Alkohol" (Nordahl, Natvig, Samdal, Thyholdt, & Wilhelmsen, 2006).

In order to comply with the needs of preventive efforts in junior high schools in Oslo, the program, "Unge & Rus", received political and financial support from the Norwegian government for initial implementation (stage 3). Because the program was launched as a

mandatory program, all junior high school teachers were (and still are) regularly invited to a one-day workshop with training provided by KoRus North at the Education Agency of Oslo. Since the 2006 decision to implement “Unge & Rus” in Oslo, the program has become fully operational according to the implementation stages (stage 4) and has become “business as usual” for junior high school teachers delivering preventive alcohol education in Oslo. Because the program had become fully operational, and the quality and participation of schools in Oslo had been documented in a process evaluation (Steinkjer, 2008), there was a need to conduct an outcome evaluation of the program “Unge & Rus” (stage 5).

The Norwegian Directorate of Health, therefore, commissioned the Regional Center for Child and Youth Mental Health & Child Welfare in North, who then established the W8 [wait] project as an independent research group to evaluate the outcome effectiveness of “Unge & Rus”. The final stage in the implementation process is sustainability (stage 6). The goal of program sustainability is “the long-term survival and continued effectiveness of the implementation site in the context of a changing world” (Fixsen et al., 2005). The results provided in paper 2, showing a general lack of overall effectiveness for the “Unge & Rus” program, as conducted under “real-world” conditions, do not inspire expectations of program sustainability. Implementation refers, namely, to the integrity of the intervention or to the quality and consistency of its delivery (Glasgow et al., 2003). Research has indicated that, although schools implement evidence-based programs, they sometimes fail to show effectiveness due to low quality of implementation and fidelity (Hallfors & Godette, 2002). A low quality of fidelity could be due to a low level of engagement among teachers. As the program has been made mandatory for all junior high schools in Oslo, the lack of opportunity for both school principals and teachers to choose a program themselves could cause a lower level of engagement in program delivery. Teachers did, in fact, report that the time spent on

program delivery was in line with program procedure, however, teacher attendance at program training was low.

Our results initially seem to stand in contrast to the positive effects found in the evaluation study of the previous version of “Unge & Rus”; namely, the “Ungdom og Alkohol” program. Results from the evaluation of “Ungdom og Alkohol” showed a significant reduction in alcohol use when comparing the HRS condition with the control condition, whereas no significant differences between the LRS condition and the control condition were detected, which is in line with the findings from our evaluation of the effectiveness of “Unge & Rus” in paper 2. It should be noted that the evaluation study of “Ungdom og Alkohol” has been criticized by Pape, Baklien, and Rossow (2007), who argued that the study used unsuitable measures of alcohol use, including a poor indication of time periods. However, this critique was addressed and new analyses were provided, which resulted in conclusions that supported the original study conducted by Wilhelmsen and colleagues in 1994 (Natvig, 2009). Pape (2009) further criticized the fact that the evaluation study of “Ungdom og Alkohol” was carried out by the program developers rather than external researchers. Program developers often serve as evaluators for their own programs (Gandhi, Murphy-Graham, Petrosino, Chrismer, & Weiss, 2007). “Unge & Rus” is not the first program that has failed to show positive outcome effects on alcohol use when independently evaluated on a large scale. Similar findings were also obtained in an evaluation of Project SUCCESS by Clark et al. (2010).

Generally speaking, school-based prevention programs that aim to prevent the use of alcohol have been criticized for poor outcomes and low effect sizes (Babor et al., 2010). Findings suggest that knowledge can be increased and expectancies about alcohol may be changed, but

that affecting the drinking behavior is a difficult task that has generally failed to produce effects (Foxcroft, Lister-Sharp, & Lowe, 1997; Strøm, Adolfsen, Fossum, et al., 2014). Nevertheless, information about the risk of early onset of alcohol use has been important in supporting the development of preventive interventions. The majority of evaluation studies conducted on preventive programs has been carried out in North America (Foxcroft & Tsertsvadze, 2011). Additionally, in the United States, where most of the research on early onset drinking has been performed, the average age for underage drinking is 13 (Substance Abuse and Mental Health Services Administration, 2011). Governments and communities generally seek to prevent the onset of alcohol use and to reduce alcohol drinking. They have found schools to be the optimal setting for delivery of alcohol preventive programs. A range of school-based interventions that aim to prevent and reduce alcohol use have been evaluated. In many cases, such analysis focuses merely on the program's ability to modify variables like knowledge, intentions or other skills, rather than on the program's effectiveness in modifying the actual drinking behavior (Foxcroft et al., 1997; White & Pitts, 1998).

The third paper in this thesis explored the effectiveness of school-based programs on alcohol use by employing meta-analytic techniques. Only evaluation studies of school-based preventive programs using random assignment were included, as this is the best design to guarantee high internal validity (Shadish et al., 2002). A total of 28 studies were located, 12 of which reported continuous outcomes and 16 of which reported categorical data. The overall effect size for studies reporting continuous outcomes (combined) was small but significant ($\bar{g} = 0.22$). Furthermore, the results from this meta-analysis showed significant positive intervention effects on the quantity of alcohol consumed with a small effect ($\bar{g} = 0.29$). However, no significant effect was found for the frequency of alcohol drinking. The overall mean effect size among studies reporting categorical data (*OR*), in terms of the proportion of

drinkers, was not significant. A suggested reason for the lack of effect among studies reporting the categorical data is that the effectiveness of an intervention may be underestimated when the outcome variable is dichotomized rather than using a continuous measure. Nevertheless, dichotomizing variables is common in medical research and health sciences. In short, the information about the variance within the sample is lost when continuous variables are dichotomized resulting in attenuated effect sizes (Altman & Royston, 2006).

An interesting finding in paper 3 was the small, but positive effect preventive programs had on established alcohol behavior reported in weekly drinking which could imply an important reduction in weekly alcohol consumption among adolescents who already consummate alcohol. At the same time, there was no effect from preventive programs on the adolescents' lifetime use of alcohol. A major goal of substance abuse prevention programs is to delay the onset of drinking, commonly reported as lifetime alcohol use. Lifetime alcohol use therefore includes both adolescents that do drink alcohol and those who do not. The lack of effect on lifetime drinking could imply that universal alcohol prevention programs do not succeed in delaying alcohol debut, but at the same time, the small but positive effect on weekly drinking could imply an important reduction in alcohol consumption among those adolescents being in heightened risk for alcohol related difficulties. As such, substance abuse prevention programs may be of some importance due to the possible preventive alcohol effects for adolescents already drinking in relative early ages.

We could not find any evidence of highly intensive programs being more effective than less intensive programs. This is in line with the findings of Gottfredson and Wilson (2003), who, despite finding no statistically significant differences between the various school levels,

argued that programs targeting junior high schools are slightly more effective than those that target elementary or high schools. Research has suggested that prevention programs for alcohol use may affect boys and girls differently (Kauffman, Silver, & Poulin, 1997; Kumpfer et al., 2008). As the gender distribution was equal in most studies included in the meta-analysis, and program effects were not reported separately for girls and boys, the results could not support a differential program effect for gender. The evidence from this meta-analysis suggested that, by implementing school-based preventive programs, a small positive effect can be achieved on overall alcohol use in the short term (4 – 12 months), in addition to a significant reduction in the overall quantity of alcohol consumption.

Studies of program effectiveness aim to produce robust effects in addition to understanding variation in outcomes across heterogeneous settings and different program deliverers (Glasgow et al., 2003). A significant heterogeneity between studies included in this meta-analysis was detected. However, the moderator analyses that were conducted could not explain these variations. This could be due to the low statistical power caused by the small number of included studies in each moderator analysis.

This meta-analysis showed that the effect from universal alcohol preventive interventions is more likely to be seen among adolescents with pre-established drinking behavior. This is in line with a Cochrane review of 53 well-designed school-based studies, in which it was observed that the most positive effects were reported for drunkenness and binge drinking (Foxcroft & Tsertsvadze, 2011). There is evidence for the usefulness of universal and selective approaches, however, evaluation studies of selective programs have been found to refer more to treatment of adolescents than to prevention (Spath, Greenberg, & Turrisi, 2008). Universal school-based programs are delivered to all adolescents and are not targeted towards

adolescents considered to be at high risk of alcohol consumption. In an analysis of 52 reviews, interventions across a range of outcomes have been shown to have consistently large effects on adolescents at risk as compared to the normative population (Weare & Nind, 2011). In addition, Weare and Nind (2011) reported that universal programs alone were not as effective as selective programs targeting adolescents at risk, suggesting that a combination of universal and selective approaches could increase the effectiveness of preventive programs.

The effect sizes of universal school-based prevention programs are generally small (Weare & Nind, 2011). For instance, in one meta-analytic review ($K = 53$), the effectiveness of universal school-based programs that aim to prevent violent and aggressive behavior was found to produce an overall small effect size of 15% reduction (Hahn et al., 2007). Additionally, the effectiveness of universal school-based bullying prevention programs found that, on average, bullying decreased by 20-23% and victimization decreased by 17-20% (Ttofi & Farrington, 2011). However, it is important to bear in mind that even small effects from preventive programs can make a difference of practical importance for adolescents. Targeting an entire population using a universal approach has several advantages. In addition to the fact that resources to screen for at-risk adolescents are kept low (Weare & Nind, 2011), there is the finding that adolescents at risk are the ones who benefit most from such programs, while also avoiding stigmatization. Furthermore, school-based drug preventions have been found to be a good investment for society when comparing the costs and benefits of reduced substance and alcohol use (Caulkins, Pacula, Paddock, & Chiesa, 2004). The conclusions regarding preventive effectiveness presented in this dissertation can only be drawn from the universal program measures reviewed. It is, therefore, important to bear in mind how such programs differ from more selective prevention programs.

Methodological considerations

Several methodological considerations have to be made when conducting this kind of research, due to the fact that design, among other factors, can influence the estimated effect of a program (McCartney & Rosenthal, 2000). Randomized controlled trials (RCT) are considered to be the best standard for evaluation of effectiveness. The International Committee of Medical Journal Editors defines RCT as “any research project that prospectively assigns human subjects to intervention and comparison groups to study the cause-and-effect relationship between a medical intervention and a health outcome” (De Angelis et al., 2005). They further emphasize that “medical intervention” refers to any intervention used to modify a health outcome. By using randomization, the equivalence of the studied groups is ensured. The meta-analytic review in paper 3 exclusively included studies with RCT design, reporting outcome evaluation results for alcohol use of various school-based interventions, which resulted in a limited number of studies being accepted for inclusion. However, an RCT-design provides no guarantee against drop-out or the possibility of a differential drop-out rate between the experimental and control conditions, which may lead to reduced internal validity.

School-based prevention studies commonly use schools as the unit of assignment, even though the most common approach is to use individuals as the unit of analysis and to compare the individuals in the intervention schools with those in the control schools on salient outcomes variables (Clayton & Cattarello, 1991). A large number of studies, despite using a cluster design, analyzed the results at the individual level. If the clustering effect is ignored by the individual study, this could constitute a challenge when interpreting the meta-analytic findings as the estimated mean effect could be too high (Campbell, Mollison, Steen, Grimshaw, & Eccles, 2000). A possible limitation in paper 3 may be that the majority of the

RCTs identified were cluster RCTs, using schools or classes as the unit of random assignment. Analyses were conducted to explore possible differences between studies using RCT and cluster RCT, but the results showed no significant differences in mean effects for the two design types.

One limitation in paper 2 was the lack of randomization. The commission for the W8 [wait] project was to explore the overall effectiveness of “Unge & Rus” as it is implemented in junior high schools in Oslo. Since the intervention group was already given, we could not randomly assign the participating students to the different conditions. Thus, a quasi-experimental design including a comparison group was used. Large-scale studies using repeated measure designs are found to be convincing in evaluating effectiveness when randomization is not possible or practical (Flay et al., 2005). However, quasi-experimental design may be biased, as there is always the possibility of differences between the intervention group and the control group. Hence, in paper 2, several sources of bias were considered. The control group was carefully selected to ensure that it was as similar as possible to the intervention group. Analyses showed that the intervention and control groups did not differ on any measured outcome variables at baseline, with the exception of alcohol outcome expectancies. Students in the control group had higher AOE than those in the intervention group.

There was a lack of adequate information about the quality of implementation data in paper 2. Implementation data are critical to interpreting outcomes to strengthen the conclusion of a program (Barry & Jenkins, 2007). However, the number of treatment conditions can complicate the analysis strategies by varying too many factors, like the number of sessions, which makes it challenging to be certain of what was delivered and what the effects were

(Clayton & Cattarello, 1991). In paper 2, the aim was to measure the effectiveness of the program as it is normally delivered in junior high schools in Oslo. The previously conducted process evaluation of the program in Oslo showed that the intervention had been implemented, and that the majority of schools deliver approximately 75% of the entire program (Steinkjer, 2008). It has been suggested that the limited effects presented in paper 2 are the result of poor implementation quality and shortcomings in the delivery process of the program. However, taking into consideration the results from previously conducted process evaluations, another reason for limited results in paper 2 could be that the program's objectives are too ambitious for the targeted population.

Evaluations of school-based prevention programs have generally been criticized for methodological issues concerning the hierarchical data structure, which may inflate the Type I error rate (Murray & Hannan, 1990). The structure in the W8 [wait] sample was hierarchical and, therefore, the assumption of independence was violated. This means that the average correlation between variables measured on students from the same school will be higher than the average correlation between variables measured on students from different schools (Singer & Willett, 2003). Multilevel analysis, provided in paper 2, takes into account the clustering of individuals within schools in relation to the dependency of observations both within classes and within schools (Hox, 2010). Multi-level models examine how the dependent variables are modified by time, situational and individual characteristics. Multi-level models do not assume equal numbers of observations, such that data from respondents with missing observations can be used without constituting any problems (Hox, 2010; Kreft & De Leeuw, 1998).

One limitation of all the papers included in this thesis is the reliance on individual self-report data. The primary assessment form for alcohol use is individual self-reports (Del Boca &

Darkes, 2003). It is important to be aware of the potential threat to validity posed by the use of self-reports. Alcohol use is a sensitive issue associated with social values, whereby self-reported data may be biased (National Institute for Health and Clinical Excellence, 2007). Adolescents who are participating by responding to a questionnaire may express an intention to engage in a given behavior, however, when they enter into the real situation, their perceptions may change, thus leading to a different behavior. In some contexts, adolescents may over-report their alcohol use based on what they perceive to be the socially desirable response. In other contexts, adolescents may under-report their alcohol use due to the fear of unknown consequences. School-based surveys could also underestimate adolescent alcohol use as they do not include students' non-responders, whose drug use may be higher than that of their peers. Additionally, adolescents may not be able to accurately recall past behavior or may choose not to report it accurately (Fishbein & Ajzen, 2010). Short reference periods, such as the past 30 days, are easier to recall, however, the past month may not be representative of the students' general drinking behavior (Del Boca & Darkes, 2003). Despite the fact that the primary assessment strategy for alcohol use behavior is individual self-reporting, concerns have been raised that this method may not be sufficient and should be supplemented with biochemical verifications (White & Pitts, 1998). In terms of reliability, studies of self-reported alcohol use suggest that they are consistent indicators of drinking behavior, which is demonstrated by high test-retest reliability (Aas, 1995). Overall, self-reported methods of alcohol use are found to be reliable and valid measures (Del Boca & Darkes, 2003). Nonetheless, it has been suggested that the validity of self-reports may also be enhanced when the responding adolescents are provided with complementary information about the response processes (Forman & Linney, 1991). The W8 [wait] project tried to reduce the probability of self-report bias by using items that were constructed to be clear and time-bound and by ensuring the confidentiality of participants.

The findings in paper 2 revealed a generally low frequency of alcohol use among the sample. Hence, it was challenging for the intervention to have a significant impact on the participants' drinking behavior. However, the effect size from preventive interventions that provided effects beyond one year were not found to be significant in paper 3, where participants had the same mean age (13 years), as in paper 2. Measurements of a variable for the same group of individuals at a number of consecutive points in time are defined as repeated measures or longitudinal data (Kreft & De Leeuw, 1998). Because adolescents are at an age when they are most susceptible to onset of drinking, it has been suggested that the length of time for follow-up should be considered when the objective is to delay onset and reduce alcohol consumption (Clayton & Cattarello, 1991).

Attrition effects are important when making assumptions about the equality of those who are measured and those who drop out of the study. A possible limitation in paper 2 may be the higher attrition among students who had a higher frequency of alcohol use and a higher age of alcohol debut. This phenomenon was not unexpected. Research on attrition shows that those who drop out of a study are more likely to be substance users than those who remain in the study (Biglan et al., 1991). Nevertheless, the response rate was acceptable and the attrition rate did not differ between the intervention and control groups for this study (Hansen, Tobler, & Graham, 1990).

Generalizability refers to the external validity of whether the findings can be generalized to other circumstances (Moher et al., 2010). The W8 [wait] project specified in detail both the sample and how it was obtained. The sample for paper 1 and 2 consisted of students from junior high schools in Oslo and Akershus. Oslo and Akershus are neighboring counties, both of which are large and central as compared to other counties in Norway. According to the

Norwegian statistics, these two counties are homogenous in terms of socioeconomic status as well. The participating sample also needs to reflect the invited population. The sample in the W8 [wait] project represented 46.5% of the total population of 8th grade students in the selected area of study. A limitation in these papers is the non-participation of students. They may represent a selective group, which could present a possible threat to external validity. To what extent participating and non-participating students differed could not be evaluated due to a lack of information on those who chose not to participate in the W8 [wait] project. The findings on early drunkenness, presented in the first paper, are in line with findings from the national Ungdata survey, which had a response rate of 82% from junior high school students ($N = 63,201$) and is presumed to be representative for Norwegian adolescents (NOVA, 2014).

If those who gather the data are the same individuals who deliver the program, there may be an issue of competing interests. This question has been raised for evaluation studies in general, resulting in recommendations to allow external researchers to examine data in order to validate the support and dissemination in terms of drug prevention policy (Gandhi et al., 2007). This is one of the strengths of the evaluation study presented in paper 2, where the study was conducted by an independent research group rather than the program providers.

Conclusion

The W8 [wait] project found that the onset of alcohol drinking has already occurred among 24% of the 8th grade students in a sample drawn from Norwegian junior high schools.

As alcohol use among adolescents continues to be an important public health issue, study findings support the implementation of preventive interventions in schools. Furthermore, the findings from this study suggest that the preventive programs should be based on theoretical frameworks that include psychosocial variables. “Unge & Rus” was developed by considering

the empirical evidence on program characteristics that are considered effective in delaying and preventing alcohol use among adolescents. The outcome evaluation of “Unge & Rus” showed a limited effect in terms of the program’s objectives conducted under “real-world” conditions. This lack of effect may be caused by poor implementation quality and lack of fidelity in the delivery of the program. Regardless of the cause, it is important to lower expectations somewhat in relation to the measured effectiveness outcomes of school-based preventive programs using universal approaches. As seen in the meta-analytic review, the generalized effect shown in high quality studies varied from no impact on adolescent alcohol behavior to a small positive effect on the adolescents’ weekly alcohol consumption, suggesting that more selective approaches are needed targeting adolescents who are identified as being at higher risk.

Implications and future research

The knowledge gained through this research is important in identifying and developing effective prevention approaches and may have several implications. First of all, there is a need to address the lack of association between the aims of “Unge & Rus” and the results of the effectiveness evaluation. As discussed throughout this dissertation, ensuring effective implementation of interventions is an important challenge. There is generally room for improvement in the practice of delivering school-based prevention programs (Gottfredson & Gottfredson, 2002). Schools need resources to enable them to effectively implement alcohol interventions as prevention programs have been found to be more efficacious when taught by teachers who have acquired the necessary training in program delivery and sufficient knowledge about the subject.

Future research should explore the effects of combining school-based selective prevention programs with universal prevention programs, as suggested by Weare and Nind (2011).

However, the preventive framework is recommended in schools not only to prevent problem behaviors like alcohol use, but also to work more actively on increasing positive behaviors and strengthening characteristics that may prevent potential problems. Research also needs to continuously develop and test the implementation of interventions already shown to effectively reduce alcohol use among adolescents.

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Paper 1

Adolfson, F., **Strøm, H. K.**, Martinussen M., Natvig, H., Eisemann, M., Handegård, B. H., & Kuposov, R. (2014). Early drinking onset: a study of prevalence and determinants among 13-years old adolescents in Norway. *Scandinavian Journal of Psychology*, 55, 505-512. doi: 10.1111/sjop.12151.



Personality and Social Psychology

Early drinking onset: A study of prevalence and determinants among 13-year-old adolescents in Norway

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Early drinking onset is associated with different psychosocial adjustment problems among adolescents. The aim of this study was to assess determinants associated with early drinking and to identify factors predicting early drinking onset among adolescents. The study included 1,550 eighth-graders with a mean age of 13.5 years from 41 schools. A total of 24% (boys 29%, girls 19%) had ever drunk alcohol, while 14% had drunk some alcohol in the last 30 days. Further, early drinking was associated with gender, religion, school performance, smoking and bullying in the bivariate tests. Predictors of early drinking onset were identified by generalized linear mixed models with two multivariable models created. The first model included social and environmental variables. Entering intentions, expectancies, attitudes and norms into the multivariable analysis resulted in a significant improvement of the model fit constituting 86% in the second model. The percentage correctly classified those (56%) who had been drinking in the second model which was two times higher compared to the first model. Gender, religion and smoking emerged as significant predictors of drinking in both models.

Key words: Adolescents, early drinking onset, prevalence, prevention, risk factors.

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INTRODUCTION

Prevention of alcohol use among adolescents has been studied for a long time (Davies & Stacey, 1971). Nonetheless, while risk and protective factors for alcohol use are known and well described elsewhere (Plant & Miller, 2001), drinking among adolescents still remains a major social and health problem, representing a burden to both the individual and society (Babor, Caetano, Casswell *et al.*, 2010). Recent studies have demonstrated that alcohol use among adolescents in Europe, with some exceptions, has been relatively unchanged in most countries over the past years (Heron, Macleod, Munafò *et al.*, 2012), whereas the level of heavy episodic drinking has shown a small but continuous increase over the last 12 years (Hibell, Guttormsson, Ahlström *et al.*, 2009).

Studies have also revealed that patterns of alcohol use vary between countries, for example adolescents in the Nordic countries and the UK typically drink more, but on fewer occasions than adolescents in the Mediterranean countries, who drink more frequently, but fewer units of alcohol each time (Hibell *et al.*, 2009). According to The European School Survey Project on Alcohol and Other Drugs (ESPAD), Norwegian adolescents represent the group with lowest alcohol consumption among the 15- to 16-year-olds in Europe (Hibell, Guttormsson, Ahlström *et al.*, 2012), and the trend of decreasing alcohol use among adolescents in Norway has been stable since 1999. As concerns gender differences in drinking, the ESPAD study has shown that European boys drink one-third more than girls. Norwegian girls, however, from 1995 to 2011 demonstrated a dramatic increase in alcohol use compared to previous years (Hibell *et al.*, 2012).

It has long been acknowledged that early onset of alcohol use is associated with more severe problems resulting from alcohol use such as dependence, alcohol related disorders (Dawson, Goldstein, Chou, Ruan & Grant, 2008), suicide (Garlow, 2002), violence and injuries (Gruber, Di Clemente, Anderson & Lodico, 1996) and low academic performance. The definition of early drinking is still unclear and controversial regarding the cut-off age for when drinking can be referred to as early; this varies from age 12 or younger (De Genna, Cornelius & Donovan, 2009) to age 15 or younger (Humphrey & Friedman, 1986). While studies do not agree on whether it is alcohol use in childhood or in early adolescence that represent greater risk, in general they concur that early alcohol use predicts later problematic drinking. Traditionally, biological and genetic factors have been considered the major determinants for alcohol use in a bio-medical context (Cloninger, Svrakic & Przybeck, 1993). In addition, a broader framework has emerged emphasizing the importance of socioeconomic, environmental factors (SES, religion, family, school and friends) (Burnside, Baer, McLaughlin & Pokorny, 1986) and such factors as alcohol attitudes, expectancies, intentions and norms (Aas, 1993; Ho, Poorisat, Neo & Detenber, 2013) in drinking among adolescents. Of special interest is the predictive validity of factors related to early drinking onset, and some studies have defined early onset of drinking by age 14. In particular, earlier age of alcohol initiation was found to be predicted by ethnicity, a larger degree of parental drinking, poorer performance at school and having more friends who drink (Hawkins, Graham, Maguin, Abbott, Hill & Catalano, 1997), behavioral problems (Clark, Parker & Lynch, 1999), smoking (Klein, 2006) and male gender (Rose, Dick, Viken, Pulkkinen

& Kaprio, 2001). Conduct problems, together with attention problems are associated with alcohol use. Symptoms of anxiety and depression are related to girls' alcohol drinking, and among both girls and boys' alcohol intoxication predicted frequent drinking and illegal drug use (Strandheim, Bratberg, Holmen, Coombes & Bentzen, 2011). In addition, results from other studies indicate a shift in predictability regarding drinking which is related to age or development (Zucker, 2006; Masten, Faden, Zucker & Spear, 2008). For example, expectancies about the effects of alcohol and intent to use alcohol have age-related shifting. Dunn and Goldman (1996, 1998) have demonstrated that negative expectancies decrease while positive expectancies increase during later middle childhood and early adolescence. As for intention to drink there is an increase with age during elementary school (Donovan, Leech, Zucker & Loveland, 2004). Specifically, the planning of prevention efforts should be based on research on risk and protective factors associated with early drinking onset. Previous studies conducted in Norway on alcohol use among adolescents were either mostly limited to ages 15–16 years (Vedøy & Skretting, 2009; Strandheim, Holmen, Coombes & Bentzen, 2010; Øia, 2012) or they were conducted more than 10 years ago (Kloep, Hendry, Ingebrigtsen, Glendinning & Espnes, 2001). Presumably, our study of drinking among young adolescents can provide better understanding of the role of possible relationships between various individual and environmental factors with early drinking onset. Knowledge on such relationships might be of relevance both for detecting adolescents at risk for early drinking and for preventive matters. The aims of the present study were, (a) to estimate the prevalence of early drinking among Norwegian adolescents, (b) to identify factors correlated with early drinking, and (c) to test models for predicting early drinking onset.

METHOD

Participants

The data for the present study were collected as part of a larger project "W8 [wait]" investigating the effect of a school-based alcohol prevention program used in junior high schools in Norway (www.w8.uit.no) (Kyrrestad Strøm, Adolfsen, Handegård et al. 2014).

Principals from 41 (2,020 pupils) of the 91 invited schools (4,356 pupils) agreed to participate in the study. This resulted in a baseline sample of 1,574 8th graders (77.9% out of 2,020) who answered the internet-based questionnaire. Only subjects with complete data were included in the analysis which yielded 1,550 pupils. Mean age was 13.5 ($SD = 0.7$), 50.6% were girls and 49.4% were boys. Concerning adolescent alcohol drinking we used questions about their alcohol experience. Risk factors we studied were drinking peers, gender, smoking and bullying. We also included a question as to whether the adolescent's parents had been talking about alcohol at home since parental permissiveness to drinking has been shown as a risk factor (Kosterman, Hawkins, Guo, Catalano & Abbott, 2000). These factors are based on theoretical approaches from problem behavior theory, social context theory and theory of socialization (Donovan et al., 2004).

Measures

Background variables and situation at school. The adolescents were asked about their gender, age, school grades and religion. Family situation was assessed by asking how many adults he/she lived with

using the response categories "two parents/adults" (1), "one parent/adult" (2) and "others" (3). Family economy was assessed by asking about their family's economic situation and response categories ranging from "very bad" (1) to "very good" (5). Adolescents' social life and school performance was assessed by questions such as; "How many close friends do you have" and "How do you rate your skills at school".

One question whether the adolescents have bullied others and one question whether they have been bullied by others, originally used in the Olweus bullying program (Olweus, 2005), were also included, with response categories from "not at all" (1), "rarely" (2), "2–3 times a month" (3), "weekly" (4), "several times a week" (5).

Alcohol use variables

Several measures were used to assess alcohol use in the study. First, the respondents were asked "Have you ever had at least one glass of alcohol?" Individuals who answered positively were asked a series of follow-up questions about alcohol use and attitudes.

Frequency of monthly alcohol use was measured by a question adopted from Aas and Klepp (1992) "How often have you been drinking alcohol the past three months?" with five response categories "not at all" (0), "1–2 times in past 3 months" (1), "once a month" (2), "2–3 times a month" (3), "at least once a week" (4).

Alcohol inebriation was measured for the period of the past three months asking "How many times did you drink so much alcohol that you felt inebriated". Originally responses ranged from "once" (0) to "11 or more times" (7). The categories were recoded to no times (0), 1–2 times (1) and more than 2 times (2).

Drinking behavior among close friends and/or siblings was assessed by asking whether the pupil had close friends and/or siblings who drink alcohol. The response alternatives were "no close friends/siblings who drink" (1), "have close friends/siblings who drink" (2) and "don't know" (3).

Parents' talking to child about harm of alcohol was assessed by a single question, "Did your parents/caregivers talk to you in the last 3 months about harm from using alcohol or other drugs?" with response alternatives "yes" (1) and "no" (2).

Alcohol expectancies were assessed with the Global Positive and Social Positive scales from the modified Norwegian version (Aas, 1993; Christiansen, Goldman & Inn, 1982; Christiansen & Goldman, 1983). The adolescents were asked five questions to indicate alcohol expectancy on a seven-point scale, with items such as: "many alcoholic drinks taste good" and "parties become more fun when alcoholic beverages are consumed there." The response categories ranged from "strongly disagree" (1) to "strongly agree" (7). Cronbach's alpha was 0.75.

Social norm scale included four questions: "Would your friends like or dislike you if you drink at least one glass of alcohol?", "Would your parents/guardians like or dislike you if you drink at least one glass of alcohol?" with answers ranging from "dislike it very much" (0) to "like it very much" (4). Two more questions were used: "How old do you think girls and boys should be before they can drink at least one glass of alcohol?" Cronbach's alpha 0.71 was acceptable (DeVellis, 2003) for the social norms scale which had been previously used in the "Young in Norway 2002" study.

Attitudes to alcohol consumption measured to what degree adolescents found it acceptable for same aged peers to drink alcohol. Alcohol-related attitudes were a sum of five questions from Conner and Norman (2005) where lower scores represent more negative attitudes towards alcohol use. A sample question included was, "Do you find it acceptable that an 8th grader drinks a glass of alcohol without any adults present?" The response categories ranged from "no, totally wrong" (1) to "yes, it's ok" (7). Cronbach's alpha for the *Attitude* scale was 0.86.

Intentions to drink were assessed by two questions on how likely it would be for the adolescents to drink the next three months, and to become inebriated. The response categories ranged from "quite unlikely" (1), to "quite likely" (5). Spearman-Brown reliability (Eisinga, Grotenhuis & Pelzer, 2012) estimate for the two items are 0.66.

Procedure

Each participating school was responsible for distributing a written consent form and information about the study to the parents. Written consent was requested from both the adolescents and their parents. Pupil data were collected in class using online questionnaires. The study was approved by the Regional Committee for Medical Research Ethics.

Statistical analyses

To assess the association between drinking experience (yes/no) and various predictors, generalized linear mixed modeling was employed, using a logit link function. Both bivariate and multivariable analyses were run. To assess the predictive value of studied variables on early drinking, the percentage of correctly classified subjects was reported, using a predicted probability of 0.5 as a classification cut-off. Two multivariable models were created. The first model included demographic variables and adolescent behavior characteristics. The second model also included alcohol related intentions, expectations, attitudes and norm variables. Multivariate analyses in the second model were adjusted for all variables included in the first model. Data were analyzed using the Statistical Package for Social Sciences (SPSS-21.0; IBM, Armonk, NY).

RESULTS

Sample characteristics

Among the demographic characteristics, 50.6% were girls, and a total of 82.6% of the adolescents reported living in a household with two parents/guardians and 17.4% with one parent/guardian. The family's economic situation was reported as good or very good by 79.8% of the respondents, 19.1% as moderately good and only 1.1% of the sample reported about bad or very bad economic situations. The adolescents were asked about what religion

their family were closest linked to. They answered Christianity (67.6%), Islam (9.9%) and 3.3% who reported other religions such as Buddhism and Hinduism, while 19.2% of the pupils reported that their family were non-religious. A total of 97% of the adolescents reported to have two or more close friends.

Self-reports showed that 24% had drunk at least one glass of alcohol. Significantly more boys (29%) than girls (19%) reported ever having been drinking ($\chi^2 = 20.8$; $df = 1$; $p < 0.001$). The proportion of boys versus girls who reported drinking more than one drink in the past three-month period was also larger (10.7% versus 7.9%) ($\chi^2 = 30.5$; $df = 7$; $p < 0.001$). A smaller proportion of girls compared to boys had alcohol-using friends (29% versus 36%) ($\chi^2 = 6.1$; $df = 2$; $p < 0.05$), whereas when being asked about having older or same age drinking siblings, more girls than boys replied positively (32% versus 26%) ($\chi^2 = 17.2$; $df = 3$; $p < 0.01$) (Table 1).

Bivariate analysis

The relationships between drinking experience and studied variables are presented in Table 2. The variables that showed the strongest and significant associations with drinking were male gender (OR = 1.8, 95% CI 1.4–2.3), religion (OR = 0.3, 95% CI 0.1–0.5) with Christianity as a reference, worse than average performance at school (OR = 3.9, 95% CI 1.9–7.9), smoking (OR = 13.0, 95% CI 8.2–20.7), bullied others (OR = 2.0, 95% CI 1.5–2.8), global (OR = 1.5, 95% CI 1.3–1.6) and social (OR = 2.0, 95% CI 1.8–2.2) positive expectancies towards drinking, positive attitudes towards drinking (OR = 2.5, 95% CI 2.2–2.8), intentions to drink (OR = 1.9, 95% CI 1.7–2.1) and social norms towards drinking (OR = 3.2, 95% CI 2.8–3.7).

Table 1. Alcohol Use for Boys, Girls and the Total Sample and test of significance

Questions	Boys N (%)	Girls N (%)	Total N (%)	p
Have you ever been drinking at least 1 small glass of alcohol?				
No	545 (71)	636 (81)	1181 (76)	0.001**
Yes	222 (29)	150 (19)	372 (24)	
How often have you been drinking alcohol the last three months?				
Not at all	685 (89)	724 (92)	1409 (91)	0.001**
1–2 times in last 3 months	51 (6.6)	41 (5.2)	92 (6)	
Once a month	9 (1.2)	14 (1.8)	23 (1.5)	
2–3 times per month	12 (1.6)	5 (0.6)	17 (1.1)	
At least once a week	10 (1.3)	2 (0.3)	12 (0.8)	
If you think of the last 3 months, how many times did you drink so much that you clearly have felt inebriated?				
0 times	744 (97.3)	770 (97.8)	1514 (98)	0.001**
1–2 times	11 (1.4)	11 (1.4)	22 (1.2)	
More than 2 times	9 (1.3)	5 (0.8)	14 (0.8)	
Drinking friends				
No	269 (50)	355 (56)	624 (53.7)	0.05*
Yes	190 (36)	182 (29)	372 (32)	
Don't know	74 (14)	92 (15)	166 (14.3)	
If you have older/same age siblings, do they drink alcohol?				
No older siblings	217 (29)	240 (31)	457 (30)	0.001**
Don't know	202 (27)	199 (25)	401 (26)	
No	139 (18)	92 (12)	231 (15)	
Yes	198 (26)	253 (32)	451 (29)	

Note: * $p < 0.05$, ** $p < 0.005$.

Table 2. Associations between Alcohol Use and Studied Variables

Variable	N	Never tried alcohol n (%)	Have tried alcohol n (%)	Bivariate			Multivariable Model 1		
				F	OR	95% CI	F	OR	95% CI
<i>Background variables</i>									
Gender									
Girls	785	637 (81)	148 (19)	22.0***	Ref	1.4-2.3	9.3**	Ref	1.2-2.1
Boys	765	553 (71)	223 (29)		1.8***			1.6**	
Religion				9.2***	Ref		8.7***	Ref	
Christianity	1059	799 (75)	260 (25)		0.3***	0.1-0.5		0.1***	0.1-0.3
Islam	152	141 (93)	11 (7)		0.5	0.2-1.1		0.4	0.2-1.1
Other	52	45 (87)	7 (13)		1.4*	1.0-1.9		1.2	0.8-1.7
None	298	205 (69)	93 (31)	1.2			1.0		
Family situation					Ref			Ref	
Two parents	1265	978 (77)	287 (23)		1.2	0.9-1.6		1.2	0.8-1.7
One parent	266	196 (74)	70 (26)	1.3			0.8		
Family economy					Ref			Ref	
Very good	307	241 (79)	66 (21)		1.1	0.8-1.5		1.3	0.9-1.9
Good	930	713 (77)	217 (23)		1.3	0.9-2.0		1.1	0.7-1.8
Moderate	296	217 (73)	79 (27)		2.2	0.7-6.3		1.5	0.4-5.5
Bad/Very bad	17	11 (65)	6 (35)						
<i>School, friends, parents</i>									
School performance				7.2**	Ref		2.0	Ref	
Better	582	462 (79)	120 (21)		1.2	0.9-1.6		1.1	0.8-1.4
Moderate	938	706 (75)	232 (25)		3.9***	1.9-7.9		2.4*	1.0-5.8
Worse	37	18 (49)	19 (51)				1.6		
Amount of close friends				1.3	Ref			Ref	
More than 3	1193	903 (76)	290 (24)		0.8	0.6-1.1		0.8	0.5-1.1
2-3	325	256 (79)	69 (21)		1.6	0.7-3.7		1.4	0.5-3.9
1	28	18 (64)	10 (36)		0.4	0.1-1.9		0.2	0.01-1.8
No close friends	14	12 (86)	2 (14)	2.7			1.5		
Parents talking with child about harm of alcohol					Ref			Ref	
Yes	706	555 (79)	151 (21)		1.2	0.96-1.6		1.2	0.9-1.6
No	845	626 (74)	219 (26)						
<i>Smoking, bullying</i>									
Smoking				117.0***	Ref		97.8***	Ref	
No	1446	1161 (80)	285 (20)		13.0***	8.2-20.7		13.7***	8.1-23.0
Yes	115	29 (25)	86 (75)				0.5		
Have been bullied at school				1.0	Ref			Ref	
Never	1170	906 (77)	264 (23)		1.1	0.8-1.6		0.8	0.5-1.2
Seldom	275	206 (75)	69 (25)		1.1	0.5-2.0		0.8	0.4-1.7
2-3 times/month	55	41 (75)	14 (25)		1.9	0.9-3.9		1.1	0.4-2.9
Several times/week	36	24 (67)	12 (33)						

Table 2 (continued)

Variable	N	Never tried alcohol n (%)	Have tried alcohol n (%)	Bivariate		Multivariable Model 1				
				F	OR	95% CI	F	OR	95% CI	
Have bullied others at school										
Never	1263	1006 (80)	256 (20)	11.1***	Ref		4.0**	Ref	1.3-2.8	
Seldom	226	149 (66)	77 (34)		2.0***	1.5-2.8		1.9*	0.8-6.6	
2-3 times/month	22	11 (50)	11 (50)		3.7**	1.5-9.0		2.4	0.6-7.7	
Several times /week	21	7 (39)	11 (61)		5.0**	1.8-13.5		2.2		
Attitudes, norms and intention										
Global positive expectations towards drinking										
Social positive expectations towards drinking					61.2***	1.3-1.6		4.8*	0.6-1.0	
Positive attitudes towards drinking					158.3***	1.8-2.2		8.0**	1.1-1.8	
Intentions to drink					255.5***	2.2-2.8		20.7***	1.2-1.7	
Social norms					121.4***	1.7-2.1		6.3*	1.0-1.4	
					254.4***	2.8-3.7		63.7***	1.7-2.5	
Multivariable Model 2										
					F	OR	95% CI			

Note: *p < 0.05, **p < 0.01, ***p < 0.001.

Multivariable analysis

As shown in the Table 2, when all variables were entered in a multivariable model at first level (first model), the amount of correctly classified subjects was found to be 82.2%. The first model classified correctly only 29.1% of those having been drinking alcohol at least once. Variables found significantly to predict drinking were gender (OR = 1.6, 95% CI 1.2-2.1), religion (OR = 0.1, 95% CI 0.1-0.3) worse than average performance at school (OR = 2.4, 95% CI 1.0-5.8), smoking (OR = 13.7, 95% CI 8.1-23.0) and having bullied others (OR = 1.9, 95% CI 1.3-2.8).

Adding to the predictor set psychosocial variables such as intentions to drink, expectancies, attitudes and norms towards drinking to the multivariable model at the second level, resulted in a significant improvement in the model fit and increased the percentage of correctly classified subjects to 86.3% overall. The second model correctly classified 56.2% of those having been drinking alcohol at least once. Gender, religion and smoking were still found significantly associated with drinking, as well with social positive expectancies towards drinking (OR = 1.4, 95% CI 1.1-1.8), global positive expectancies (OR = 0.8, 95% CI 0.6-1.0), positive attitudes towards drinking (OR = 1.4, 95% CI 1.2-1.7), intentions to drink (OR = 1.2, 95% CI 1.0-1.4) and social norms about drinking (OR = 2.1, 95% CI 1.7-2.5).

DISCUSSION

The study aimed to estimate the prevalence of early drinking among Norwegian adolescents. In total, 24% of the participants reported having drunk at least a glass of alcohol. Results are similar to those found by Donovan and Molina (2011) among American adolescents where 25% reported having had a drink at the same age. The estimated prevalence of early-onset drinking among 13-year-olds in our study could potentially be of concern to health authorities in light of the documented association between age of first drink and negative outcomes later in life. Nonetheless, such a cause-effect relationship was recently questioned by Kuntsche, Rossow, Simons-Morton, Bogt, Kokkevi and Godeau (2013). In particular, it was suggested that other aspects of drinking, such as early drunkenness, may be more important for health and social consequences (Kuntsche *et al.*, 2013; Rossow & Kuntsche 2013).

Some regularity in drinking habits among the studied 13-year-old adolescents was indicated among 4.1% of boys and 2.7% of girls who reported drinking with a frequency of three or more times during the past three months. These are similar to those reported in a recent WHO study among young people (Currie, Zanotii, Morgan *et al.*, 2012), where percentage of weekly drinking among 13-year-old adolescents in Norway was reported to 3.0% of girls and 5.0% of boys.

In our study 2.1% of the total sample reported having been inebriated. In a study by Strandheim and colleagues (2010) comprising 8,983 of 13-19-year-old Norwegian high school students, it was found that 6.2% in the 13-15 years group reported having been inebriated at least once. Lower figures for intoxication estimated in our study are most probably due to our sample's lower average age of 13.5 years.

Among the assessed socioeconomic variables in the present study, only religion was significantly associated with adolescents' early drinking. Our findings were different from previous studies in other countries, where an association between socioeconomic variables such as family economy, family situation and early drinking had been documented (Melotti, Lewis, Hickman, Heron, Araya & Macleod, 2013). One reason might be that these studies were based on samples with lower socioeconomic levels than our study sample. The fact that Norway is a country with less pronounced differences concerning socioeconomic status, especially poverty levels, than in other countries, might explain the difference in associations. Concerning the measures of socioeconomic status used in our study they could have been improved by looking at material wealth since that is related to families' resources to participate in activities in the society. Another important measure of socioeconomic status is parental occupation since that is correlated to a stable income (Vereecken, Incley, Subramanian, Hublet & Maes, 2005).

The finding of a strong association between early drinking onset and gender and religion was not new and in line with a number of prospective studies focusing on social determinants of early drinking (Amundsen, 2012; Amundsen, Rossow & Skurtveit, 2005). An interesting finding was that smoking yielded the strongest association with early drinking onset. Presumably this is of importance regarding the role of smoking prevention in breaking the chain of events which might influence initiation of drinking. On the other hand, the underlying mechanisms of such a relationship are not clear since we did not study whether smoking causes drinking or vice versa, or whether there are common antecedents of both such as peer pressure or individual risk factors such as stress, anxiety and depression which we did not measure in our study. One can also argue that the effect of smoking prevention on onset of drinking will yield limited results due to the fact that relatively few have started smoking at the age of 13 years.

No associations between early drinking onset and adolescent's communication with parents about the harmful effect of alcohol emerged in our study. On the other hand, parental alcohol-specific rules were related to postponement of drinking debut among adolescents at different ages (Van der Vorst, Engels, Meeus & Deković, 2006). A meta-analysis found programs with family interventions effective in reducing alcohol initiation and frequency of alcohol use among adolescents (Smit, Verdurmen, Monshouwern & Smit, 2008).

According to the results of the study, a considerable increase in the proportion of correctly classified early drinkers occurred after entering the psychosocial variables such as expectancies, attitudes, intentions and norms into the model (increasing from 29.1% to 56.2%). Findings support the use of programs oriented towards psychosocial variables and expand previous research about a consistent relationship between early drinking and the role of adolescent's expectancies, attitudes, norms and intentions (Aas, 1993; Ho *et al.*, 2013) in order to prevent drinking.

In spite of numerous socioeconomic and behavioral variables included in the study, many of them failed to show significant relationships to early drinking onset after having been included in model 1. Our findings generate knowledge of factors associated with drinking onset that might be interesting for the

Norwegian authorities when planning preventive efforts in schools. These efforts should involve identification of adolescents that have several risk factors including early onset of drinking and providing targeted interventions for these groups.

One potential limitation of this study is its cross-sectional design compromising conclusions regarding the causal role of studied variables for early drinking onset. Second, the reliability of the questionnaire might have been affected by the study participants not fully understanding the meaning of some key questions used in the questionnaire regarding alcohol and drunkenness. On the other hand, several studies on test-retest reliability of self-reported alcohol consumption have supported the reliability of adolescents' self-reports assessing on their drinking (Aas, Leigh, Anderssen & Jakobsen, 1998). Further limitations related to the study might be the construct validity of some scales. The expectancies and attitudes scales are not correlated to other concepts within the same theme. Qualitative information from the adolescents might also give additional information.

Finally, other factors related to onset of early drinking, such as parental drinking (Baumrind, 1985; Sondhi & Turner, 2011) and the child's conduct problems (Campbell, Shaw & Gilliom, 2000; Kaplow, Curran & Dodge, 2002; Masten *et al.*, 2008) were not considered in the present study. More comprehensive studies with the current limitations taken into account should provide a better overview on determinants and predictors of early drinking onset. Studies using methods such as structural equation modeling and growth curve modeling makes the possibility of increasing the knowledge of transitions in adolescents' development, especially from regular to problematic drinking.

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Paper 2

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Preventing Alcohol Use with a Universal School-Based Intervention: Results from an Effectiveness Study

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Abstract

Background

The effectiveness of the universal school-based alcohol prevention program, “Unge & Rus” [Youth & Alcohol] was tested by an independent research group. The program aims to prevent alcohol use and to change adolescents’ alcohol-related attitudes and behavior. The main outcome measure was frequency of monthly alcohol use, favorable alcohol attitudes, perceived behavioral control (PBC), positive alcohol expectancy and alcohol-related knowledge.

Methods

Junior high school students ($N = 2,020$) with a mean age of 13.5 years participated in this longitudinal pre, post and one-year follow-up study with a quasi-experimental design, involving an intervention group and a comparison group recruited from 41 junior high schools in Norway. Multilevel analysis was used to account for the repeated observations (level 1) nested within students (level 2) who in turn were clustered within school classes (level 3).

Results

Results showed an increased level of alcohol-related knowledge in the intervention group ($p < .005$) as compared to the control group at one-year follow-up. However, no significant difference in change was found between the intervention group and the control group in frequency of monthly alcohol use, alcohol-related attitudes, PBC or alcohol expectancy at one-year follow-up.

Conclusions

This study offers adequate data on the effectiveness of a school-based alcohol prevention program widely implemented in Norway. Under its current method of implementation, use of the program cannot be supported over the use of standard alcohol curriculum within schools.

Key words: adolescents, alcohol, prevention, effectiveness, multilevel analysis.

Background

A public health priority of the World Health Organization is to prevent harmful use of alcohol [1]. Alcohol drinking is the most prevalent and socially acceptable form of substance use among young people and adults. Likewise, alcohol is the most frequently used intoxicating substance in junior high school [2, 3]. Early onset of alcohol use is associated with problematic substance use in later adolescence and serves as a predictor of alcohol dependence and other mental health problems [4, 5].

Alcohol interventions are an important priority within school-based prevention, but the effectiveness of alcohol prevention programs has been modest [6]. Meta-analytic findings showed a significant mean treatment group difference in 18 high quality alcohol interactive programs with a small mean effect size of Hedges' $g = 0.14$ [7]. However, a more recent review documented that six out of eleven alcohol-specific trials showed significant reductions in alcohol use [6].

One of the school-based interventions widely implemented in Norway is "Unge & Rus" [Youth & Alcohol]. This program shares several core components with successful interventions like the European Drug Addiction Prevention (EU-DAP) program, "Unplugged" [8, 9]. The EU-DAP study concluded that the program, "Unplugged", can delay progression to frequent drinking and reduce occurrence of alcohol-related behavioral problems in European students [9]. Both "Unplugged" and "Unge & Rus" are based on a Social Influence Model in which the students are asked to participate and share normative beliefs [10-13]. They both target adolescents at junior high schools and have a peer-led component in the standard

intervention curriculum. Both interventions have a family component that includes parents, and both interventions offer training to teachers in order to aid program implementation.

The “Unge & Rus” [Youth & Alcohol] intervention

The intervention was developed by Wilhelmsen [14] in cooperation with Henriksen [15] and has been mandatory in several municipalities in Norway since 2006. The intervention is free of charge and is easily accessible online to parents, teachers and students. The website, www.ungeogrus.no, is managed by the Norwegian Knowledge Center for Drugs in the North.

The intervention, “Unge & Rus”, which is a combined version of the two programs, “Ungdom og alkohol” [Young and Alcohol] [14] and “Foreldresamarbeidet” [Parents Working Together] [15], has never been evaluated before.

The program “Ungdom og alkohol” [Young and Alcohol] was only designed for students and aimed to: 1) postpone student’s alcohol debut; 2) reduce experimenting with alcohol; and 3) influence alcohol behavior by affecting causes of drinking. The evaluation study [16] of “Ungdom og alkohol” randomly assigned four schools to each of three conditions: highly role-specified (HRS), less role-specified (LRS), and control condition. The HRS condition had twice the number of peer leaders per class and a more detailed program prescription than the LRS condition. The HRS group had significantly larger reductions in the outcomes of alcohol use than the control group, whereas the difference between the LRS and the control group did not reach statistical significance [14]. The difference in alcohol use between the highly role-specified intervention condition and the control condition was small (Cohen’s $d = 0.13$).

The other program, “Foreldresamarbeidet” [Parents Working Together], was designed for parents. The program aimed to increase the collaboration between parents/guardians and the school, to increase parent’s/guardian’s authority in setting limits for their adolescents, and to increase parent’s/guardian’s competence to communicate with their adolescents about alcohol. No effectiveness study of the parent component has been conducted. The program was tested in two junior high schools in the community of Bodø, 1997-1998 [15]. The majority of parents assessed the program as useful and as having led to positive experiences. The report showed that the program created opportunities for parents to clarify common boundaries and to share in conversations with one another about drugs.

The purpose of the present intervention, “Unge & Rus”, was to facilitate cooperation between the school and the parents to allow students to: 1) develop knowledge about alcohol and the ability to think critically about its use; 2) strengthen attitudes against the use of alcohol; 3) reinforce the ability to say no to alcohol; and 4) delay the first use of alcohol.

Students are actively involved in the program by working on five different components. The first component includes a cultural and traditional theme addressing the consequences of alcohol abuse and alternatives to alcohol use, with a focus on developing awareness of the influence that friends, family, community, and society can have. The first component aims to share knowledge and attitudes related to alcohol use in different cultures, thus enabling young people to make their own choices and better manage negative influences. The purpose of the second component is to educate students about norms for alcohol use, thus aiming to correct misconceptions among students; e.g., that young people have a tendency to overestimate peer drinking and drug use [17, 18]. The third component is designed to increase students’ knowledge about alcohol use by sharing facts on the physiological effects of alcohol on the body. The fourth component of the intervention seeks to increase resistance skills and

the ability to handle drinking pressure. The fifth component involves working with alcohol-related attitudes.

The program recommends a timeframe of 20 school hours to work with the students in addition to two parent meetings. The intervention is carried out by teachers who receive an 8-hour course from the Norwegian Education Agency, with theoretical and practical training on how to deliver the program in a classroom setting. The program engages students to work on individual assignments, group projects and homework, using tasks that are directly connected to alcohol use. The students use the program website (www.ungeogrus.no) while working their way through the program components.

The W8 [wait] study

The W8 [wait] study was a research project commissioned by the Norwegian Directorate of Health to evaluate the effectiveness of the school-based alcohol intervention, “Unge & Rus”, as it is implemented among all 8th grade students in Oslo, the capital of Norway. The name W8 [wait] was created as an acronym to separate the research project from the intervention itself (“Unge & Rus”).

The effectiveness of the intervention, “Unge & Rus”, was examined by comparing schools in Oslo to a group of schools receiving the standard Norwegian junior high school curriculum, in order to test whether there were significant group differences in the outcome measures over time. The Norwegian authorities have made schools responsible for introducing information on drugs and alcohol abuse as part of the standard curriculum in junior high schools, in order to increase alcohol-related knowledge among adolescents [19].

In this study, we want to test whether the rate of change in frequency of monthly alcohol use, alcohol-related attitudes, alcohol expectancy, alcohol-related knowledge, and

perceived behavior control, differ between the intervention and the control group. This paper will provide details on an independent effectiveness study of the intervention, “Unge & Rus”.

Methods

Participants and procedure

The effectiveness of “Unge & Rus” was tested using a longitudinal pre, post and one-year follow-up study with a quasi-experimental design, comparing an intervention group to a control group selected from 41 junior high schools in Norway. The study was conducted in Oslo and Akershus. Oslo implemented the program as a mandatory educational program in all of the 47 junior high schools, of which 24 schools accepted the invitation to participate in this study as the intervention group. The 23 schools that did not participate either did not provide a response to the invitation or refused based on reasons such as lack of time and resources. The control group (17 schools) was recruited from neighboring municipalities in Akershus, according to geographic vicinity and other socio-demographic characteristics as provided by Statistics Norway (www.ssb.no/english). The eligible sample consisted of 4,356 students, whereas 2,020 agreed to participate in the study.

The baseline sample consisted of 1,574 eighth-grade students with a mean age of 13.46 years ($SD = 0.68$), of which 50.6% were girls. A total of 24.0% had consumed at least one glass of alcohol, 81.5% lived with both of their parents, and 86.7% participated regularly in organized activities. The composition of perceived religious affiliation was: 67.6% Christian, 9.9% Islamic, and 3.3% other religions, with a further 19.2% reporting no religious affiliation.

Each participating school was responsible for distributing envelopes to all students including a study invitation with information sheets; one assigned to the parents and one assigned to the student. Parents had to sign the written consent and return it to the school in

order for their son/daughter to take part in the study. Data was collected by anonymous self-report online questionnaires, filled out during class time. Participating students were rewarded after each test with minor school-related profile articles like pens, candy and post-it pads, in addition to participation in a lottery where ten students won a tablet computer at the one-year follow-up. Descriptive information on program implementation was collected from the teachers ($N = 47$) using an online questionnaire at T2.

The baseline assessment was conducted in January, 2011 (T1). The intervention took place during the spring semester of 2011. The first post-test was conducted in May, 2011 (T2), and the one-year follow-up test was carried out in May of 2012 (T3). The study was approved by the Regional Committee for Medical Research Ethics.

Measures

Socio-demographic characteristics

Demographic variables included the adolescents' age at baseline, gender, family structure (e.g., living with two parents, one parent or other relatives), religion (Christianity, Islam, Other), friends (number of friends), and leisure activities (yes or no).

Alcohol Use (AU)

The two questions measuring adolescents' Alcohol use (AU) were adopted from Aas and Klepp [20]. The first question was, "Have you ever consumed a glass of alcohol?" coded "No" (0) and "Yes" (1). The second question was, "How often have you consumed alcohol during the past three months?" The responses were recoded to represent a 30-day frequency measure and ranged from (1) "no times" (= 0 times monthly) to (7) "4 - 7 times a week" (= 23.6 times monthly).

Alcohol Attitudes (AA)

Alcohol Attitudes (Alc. Att) measured to what degree they found it acceptable for students of the same age to drink alcohol in various situations. The Alcohol Attitudes scale comprised a mean of five questions where lower scores represented more conservative attitudes towards alcohol use [21]. A sample question was, “Do you find it acceptable for an 8th grader to drink a glass of alcohol without any adults present?” The response categories ranged from “No, totally wrong” (1) to “Yes, it’s ok” (7). The Cronbach’s alpha for the *Alcohol Attitudes* scale was .86.

Perceived Behavioral Control (PBC)

Perceived behavioral control (PBC) was measured by four items asking students to estimate the degree of PBC on a 7-point scale measured by questions such as, “If someone is offering me a glass of wine or beer, I don’t know/I know how to refuse”. The response categories ranged from “I don’t know any ways to refuse” (1) to “I know several ways to refuse” (7). Higher scores indicate higher resistant self-efficacy scores. The Cronbach’s alpha for the PBC scale was .77.

Alcohol Expectancy Questionnaire (AEQ – A)

Alcohol expectancy (AEQ-A, the social scale) was based on a short and modified Norwegian version of the Alcohol Expectancy Questionnaire for Adolescents [13, 22]. The five items asked students to indicate their positive alcohol expectancy on a 7-point scale with items such as, “Many alcoholic drinks taste good” and “Parties become more fun when alcoholic beverages are consumed there”. The response categories ranged from “strongly disagree” (1) to “strongly agree” (7). AEQ-A had a Cronbach’s alpha of .75.

Knowledge

Knowledge regarding alcohol was measured with three items, each allowing four response alternatives (only one correct option). These questions were: “What is the age limit for buying beer and wine in Norway?”, “What does blood-alcohol concentration measure?” and “What is the name of the kind of alcohol used in beer, wine and spirits?” The variable was coded as 1 for all answers right, and 0 for other answers (0, 1 or 2 correct answers).

Dosage measures

Teachers from both the intervention and control groups were asked, “Have you participated in the program training for “Unge & Rus” during the last two years?” and “Have you visited the website (www.ungeogrus.no)?” Response categories were recoded to represent how many hours had been spent on the website with a range from “Less than one hour” (= 0.5) to “More than five hours” (= 6). Teachers in the intervention group were additionally asked three questions: 1. “How many hours did you spend on “Unge & Rus” in your class?” Response options were recoded to represent the number of hours spent ranging from “1-5 hours” (= 3) to “More than 30 hours” (= 35); 2. “How many weeks were spent on “Unge & Rus” in your class?” Response options were recoded to represent the number of days used from “Less than a week” (= 3) to “More than three weeks” (= 25); 3. “Was the peer leader training implemented at your school?” Response was registered as “Yes” or “No”. Teachers in the control group were additionally asked, “Have you been working with any alcohol curriculums during the last two years in your class?” The three response options were: “No”, “Yes, with “Unge & Rus” and “Other efforts – please specify”.

Statistical methods

Data were analyzed using the Statistical Package for Social Sciences (SPSS 21.0). The structures of these data were expected to be hierarchical, since students from the same class

tend to be more similar to each other than students from different classes. The level of within class dependency was therefore examined.

To test whether the rate of change in the outcome measures differed between the intervention and comparison group, multilevel analysis and generalized multilevel analysis were used. Three-level models were implemented with repeated observations (level 1) nested within students (level 2), and students clustered within school classes (level 3) (equation 1) [23]. On level 1 the outcome was modeled as a linear function of time. With the treatment group variable as a predictor on level 3, the composite multilevel of change looks like this:

$$Y_{ijk} = (\gamma_{000} + \gamma_{001} \cdot \text{Group}_k + \gamma_{100} \cdot \text{Time}_{ijk} + \gamma_{101} \cdot \text{Group}_k \cdot \text{Time}_{ijk}) + (R_{0jk} + U_{10k} \cdot \text{Time}_{ijk} + R_{1jk} \cdot \text{Time}_{ijk} + U_{00k} + E_{ijk})$$

Y_{ijk} = Outcome at measurement i for individual j in school class k .

$\gamma_{000}, \gamma_{001}, \gamma_{100}, \gamma_{101}$ = Fixed effects

$R_{0jk}, U_{00k}, R_{1jk}, U_{10k}$ = Random intercepts and slopes on level 2 (individuals) and 3 (classes)

E_{ijk} = The residual for measurement i for individual number j in school class k

The overall effects were predicted with the time variable coded continuously. We also tested whether there were group differences on the post-measurement survey. This analysis was still based on a longitudinal model, however, time was treated as a categorical variable in this case [24]. By varying the reference time point in the analysis, predicted group differences on each occasion can be estimated. The multilevel analysis used Full information maximum likelihood estimation, a method that does not require an equal number of observations for all participants, so respondents with missing observations can be included in the analysis [25]. All continuous outcomes were comprised of summary scores created by calculating the raw scores across all individual items within each scale.

Results

Participant flow

A total of 91 schools were eligible and invited to participate in the study. Fifty schools gave no response or did not participate due to the principal's refusal explained by, e.g., lack of time and resources or participation in other programs and research within their school. Figure 1 illustrates the flow of participants through each stage of the study. A total of 41 schools finally accepted the study invitation, out of which 2,020 students agreed to participate. The sample of consenting students represents 46.5% of the total population of 8th grade students in the selected study area.

The response rate was calculated as the proportion of adolescents participating in each study assessment relative to the numbers who consented to participate. This resulted in a baseline response rate of 77.9% ($n = 1,574$). Some students not participating at post-test may have participated in the follow-up. After the post-test and at the one-year follow-up, the response rates from participating students in the intervention group were 75.3% at T2, and 56.4% at T3, respectively. The response rates from students in the control group were 78.5% at T2 and 61.5% at T3.

<< Insert Figure 1 about here >>

Attrition analysis

We compared participants who dropped out after the pretest ($n = 190$) with those who completed each measurement of the study ($n = 750$) on main outcome variables using multilevel analysis.

The amount of dropouts after the pretest did not differ between groups, with 9.3% from the intervention group and 9.8% from the control group. The amount of students who participated on each measurement time point in the study was higher in the intervention group (39.4%) than in the control group (33.5%). Results showed that students who dropped out

after the pretest differed from those who completed in terms of more frequent monthly alcohol use ($t = -2.50, p = .01$), with a small effect size ($d = -0.19$), and lower scores in alcohol-related knowledge ($t = -2.95, p < .005$), also with a small effect size ($d = -0.20$). No significant differences were found for attitudes, PBC and alcohol expectancy. Results from the generalized multilevel analysis showed a difference between students who dropped out, as compared to those who completed, in higher onset of alcohol debut $OR = 1.55$ ($t = 2.13, p < .05$). Additionally, boys had 1.91 higher odds of dropping out than girls did ($t = 3.88, p < .0005$). It is noteworthy that approximately 50% of individual dropouts at follow-up were explained by school class attrition, and equal numbers of schools were lost from baseline to one-year follow-up in both conditions. Overall, the attrition from consenting students was 22.1% at T1, 23.5% at T2 and 41.73% at T3, which is consistent with other longitudinal studies [26].

Program Dosage

Teachers from the intervention group reported that the program delivery was 17.9 ($SD = 8.6$) hours in class, and that they had spent 11.6 ($SD = 6.5$) days on the program on average. A total of 92.6% ($n = 25$) of the teachers had also trained a peer leader within their class. The website (www.ungeogrus.no) was visited for 2.9 hours on average ($SD = 1.9$). During the last two years, 33.3% ($n = 9$) of the teachers in this study had participated in the Norwegian Education Agency program training.

The program website was visited by the control group teachers at an average of 0.8 hours ($SD = 1.7$). A total of 45% of the control-group teachers reported that no alcohol curriculum was delivered in class, while 45% had delivered a smoke-free campaign and 10% had delivered the “Unge & Rus” program during the last two years.

Program Impacts

The following presents descriptive results with means and standard deviations on the pretest, post-test and follow-up (Table 1), in addition to a summary of the multilevel analysis, showing the baseline and change statistics for overall effects measured from baseline to sixteen months (Table 2), and short-term effects measured from baseline to four months (Table 3).

<< Insert Table 1 about here >>

Alcohol Use (AU)

The intra-class correlation (ICC) in level 2 showed that 12.8% of the variance was between students of the same class. At level 3, the ICC showed that 0.7% of the variance occurred across classes. Baseline rates on frequency of alcohol use showed no significant difference between groups ($t = -0.69, p = .49$). Short-term effects, measured four months after baseline, showed that the interaction term between group and time was close to zero and non-significant ($t = 0.02, p = .99$). The overall effects showed no significant time-by-group interaction on alcohol use ($t = -0.83, p = .41$), indicating no evidence of a different development in the intervention group as opposed to the control group.

Alcohol Attitudes (AA)

The ICC at level 2 showed that 54.4% of the variance was between students and, in level 3, the ICC showed that 8.4% of the variance occurred across classes. Students' attitudes to alcohol showed no significant baseline difference between groups ($t = 0.85, p = .39$). Short-term effects showed that the interaction term between group and time was not significant ($t = -1.73, p = .08$). The overall effect measuring attitudes toward alcohol use revealed that the interaction term between group and time was close to zero and non-significant ($t = 0.61, p = .54$), indicating that the groups did not develop differently.

Perceived Behavioral Control (PBC)

The ICC at level 2 showed that 33.3% of the variance was between students of the same class and, in level 3, the ICC showed that 1.9% of the variance occurred across classes. There were no significant baseline differences between groups ($t = -0.58, p = .56$). The short-term effect measured after four months showed that the interaction term between group and time was close to zero and non-significant ($t = 0.82, p = .41$). The results also did not show an overall significant group-by-time interaction in PBC, when measured after sixteen months ($t = -0.21, p = .83$). This implies that the two groups did not develop differently.

Alcohol Expectancy Questionnaire (AEQ – A)

The ICC at level 2 showed that 46.9% of the variance was between students and, in level 3, the ICC showed that 5.9% of the variance occurred across classes. Students from the control group had significantly higher alcohol expectancy at baseline ($t = 2.20, p = .03$). There was a significant group-by-time interaction in *AEQ-A* ($t = -2.71, p = .007$) when measured after four months, showing that students from the control group developed more positive expectancies toward alcohol than students from the intervention group. Measured after sixteen months, the overall results did not show a significant group-by-time interaction in alcohol expectancy ($t = -0.05, p = .96$).

Knowledge

The frequency of all answers correct among students in the intervention group and the control group was 33.8% and 39.4% at pretest, 40.8% and 40.3% at posttest, and 53.1% and 48.5% at one-year follow-up, respectively. There was no significant difference between the groups at baseline. The GLMM analysis measuring knowledge did not show a significant difference in the rate of change between the intervention and the control group in terms of number of students with correct answers ($t = -1.43, p = .153$), measured after four months. A

significant difference in the rate of change in alcohol-related *Knowledge* between groups measured from baseline to sixteen months ($t = -2.91, p = .004$) was detected.

<< Insert Table 2 about here >>

<< Insert Table 3 about here >>

Discussion

The aim of the current study was to evaluate the effectiveness of a universal school-based alcohol prevention program among junior high students in Oslo. The analysis examined the impact of the intervention on students from baseline to the one-year follow-up, a period of sixteen months.

Results showed that the development from baseline to one-year follow-up was not significantly different between the intervention and the control group, except for alcohol-related knowledge. The number of students with all knowledge items correctly answered increased more from baseline to one-year follow-up in the intervention group than in the control group. The test of short-term effects measured after four months showed no significant difference between groups, except in alcohol expectancy. Baseline rates were equal in both groups for all outcomes, apart from alcohol expectancy. The control group had higher alcohol expectancies at baseline and after four months, when compared to the intervention group. This finding indicates that the intervention may affect adolescents' alcohol expectancies in the short term, whereas the effect does not last in the long term.

The absence of an enduring overall effect on alcohol expectancies may be due to several reasons, such as individual changes in beliefs about alcohol use as a socially acceptable behavior or the ability of an intervention to maintain its effectiveness one year after implementation. These findings are in accordance with previous research showing that

alcohol-related knowledge can be increased and alcohol expectancies may be changed in the short term, while influencing drinking behavior in the long term is a difficult task [4, 27-31].

This study showed an overall lack of effectiveness for the intervention, according to the program's defined objectives. However, a longitudinal study among adolescents is expected to show that people in this stage of life have increased interest in alcohol use. The frequency of alcohol use in this study was low in both groups at baseline and, likewise, at the one-year follow-up. Our findings are consistent with the European School Survey Project on Alcohol and Other Drugs (ESPAD), which reports Norwegian adolescents as the group with the lowest alcohol use among all 15 and 16-years-olds in Europe [32]. However, nearly 20 percent of the adolescents in this study had already experienced a debut of alcohol use despite their young age, and the large standard deviations in our results reveal a subgroup of more frequent drinkers. The level of within-school class dependency for alcohol use in this study was low. The majority of students in this study do not drink alcohol, so this explains the low variation between classes. This indicates that, when they do drink, it is in other social contexts that are not related to their fellow classmates.

Adolescents are vulnerable to peer pressure, and research shows that alcohol use is predicted by having peers who consume alcohol [33, 34]. The resistance to peer pressure, measured by PBC in this study, showed that the level of within-class dependency was relatively low. This indicates that the PBC among adolescents is not necessarily influenced by a school-based program, but that friends and family may have an effect on the degree of PBC. On the other hand, this study found higher levels of dependency within classes in alcohol expectancies and alcohol-related attitudes. This could indicate that schools can have an impact on adolescents' alcohol expectancies, and that they are in a position to promote preferable attitudes. However, this could also indicate a different implementation quality between schools. The previous version of this program demonstrated the effect of implementation

quality showing a significant reduction in alcohol use when comparing a highly role-specified condition with the control condition, but did not find a significant difference between the low role-specified condition and the control condition [14].

Teachers' descriptive reports on time spent using the program are in line with program procedures, but the relatively low attendance in program training might have contributed to a lower implementation quality in the schools. All participating schools are public schools with regular alcohol and drug education within their standard curriculums. The intervention group in this study received the "Unge & Rus" intervention in addition to the regular program. The comprehensiveness of these standard curriculums varies, as does the experience of each school implementing them. However unlikely, we cannot exclude the possibility that the standard curriculum of the control schools was equally as effective as the intervention evaluated in this study. Health promotion and prevention through societal laws and regulations might influence both the parents and the adolescents to maintain a more restrictive approach to alcohol use [35]. Our findings revealed a generally low frequency of alcohol use among the sample. When the frequency of alcohol use is low in both groups, we cannot expect the intervention to have a high impact in relation to drinking behavior. However, these findings also revealed that there is a group of more frequent drinkers that may not be influenced by this type of intervention. Characteristics of those who drink more frequently are different from those who do not drink. The identified predictors of drinkers participating in this study were found to be more often boys, smokers and adolescents with a non-Islamic religious affiliation [36].

Participants were recruited for the comparison group from schools in a neighboring municipality with a similar demographic pattern to those of the intervention group. The municipalities compared in this study, Akershus and Oslo, are often described as one region due to the similarities in their populations [37]. The participating schools from Akershus are

located, to a larger degree, in rural areas than those from Oslo, and both municipalities are economically prosperous.

Even though the “Unge & Rus” program contains several key components that identify successful interventions [38], this study could not find a difference between students receiving the intervention as compared to students in the control group. Universal school-based prevention programs have, in general, been criticized for poor outcomes and low effect sizes [6, 7, 39, 40]. Nonetheless, several evidenced-based alcohol prevention programs targeted towards adolescents do exist [41]. The majority of these programs use interactive designs that actively involve students [7], include structured activities and a parent component, and offer teachers training [34] in addition to on-line delivery [42], similar to “Unge & Rus”.

Strengths and limitations

Some schools did not respond to the invitation and some principals refused based on reasons such as prioritization of time, resources, other programs or research within their school. Such reasons are most likely unrelated to adolescent alcohol consumption and probably occur with similar frequency in both groups, which indicates that the results may be generalized, and that this type of missing data was unsystematic and equal across groups. We could not find any evidence of differential attrition between conditions. Students were tracked over time by a unique id-code and all participants were included in the analysis, regardless of their individual exposure to program activities in the intervention group. Dropout rates did not differ between the assigned conditions, but attrition was related to alcohol use at baseline. Subject attrition in prevention research has generally shown that subjects who typically disappear from the study are more likely to be users than those who remain [43, 44].

The current study has some limitations that should be pointed out. First, we evaluated the effectiveness of “Unge & Rus” in Oslo, where the program has been mandatory in schools since 2006. Schools from neighboring municipalities were invited to participate as part of a comparison group. Since the intervention schools were already selected, a randomized, controlled trial could not be conducted. Most of the evidence on alcohol research comes from quasi-experimental studies where the possibility of bias and confounding variable always exists, thus resulting in lowered internal validity [28].

Secondly, attrition in approximately 50% of the cases was explained by school class attrition. When school class attrition has occurred it's more likely that the data collection has failed as a consequence of the teacher's organization and low motivation rather than student characteristics. There could be other reasons, but it is less likely that this type of attrition correlates with the study outcome measures.

Thirdly, there was also a lack of adequate information about the quality of implementation. Implementation of a school-based program is not without challenges, so we cannot know for certain whether the program was delivered in a less-than-optimal manner, whether the program simply does not work in its present form, or whether the control group's curriculum is perhaps equally as effective as the one evaluated in this study. If there is an implementation problem, it would be natural to perform follow-up studies on the dimension that emerged as critically important in the study by Wilhelmsen et al. [14]; namely, the degree of structure in the program implementation. The program activates students to work in groups, and a peer leader is in charge during those group activities. A peer-led activity might be less structured when compared to an activity led by a trained teacher who may influence the effectiveness of the program.

Fourthly, this study relied on self-report measures from a young sample. We cannot be sure that all adolescents fully understood the meaning of key words used in the questionnaire

(e.g., alcohol and drunkenness). This might affect the construct validity of the questionnaire. However, in terms of reliability, studies of self-reported alcohol use suggest that these are reliable indicators of drinking behavior as indicated by high test-retest reliability [45, 46].

Fifth, the variable measuring alcohol-related knowledge was not optimal. It turned out that there was little variation in the responses. In addition to a poor validity of the variable, it should have included more questions measuring knowledge of the adverse effects of alcohol.

Conclusion

This study provides new information on the effectiveness of the “Unge & Rus” prevention program implemented in junior high schools in Oslo. The rate of change did not differ between participants receiving the intervention and those receiving the standard alcohol curriculum. Furthermore, as the program needs to be delivered in a regular school setting, these findings cannot support the use of the intervention, as it is currently implemented, over the use of standard alcohol curriculum.

The implications from our findings on prevention practice raise an important question as to whether the lack of results depends on the implementation process or the program content. Early onset of alcohol drinking predicts several risk factors for problem behaviors. Therefore, research on preventing alcohol drinking still needs to be improved. Decisions made by politicians and school administrators on implementation of evidence-based preventive interventions are, therefore, an important issue. In combination with health promotion, a school-based intervention has the opportunity to reach several contextual and cultural areas. Implementation of more specific interventions targeted towards selected groups and families could be more effective than the use of universal preventive school-based programs.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All authors participated in the design of this study. HKS drafted the manuscript and conducted the analysis. FA contributed to the design of the questionnaires and revision of the manuscript. BHH contributed with supervision of the statistical analysis, data preparation and revision of the manuscript. HN contributed by designing the questionnaires, preparing data and revising the manuscript. ME contributed with revision of the manuscript. MM contributed with methodological supervision and revision of the manuscript. RK contributed with designing the questionnaires and revising the manuscript. All authors have read and approved the final manuscript.

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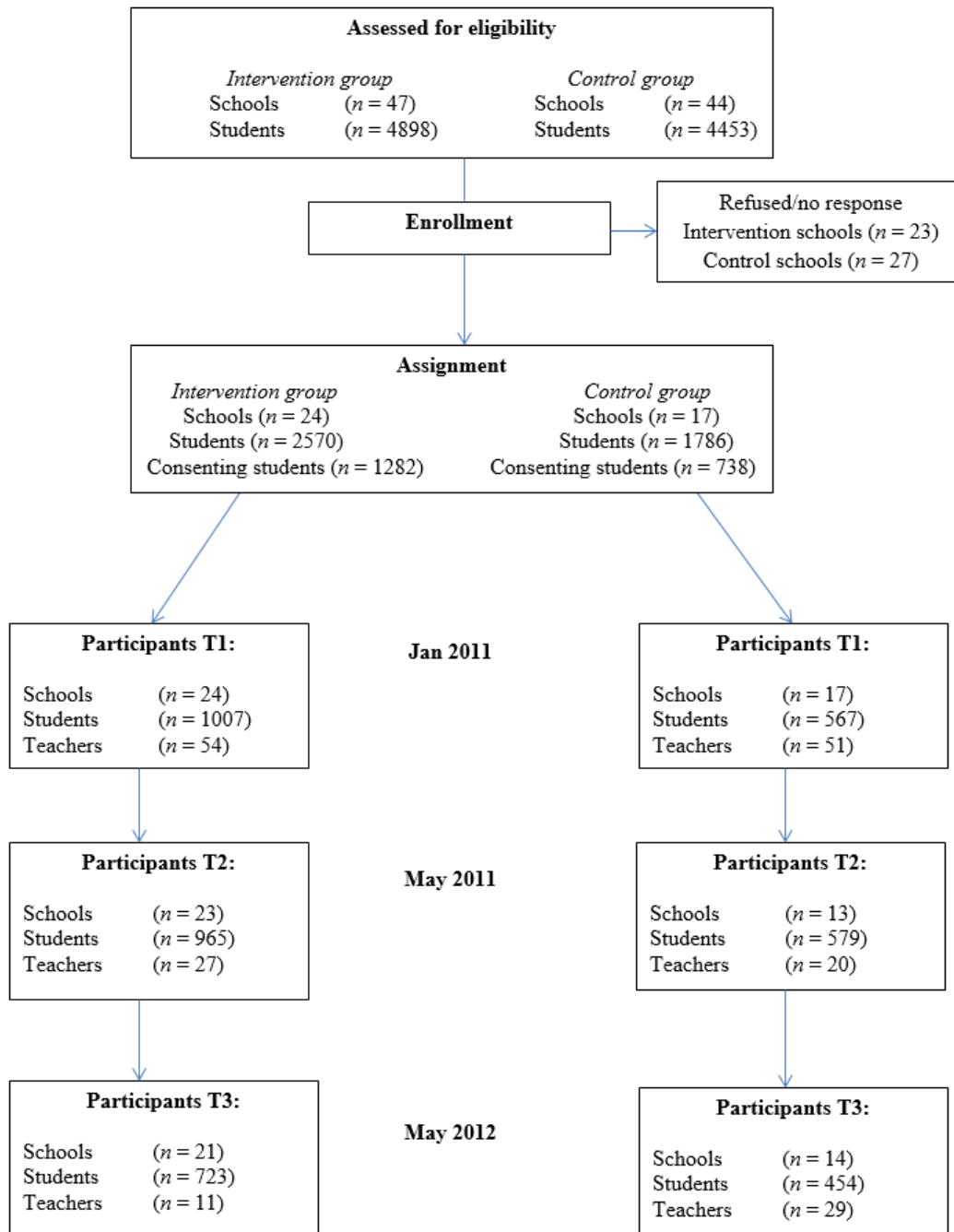


Figure 1. Flow of Participants

Table 1. Descriptive Results

Measures	Pretest		Posttest		Follow-up	
	Intervention	Control	Intervention	Control	Intervention	Control
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Alcohol use	4.14 (8.45) <i>n</i> = 999	4.85 (8.92) <i>n</i> = 566	4.64 (8.73) <i>n</i> = 960	5.62 (9.32) <i>n</i> = 577	5.40 (8.49) <i>n</i> = 720	6.10 (8.94) <i>n</i> = 453
Alcohol Attitudes	2.18 (1.33) <i>n</i> = 987	2.29 (1.38) <i>n</i> = 561	2.40 (1.50) <i>n</i> = 963	2.62 (1.58) <i>n</i> = 579	3.06 (1.88) <i>n</i> = 723	3.30 (1.78) <i>n</i> = 454
PBC	5.91 (1.30) <i>n</i> = 983	5.92 (1.25) <i>n</i> = 558	5.65 (1.50) <i>n</i> = 963	5.77 (1.36) <i>n</i> = 579	5.54 (1.63) <i>n</i> = 723	5.77 (1.22) <i>n</i> = 454
AEQ-A	2.41 (1.25) <i>n</i> = 980	2.54 (1.29) <i>n</i> = 556	2.51 (1.43) <i>n</i> = 963	2.82 (1.54) <i>n</i> = 579	3.01 (1.68) <i>n</i> = 723	3.23 (1.50) <i>n</i> = 454

Note: Alcohol use (0-23.6), Alcohol Attitudes (1-7), PBC (1-7), AEQ-A (1-7).

Table 2. Multilevel Model Results for Overall Effects

	Alcohol use	Alcohol Attitudes	PBC	AEQ-A
Fixed parameters				
<i>Intercept</i>	0.17 (0.07)*	2.17 (0.07)*	2.07 (0.05)*	2.30 (0.06)*
Group	-0.06 (0.09)	0.08 (0.10)	-0.04 (0.07)	0.19 (0.08)*
Time	0.02 (0.00)*	0.06 (0.00)*	0.01 (0.00)*	0.05 (0.00)*
Group x Time	-0.00 (0.01)	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Random parameters				
<i>Level 1</i> Within subjects	3.84 (0.10)*	0.78 (0.03)*	1.07 (0.03)*	0.85 (0.03)*
<i>Level 2</i> Between subjects	0.57 (0.09)*	1.12 (0.06)*	0.55 (0.04)*	0.84 (0.05)*
<i>Level 3</i> Between classes	0.03 (0.03)	0.16 (0.04)*	0.03 (0.01)	0.10 (0.03)*

Note. * $p < .05$. Parameter estimates and standard errors (in parentheses). Intervention group = 1, Control group = 0. Time coded monthly: 0, 4, 16 months.

Table 3. Multilevel Model Results for Short-Term Effects

	Alcohol use	Alcohol Attitudes	PBC	AEQ-A
Fixed parameters				
<i>Intercept</i>	0.45 (0.07)*	2.49 (0.07)*	2.24 (0.05)*	2.59 (0.06)*
Group	-0.08 (0.12)	0.17 (0.11)	-0.07 (0.08)	0.32 (0.09)
Time	0.21 (0.09)*	-0.26 (0.05)*	-0.14 (0.05)*	-0.16 (0.05)*
Group x Time	-0.00 (0.14)	-0.14 (0.08)	-0.07 (0.08)	-0.22 (0.08)*
Random parameters				
<i>Level 1</i> Within subjects	4.19 (0.11)*	1.05 (0.03)*	1.09 (0.03)*	0.99 (0.03)*
<i>Level 2</i> Between subjects	0.86 (0.09)*	1.18 (0.06)*	0.55 (0.04)*	0.88 (0.05)*
<i>Level 3</i> Between classes	0.04 (0.03)	0.19 (0.04)*	0.03 (0.01)*	0.11 (0.03)*

Note. * $p < .05$. Parameter estimates and standard errors (in parentheses). Intervention group = 1, Control group = 0. Time measured after four months.

Paper 3

Strøm, H. K., Adolfsen, F., Fossum, S., Kaiser, S., & Martinussen, M. (2014).

Effectiveness of preventive alcohol interventions for adolescents: A meta-analysis of randomized controlled trials. *Substance Abuse Treatment, Prevention, and Policy*, 9, 1-11, doi: 10.1186/1747-597X-9-48.



REVIEW

Open Access

Effectiveness of school-based preventive interventions on adolescent alcohol use: a meta-analysis of randomized controlled trials

Henriette Kyrrestad Strøm^{*}, Frode Adolfsen, Sturla Fossum, Sabine Kaiser and Monica Martinussen

Abstract

Background: Preventive interventions for adolescents are an important priority within school systems. Several interventions have been developed, but the effectiveness of such interventions varies considerably between studies. The purpose of this study was to assess the effectiveness of universal school-based prevention programs on alcohol use among adolescents by using meta-analytic techniques.

Method: A systematic literature search in the databases, PubMed (Medline), PsycINFO (Ovid), EMBASE (Ovid) and WEB of Science (ISI) was conducted to search for empirical articles published in the period January 1990 to August 2014.

Results: In total, 28 randomized controlled studies with 39,289 participants at baseline were included. Of these 28 articles, 12 studies ($N = 16279$) reported continuous outcomes (frequency of alcohol use and quantity of alcohol use), and 16 studies ($N = 23010$) reported categorical data (proportion of students who drank alcohol). The results of the random effects analyses showed that the overall effect size among studies reporting continuous outcomes was small and demonstrated a favorable effect from the preventive interventions (Hedges' $\bar{g} = 0.22$, $p < .01$). The effect size among studies reporting categorical outcomes was not significant ($OR = 0.94$, $p = .25$). The level of heterogeneity between studies was found to be significant in most analyses. Moderator analyses conducted to explore the heterogeneity showed neither significant difference between the different school levels (junior high schools and high schools), nor between the varied program intensities (low, medium and high intensity programs). The meta-regression analyses examining continuous moderators showed no significant effects for age or gender.

Conclusions: The findings from this meta-analysis showed that, overall, the effects of school-based preventive alcohol interventions on adolescent alcohol use were small but positive among studies reporting the continuous measures, whereas no effect was found among studies reporting the categorical outcomes. Possible population health outcomes, with recommendations for policy and practice, are discussed further in this paper.

Keywords: Alcohol prevention, Alcohol drinking, Adolescents, Meta-analysis

Background

Early onset of alcohol use is associated with problematic substance abuse in later adolescence [1-4]. The study of Health Behaviour in School-aged Children (HBSC) show that on average 39% have their first alcoholic drink at age 13 or younger [5]. The prevalence rates and consequences of underage drinking warrant a comprehensive public health approach, grounded in evidence-based preventive

interventions and policy-making [6]. The *European status report on alcohol and health* noted that 40% of the European countries did not have a written national alcohol policy in 2009, whereas in most Western countries drug prevention in schools has been a top priority [7]. Alcohol use among adolescents is a major public health concern and the political will to address this problem is considerable [8]. A range of preventive interventions to reduce or postpone alcohol debut among adolescents has been developed, and schools are important settings for such programs because large numbers of adolescents may be reached while costs are kept relatively low. Numerous

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Norway

estimates have been made of the social costs of early alcohol use, indicating that school-based drug and alcohol prevention programs should be a good investment [9]. The European Action plan states that those countries that are most active in implementing evidence-based alcohol policies and programs will profit from substantial gains in public health and well-being, productivity, and social development [10].

Universal school-based prevention is aimed at all students, regardless of their level of risk for alcohol use [11]. However, it is unclear whether or not the universal prevention programs are, in fact, effective. Several literature reviews [6,12-16] and meta-analyses [17-21] have been conducted in this field. Some well-designed studies have suggested that school-based programs have the potential to reduce alcohol use among adolescents, but at the same time research has indicated that most drug prevention programs have no effect [8,17]. Tobler and colleagues [17] conducted a meta-analysis of 207 universal school-based drug prevention programs, including studies with alcohol use as an outcome variable. They stated that program delivery matters more than program content and characterized successful programs as being interactive; i.e. programs that actively involve students while also including peer leaders [17]. This finding was also supported by a recent Cochrane review of 53 studies/programs, which concluded that the content of programs varied and suggested that program delivery may be more important for the effectiveness of the intervention than specific content [16].

It is argued that school-based interventions are most efficacious for preventing and reducing alcohol use among adolescents when delivered as primary prevention programs to youths who have not yet begun to experiment with alcohol [12,22,23]. Evidence suggests that prevention programs need to be initiated prior to seventh grade and that they need to address the associated risks of early drinking [24,25]. The overall aim of school-based prevention is generally to delay the onset of drinking or to reduce alcohol consumption frequency. However, producing a meaningful effect on drinking behavior through school programs is a difficult task. Some research findings suggest that interventions aimed at preventing alcohol use are not likely to be effective [26-28], yet it is argued that large proportions of the resources in the prevention field are, in fact, dedicated to programs that have little potential to prevent and reduce alcohol abuse [29]. There are limited findings supporting the “universality” of intervention effects on alcohol outcomes [6]. For instance, a meta-analysis conducted by Rundall and Bruvold in 1988, evaluating the effect of school-based prevention programs, reported both a low short-term effect ($\bar{g} = 0.11$) and a low long-term effect ($\bar{g} = 0.12$) on alcohol use behavior. They also found that school-based alcohol use prevention programs had more instances of producing no effect or

negative effects when compared to smoking prevention programs [18]. Similar findings were reported by Tobler and colleagues [17], where significant results were obtained only in one out of three cases, showing an overall small effect size ($\bar{g} = 0.14$).

The objective of the present investigation was to perform an up to date meta-analysis of well-controlled experimental studies examining the overall effects of universal school-based preventive programs on alcohol consumption among adolescents under the age of 18 years. Randomized controlled trials (RCT) have been found to yield larger program effects than studies using quasi-experimental designs [20,30]. The majority of the existing reviews have included also non-randomized studies, whereas this paper aims to include only randomized studies, because RCTs in general have stronger internal validity than quasi-experimental designs [31]. Different moderator analyses were conducted. First, we wanted to test if the effects of interventions vary between different school levels (elementary-, junior high- and high-school). Programs targeting adolescents in junior high schools are found to be marginally more effective than those targeting adolescents in elementary or high schools [21]. The majority of adolescents begin drinking alcohol prior to reaching adulthood; therefore, prevention programs need to target school-aged children and adolescents before they have established expectations and beliefs surrounding alcohol consumption [32].

Tobler and colleagues [17] found that programs with a duration of 11 to 30 hours were significantly more effective than those with a duration of 10 hours or less. However, a systematic review conducted by Cuijpers in 2002 stated that there is no definite evidence that intense programs are more effective than less intensive programs. Gottfredson and Wilson [21] showed in their research that program with brief duration are generally as effective as those with longer duration. Due to these inconsistent conclusions in relation to how the number of program sessions (intensity) may impact the effect, we also wanted to test the intensity of the program [8,17,21].

Finally, we wanted to explore whether the effects of preventive interventions vary with age and gender [33]. The prevalence of alcohol drinking increases significantly between the ages of 11 to 15 [5], and boys are generally found to drink more often and in greater quantities than girls. It is therefore likely that the effect of programs may differ between age groups and gender [16,34-36].

Methods

Inclusion and exclusion criteria

Several inclusion and exclusion criteria were used to identify studies. Studies were included if they: (a) evaluated universal school-based prevention programs; (b) used randomized controlled trial (RCT) design with a

control group; (c) assessed alcohol use outcomes; (d) provided sufficient information to calculate between-group effect size estimates; (e) included participants with a mean age of less than 18 years at pre-test; and (f) were published in English between January 1990 and August 2014.

Studies were excluded if the interventions: (a) were not described; (b) were designed for selective groups; or (c) were based on family and community components.

Search strategies

A systematic search was performed for studies published in the period January 1990 to August 2014. Articles were retrieved through the databases, PubMed (Medline), PsycINFO (Ovid), EMBASE (Ovid), WEB of Science (ISI), and through the reference sections of published studies and relevant reviews [16]. Specific search methods were used for each database; e.g., medical subject headings (MeSH) [37] were used for the database MEDLINE (PubMed). Search details for MEDLINE (PubMed) were as follows: (((“Alcohols”[Mesh] OR “Alcohol Drinking”[Mesh]) AND “Alcohol Drinking/prevention and control”[Mesh]) AND “Adolescent”[Mesh]) AND (((“Early Intervention (Education)”[Mesh] OR “Intervention Studies”[Mesh]) OR “Evaluation Studies as Topic”[Mesh]) OR “Program Evaluation”[Mesh]) AND Randomized Controlled Trial. A similar search was conducted in WEB of Science (ISI).

In EMBASE (Ovid) and PsycINFO (Ovid), search phrases included: (School Based Intervention or Intervention or Treatment Outcomes or Primary Mental Health Prevention or Treatment Effectiveness Evaluation or Early Intervention, and (Alcohols or Binge Drinking or Alcohol Drinking Patterns or Alcohol Abuse), and (Adolescent Psychology or Adolescent Development or Adolescent Attitudes or adolescents), and (Drug Abuse Prevention or Prevention). The search was limited to *human* and *English language*.

Overall 370 published articles were identified (PubMed 75 studies, EMBASE 66 studies, WEB of Science 135 studies, and PsycINFO 94 studies) in addition to 19 studies from previously conducted meta-analyses and reviews.

The process for determining the eligibility of studies to be included was conducted by two of the authors and consisted of a three-step process: 1) the title of the article was examined; 2) the abstract was reviewed; and 3) the full text was read. A total of 242 studies were excluded after screening the title and abstract of the papers. Additionally, 54 studies were eliminated after reading the full text because they did not fulfill the inclusion criteria. In addition, 20 duplicates were deleted. Thus, the final pool of included studies in the present meta-analysis consisted of 28 studies (Figure 1).

Coding of variables

According to the project protocol, the following variables were coded for each study: descriptive information (e.g., year of publication, country), sample information (baseline characteristics like sample size, gender, and age), school level (e.g., elementary school, junior high school, or high school), program intensity (low intensity of less than 1 to 5 hours, medium intensity of 6 to 10 hours, and high intensity of 11 to 15 hours or more), and measurement characteristics like time points of follow-ups (< 3 months, 4 to 12 months, and > 13 months). Alcohol use outcomes were coded as weekly drinking (7 days' alcohol use), monthly drinking (30 days' alcohol use), and lifetime alcohol use (e.g., Ever used alcohol). The categorical outcomes measured the percentages of students who consumed alcohol within a defined period of time. The continuous outcomes were reported as means and standard deviations and measured the frequency of alcohol use (the number of times alcohol was consumed within a defined period of time) and the quantity of alcohol consumption (the mean number of drinks within a defined period of time).

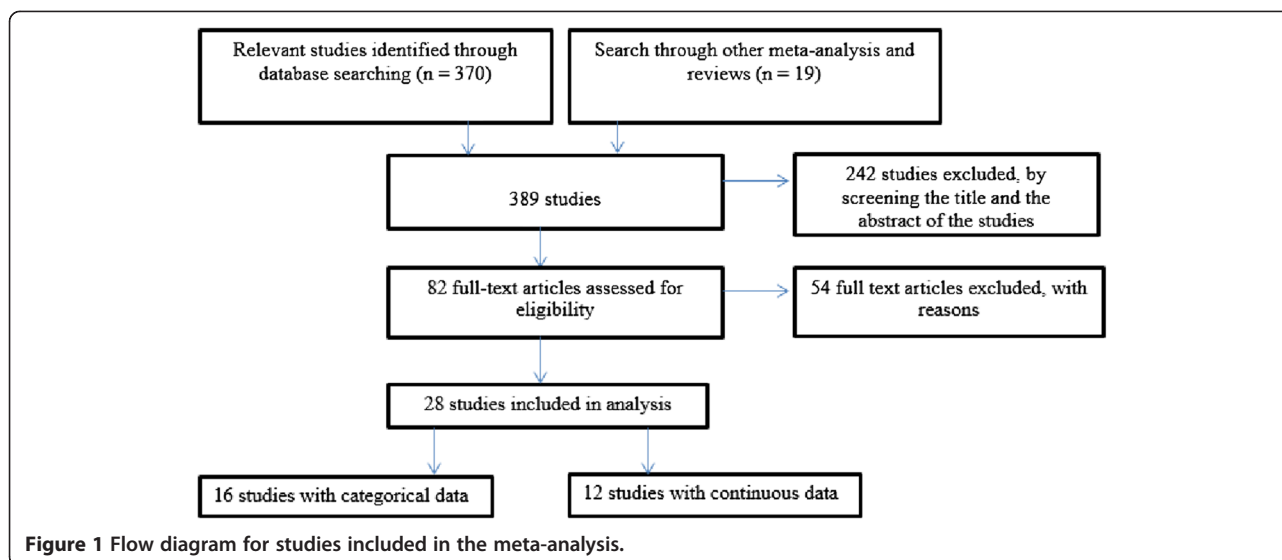
The studies were coded by the first and the second author. To assess inter-rater reliability, 6 of the 28 studies (21%) were randomly selected and coded by two of the other authors. The main variables included in the meta-analysis calculations and moderator analyses were selected for reliability check. Inter-rater agreement was estimated as Intra-class correlation coefficients (ICC; absolute agreement). There was 100% agreement between the coders for descriptive data (school-based studies and country). ICC was 0.92 for age, 0.99 for gender (proportion of boys), and 0.99 for effect size data.

Statistical analyses

The meta-analysis was conducted using the Comprehensive Meta-Analysis program version 2.2.057 [38]. Descriptive data were analyzed using the Statistical Package for Social Sciences (SPSS 21.0).

Because we assumed that the true effect could vary from study to study, and that factors other than sampling error could contribute to the observed variation in effect sizes (e.g., study design, sample characteristics, and type of intervention), a random effects model was used for the meta-analysis calculations. Study weights are more equal under the random effects model compared to the fixed effect model. Mean effect sizes and other meta-analysis calculations were weighted according to the inverse variance statistics comprised of both random variation and variation between studies [39].

The heterogeneity test, *Q*, was used to examine variation between studies. A significant *Q* rejects the null hypothesis of homogeneity and indicates that the variability between the effect sizes is greater than subject-level sampling alone and that moderators should be examined [40]. The ratio of



true heterogeneity to the total variance across the observed effect estimates was reported as a I^2 statistic. The I^2 statistic ranges from 0-100% and is not affected by the number of included studies in a meta-analysis [39]. A I^2 statistic close to zero indicates non-significant variance.

Two different effect-size statistics were used in the meta-analysis, standardized mean differences (Hedges' g) for continuous outcomes and odds ratios (OR) categorical outcomes respectively.

Hedges' g was calculated as the difference between the mean post-test scores of the control group and the intervention group divided by the pooled standard deviation. A positive effect size was indicated by less frequent alcohol use and less quantity of alcohol consumed in the intervention group. According to Cohen's criteria [41], effect sizes are denoted as follows: $g = 0.2$ denotes a small effect, $g = 0.5$ a medium effect, and $g = 0.8$ a large effect [42].

Effect sizes for studies reporting categorical types of data were calculated as OR , which is a measure of the association between exposure and outcome [40]. A positive effect size was indicated by $OR < 1$ (fewer reporting alcohol consumption in the intervention group compared with the control group). Whereas an OR of 0.59 denotes a weak effect, an OR of 0.29 denotes a moderate effect, and an OR of 0.15 denotes a strong effect [43]. A value of 1.00 indicates no difference in the rate of alcohol consumption between the intervention group and the control group. A negative effect (higher consumption in the intervention group compared with the control group) was indicated by $OR > 1$.

All of the studies included examined the effectiveness of school-based programs on preventing alcohol use among adolescents. Included studies used either schools (cluster RCT) or students (RCT) as the unit for randomization. Mixed effect analyses were conducted to examine whether

there was any difference between studies using RCT and cluster RCT.

To calculate the overall mean effect size, the mean of all outcomes and time points was calculated within each study before the overall mean was calculated.

When studies reported the effect of several components, like a parent component or combined components, we used the outcomes of the student intervention only [44]. When included studies used more than one intervention, we used the study as the unit for analysis and combined the effect sizes of the subgroups within each study [45]. When studies distinguished between groups by reported alcohol use at baseline, we calculated the mean alcohol use for all subgroups in both the intervention and control groups [46]. To test whether or not the observed overall effect was robust the Fail-safe N was calculated using Rosenthal's procedure [47]. The fail-safe N is the number of studies with null-findings required to reduce a significant mean effect into a non-significant result.

Moderator analyses were only conducted when the category included at least three studies. Categorical variables (school level and program intensity) were examined by using a mixed-effects analysis and continuous moderators (age and proportion of boys) by conducting meta-regression analyses.

Results

Description of included studies

We identified 28 randomized studies from nine different countries, of which the majority came from the USA (61%) followed by Australia (14%). The mean publication year was 2003 ($SD = 6.77$). Demographic characteristics were only reported for the baseline samples. The total number of baseline participants was 39,289 with a mean age of 13.16 ($SD = 1.96$) years. The gender distribution

was equal (50%). Sample sizes varied, ranging from 104 to 7,079 ($M = 2017$; $SD = 1810$). The majority of included studies were conducted in junior high schools (68%). Sixteen studies reported categorical measures on alcohol use (Table 1), and twelve studies reported continuous measures on alcohol use (Table 2).

The majority of the included studies used prevention strategies addressing normative and social influences. In addition, some interventions provided alcohol education and life skills training, including coping strategies and problem solving skills [44,45,48-51]. Furthermore, most of the studies measured outcomes like cigarette/marijuana and drug use, in addition to alcohol use [45,48,49,52-55]. Two studies also assessed bullying and harmful behavior [50,56].

Quality of studies

All included studies used a randomized control design. Two of the 16 studies using categorical measures, used the students as the unit for randomization (RCT) while 14 used the schools as the unit of assignment (cluster RCT). Among the 12 studies reporting the continuous outcomes, four studies used students and eight used the schools as the unit of assignment. Mixed effect analyses comparing the two groups (RCT versus cluster RCT) showed no significant differences for studies reporting the categorical outcomes ($Q = 0.79$, $df = 1$, $p = .37$) or continuous

outcomes ($Q = 1.56$, $df = 1$, $p = .21$). The methods used for randomization included use of computer or online systems [50,51,57-59], coin tossing [60], simple random sampling (e.g., random assignment by an independent researcher) [44,56,61], and random assignment of numbers to the students to further assigned them to the condition [52]. In the remaining 13 studies the method of randomization was unclear [45,46,48,49,53-55,62-72]. One study additionally calculated and assumed random allocation of schools [71]. Students were blind to group assignment in two studies [59,61].

Follow-up assessments were conducted within a time range from one to 42 months, distributed among 12 different follow-up periods. Most common was one year follow-up ($K = 15$) followed by two year ($K = 6$), 18 months ($K = 6$), six month ($K = 6$), and three month follow-up periods ($K = 6$). Attrition rates were reported by seven of the 12 studies reporting continuous outcomes, and by ten of the 16 studies reporting categorical outcomes. Attrition rates varied from 5% to 52%.

Intervention effects

For studies reporting continuous outcomes, the overall meta-analysis calculations resulted in a small and significant effect in favor of the intervention ($\bar{g} = 0.22$, $z = 2.99$, $p < .01$) (Table 3). The value of the file drawer statistic indicated that at least 301 unpublished studies would be

Table 1 Study characteristics for studies reporting categorical measures on alcohol use

Study	N	Gender boys	Age	School level	Program	Program intensity	Outcome	Time points in months	OR T1	OR T2	OR T3	OR T4
Bodin et al. 2011 [60]	1752	49%	14.50	HS	ÖPP	Medium	a	12, 30	0.83	0.90		
Bond et al. 2004 [56]	2678	47%	14.00	HS	GP	High	c	12, 24, 36	0.82*	0.88	0.84*	
Caria et al. 2011 [68]	5541	51%	13.00	JHS	EU-Dap	High	a	18	0.93			
Clayton et al. 1991 [70]	1927	51%	11.50	JHS	Project DARE	High	c	6, 12, 24	1.06	1.12	1.00	
Ellickson et al. 1990 [46]	3852	49%	13.00	JHS	Project ALERT	High	a, b	3, 12, 15	0.99	1.03	0.99	
Furr-Holden et al. 2004 [49]	566	54%	13.00	JHS	GBG	High	c	24	1.04			
Griffin et al. 2009 [52]	178	54%	13.50	JHS	The Brave	High	b	12	0.13***			
Koning et al. 2009 [44]	2570	51%	12.70	JHS	HSD	Medium	a	8, 12	0.96	0.80*		
McBride et al. 2004 [71]	2343	-	13.00	JHS	SHAHRP	High	a, b	8, 12, 18	0.80	0.80*	0.87	
McCambridge et al. 2011 [50]	416	55%	17.50	HS	MI	Low	C	3, 12	1.22	1.04		
Ringwalt et al. 1991[54]	1270	48%	10.40	JHS	Project DARE	High	C	3	1.22			
Ringwalt et al. 2009 [59]	6028	49%	10.50	JHS	Project ALERT	High	b, c	24	1.08			
Schinke et al. 2000 [67]	1396	51%	10.28	ES	LST	High	A	6, 18, 30, 42	0.66***	0.78	0.80	0.68**
Spoth et al. 2002 [55]	919	52%	10.50	JHS	LST	High	C	12	0.94			
St. Pierre et al. 2005 [72]	1649	50%	10.50	JHS	Project ALERT	Medium	B	24	1.09			
Sun et al. 2008 [69]	2064	53%	15.70	HS	TND-4	Medium	B	12	1.00			

Note. a = Report changes in weekly alcohol use, b = Report changes in monthly alcohol use, c = Report changes in lifetime alcohol use. OR = Odds Ratio. JHS = Junior High School; HS = High School; ES = Elementary School. EU-Dap = European Drug Abuse Prevention; GBG = Good Behavior Game; GP = Gatehouse Project; HSD = Healthy School and Drugs; LST = Life Skills Training; MI = Motivational Interview; ALERT = Adolescent Learning Experiences in Resistance Training; DARE = Drug Abuse Resistance Education; ÖPP = Örebro Prevention Programme; The BRAVE = Building Resiliency and Vocational Excellence; TND-4 = Project Towards No Drugs Abuse. * $p < .05$. ** $p < .01$ *** $p < .001$.

Table 2 Study characteristics for studies reporting continuous measures on alcohol use

Study	N	Gender boys	Age	School level	Program	Program intensity	Outcome	Time points in months	Hedges'g T1	Hedges'g T2	Hedges'g T3
Caplan et al. 1992 [66]	282	55%	12.00	JHS	PDYP	High	c	3	0.33*		
Clark et al. 2010 [62]	2467	49%	16.72	HS	Project SUCCESS	Medium	b	1, 12	0.01	0.04	
D'Amico et al. 2002 [45]	300	42%	16.00	HS	DARE & RSTP	Low	a	2, 6	0.06	0.27***	
Newton et al. 2009 [57]	764	60%	13.08	JHS	CLIMATE ²	High	a	1, 6	0.12	0.36***	
Peleg et al. 2001 [64]	1000	44%	15.50	JHS	LST	Medium	c	12, 24	1.17***	0.95***	
Reddy et al. 2002 [53]	4776	51%	11.90	JHS	HRIDAY	High	c	12	0.18***		
Shope et al. 1992 [63]	2589	-	10.50	ES	AMPS	Medium	c	6, 18, 30	0.06	0.12	0.11
Vogl et al. 2009 [61]	1466	59%	13.00	JHS	CLIMATE ¹	Medium	a	1, 6, 12	0.01**	0.02	0.04
Warren et al. 2006 [48]	4734	53%	12.50	JHS	keepin'it R.E.A.L	Medium	b	18	0.07*		
Werch et al. 2005 [58]	604	44%	15.24	HS	Project SPORT	Low	c	3, 12	0.22**	0.10	
Werch et al. 1996 [51]	104	44%	13.80	JHS	STARS	Medium	b	1, 2	0.21	0.46*	
Wilhelmsen et al. 1994 [65]	915	-	13.50	JHS	Young and alcohol	Medium	c	3	0.04		

Note. a = Report changes in weekly alcohol use, b = Report changes in monthly alcohol use, c = Report changes in lifetime alcohol use. JHS = Junior High School; HS = High School; ES = Elementary School. AMPS = Alcohol Misuse Prevention Study; CLIMATE = ¹Alcohol Course, ²Alcohol and Cannabis course; DARE = Drug Abuse Resistance Education; HRIDAY = Health Related Information and Dissemination Among Youth (Hindu word for "Heart"); R.E.A.L = Refuse, Explain, Avoid, Leave; LST = Life Skills Training; PDYP = Positive Youth Development Program; RSTP = Risk Skills Training Program; SUCCESS = Schools Using Coordinated Community Efforts to Strengthen Students; STARS = Start Taking Alcohol Risks Seriously. **p* < .05. ***p* < .01 ****p* < .001.

needed to reduce the obtained effect to a non-significant finding, which is considerably higher than the suggested limit (5 *K* + 10 = 70). The overall effectiveness for frequency of alcohol use was small, and not significant (\bar{g} = 0.09, *z* = 1.94, *p* = .053). The intervention effects for the quantity of alcohol consumed was small and significant in favor of the interventions (\bar{g} = 0.29, *z* = 2.46, *p* < .01). The overall mean effect size for studies reporting categorical outcomes was not significant (\bar{OR} = 0.94, *z* = -1.15, *p* = .25). The tests of heterogeneity showed a significant variance between the included studies, indicating that moderators may be present.

Primary outcomes

Different analyses were conducted to estimate the effect of preventive alcohol interventions over time (Table 3) and to compare the effect of the three primary outcomes

that included weekly alcohol use, monthly alcohol use, and lifetime alcohol use for studies reporting the categorical outcomes (Table 4) and for the studies reporting continuous outcomes (Table 5).

Intervention effects < 3 months

Within the measure of a short-time interval (< 3 months), studies reporting continuous measures showed a small but significant positive effect size of alcohol preventive interventions. Studies reporting categorical outcomes showed a small but negative effect size on alcohol use, indicating that the intervention groups scored higher on alcohol use as compared to the control group (see Table 3). The test of heterogeneity was not significant, but this could be due to low power as there was a small number of included studies.

Table 3 Overall effect sizes and combined outcomes by different time points presented for studies reporting continuous and categorical measures

	Studies reporting continuous measures							Studies reporting categorical measures						
	K	N	\bar{g}	95% CI	Q	df	I ²	K	N	OR	95% CI	Q	df	I ²
Overall effect size	12	16279	0.22**	0.08-0.36	184.11***	11	94.03%	16	23010	0.94	0.85-1.04	38.08***	15	60.61%
Alcohol use:														
<3 months	8	6617	0.10**	0.03-0.17	10.66	7	34.35%	3	5763	1.18*	1.00-1.40	0.82	2	0.00%
4-12 months	8	10479	0.27*	0.03-0.52	239.19***	7	97.07%	11	16409	0.86*	0.75-0.99	29.57***	10	66.18%
>13 months	3	6617	0.37	-0.14-0.88	113.88***	2	98.24%	10	18177	0.95	0.89-1.02	9.525	9	5.52%

Note. Random effect model. *k* = number of studies; *N* = total number of participants; \bar{g} = mean Hedges'g; \bar{OR} = mean Odds Ratio; *Q* = test of heterogeneity; 95% CI = confidence interval; *df* = degrees of freedom; *I*² = proportion of observed dispersion. **p* < .05 ***p* < .01 ****p* < .001.

Table 4 Intervention effects on adolescent alcohol use of combined time points for studies reporting categorical measures

	Studies reporting categorical measures						
	k	N	OR	95% CI	Q	df	I ²
Weekly drinking	6	10140	0.86***	0.78-0.95	3.71	5	0.00%
Monthly drinking	6	11544	0.92	0.75-1.12	22.05***	5	77.33%
Lifetime drinking	7	11725	1.04	0.93-1.17	11.02	6	45.53%

Note. Random effect model. k = number of studies; N = total number of participants; OR = mean Odds Ratio; 95% CI = 95% confidence interval; Q = test of heterogeneity; df = degrees of freedom; I² = proportion of observed dispersion. *p < .05 **p < .01 ***p < .001.

Intervention effects between 4–12 months

The effect sizes for the follow-up period from four to 12 months were small and significant for both OR and Hedges' g, favoring the preventive intervention programs. Both heterogeneity tests were significant (see Table 3).

Intervention effects > 13 months

Long-term follow-up (> 13 months) showed non-significant effect sizes for the interventions. The level of heterogeneity was significant in studies reporting continuous outcomes but not significant among studies reporting categorical outcomes (see Table 3).

Weekly alcohol use

Overall nine studies measured weekly alcohol use [44-46,57,60,61,67,68,71]. The overall effect sizes were small and significant, demonstrating a positive intervention effect. The heterogeneity test was not significant (see Table 4 and Table 5).

Monthly alcohol use

Ten studies measured monthly alcohol use [46,48,51,52, 58,59,62,69,71,72]. The overall effect sizes were not significant. The test of heterogeneity within studies reporting continuous changes in monthly alcohol use was not found to be statistically significant, however, it was significant within studies reporting categorical outcomes (see Table 4).

Lifetime alcohol use

Twelve studies measured the lifetime use of alcohol [49,50,53-56,59,63-66,70]. The overall effect sizes were not significant for OR or Hedges' g. The level of heterogeneity

was significant between studies reporting the alcohol quantity, but not significant in studies reporting the frequency of alcohol use (Table 5) or among studies reporting the categorical outcomes (Table 4).

Moderator analysis

The moderator analysis comparing different school levels did not show significant differences between interventions implemented at junior high school or high school (Table 6). Because there were only two studies conducted at elementary schools, these were not included in this analysis [63,67].

The moderator analysis between different levels of program intensity showed no significant differences between medium intensity (6 to 10 hours) or high intensity programs (11 to >15 hours) (Table 6). Low intensity programs were not included in the moderator analysis as there was only one study reporting categorical outcomes [50] and only two studies reporting continuous outcomes [45,58].

Meta regression

Meta regressions were conducted to examine the influence of the moderator variables, age and gender, on the effectiveness of preventive alcohol interventions.

Gender was coded as the proportion of boys in the study samples. The meta-regression results were not significant for gender in studies reporting continuous outcomes ($\beta_1 = -0.02, z = -1.23, p = .22$), nor in studies reporting categorical outcomes ($\beta_1 = -0.01, z = -0.45, p = .65$).

Similarly, age was not found to be a significant moderator, both for studies reporting continuous outcomes ($\beta_1 = 0.04, z = -0.98, p = .33$) and for studies reporting categorical outcomes ($\beta_1 = -0.01, z = -0.45, p = .65$).

Discussion

The aim of the current meta-analysis was to estimate the effectiveness of school-based preventive programs on alcohol use among adolescents. To our knowledge, this is the first meta-analysis on this topic that exclusively included studies with randomized designs. Furthermore, the aim was to assess the effectiveness of the interventions over time and to examine whether the effect of the intervention differed according to the different school levels or level of program intensity.

Table 5 Intervention effects for studies reporting continuous measures for frequency and quantity of alcohol use

	Frequency of Alcohol Use							Quantity of Alcohol Use						
	k	N	\bar{g}	95% CI	Q	df	I ²	k	N	\bar{g}	95% CI	Q	df	I ²
Weekly drinking	0	-	-	-	-	-	-	3	3570	0.13*	0.01-0.25	3.98	2	49.70%
Monthly drinking	2	2119	0.07	-0.05-0.20	1.76	1	43.18%	2	4838	0.13	-0.09-0.35	1.81	1	44.69%
Lifetime drinking	2	3536	0.10	-0.06-0.27	4.25	1	76.45%	3	2216	0.50	-0.18-1.17	88.75***	2	97.75%

Note. Random effect model. k = number of studies; N = total number of participants; \bar{g} = mean Hedges'g; 95% CI = 95% confidence interval; Q = test of heterogeneity; df = degrees of freedom; I² = proportion of observed dispersion. *p < .05 **p < .01 ***p < .001.

Table 6 Moderator analysis for school level and program intensity for studies reporting continuous and categorical measures

	Studies reporting continuous measures						Studies reporting categorical measures							
	k	\bar{g}	95% CI	Q	df	I^2	Total between Q	k	\bar{OR}	95% CI	Q	df	I^2	Total between Q
School level:							0.80							0.00
Junior high school	7	0.12***	0.05-0.19	14.41*	6	58.42%		8	0.91	0.77-1.07	25.24***	7	72.26%	
High school	4	0.35	-0.15-0.85	143.91***	3	92.92%		4	0.91	0.80-1.03	2.93	3	0.00%	
Program intensity:							0.07							0.09
Medium (6 to 10 hours)	7	0.23	-0.00-0.46	180.11***	6	96.67%		3	0.90	0.76-1.07	0.47	2	0.00%	
High (11 to >15 hours)	3	0.20***	0.13-0.26	1.34	2	0.00%		12	0.93	0.82-1.06	36.16***	11	69.58%	

Note. Mixed effect analysis. *k* = number of studies; \bar{g} = mean Hedges'g; \bar{OR} = mean Odds Ratio; 95% CI = 95% confidence interval; Q = test of heterogeneity; df = degrees of freedom; I^2 = proportion of observed dispersion. * $p < .05$ ** $p < .01$ *** $p < .001$.

The overall effect size among studies reporting continuous outcomes was small but significant, indicating that alcohol prevention interventions may have a positive influence on alcohol use among adolescents. However, the overall effect size of studies reporting categorical outcomes was weak and not significant. Categorization of continuous variables is common in health sciences and medical research, but there is a cost to dichotomizing continuous variables [73]. Studies that report categorical or dichotomous data lose one-third to two-thirds of the information on the variance of the sample [74]. This reduces the calculated effect sizes and, thus, the effectiveness of the intervention may be underestimated when using this approach. This might explain why there was no significant overall effect among studies reporting the categorical outcomes. Furthermore, this analysis showed a small but significant effect on adolescents' weekly alcohol use. The effectiveness on monthly alcohol use was small and in a desired direction favoring the preventive programs in studies reporting the continuous outcomes, whereas this effect was not significant among studies reporting categorical data. The prevention programs did not affect general alcohol use among adolescents, measured by lifetime alcohol use, a finding that was expected. Outcomes measuring adolescents' lifetime alcohol use include whole samples, of which the majority has not started to drink alcohol yet.

Results measuring the effectiveness of the preventive interventions after a short term follow-up (< 3 months) were mixed. The generalized preventive effect for studies reporting continuous outcomes was positive and in favor of the preventive program. This result is in line with other studies that have found that school-based alcohol interventions can be an effective approach to preventing alcohol use in the short term [6,12]. Furthermore, the heterogeneity test was not significant, suggesting no significant variance between those studies. However,

among studies reporting categorical measures, the results indicated a higher alcohol use rate in the intervention group as compared to the control group, which may indicate an adverse effect of the interventions. This finding should nonetheless be interpreted with caution, since only three of the included studies reported categorical outcomes at 3 months. Aside from this finding, all effects were in favor of the interventions although the effects were small.

The overall impression of the results was that the prevention effects on alcohol use are significant and positive, in addition to increasing over time for the follow-up period four to twelve months. The effect of school-based prevention was generally positive on adolescents' alcohol use (weekly and monthly), however, such positive effect was not measured for lifetime drinking. This could indicate that preventive programs fail to postpone the onset of alcohol use or that the number of adolescents drinking alcohol in either group may be too low to demonstrate a statistically significant difference between the two groups. An implication of this finding is that studies should follow the adolescents for longer periods of time, at least long enough for experimentation of alcohol use to occur. This result held for studies reporting both continuous and categorical outcome measures.

Research has demonstrated that brief program duration of less than four months is generally as effective as those with a longer duration [21]. Additionally, a recently conducted meta-analysis concluded that brief school-based alcohol interventions (shorter than five hours of duration) may be effective in reducing adolescents alcohol use [20]. On the other hand, research has also showed that prevention programs seem to be more successful when they are maintained over several years, interactive [17], and incorporate more than one strategy; e.g., addressing social norms, building social resistance skills, providing booster-sessions, and using peer-leaders [29]. Unfortunately, there was a

general lack of detailed information on intervention strategies used among the included studies. Evaluation studies should provide more detailed information about potential moderators like implementation process, program fidelity, and attrition rate that will provide valuable information. This issue has also been raised elsewhere [16,75].

The long-term results from this meta-analysis show no significant differences between intervention and control groups beyond the one year follow-up. The discontinuity in the development of drinking behavior during adolescence might explain the challenges that preventive intervention faces in reaching long-term effects [76]. Some evidence from school-based prevention research indicates that intervention programs do not reduce alcohol use in the long term (> 12 months) [77]. However, a review of the long-term effectiveness of alcohol prevention programs provides evidence of reduced alcohol use for up to 15 years after program implementation [78].

The majority of included studies was implemented at junior high school level. The moderator analysis in this meta-analysis showed no significant effect between different school levels. Furthermore, the moderator analysis did not show any statistically significant differences in the comparison of low, medium, and high intensity programs. Both findings are in line with the previous work conducted by Tobler and colleagues [17]. They eliminated grade as an effective program predictor based on non-significant findings in addition to report no significant difference between high and low intensity of programs [17]. As such, it is promising that treatment efforts with medium intensity do seem to obtain treatment effects comparable to programs of higher intensity due to possible cost-benefit gains. A national survey conducted among US schools showed that the effectiveness of preventive practices would be improved if schools increased the intensity of program activity [79].

Studies suggest that primary prevention programs for alcohol use should occur prior to sixth grade, particularly for the group at high risk of early use [80]. Unfortunately, there were only two included studies in our analysis that reported on elementary schools and, therefore, we were not able to confirm this finding.

Implications

Our findings show that the preventive effects of school-based preventive interventions on adolescent alcohol use are small but generally positive, regardless of the intensity of the program. It is important to bear in mind that even small effects can make a difference. School-based alcohol interventions are found to be cost effective because they may avert costs associated with harmful drinking. Research by Caulkins and colleagues [9] estimated that even small effect sizes in universal prevention interventions could lead to important savings for the society. Implementing universal preventive interventions within schools, where a

large number of adolescents are reached, can lead to positive health outcomes within the society as further suggested by this study. Delaying alcohol debut among adolescents is important and has several possible health gains such as well-being and social development, important to both the public and the individual [10].

This study could not find any evidence to suggest which school level is preferable for implementing a preventive intervention or which level of program intensity would be most efficacious. Neither were age nor gender found to be moderators for effectiveness, however, the overall effectiveness of school-based preventive alcohol interventions for adolescents was measured as preferable and significant up to a year from implementation. After one year, our findings show no significant results. Only three studies with continuous measures reported long-term treatment effect, whereas 10 studies reported no treatment effect on categorical measures of alcohol use.

Limitations

This study has some limitations that should be taken into consideration when interpreting the results. The literature search resulted in relatively few studies that fulfilled the inclusion criteria. There were considerable differences in sample sizes between the studies, although the total number of adolescents included in the analysis is fairly large. Additionally, there was a significant heterogeneity between the studies, while the moderator variables could not explain this variability. This indicates widely dispersed results, meaning that the true effects most likely do vary [39]. In addition, the moderator analyses included only a small number of studies, which led to low statistical power, and the variance in age and gender between studies was small. A non-significant *p*-value should not be taken as evidence that the effect sizes are consistent, since the lack of significance may be due to low power [39]. One strong aspect of this meta-analysis is that we only included randomized controlled studies. This provided stronger evidence of the interventions' effectiveness, since randomized studies have the highest possible internal validity.

Conclusion

Our findings show that school-based interventions overall have a small but positive effect on alcohol use among adolescents up to one year after program implementation for both boys and girls independent of age. Small effect sizes can make a difference, especially when it comes to universal preventive interventions. Alcohol education should be considered as part of a wider policy approach and should be based on educational practices that have been proven to be effective [81]. Interventions should be focused on specific ingredients that lead to preventing alcohol use among adolescents. Future research

needs to continue developing and testing the implementation of interventions already demonstrated to reduce alcohol use among adolescents. The evidence base related to school-based alcohol interventions must continue to develop in order to improve their effectiveness.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

HKS and FA conducted the search for articles and selected relevant studies. HKS carried out the statistical analyses and drafted the manuscript with contributions from FA and SK. SF and MM contributed to methodological supervision as well as revision and drafting of the manuscript. All authors read and approved the final manuscript.

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