

# **Alcohol Alert**

**The development and evaluation  
of a Web-based computer-tailored game  
to reduce binge drinking among adolescents**

Astrid Franziska Jander

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Astrid Franziska Jander

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## **Promotor**

Prof. dr. Hein de Vries

## **Copromotoren**

Dr. Liesbeth Mercken

Dr. Rik Crutzen

## **Beoordelingscommissie**

Prof. dr. Nanne K. de Vries (voorzitter)

Prof. dr. Rutger C.M.E. Engels, Radboud Universiteit Nijmegen

Prof. dr. Lilian Lechner, Open Universiteit Nederland

Prof. dr. Dike van de Mheen

Prof. dr. Gerjo Kok

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# Chapter 1

## General Introduction

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Binge drinking is a prominent health problem in Europe and the Netherlands. Binge drinking, or drinking a large amount of alcohol in a relatively short time period, is associated with severe short- and long-term health consequences (WHO, 2004). Adolescents are a particularly susceptible group, as they tend to engage in dangerous drinking practices more often than do older adults, and they are more endangered by the effects of alcohol on their brains, which are not yet fully developed (Bava & Tapert, 2010; Clark, Thatcher, & Tapert, 2008).

There are many slightly different definitions for dangerous drinking practices such as binge drinking, and various terms are used throughout the literature. The World Health Organization (WHO), for example, defines a “heavy episodic drinker” as an adult ( $\geq 15$  years) who drinks at least 60 grams or more of pure alcohol at least once a week (WHO, 2010), which is approximately equivalent to six standard drinks of alcohol on one occasion. Midanik and colleague defined “frequent heavy drinking” as drinking five or more alcoholic drinks on one occasion at least once a week (Midanik & Room, 1992). This amount of alcohol is called a “potentially intoxicating amount.” Whereas heavy episodic drinking and frequent heavy drinking occur at a frequency of at least once a week, the definition of binge drinking is less strict in terms of frequency. In this dissertation we qualify a binge drinker as someone who has reported at least one binge drinking episode in the previous 30 days, which is in accordance with the time frame used in other Dutch epidemiological studies about alcohol use in adolescents (Verdurmen et al., 2011). Furthermore, our definition accounts for gender-specific differences in body weight and water content because these are very important when it comes to comparing men’s and women’s alcohol consumption and corresponding alcohol intoxication level (Dawson & Archer, 1992). Binge drinking is therefore often defined as drinking four or more glasses of alcohol for women and five or more glasses for men on one occasion, as with this amount men and women have a blood alcohol concentration (BAC) of at least 0.08 (Farke & Anderson, 2007). Consequently, in this dissertation a binge drinker is defined as someone drinking 4/5 standard glasses of alcohol if s/he is a girl/boy on one occasion at least once in the previous 30 days.

## **Consequences of alcohol consumption**

When it comes to consequences of alcohol use, there is a difference between consequences of average volume of consumption and pattern of alcohol consumption (WHO, 2004). Average volume of consumption is the average amount of alcohol consumed each day. Pattern of alcohol consumption describes the way the alcohol is consumed. For example, someone who drinks seven glasses of alcohol in one week consumes an average volume of one glass per day, but the person could also be drinking no alcohol at all for six days of the week and then seven glasses of alcohol on one occasion on day seven (Midanik

& Room, 1992). Even though average volume and pattern of consumption are related to each other, average volume of consumption is mostly associated with long-term consequences, whereas pattern of alcohol consumption (e.g., binge drinking) is mostly associated with short-term or acute consequences (WHO, 2004).

Long-term consequences that emerge later in life due to average volume of consumption are chronic illnesses such as different forms of cancer (e.g., liver cancer, female breast cancer, stomach cancer), cardiovascular diseases (e.g., hypertension and cardiac arrhythmias), liver cirrhosis, and mental conditions, although the causal relationship between alcohol and mental conditions is not clearly established, except for depression (WHO, 2004). Acute adverse health consequences include unintentional injuries due to (road traffic) accidents, intentional injuries due to violence, crimes and aggression caused by the effects of alcohol (Gmel & Rhem, 2003; Graham, West, & Wells, 2000; Swahn, Simon, Hammig, & Guerrero, 2004), (illicit) drug use, and smoking (Miller, Naimi, Brewer, & Jones, 2007). Further consequences, which are specifically influential for adolescents and young adults, include unwanted or unsafe sex (Bonomo et al., 2001) and unintended pregnancies. Moreover, as the brain is not yet fully developed in adolescents, brain damage, impaired learning, and cognitive deficits are particular irreversible consequences of drinking for this age group, and their effects continue during adulthood (Brown, Tapert, Granholm, & Delis, 2000; Peterson, Rothfleisch, Zelazo, & Pihl, 1990; Zeigler et al., 2005). Finally, the younger the adolescents are at the onset of alcohol use, the higher their odds of abusing alcohol later in life (Grant, Stinson, & Harford, 2001). Onset of alcohol use has been further associated with antisocial symptomatology and an elevated risk for stressful life events (e.g., trouble with the police) during adulthood (Irons, Iacono, & McGue, 2014).

As already mentioned, binge drinking is a prominent problem in Europe and the Netherlands. On average, 39% of 15- to 16-year-old adolescents in Europe reported having had at least one binge drinking period in the last 30 days (Hibell et al., 2011). This number varies across the European countries. According to the same report, Denmark and Malta had the highest binge drinking rate, with an average of 56% of adolescents reporting at least one binge drinking occasion in the last 30 days, and Iceland had the lowest rate, with 13% reporting one binge drinking occasion. Data from the Netherlands were not included in the aforementioned study, but data from a Dutch study conducted in the same year showed that 57% of 16-year-olds and 62% of 17- to 18-year-olds had engaged in binge drinking at least once in the previous 30 days (Verdurmen et al., 2011). Both the European survey and the Dutch survey reported higher rates of binge drinking among boys compared to girls (43% versus 38% in the European study; 62% versus 52% in Dutch 16-year-olds, and 70% versus 53% in Dutch 17- to 18-year-olds).

These numbers should be seen in the light of the legal context in the Netherlands. For many years, Dutch adolescents were allowed to buy low-strength alcoholic beverages (i.e., alcohol percentage by volume  $\leq 15\%$ ) when they turned 16 and all other kinds of alcoholic beverages when they turned 18. This means that Dutch adolescents could buy and consume alcohol without the permission of a parent before they had reached full adulthood (18 years of age, according to Dutch law). This legal situation has changed since January 1, 2014. Now, the legal buying age for any kind of alcoholic beverage is 18 years. Furthermore, the possession of alcohol for adolescents younger than 18 has become illegal in public places (Government, 2014). However, this regulation does not affect the private or home environment of adolescents, which means that drinking in this environment is still legal.

### **Determinants of alcohol use**

Numerous studies have been conducted over the years to determine factors that lead to adolescent alcohol use. Many studies have thereby focused on the impact of peers, parents, and motivational determinants or combinations of them (Wilks, Callan, & Derek, 1989).

In an attempt to explain different motivations of adolescents to drink alcohol, Lynne Cooper developed a four-factor model that could relate four different motivations, the so-called drinking motives, to different drinking patterns (Cooper, 1994). The four emerging drinking motives are called the social motive, enhancement motive, coping motive, and conformity motive. These motives should be seen as the reasons for underlying drinking behavior. The social motive, which is drinking to get social rewards and affiliation, is the most commonly reported drinking motive for young people, followed by the enhancement motive, which is drinking to increase one's feeling of well-being (Kuntsche, Knibbe, Gmel, & Engels, 2005). Social motives are associated with moderate drinking and enhancement motives with heavy drinking. Less frequently, young people reported drinking for coping motives, which is drinking to avoid the experience of negative emotions. This motive is associated with alcohol-related problems. The conformity motive describes drinking for reasons such as avoiding social rejection. This drinking motive has rarely been mentioned by adolescents as a motive for drinking (Kuntsche et al., 2005).

Personality characteristics also influence adolescents' drinking habits. A review about problematic drinking in college students identified high levels of sensation seeking to be related to problem drinking and found impulsivity and venturesomeness to be associated with quantity and frequency of alcohol use (Ham & Hope, 2003).

The Transtheoretical Model of Change (TTM) states that individuals progress through five stages when changing behavior: precontemplation, contemplation, preparation, action, and maintenance (Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1993). Research using the TTM to study alcohol use in students found that when students changed from drinking alcohol to quitting, the perceived cons of drinking started to outweigh the perceived pros of drinking. When they started drinking, the perceived pros started to outweigh the perceived cons of drinking. This switch happens in the contemplation and preparation phases (Migneault, Pallonen, & Velicer, 1997).

Previous research has often assessed the influence of motivational factors on health behavior with the help of the Theory of Planned Behavior (TPB) (Ajzen, 1991; Ajzen & Manstead, 2007). One study assessing the applicability of the TPB to alcohol use and misuse of alcohol, found that intention significantly predicted various alcohol measures (explained variance ranging from 26%-38%) of fifth- through eighth-graders and that attitudes, subjective norms, and perceived behavioral control all significantly explained up to 76% of variances in intention to engage in these behaviors (Marcoux & Shope, 1997). This study, furthermore, compared the ability of the TPB with the ability of the Theory of Reasoned Action (TRA) (Fishbein, 1979), which is the predecessor of the TPB and does not include the concept of behavioral control, to explain alcohol use. It found that the TPB explained alcohol use better than the TRA. A study of binge drinking intentions and binge drinking at one-week follow-up revealed that attitude, self-efficacy, and perceived control were predictive for binge drinking intentions, accounting for 66% of the variance in intention, and intention and self-efficacy were predictive for binge drinking at one-week follow-up (Norman & Conner, 2006). Another study used the extended TPB, including variables as descriptive norms (social modeling), anticipated regret, and past behavior as predictors of binge drinking intentions and behavior to improve prediction of both (Cooke, Sniedhotta, & Schüz, 2007). Results indicated that TPB variables explained 37% of the variance in intentions. Adding past behavior significantly increased the explained variance in intention to 43%, entering descriptive norm and anticipated regret resulted in a total of 58% of explained variance. When it comes to behavior, adding past behavior to intention and perceived behavioral control increased explained variances in behavior from 27% to 32%. Whereas descriptive norms are perceived influences and approval of drinking peers—thus cognitive factors—peer influences can also be situational.

For example, one study found that the importance of socializing with peers explained 7% of the variance in heavy drinking in adolescents (Oostveen, Knibbe, & De Vries, 1996). Another study about environmental predictors of heavy episodic drinking in college students found that if friends are present, an event is 2.4 times more likely to become a heavy episodic drinking moment, and if there are many people intoxicated

at the event, the likelihood increases 12.8 times (Clapp & Shillington, 2001). Changes in adolescent alcohol use were found to be related to changes in peer alcohol use, and initial status of peer alcohol use was predictive of later adolescent alcohol use and vice versa (Curran, Stice, & Chassin, 1997). There is, however, a discussion of whether peer influence occurs through modeling and encouragement of alcohol use as antecedents of adolescents' alcohol use or whether peers select each other as friends based on behavioral characteristics such as drinking or smoking (Sieving, Perry, & Williams, 2000).

A previous study came to the conclusion that peer influences play a dominant role (Sieving et al., 2000), whereas another study reported changes over time, with peer influences being the dominant process in early adolescence (13 to 14 years) and peer selection processes becoming stronger during mid-adolescence (15 to 16 years) (Mercken, Steglich, Knibbe, & Vries, 2012). Many interventions that aimed at reducing alcohol use in adolescents found that important mediators of the intervention effect were changes in susceptibility to peer influences (Komro et al., 2001; Schinke, Schwinn, Di Noia, & Cole, 2004; Werch et al., 2010). Peer influences also depended on the context in which they take place. For example, contextual factors that increased young people's drinking were the size of the group (the bigger the group, the more alcohol is consumed), drinks being ordered in groups, and the main activity being talking (instead of dancing) (Knibbe, Van De Goor, & Drop, 1993).

Although many studies have shown that the influence of drinking peers on adolescent drinking is stronger than the influence of drinking parents, particularly when the adolescent grows older (Björkqvist, Båtman, & Åman-Back, 2004; Jackson, 1997; Scholte, Poelen, Willemsen, Boomsma, & Engels, 2008), parents still have a considerable influence on drinking even after the adolescents have left for college (R. Turrisi, James Jaccard, Racheal Taki, Heather Dunnam, & Jennifer Grimes, 2001a). In the study by Turrisi et al. (2001), parents were encouraged to engage in good communication about alcohol with their children just before they left for college. Parents influence the behavior and attitude of their children through parenting styles (the overall attitude of the parent toward the child) (Baumrind, 1971) or more goal-directed parenting practices (specific actions parents take to raise their child).

One effective parenting practice to reduce alcohol use in adolescents is setting rules concerning alcohol use. Children of parents who provide strict rules concerning alcohol use began drinking alcohol at a later point in time (Van Der Vorst, Engels, Deković, Meeus, & Vermulst, 2007), drank less alcohol, and engaged less in binge drinking compared to children with parents who provided more lenient rules (Spijkerman, van den Eijnden, & Huiberts, 2008; Van der Vorst, Engels, Meeus, Dekovi, & Van Leeuwe,

2005; Van Der Vorst, Engels, Meeus, & Deković, 2006). Less clear is the effect of communication about alcohol on adolescent alcohol use (Ryan, Jorm, & Lubman, 2010).

One study reported a positive effect of communication on alcohol use (Turrisi et al., 2001a), whereas another study found a slightly negative effect of communication on alcohol use (Ennett, Bauman, Foshee, Pemberton, & Hicks, 2001). One study that differentiated between quality and frequency of communication found that quality of communication was negatively associated with alcohol use, whereas frequency of communication was positively associated with alcohol use (Spijkerman et al., 2008).

Monitoring an adolescent's friends and whereabouts was also associated with less alcohol consumption of the adolescent (Wood, Read, Mitchell, & Brand, 2004). Finally, whether parents drink themselves has an influence on the alcohol use of the child. A review showed that if the parents drink alcohol, the child is more likely to initiate alcohol use at an earlier stage, and parental alcohol use is predictive for later adolescent alcohol use (Ryan et al., 2010). However, most of the studies conducted to test the effects of rules and communication on alcohol consumption were conducted among younger adolescents, aged 12 to 17 (Ennett et al., 2001; Spijkerman et al., 2008; Van Der Vorst et al., 2006), or older American adolescents in the transition from high school to college (Turrisi et al., 2001a; Wood et al., 2004). Thus, the strongest support for the influence of parents comes from data of adolescents who are not legally allowed to drink. The same applies to the research on motivational and peer influences. At the time we were conducting the study, our target group of Dutch 16- to 18-year-old adolescents was legally allowed to drink alcohol. In this dissertation we are therefore investigating the determinants of motivational, peer, and parental influences as well as the effects of rules and communication on Dutch adolescent alcohol use, as there is a lack of research focusing on this particular target group.

## **The theoretical framework**

Many of the theoretical concepts that have been used in research about motivational determinants of adolescent alcohol use are incorporated in the I-Change Model (ICM) (De Vries, Kremers, Smeets, Brug, & Eijmael, 2008; De Vries et al., 2003). The predecessor of the ICM is the Attitude-Social influence-self-Efficacy (ASE) model (De Vries & Mudde, 1998), which was based on the TRA (Fishbein, 1979) and Social Cognitive Theory (Bandura, 1986). The ASE model states that a person's behavior is a function of that person's intention toward the behavior. Intention to perform a certain behavior is influenced by three motivational factors: the person's attitude toward the behavior, social influences the person experiences, and his or her self-

efficacy expectations. The ASE model has been used as an integrative model to explain motivational and behavioral change.

The ICM extended the ASE model by incorporating theories like the TPB (Ajzen, 1991), Health Belief Model (HBM) (Janz & Becker, 1984), Precaution Adoption Model (Weinstein, 1988), and TTM (Prochaska & DiClemente, 1983). The ICM further added more proximal factors, such as hindering and facilitating factors. Hindering factors are perceived barriers that withhold a person from bringing the intention to perform a certain behavior into action. This is also known as the intention-behavior gap. Facilitating factors include preparatory plans and coping plans. Preparatory plans help bridge the intention-behavior gap through specific plans about actions to be taken in order to initiate the desired behaviors (Araújo-Soares, McIntyre, & Sniehotta, 2009; Van Osch, Reubsaet, Lechner, & de Vries, 2008). Coping plans help reduce relapse after a successful behavior change by providing specific plans for how to act in a predefined difficult situation (Sniehotta, Schwarzer, Scholz, & Schüz, 2005; Van Osch, Lechner, Reubsaet, Wigger, & de Vries, 2008). Similar to the TTM, the ICM regards behavior change as a process that occurs in three stages, although the stages of ICM differ in makeup from those outlined in the TTM: the pre-motivational, motivational, and post-motivational phases. In each of these stages, other factors play an important role. In the pre-motivational stage, predisposing factors (i.e., behavioral factors, psychological factors, biological factors, social and cultural factors), awareness factors (i.e., knowledge, cues to action, risk perception), and information factors (i.e., message, channel, source) play a dominant role. These pre-motivational factors influence the motivational stage, which is characterized by attitude, social influences, and self-efficacy. The most proximal motivational factor to behavior is intention. In the post-motivational stage, the behavior change has taken place, and coping plans are often necessary to maintain the new behavior.

The ICM has previously been used to build interventions to change different unhealthy behaviors into more healthy behaviors. It has successfully helped adult smokers to quit smoking (Schulz et al., 2014; Smit, Vries, & Hoving, 2012), prevented school children from starting to smoke (Ausems, Mesters, van Breukelen, & De Vries, 2002), and helped adults reduce their alcohol intake (Schulz et al., 2013; Schulz et al., 2014), increase their physical activity (Smeets, Brug, & de Vries, 2008), and increase fruit and vegetable consumption (Van Keulen et al., 2011).

## **Computer-tailoring**

The interventions mentioned in the previous paragraph were all computer-tailored interventions. Computer tailoring (CT) means creating highly personalized feedback

messages about the lifestyle behavior in question by tailoring these messages to the individual characteristics of the recipient as assessed in a questionnaire (Kreuter & Skinner, 2000). These individual characteristics can be demographic as well as socio-cognitive (i.e., attitude, self-efficacy, etc.). In this way the person will receive a message that is personally relevant and will therefore be more likely to attract attention and be read, saved, discussed, and remembered than a non-tailored general message (De Vries & Brug, 1999). CT interventions are often delivered through the Internet, which has the potential to reach a huge audience, can be used anonymously, and is convenient for the respondent to fill in because he or she can determine the time and place to do so.

Web-based CT interventions have been proven to be efficacious in changing different lifestyle behaviors such as smoking (Elfeddali, Bolman, Candel, Wiers, & Vries, 2012; Smit et al., 2012; Te Poel, Bolman, Reubsæet, & de Vries, 2009), alcohol use (Riper et al., 2009; Schulz et al., 2013; Schulz et al., 2014), physical activity (Van Stralen, De Vries, Mudde, Bolman, & Lechner, 2011), and determinants of fat, fruit, and vegetable intake (Oenema, Tan, & Brug, 2005). Another advantage of Web-based CT interventions is that they are cost-effective because they come with very low costs (Krebs, Prochaska, & Rossi, 2010; Lustria et al., 2013; Smit, Evers, De Vries, & Hoving, 2013). Although the effect sizes of many Web-based CT interventions are generally small (Krebs et al., 2010; Lustria et al., 2013), combined with the potentially high reach of these interventions, the impact on public health can still be promising (Glasgow, Vogt, & Boles, 1999). In the Netherlands, 97% of the 12- to 65-year-old population has access to the Internet (Centraal Bureau voor Statistiek, 2013b), but adoption, implementation, and continuous use of the intervention are further important factors that determine the effectiveness of an intervention (Glasgow et al., 1999). Particularly, implementation and maintenance—the correct and complete use and re-use of the intervention—are threatened, as another major problem with Web-based CT interventions is that they often suffer from high drop-out rates (De Vries et al., 2012; Elfeddali et al., 2012; Kohl, Crutzen, & Vries, 2013). High drop-out rates have consequences for the impact of public health interventions, as they are likely not effective if not used properly, and for the evaluation of the intervention, as this results in less power to detect the potential effects of the intervention (Eysenbach, 2005). Because of all the advantages of computer tailoring, the intervention described in this dissertation also makes use of these principles. To tackle the problem of high drop-out, we tried a new approach to motivate adolescents, which is described in the next section.

## **Engaging adolescents**

Adolescents are a particularly difficult target group when it comes to online health behavior interventions. First of all, they grew up with the Internet and use the Internet

in a different way than do adults (Fox, 2006; Gross, 2004; Hansen, Derry, Resnick, & Richardson, 2003). Adolescents use the Internet for e-mail, instant messaging, gaming, social network sites, and downloading content (Gross, 2004; Van den Eijnden & Vermulst, 2006), whereas adults use the Internet mainly for e-mail and information seeking (De Haan, Van't Hof, & Van Est, 2006; Van den Eijnden & Vermulst, 2006). Furthermore, adolescents are often not yet suffering from any unhealthy-lifestyle-related illnesses. Prevention of these illnesses is most effective when it changes unhealthy behaviors at an early stage because most adult unhealthy lifestyle behaviors develop during adolescence and track into adulthood (Kelder, Perry, Klepp, & Lytle, 1994). Thus, it is important to engage adolescents in Web-based health behavior interventions to change their health behavior, and special measures are necessary to increase motivation and engagement in these interventions. A main focus during the development of the intervention described in this dissertation was therefore to engage adolescents in the intervention. To accomplish this, we involved the target group at various stages during intervention development, following the principles of social marketing (Evans, 2006). We furthermore looked at other successful approaches described in other studies.

The literature, for example, describes that gaming approaches have been successful to increase intrinsic motivation in adolescents (Papastergiou, 2009; Tüzün, Yılmaz-Soylu, Karakuş, İnal, & Kızılkaya, 2009). If the main goal of a game is to educate people and change (health) behavior, instead of merely entertaining people, it is referred to as a serious game (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012). The popularity of entertainment games is evident, as there are numerous consoles available and the Internet is full of Web sites that offer the possibility to play various kinds of entertainment games. We also brought up this problem in the focus group interviews and asked adolescents how to present such an intervention in order to increase their engagement in it. During the focus groups, adolescents confirmed that they liked to play games on the Internet and that making the intervention into a game could be a way to keep them interested. So far, some serious games for healthy lifestyle promotion have been tested for effectiveness. Although not every effect study uses a randomized controlled trial to evaluate effectiveness, a meta-analysis and a systematic review report the strongest effects of games on knowledge acquisition and smaller effects on attitude change and behavior change (Connolly et al., 2012; DeSmet et al., 2014). A systematic review of serious games about alcohol and other drugs for adolescents identified eight studies; only one reported a decrease of drug use frequency, whereas six reported increased content knowledge and two reported increased negative attitudes (Rodriguez, Teesson, & Newton, 2014).

In conclusion, serious games have been proven to increase motivation and showed effects on content knowledge and behavior. We therefore chose to use a game as a

vehicle to carry the computer-tailored intervention to increase the engagement and motivation of adolescents.

### **Outline of the dissertation**

In this dissertation, the development and evaluation of a Web-based computer-tailored intervention to reduce binge drinking in 16- to 18-year-old adolescents is described. The first part focuses on the formative research that was done in advance of the development of the intervention, with special attention given to reducing drop-out (chapters 2-4). The second part focuses on the development and evaluation of the intervention (chapters 5-6).

Chapter 2 describes the focus group interviews conducted with the goal of getting more insight into determinants of drinking and how alcohol is dealt with within families. Separate focus groups were held with 16- to 18-year-old adolescents and with parents of this group.

Chapter 3 describes a Delphi study about effective strategies to reduce binge drinking in adolescents using a Web-based CT intervention and strategies to reduce drop out from these interventions. Experts in this Delphi study came up with strategies for interventions targeted at parents and adolescents separately.

Chapter 4 discusses the effects of the parenting practices of setting rules and communicating with the child about alcohol.

Chapter 5 describes the development and the content of the intervention in detail.

Chapter 6 describes the efficacy of the intervention to reduce binge drinking and alcohol use in general.

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# Chapter 2

## **Determinants of binge drinking in a permissive environment: focus group interviews with Dutch adolescents and parents**

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Based on:

Jander, A., Mercken, L., Crutzen, R., de Vries, H. (2013). **Determinants of binge drinking in a permissive environment: focus group interviews with Dutch adolescents and parents.** *BMC Public Health*, 13, 882.

### **Abstract**

**Background:** Compared to other European countries, the Netherlands scores among the highest of binge drinking rates of 16- to 18-year-old adolescents. Dutch adolescents aged 16 are legally allowed to buy and consume low-strength alcoholic beverages. This study focused on determinants of binge drinking in such a permissive environment from the perspectives of adolescents and parents.

**Methods:** Focus group interviews were conducted with adolescents aged 16 to 18 (N=83), and parents of adolescents of this age group (N=24). Data were analyzed using thematic analyses methods.

**Results:** Most reasons adolescents mentioned for drinking were to relax, increase a good mood, and to be social. Also peers around them influenced and increased adolescents' drinking. Comparing adolescents and parental statements about their perspectives how alcohol use is handled and accepted by the parents we found that generally, those perspectives match. Parents as well as adolescents stated that alcohol use is accepted by parents. However, when looking at essential details, like the acceptable amounts that children may consume, the perspectives differ enormously. Adolescents think their parents accept any amount of drinking as long as they do not get drunk, whereas parents reported acceptable limits of one or two glasses every two weeks. Parents further indicated that they felt unsupported by the Dutch policies and regulations of alcohol use. Most of them were in favor of an increase of the legal purchasing age to 18 years.

**Conclusions:** Parents and adolescents should both be targeted in interventions to reduce alcohol use among adolescents. In particular, communication between parents and children should be improved, in order to avoid misconceptions about acceptable alcohol use. Further, adolescents should be supported to handle difficult social situations with peers where they feel obliged to drink. Additionally, revisions of policies towards a less permissive standpoint are advised to support parents and to impede availability of alcoholic beverages for adolescents/children younger than 18 years.

## Background

Binge drinking (i.e., drinking 4/5 or more standard glasses of alcohol for women/men on one occasion) is a growing problem in Europe. A survey showed 24% of all 15- to 24-year-old Europeans reported binge drinking at least once a week (Anderson, 2007). In the Netherlands the frequency of adolescent binge drinking is among the highest in Europe (Hibell et al., 2004; Van Dorsselaer, Zeijl, Van den Eeckhout, Ter Bogt, & Vollebergh, 2007). A recent study showed that 59% of all 16-year-old and 71% of all 17- to 18-year-old Dutch adolescents have had at least one binge drinking occasion in the past 30 days (Monshouwer et al., 2008). The Netherlands is one of few countries in the world that have a legal purchasing age of 16 years for low-strength alcoholic beverages like beer and wine (International Center for Alcohol Policies, 2010). This implies that regulations concerning alcohol purchases in this underage group are absent and that it is the responsibility of parents and adolescents to regulate their alcohol consumptions. In this respect, Dutch adolescents and parents face a unique situation, in which families have to deal with the alcohol use of adolescents in a permissive environment, where underage adolescents are legally allowed to buy alcohol and it is also accepted that adolescents drink at a relatively young age. These adolescents often still live at home in contrast to, for example, the US where the legal drinking age is much higher and more adolescents already live on their own when they enter the legal drinking age. Not much research has focused on this specific target group yet, so adequate knowledge about determinants of alcohol use is lacking. It is important to investigate in more detail what determines alcohol consumption and, more interestingly, binge drinking in this specific group and what the role of parents is, in order to give recommendations for possible interventions to reduce alcohol use in these adolescents.

It is important to reduce alcohol use in adolescents because it is associated with a variety of negative consequences, such as getting into fights, experiencing dating violence, having forced intercourse, having considered or attempted suicide, and using other (illicit) drugs (Miller et al., 2007; Plant, Plant, Miller, Gmel, & Kuntsche, 2009). In addition, binge drinking also negatively affects school performance (Miller et al., 2007), impairs learning and memory, and can result in permanent brain damage and cognitive deficits (Zeigler et al., 2005). In order to fight these consequences we need to know what the determinants of alcohol use in this age group are.

Studies and reviews about determinants of alcohol use and binge drinking during adolescence and young adulthood identified several factors that influence alcohol consumption. Firstly, several studies addressed personal factors. One study examined the predictive value of constructs of the theory of planned behavior (Ajzen, 1991) in fifth to eighth grade students and found intention to drink alcohol accounted for 26% of the variance in alcohol use, while attitudes, subjective norms, and perceived

control explained 76% of the variance of intention to drink (Marcoux & Shope, 1997). Another study using an extended version of the theory of planned behavior showed that in undergraduate students attitudes and anticipated regret were strong predictors, explaining 58% of variance in intention not to binge drink, and that past behavior significantly predicted actual binge drinking behavior, explaining 32% of the variance (Cooke et al., 2007). A more recent study suggests that beliefs of undergraduate students predicted intentions to binge drink in the evening and actual drinking behavior (French & Cooke, 2012). Those beliefs were that friends approve binge drinking, lack of money would make it difficult to binge drink, getting drunk is enjoyable, sports teams approved binge drinking, and that celebrating, drinking patterns, and environment make it easier to binge drink. These beliefs strongly overlap with so called drinking motives based on the motivational model of alcohol use (Cooper, 1994). In a review about drinking motives of ten- to 25-year-old adolescents, the social drinking motive, which is drinking together with other people in order to get socially rewarded, was found to be related to moderate alcohol use. Enhancement drinking motives, which is drinking to enhance a positive mood, were related with heavy drinking, and coping motives, which means drinking to deal with negative emotions, with alcohol-related problems (Kuntsche et al., 2005). Finally, adolescents who score high on a sensation seeking and impulsivity scale also tend to engage in problem drinking more often than adolescents that score low (Ham & Hope, 2003). An increase in sensation seeking and risk-taking propensity was predictive of greater odds of alcohol use (MacPherson, Magidson, Reynolds, Kahler, & Lejuez, 2010). It is interesting to find out what personal factors play a role in 16- to 18-year-old adolescents that are allowed to drink alcohol to see whether the factors are comparable or perhaps that additional factors play a role.

Secondly, studies examining peer influences on binge drinking revealed that the presence of friends increased the likelihood that a certain event would become a heavy drinking event by 2.4 times (Clapp & Shillington, 2001). Perceived friends' drinking behavior and the friends' normative standards were the strongest predictor of alcohol use for female adolescents (Wilks et al., 1989). There is some evidence that not just peer influence leads to similar drinking patterns in adolescents, but also peer selection (Mercken, Snijders, Steglich, & de Vries, 2009), which is selecting similar others as friends. However, the results concerning peer selection are mixed: in young adolescents (13 to 14 years) peer influences play a dominant role, but with increasing age peer selection becomes more important (Mercken et al., 2012). Other studies have found that both processes are important and stable over time (Curran et al., 1997), but also that peer influences are more essential than peer selection (Sieving et al., 2000). Furthermore, there is evidence that the influence of drinking friends on regular alcohol consumption of adolescents increases when adolescents grow older (Scholte et al., 2008). Assuming that peers

do have a big influence on adolescent drinking, it is interesting to know how Dutch adolescents perceive this influence.

Finally, parental influences have been subject of study in order to explain binge drinking. One study found that adolescents with substance using peers were at greater risk of using alcohol only when their parents reported problems with alcohol. When parents did not have problems with alcohol use, adolescents with substance using peers were less at risk of using alcohol (Jones, Hussong, Manning, & Sterrett, 2008). Furthermore, several other studies emphasize that certain parenting practices (i.e., specific and goal directed behaviors parents perform to socialize their children) positively influence alcohol consumption of adolescents. Parental monitoring, whether or not parents control and monitor the activities and whereabouts of their offspring, and parental disapproval of heavy drinking was associated with less heavy alcohol consumption in adolescents (Wood et al., 2004). Similarly, having strict rules concerning alcohol consumption seems to prevent adolescents from starting heavy alcohol consumption (Van der Vorst et al., 2005). Stricter alcohol rules are associated with less alcohol consumption and binge drinking in adolescents (Spijkerman et al., 2008). Studies about communication between parents and children about alcohol intake have shown beneficial effects on alcohol consumption (Turrisi et al., 2001a) as well as non-effective or even detrimental effects (Ennett et al., 2001). A systematic review (Ryan et al., 2010) of parenting factors associated with reduced adolescent alcohol use further found that parental modeling, limiting the alcohol availability to the child, the parent-child relationship quality, parental involvement, and general communication were associated with delayed alcohol initiation and reduced levels of later drinking by adolescents.

However, these reviews and studies have only focused on younger adolescents aged nine to 16 years (Jones et al., 2008; MacPherson et al., 2010; Marcoux & Shope, 1997; Marsden et al., 2005; Van der Vorst et al., 2005) or older than 18 years (Clapp & Shillington, 2001; Courtney & Polich, 2009; Ham & Hope, 2003), or adolescents with a broad range of age (10 to 25 years) (Kuntsche et al., 2005). Also, these studies used a variety of alcohol measures that often lack a clear definition, like heavy alcohol use, problem drinking, excessive use or heavy episodic drinking. To our knowledge, there has not been any research on determinants of binge drinking in the age group from 16 to 18 years in countries with a legal drinking or purchasing age of 16, such as the Netherlands. Therefore, we chose to conduct focus group interviews with the target group. Focus group interviews allow detecting information when little is known about a certain topic in a specific target group. (Morgan & Kreuger, 1998). Additionally, influences of parents for this particular age group are also less explored. One may argue that their influence is declining for this age group (Scholte et al., 2008), yet, since most of the 16- to 18-year-olds are still living with their parents (Centraal Bureau voor

Statistiek, 2004) it is relevant to know whether parents still perceive a parenting role concerning binge drinking.

In this paper, we combined focus group interviews conducted with 16- to 18-year-old adolescents with focus group interviews with parents of adolescents from this age group. This allowed us to get a broad and detailed picture what determinants of alcohol use in this age group might be relevant and how alcohol use is managed in Dutch families. Further, we investigated differences and similarities in viewpoints of adolescents and parents, to provide useful insight into possible leads for further research and interventions.

## **Methods**

### **Design**

Nine focus group interviews with adolescents were conducted in schools within groups of six to 13 people. To stimulate group discussion about alcohol use and binge drinking we posed open-ended questions. Two researchers were present in all focus group interviews. One served as a discussion leader who guided the discussion until all questions were exhaustively answered. The second took notes and checked whether all questions topics were covered.

We held two focus group interviews with parents (twelve and six parents, respectively) using the same design as used in the interviews with the adolescents. Furthermore, we conducted eight one-on-one interviews (either on the telephone or face-to-face) asking the same questions as in the focus group interviews.

### **Recruitment and participants**

Fifteen schools of secondary vocational and pre-university education (adolescents in these schools were aged respectively 16 to 20 years and 13 to 18 years) were asked to participate in our study in order to get a representative sample of Dutch adolescents. In total, five schools took part in this study (response rate: 33%), located in four regions of the Netherlands (east, south, west and middle). Adolescents were recruited through a teacher and were told beforehand that the focus group was about alcohol consumption. As pupils who were in the same classes participated in the focus groups, two adolescents were still 15 years old, eight were 19 and three already 20 years old. However, the vast majority of students (N=60) were within the age range of 16 to 18 years old. Every adolescent who took part in a focus group received a letter to give to their parents, in which the parents were invited to take part in a focus group interview. Four parents indicated interest after receiving the letter from their child (response

rate: 5%). More parents were recruited with the help of an advertisement in the local newspaper (2 responses), an advertisement on the notice board in the academic hospital (2 responses), via the parents' council (12 respondents) and the first aid association (6 respondents). All parents had children in the age group 16 to 18 years. If parents also had children outside this age group we indicated that they should be talking about their 16- to 18-year-old children during the interview. Because some parents were not able to attend the focus group interviews, we decided to hold one-on-one interviews with these parents. We followed the same procedure as held during the focus group interviews, except that only discussions were possible between the interviewer and the participant and not amongst participants as in the focus group interviews.

### Procedure

Before the focus group started, adolescents were informed that the interviews would be recorded on tape, which would only be used for research purposes and not be accessible to anyone outside the research team. It was stressed that the opinion of the adolescents was important and that there were no right or wrong answers to the questions. Participants started by filling out a short questionnaire to assess some demographic variables (i.e., gender, educational level, age). Dependent on the answer to the question if they had engaged in binge drinking in the last month ("How often did you drink 4 or more (women) or 5 or more (men) glasses of alcohol on one occasion in the previous 30 days?" 1= "not at all" to 5= "more often than 6 times") we divided them into one of two groups. Adolescents got a blue or a yellow card that they had to put down in front of them so the interviewer could see which group each adolescent belonged to. The "blue group" had at least one binge drinking occasion and the "yellow group" had no binge drinking occasion in the previous 30 days. Both groups stayed in one focus group. This division enabled us to ask specific questions to only those adolescents who indicated engaging in binge drinking and other specific questions to only those who did not engage in binge drinking. Furthermore, it was possible to stimulate discussion between the groups on certain aspects one of the groups mentioned. This procedure was used to identify factors that lead to binge drinking and factors that prevent binge drinking in adolescents. After the participants had been divided into one of the two groups, the group interview started with posing the open questions to the group. When all questions had exhaustively been answered, the participants were thanked and received a voucher worth €7,50.-

The parents also received a short questionnaire before the group interview started. The questionnaire was slightly adapted, asking for their gender, educational level, number of children, and the age of the children. Parents were also informed that the interview would be tape recorded. After filling in the questionnaire, the focus group started with

posing open questions to the group. When all questions were answered, the parents were thanked for participation and received a voucher of €20.-.

### Focus group interviews

The interviews were semi-structured. The main topics of the interviews with the adolescents are summarized in Table 2.1, the main topics of the interviews with the parents in Table 2.2. Questions were written down in advance to facilitate the interviewers and to allow for similarity in main questions asked. The interviews, however, were held in a very open manner to ensure the natural flow of the discussion.

**Table 2.1:** Interview schedule adolescents (with predefined themes)

Theme	Example questions
Attitude	What do you think of binge drinking? Are there any benefits? Are there any disadvantages?
Social influences	Which people like/approve that you are binge drinking? Do these people binge drink themselves? If yes, when? What happens then? Which people dislike/disapprove that you are binge drinking? How do they let you know? Do these people binge drink?
Social network	Are there differences in opinion or influences of your friends on your binge drinking behavior? <ul style="list-style-type: none"> <li>- Friends in school or outside school</li> <li>- Older/younger friends</li> <li>- Boyfriend / girlfriend</li> <li>- Siblings</li> </ul>
First time binge drinking	When and why was the first time you have been binge drinking? How was this? Who was involved? Did that had any consequences (punishment of parents, approval of friends)?
Self-efficacy	When is it easy/hard not to binge drink?
Action plans	What do you do when you do not want to binge drink? How do you handle difficult situations?
Environmental factors	When/in which situations do you usually binge drink? When/in which situations do you drink alcohol without binge drinking? What causes you to drink? What withholds you from drinking?
Attitude parents	What do your parents think about you binge drinking?
Monitoring parents	Do your parents know where and with whom you are? Do you talk about e.g. when you have to be home in the night?
Rules parents	Are you allowed to drink alcohol at home? Are there any rules concerning your alcohol consumption in general?
Communication	Do you communicate with your parents about alcohol (how much you can drink)?
Behavior parents	Do your parents drink alcohol? If yes, when/how much? Do your parents provide you with alcohol?

**Table 2.2:** Interview schedule parents (with predefined themes)

Theme	Example questions
Attitude towards adolescent alcohol consumption	What is your opinion about alcohol use in adolescents? Are there any pros of alcohol consumption? Are there any cons?
Attitude towards adolescent binge drinking	What is your opinion about binge drinking in adolescent?
Knowledge about risks /consequences	What do you know about the consequences of binge drinking, both long term and short term?
Risk perception	How serious do you think these consequences are?
Rules	Do you handle certain rules concerning the amount of alcohol that your child may drink? Do you handle any rules concerning the times that your child has to be home when it goes out?
Beliefs about effective prevention of binge drinking	What do you think is a good way do decrease binge drinking in your child? Do you think it is necessary to decrease binge drinking in your child?
Beliefs about own influence	Do you think that you still have influence on your child's alcohol consumption?
Actions	What exactly do you do to decrease binge drinking in your child?
Consequences	What do you do if you realize your child has been binge drinking? Are there any consequences?
Needs	Do you sometimes think you could need some help with the alcohol education of your child? How should that help look like?

## Data analysis

The audio taped interviews were transcribed and analyzed using QSR NVivo 8 software for qualitative data (<http://www.qsrinternational.com>). The aim of this study was not to test hypotheses or a theory but to obtain insight into determinants of adolescent binge drinking, using both the adolescent and the parent perspective. Consequently, we used a data driven thematic approach (Braun & Clarke, 2006). Two researchers read the transcripts repeatedly in order to get familiar with the data. Using the QSR NVivo 8 software, transcripts of all interviews were coded into themes. After all transcripts were coded once, the transcripts were checked again against the codes. Text parts could be coded under more than one theme. Codes were then, where possible, grouped together to form main themes and sub themes (Tables 2.3 and 2.4). Some discussion themes were predefined in the interview schedule (Tables 2.1 and 2.2).

## Ethics approval

Ethical approval of the Regional Medical Ethics committee in the Netherlands was not necessary because participants in this study were not “subjected to procedures or required to follow certain rules of behavior” (CCMO, 2010).

**Table 2.3:** Final main and sub themes adolescents (predefined themes + themes that emerged from the data)

Main themes	Sub themes
Reasons not to binge drink	Negative experiences Environment Sports Expectancies
Influence of other people on non-binge drinking behavior	Social influence beliefs Environment
Reasons to start and continue drinking	Motives Environment Expectancies
Influence of other people on drinking behavior	Social influence beliefs Social network
Difficulties when trying not to binge drink	Cues Barriers
Parental attitude towards alcohol consumption	Parental attitude Drinking behavior parents
Influence of parents on alcohol consumption	Alcohol socialization First drink Awareness parents Drinking at home
Rules concerning alcohol consumption	Rules

**Table 2.4:** Final main and sub themes parents (predefined themes + themes that emerged from the data)

Main themes	Sub themes
Attitude towards alcohol	Pros Cons Own responsibility
Attitude towards binge drinking	Attitude towards binge drinking
Knowledge about drinking	Consequences (risks)
Parenting practices	Communication Rules Availability at home Consequences
Bringing down alcohol intake	Own drinking Communication Rewarding Schools
Responsibility	National campaigns Availability in environment policy

## Results

### Interview adolescents

#### *Questionnaire*

Nine interviews were held with 47 adolescents from secondary vocational education (three schools) and 36 adolescents with a pre-university educational background (two schools). The study sample comprised of 50 boys and 33 girls (mean age 17.2 years). The majority identified themselves as binge drinkers (65%, n=54). Thirty-two percent of the binge drinkers indicated engaging in binge drinking one to two times per month, followed by 28% who engaged in binge drinking three to four times per month. Furthermore, 20% reported binge drinking five to six times per month and another 20% engaged in binge drinking more often than six times per month.

#### *Binge drinking*

Because none of the adolescents was familiar with the term binge drinking, they were introduced to the definition (four or more glasses for women, five or more for men on one occasion). Almost all adolescents indicated that they did not think that this was a lot: "Little! I think! And maybe that's the average, but this does not do anything with us. Most of us wouldn't even feel it." Their definition of a lot would rather be: drinking every day; or drinking 16 glasses of beer. Furthermore, they were asked what they would consider as drinking too much: "You had too much alcohol when you throw up.", "If you do things unconsciously!"

#### *Reasons not to binge drink*

Adolescents who indicated that they did not engage in binge drinking were asked what reasons they had not to do so. In four of the nine groups non-drinking adolescents could not indicate a specific reason. They just "did not do it", or did not have any longing for alcohol "I do not need it. Everybody around me drank, but I thought, no, I do not need that". One girl and a boy reported that they had very bad experiences with alcohol. The girl experienced physical impairment and black outs due to drugs in her drink. The boy once drank so much that he had to be hospitalized.

Individual sport (such as cycling, boxing and swimming) at a high level also was a reason not to drink, as was having an illness that affected the liver (infectious mononucleosis). Another reason not to drink was the Islamic religion because it forbids the consumption of any alcoholic beverage. Finally, some people just did not like the taste or the effects of alcohol or they did not expect alcohol to increase their fun when going out: "I was on 'Dancetour' lately and I just drank water. I had the time of my life there. So, yes, I

had as much fun [drinking water] as when I drink 10 glasses of alcohol!” If adolescents were already classified as binge drinkers, their reasons not to drink were when they had tests at school, a sport competition, if they were sick, if they had to go to school or work the next day, or if they had to drive a car or moped.

### *Influence of other people on non-binge drinking behavior*

Three people mentioned bad examples from their older siblings as reasons not to drink. It was also mentioned that being in a relationship with someone prevents adolescents from binge drinking.

The answers to the question how people in their environment reacted to their non-drinking were two-fold. On the one hand, adolescents reported that almost all people in their environment liked that they did not drink, especially parents. On the other hand, many students mentioned that peers and friends offered them drinks very often. Furthermore, we asked if it was hard for them to resist the offering by others and again this answer was two-fold. Some of the non-drinkers said that it was no problem for them to say no, while others felt very uncomfortable and even avoided situations where alcohol was consumed: “When they go to drink somewhere, I go home and sit in front of the computer, [...] because otherwise they would offer me a drink and I would accept it.”

### *Reasons to start and continue binge drinking*

Reasons for binge drinking can be classified into three categories: Drinking motives, environmental influences and alcohol expectancies. Motives to binge drink were to belong into the group when they go out on a Saturday night, to cope with negative emotions and because it is a new experience to drink alcohol. “It is new for you if you are allowed to drink. Then you just try out everything.”

Environmental cues to binge drink that were mentioned in every group were: the weekend itself, going out at the weekend, being at a party and being together with friends (at a party or at home). In some groups being a member of a sports team (e.g., soccer, hockey) was a reason to binge drink: “On Saturday and Sunday I am usually at my hockey club, and yes, anyway. Uhm..., yes I am always drinking a couple of beers there.” Special events like Carnival and festivals were mentioned as reasons to binge drink. Furthermore, the expectation to become more relaxed and less tense was mentioned by some people. Some adolescents indicated that the more convivial a party was, the more alcohol they drank, while on the other hand, other adolescents indicated that they expected alcohol to create a more convivial atmosphere.

*Influence of other people on drinking behavior*

Adolescents stated that the size of the group affected how much they would drink. The bigger the group, the more they would consume. “For example, when I am with a friend, we drink a couple of beers. But if you are with a big group, then you often drink a lot more.” The opinions about whether friends and peers affect their drinking were quite different. Some adolescents said that they did not feel any pressure from peers to drink if they decided not to: “If I made up my mind [not to drink alcohol] then there will not be much change”. Others stated that if there is alcohol it has to be drunk or that if they are in a group, they all drink together or no one drinks. Furthermore, one person mentioned that it would matter how well you know the people you are with: “When I am with good friends then we will drink more than when I am with people I don’t know very well.”

*Difficulties when trying not to binge drink*

When asked what situations made it very difficult for them not to drink or drink less than they would otherwise, most adolescents indicated that being at a party or with friends would be the most difficult situation. Most of the time adolescents reported that when they go out, they go together with friends, and they would also leave together, which makes it more difficult not to binge drink: “You go together with your friends into the city and you leave with them. [If you want to leave] then they say ‘ah, stay another 15 minutes’. But then you are there for two more hours.” In general adolescents were convinced that the time they spent at a party significantly affected the amount of alcohol they drank. “Yeah, when I come at 12 and leave at 1 a.m. I couldn’t drink as much as if I stayed until it was very late, could I?”

*Parental attitude towards alcohol consumption*

Almost all students indicated that their parents are just fine with their alcohol consumption as long as they are not so drunk that they have to throw up. “My parents say ‘drinking is fine’, of course they would rather see me not totally drunk, but this happens from time to time. When I throw up in the house, then I have a problem. But if I am just somewhat tipsy, they like that.”, “My mom really finds it funny when I drink too much”. Some even said that their parents would not even mind if they had to throw up, but that they had to clean it up by themselves: “My mom always says: if you have to throw up, you clean it up”. Some adolescents reported that there were differences between their mother and father in attitude towards drinking. “My parents are divorced. He [the father] would beat me if he saw me drinking. I only go out when I am at my mom’s place.”

### *Influence of parents on alcohol consumption*

Often adolescents reported that they got their first alcoholic drink from their parents. The reported ages varied between six to 15 years. Most adolescents said that the first drink was a “snow-white”, which is a mix of beer and Sprite. The first time they were binge drinking was between 13 and 15 years. Most of the adolescents reported that their first time binge drinking was outside of awareness of their parents. The occasions that were mentioned most often were: being at a party, being in a bar or during Carnival. Two times it was explicitly stated that there were older friends around the first time they were binge drinking. A few adolescents mentioned that their parents were present the first time they were binge drinking but that they were not aware of their children drinking more than five glasses of alcohol. “It was there [alcohol] and they [parents] did not know that I was drinking it.”

### *Rules concerning adolescents’ alcohol consumption*

When asked whether their parents still handled rules concerning their alcohol consumption, almost all adolescents denied that. Some indicated that they had fixed rules before they turned 16, but that now their parents’ concern is more that they come home safely and not how much they drink or that they come home at a distinct time. “As long as I do not have to come home alone it is always good.” Some said that their parents would say things like: “Take it easy!” or “Don’t drink too much!” but never set specific limits for their alcohol consumption. Just very few mentioned that their parents had very strict ideas about their alcohol consumption and going out at night: “I am just allowed to drink one glass of alcohol.”

When we asked whether adolescents would respond to rules if their parents would now start to set them, reactions were divided evenly. Some said that this would have absolutely no effect on the amount they would be drinking, others said they would certainly respond to their parents rules and some were not sure (indicating that they would probably stop caring about the rules when they had been drinking five glasses of alcohol).

## **Interview parents**

### *Questionnaire*

In total, 18 parents participated in the focus group interviews and eight parents in one-on-one interviews (three face to face, five by telephone). Eight were male. Most parents (52%) indicated that their children had no binge drinking occasion in the previous 30 days. About 26% reported one or two binge drinking occasions in the previous 30 days

and 22% stated that their children had three to four binge drinking occasions in the previous 30 days.

#### *Attitude towards alcohol consumption*

We asked the parents about their attitude towards alcohol consumption in general of their children. Most parents indicated that they would prefer their children not to drink alcohol at all, but that they do not mind if their children drink within the limits: “I am not against drinking, but it needs to be within certain limits, responsibly”. Some parents were convinced that it was their child’s responsibility and that they need to trust them that they would set an appropriate limit for themselves: “I think it’s useless to forbid it. You need to guide them to a sense of responsibility so that the child itself is able to drink within certain limits. It’s their own responsibility. This is what I think.” We asked what the parents considered appropriate limits for their children: “I think for a 16-year-old two glasses every two to three weeks is appropriate.” This was a limit that most parents agreed on. An advantage that parents saw in the alcohol consumption of their offspring is that they would learn to drink: “An advantage is that they slowly learn how to drink alcohol.” “They can experience what it does to them. And I think it’s good if they see what it does to their peers if they drink too much. [...] I realized from my 17-year-old son that this was very impressive. That when others drink too much, that they act weird, experience trouble, become annoying, or situations get out of control and he did not drink at all and he became more reserved. I’m pretty sure that was influential.”

#### *Attitude towards binge drinking*

Just as the adolescents, parents were unfamiliar with the definition of binge drinking. We explained the meaning of the term (four standard glasses of alcohol for girls, five for boys) and then continued to ask them about their attitude towards these amounts. All parents indicated they had a negative attitude towards binge drinking. The degree of negativity varied from “awfully”, “dangerous”, “annoying”, “too much” or “not positive”. Some parents were not happy about this behavior, but could understand that their children engage in it: “I don’t think that this is something positive, but I can understand it a little bit.” Some parents who already experienced binge drinking in their children tried to give an explanation for the behavior of their children: “He is in a phase where he wants to be cool, cannot say no, and has totally no idea what this is doing to him. He does not know his limits because he does not drink regularly, yet. If he would go out every weekend, then he eventually would know after four or five beers, that’s where it went wrong the last time. But he does not know that yet, and then suddenly it’s boom.”

*Knowledge about drinking*

Parents named a couple of physical and intellectual consequences of binge drinking. Most often parents mentioned negative consequences on brain development. Two parents specified this more: “Look, if it affects your brain, then it affects the part involved in planning, organization, and concentration”. One parent in a group that mentioned effects on the brain immediately played down its negative consequences: “On the other hand, when I was studying, I also had a period where I drank more than average. And I did end up quite okay. So I think it’s really hard to... but I think from 12 to 16 to 18 years it is, your brain cells are in full development.” In second place parents mentioned liver damage and that you lose control over yourself as a consequences of binge drinking. Some parents mentioned intellectual problems as a result of binge drinking: “Your ability to concentrate decreases. This affects your performance on school.” Furthermore, a few parents mentioned having accidents, becoming comatose, having a hangover, and developing an alcohol addiction.

*Parenting practices*

Almost all parents indicated that their way to reduce or control alcohol consumption in their children would be through conversation: “The most important thing is to keep talking with your child. And you shouldn’t be blaming the child.” Some parents mentioned that they could influence the child through their own example: “She sees that for me it is just for social reasons, I like drinking a glass of wine or liquor, but then it stops when I have to go home by car, and that’s what she sees of course.”

It appears that parents are quite careful when talking to their children: “This subject should not become heavily loaded. Then they stop talking at all.” “I think you can better teach them what is the matter with alcohol rather than using rules and impose sanctions on it.” “Don’t preach to them. This is useless. And forbidding it, too.”

A lot of parents indicated that they had strict rules concerning alcohol consumption before their children turned 16: “It’s not allowed before you’re 16. Done. This was very clear for us!” Now that their children are between 16 and 18 years, almost all parents said that they tell them that they should not drink too much, but that they do not set specific rules concerning the amount of alcohol that they allowed their children to drink. The reasons why they did not set clear limits were: “Because you have no control about that. You make a fool of yourself if you tell them that they can just drink 3 glasses of alcohol. Do you think they comply? If you know their peer group and what they drink on one evening, you can be lucky if they have enough with five glasses. You fool yourself at the moment that you say that they cannot have more than three glasses because you know that they do not comply!” A lot of parents gave their lack of control as a reason not to provide strict rules concerning the amount of alcohol that they allow

their children to consume. Strict rules concerning at what time they have to be home at the weekend or how long they can stay when going out were also absent. Most parents stated that they find it acceptable when their offspring come home somewhere between 1 and 2 a.m. It was also mentioned that at this age, adolescents have to learn to care for themselves: "I think now when they slowly move towards 18 they have to become independent. They have to discover their own limits, that's the best for everyone."

Just two parents indicated that they had absolutely no alcohol at home and that they themselves never drink alcohol. The majority of parents had alcohol available at home and the children were allowed to take it, too: "Yes, we have everything at home. He can take a beer if he wants to." All parents indicated that their children were allowed to drink alcohol at home, even though they did not drink themselves or have no alcohol at home: "They can have a glass [of alcohol] if they want to...but I don't buy it." "I think it's enjoyable if the children drink a glass together with us. Why should they have to drink something else?"

Finally, parents who already had experienced a situation in which their children came home drunk indicated that there were no consequences but that they had to clean up the mess by themselves: "There was no need to talk about that." "He was the idiot of the family. So, I think he has learned from that." Parents who had not experienced such a situation before mentioned that they would most likely have a good conversation with their child about the negative consequences of drinking. Just a few mentioned measures like restrictions on going out or pocket money.

### *Bringing down alcohol intake*

Parents mentioned different levels at which alcohol use in adolescents and especially binge drinking could be influenced and reduced. Firstly, many of the parents mentioned strategies that they themselves could use, like setting a good example, talking to their children about the negative consequences, or rewarding their children when they did not drink: "We had the following agreement at home: If you do not smoke until you are 18, we will pay for your driving license. This kind of stimulating options. So I think if you make a deal with your child after they turn 16, like if you do not get drunk, then you will receive some kind of reward." Secondly, parents mentioned facilities like schools to engage more in education about this topic: "The schools should present someone like an ex-alcoholic because then they are really confronted with the negative consequences of drinking; then I think you can maybe reach those children." They also mentioned that national campaigns like the warning text on cigarette packaging should also be printed on bottles of alcohol. Also the amount and variety of alcoholic beverages should be reduced according to the parents. Special concern was also given to the Alco pops, the popular mix drinks with Rum that taste like lemonade: "In former

times [when we were young] we could choose from four, five things but now, the bottles get more colorful [...] drinking alcohol within limits is okay, but do not bring too much on the market. That's just inviting to try it out."

Finally, the current policy in the Netherlands concerning the availability of alcohol and the legal purchasing age of 16 should change, according to some parents, in order to influence binge drinking in this age group. For example, one parent was very frustrated about the legal purchasing age of 16 years and how this undermines her authority as a parent: "I think it is ridiculous! Really, [...] when I was 16, there was no age limit. So it depended very much on your environment how they handled alcohol and what arrangements you made. Nowadays, it is legal, so the adolescents think, so...[...] It is regulated by law, so what can you do as a parent? [...] Adolescents get an advantage here to say: I am 16, here is my ID, thus I am allowed to drink. Whereas, if this whole regulation by law is absent then me as a parent a: maybe feel more responsible, but also b: make my own arrangements with my child. But now, as I just said, they say, I am 16.[...] You have no leg to stand on." More parents indicated that they would like the age limit to rise to 18 years: "The worst puberty is over with 18 years, and then they are more reasonable."

Another policy aspect that upsets some parents was the ease with which adolescents can buy alcohol in the Netherlands: "Grocery stores shouldn't sell alcohol! [...] It is so normal. You buy your bread and you get your alcohol. No one ever thinks about that. I think this is highly improper of the government." Many parents saw the task of bringing down binge drinking in adolescents as a responsibility of the government and catering industry: "I consider binge drinking as terrible. And what especially bothers me is that this is not something of the last five years, but that it was the same 20 or 30 years ago. And every time they [the government] call 'we are going to do something about this', but the actions that are taken by the government to control this problem fail until now. [...] This clearly is omission of the government". Interviewer: "So, you think this is a task of the government?" "Yes, absolutely! This is not something of the own responsibility of people."

## **Discussion**

The current study reveals more insight into the opinion about and the handling of alcohol use within families in the Netherlands, where underage children are legally allowed to purchase and consume low-strength alcoholic beverages. The unique feature of this study is that we talked to adolescents as well as parents about factors that influence binge drinking, so we could get a broad picture about what determines binge drinking in a permissive environment.

The majority of the adolescents we talked to identified themselves as a binge drinker, which is representative for the Dutch population as a whole (Monshouwer et al., 2008). Almost all adolescents indicated that the amount of alcohol that is defined as binge drinking (4/5 glasses of alcohol) is low. Interestingly, sports seemed to have positive as well as negative influences on drinking behavior. Non-binge drinking adolescents indicated that individual sports, such as swimming or cycling, especially when at a high level, makes them refrain from drinking alcohol, whereas team sports like hockey or soccer seemed to be supportive for binge drinking events, as indicated by binge drinkers. A recent review of high school and college athletes concluded that athletes reported higher levels of alcohol consumption than did non-athletes (Lisha & Sussman, 2010). However, there are several studies that found sports to be protective for early alcohol debut (Hellandsjø Bu, Watten, Foxcroft, Ingebrigtsen, & Relling, 2002) and alcohol consumption (Elder, Leaver-Dunn, Wang, Nagy, & Green, 2000), and has even shown to be protective against alcohol consumption when adolescents have substance using peers (Thorlindsson, 2006). One study focused on sport-type differences in alcohol use among college athletes and found that swimming and diving athletes reported significantly higher levels of alcohol consumption than other sport types (Baseball/Softball, Basketball/Volleyball, Soccer, Track/Cross country) (Martens, Watson, & Beck, 2006). This is contrary to the results found in this study, where teams sport seems to be more encouraging alcohol consumption than individual sports. There might perhaps be a change of influence of sport teams. It could be that in late adolescence being a member of a sport team exposes adolescents more to other adolescents who are in an experimenting phase and thus encourage each other to drink together as a team, whereas when adolescents grow older and enter college a feeling of shared responsibility for the success of the team might work as an inhibitor to drink big amounts of alcohol. Another possible contributor to the higher alcohol consumption in team sports might be sponsorship of the teams by the alcohol industry. A study of New Zealand sport teams showed a positive association between alcohol industry sponsorship and AUDIT (Alcohol Use Disorder Identification Test) scores, indicating more hazardous drinking in people who are engaging in sports that are sponsored by the alcohol industry (O'Brien & Kypri, 2008). Sponsorship of sports through the alcohol industry is very common in the Netherlands (STAP). However, we did not check in this study if the adolescents from our sample were subject to alcohol industry sponsorship.

Further, adolescents mentioned that their desire to belong to a group and the expectation to become more relaxed were important drinking motives. This is in line with the results of a review on drinking motives (Kuntsche et al., 2005), where social motives (to obtain social rewards) and enhancement motives (drinking to enhance a good mood or well-being) were associated with moderate and heavy drinking in young people, respectively. The review also showed that conformity motives (drinking to avoid social rejection) are

hardly mentioned by adolescents; in the current study adolescents also stated to feel no peer pressure. Nevertheless, influence of friends on drinking behavior seems to be evident as it has been reported in many studies (e.g., (Bot, Engels, Knibbe, & Meeus, 2005; Mercken et al., 2012; Wilks et al., 1989)). From the literature and our study it seems that adolescents are subject to peer influences but are not explicitly aware of it. In the review of drinking motives adolescents' ages varied between ten and 25 years and most of the studies in this review were conducted in countries with a legal drinking age of 18 or higher. It is interesting to see that these motives seem to be the same in a more permissive society.

Environmental cues that would most likely lead to a binge drinking event, like being at a party or in a bar on weekend days together with friends, were also identified as the most difficult situations when trying not to drink. This indicates that alcohol consumption in social situations is widely accepted by Dutch adolescents. Furthermore, adolescents reported feeling pressure to drink alcohol when it is available. Further influences of peers explicitly mentioned were the size of the group and familiarity with the group. The bigger the group and the more familiar the members of the group were, the more alcohol they drank. This is in line with previous research (Knibbe et al., 1993). It seems important that interventions to reduce alcohol intake in adolescents should focus on this difficult situations, strengthen their efficacy to drink in a low risk manner when much alcohol is available and provide adolescents with advice how to handle peer pressure.

Also, parental attitude towards alcohol was perceived as positive by almost all adolescents, as long as they do not get drunk and throw up. Parents themselves indicated that they regard drinking by their children to be acceptable but within appropriate limits. This confirms the adolescents' perspective; however, those limits were defined by parents to be two glasses of alcohol every two weeks. The attitude towards binge drinking among their children was negative in almost all parents. Apparently, the views of parents and adolescents are not totally in line with each other. In an intervention to reduce alcohol use among adolescents it should be stressed that parents clearly communicate their expectations and definitions of appropriate drinking towards their children, in order to avoid misinterpretations of acceptable limits.

Research has shown that it is not only the perceived approval of alcohol consumption of peers or the approval of drinking of parents that determine alcohol consumption in adolescents but the disparity between these two (Cail & LaBrie, 2010). The bigger the perceived gap between parental approval and peer approval, the more adolescents tended to drink. Reducing this gap may be a valuable component in an attempt to reduce alcohol consumption. Correction of the perceived norm of peer drinking (Lewis & Neighbors, 2007; Neighbors, Larimer, & Lewis, 2004; Neighbors, Lee, Lewis,

Fossos, & Walter, 2009) on the one hand and encouraging parents to stay involved and communicate with their children to choose friends with similar attitudes towards drinking could be possibilities to reduce the gap (Cail & LaBrie, 2010). Interventions that encouraged parents to talk with their children about alcohol before they left for college showed that those students had less positive perceptions regarding drinking activities and showed less drinking and drunkenness (Turrisi et al., 2001a). Furthermore, those students also perceived their peers to have similar perceptions regarding drinking (Turrisi et al., 2001a). These studies indicate that parents still have considerable influence on their children's drinking behavior even when they are about to leave home. When adolescents still live at home, as is the case with our target group (Centraal Bureau voor Statistiek, 2004), this influence should be even easier to achieve.

Further, parents were quite aware of a number of negative effects of binge drinking on the health of their children, but despite their ideas about appropriate limits and knowledge about the consequences, most parents did not set clear rules concerning alcohol use and going out. Instead, parents rather talked to their children in an understanding, non-accusatory fashion. This again is in line with the adolescents' reports that their parents stopped handling clear rules concerning alcohol consumption and going out when they turned 16. Parents should be encouraged to keep setting appropriate rules concerning alcohol use, as these have been proven to be effective in reducing alcohol intake among adolescents (Spijkerman et al., 2008; Van der Vorst et al., 2005). Also, some adolescents indicated that this would have effect on their drinking behavior, so this may be a successful strategy in at least some adolescents.

Most parents had alcohol available at home and often thought it was more safe if adolescents drank alcohol at home in their presence than outside with peers. Yet, this perception may be incorrect as one study has shown that adult-supervised settings for alcohol use, in line with harm-minimization policies, are associated with higher levels of harmful alcohol consequences compared to zero-tolerance policies that favor abstinence of alcohol (McMorris, Catalano, Kim, Toumbourou, & Hemphill, 2011). Often parents were convinced that their children had to learn how to drink, and that prohibiting the use of alcohol, or just allowing a certain amount of alcohol, would have no effect on the alcohol use of the child. Three factors mainly contributed to these stances: that parents experienced a lack of controllability of their child's alcohol intake due to the easy availability of alcohol in grocery stores; the fact that parents could not be around their children 24/7; and the legal purchasing age of 16. Some parents indicated that they had difficulties with these policies because they weaken their position as a parent. Parents explicitly stated that as soon as their children turn 16 they do not have any control about how much their child is drinking and where the child is drinking. This generally accepted, yet wrong, assumption that parents' influence on

adolescent drinking disappears when they leave home for college has been mentioned earlier (Turrisi, Wiersma, & Hughes, 2000).

Even though some parents mentioned strategies they could use to decrease the amount of alcohol their child drank, there were also a couple of parents who thought that the responsibility to reduce the problem of binge drinking lies with the legal authorities and not with themselves. This may possibly be a side effect of the permissive rule setting of the Dutch government. Hence, interventions for Dutch parents should also focus on strengthening parents' feelings of responsibility and self-efficacy to control the alcohol intake of their child. Another possibility would be to plead to increase the legal purchasing age from 16 to 18 years. This would at least have three advantages. First, it would probably increase the feeling of control and responsibility in parents. Second, it would give a clear signal to the adolescents that underage drinking is not (no longer) acceptable and third, make it more difficult for under-age adolescents to get hold of and consume alcohol. Of course, there is a difference between the introduction of law and observing the law, as in our sample many adolescents reported drinking before the age of 16, but increasing the age limit might possibly also increase the age of first alcohol consumption. Grocery stores and bars may be more triggered to check the ID of adolescents that do not look adult and parents could also become more sensible towards providing their adolescents with alcohol when they are under 18.

The results of these focus group interviews need to be quantified using questionnaires. This would lead to more insight into which of the factors named in this qualitative research are important and changeable (Bartholomew, Parcel, Kok, Gottlieb, & Fernandez, 2011) and could give further indications on what kind of interventions to reduce binge drinking in this age group need to be developed. It is known that parents still have considerable influence on the child's alcohol intake (Spijkerman et al., 2008; Turrisi et al., 2001a; Van der Vorst et al., 2005; Wood et al., 2004) and that combining parents and children in an intervention is indeed more successful than delivering separate interventions to either the child or the parent (Koning et al., 2009). It therefore seems of utmost importance that parents are also included in these interventions to maximize the effect. Concerning the parents, we can conclude that many parents, at least from our sample, are not fully aware of the negative consequences of alcohol use, and they lack self-efficacy to control and reduce alcohol intake in their children. It also seems useful to reconsider the policies concerning the legal purchasing age and availability of alcohol to strengthen the position of parents and make availability of alcohol more difficult.

### **Limitations and Strengths**

A limitation of focus group interviews in general is that you most likely engage with people who are motivated to talk about a certain problem. This could have particularly

played a role in the interviews with parents. Parents were hard to reach and response rates were low. Despite this, we managed to get a good insight into alcohol use in Dutch families because despite their awareness of the problem and their motivation to talk to us, these parents acted as do many parents who see no problem: i.e., not setting rules and experiencing helplessness. Furthermore, we had to use one-on-one interviews with some parents, because for them it was not possible to join a focus group (e.g., because of the distance or time constraints). A disadvantage of this method is that you miss discussion with other parents in the group, but a big advantage is that you can get more in-depth insights in comparison with focus group interviews. Finally, we relied on self-reports of adolescents and parents, which can be prone to subjective bias, and due to a lack of insight information from self-report data can be missing.

The major strength of this study is that we combined focus group interviews from adolescents and parents, which creates a broader view on the problem and possible solutions to reduce binge drinking in adolescents.

### **Conclusions**

Dutch parents and adolescents are facing a unique problem. Even though adolescents aged 16 are not grown up, they are allowed to buy low-strength alcoholic beverages and are expected to engage in low risk drinking. In reality this often does not take place, as excessive consumption of alcohol is a big problem in the Netherlands. We gained insight into the reasons why Dutch adolescents binge drink and how Dutch families handle alcohol consumption. We come to the conclusion that there are many opportunities to intervene, in particular through combined parent-child interventions, in order to improve the way families deal with alcohol and ultimately reduce the alcohol intake in this age group.



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# Chapter 3

## **Web-based interventions to decrease alcohol use in adolescents: A Delphi study about increasing effectiveness and reducing drop-out**

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Based on:

Jander, A., Crutzen, R., Mercken, L., de Vries, H. (2015). **Web-based interventions to decrease alcohol use in adolescents: A Delphi study about increasing effectiveness and reducing drop-out.** *BMC Public Health*, 15, 340.

**Abstract**

**Background:** Web-based computer-tailored (CT) interventions have a high potential to reach a large number of people and effectively change health risk behaviors and their determinants. However, effect studies show small and variable effect sizes, and these interventions also suffer from high drop-out. In this study we explored how Web-based CT interventions can be used effectively to reduce binge drinking in 16- to 18-year-old adolescents.

**Method:** A three-round Delphi study was conducted. We invited experts to identify strategies to be used in Web-based CT interventions that can effectively decrease binge drinking in adolescents and to rate these strategies by importance. We asked to discriminate between interventions targeted for adolescents and those targeted for parents. Furthermore, we asked experts to suggest strategies for reducing drop-out and to indicate their importance.

**Results:** Important strategies mentioned by the experts were: encouraging parents to set appropriate rules, encouraging consistent communication, and training refusal skills among adolescents. Concerning the reduction of drop-out from Web-based CT interventions experts came up with suggestions involving the content of the intervention (e.g., relevant material, use of language, tailored messages) but also involving the use of reminders and incentives.

**Conclusion:** The results of this explorative study provide useful strategies to increase effectiveness and decrease drop-out in future interventions.

## Background

Binge drinking, particularly for adolescents, is associated with a variety of negative consequences, such as fighting, being injured and injuring others (Swahn et al., 2004), dating violence, attempting suicide, smoking, and using other (illicit) drugs (Miller et al., 2007). Furthermore, binge drinking (drinking  $\geq 4/5$  glasses per occasion for girls/boys) (Verdurmen et al., 2011) is associated with brain damage and neurocognitive deficits (Zeigler et al., 2005) and can impair learning and school performance (Miller et al., 2007), and causes high societal costs, like health-care and law-enforcement costs, as well as costs for property damage and social work services (Rehm et al., 2009). Binge drinking is prevalent in Europe with an average of 39% of adolescents having at least one binge drinking occasion in the previous 30 days (Hibell et al., 2011). Therefore, interventions are needed to reduce binge drinking among adolescents (Miller et al., 2007; Swahn et al., 2004), which should be targeted at their personal determinants (e.g., socio-cognitive variables) as well as their environment (e.g., parenting and peer influences) (Green & Kreuter, 1999). The 16- to 18-year-old adolescent group has been largely understudied, with only a few studies focusing on this age group (Kuntsche, Knibbe, Gmel, & Engels, 2006; Voogt, Kleinjan, Poelen, Lemmers, & Engels, 2013). Most studies focused on either younger adolescents (Jones et al., 2008; MacPherson et al., 2010; Marcoux & Shope, 1997; Marsden et al., 2005; Van der Vorst et al., 2005) or young adults who are 18 years and older (Clapp & Shillington, 2001; Courtney & Polich, 2009; Ham & Hope, 2003).

An effective way to reduce binge drinking in adolescents could be through Web-based CT interventions. Web-based interventions have the potential to reach a large number of people, as access to the Internet is growing worldwide (Bewick et al., 2008). Most often these interventions use the Social Cognitive Model (SCT) (Bandura, 1986), Transtheoretical Model (TTM) (Prochaska & DiClemente, 1983), or Theory of Reasoned Action/Planned Behavior (TPB) (Ajzen, 1991; Fishbein, 1979) and its determinants to develop the intervention (Webb, Joseph, Yardley, & Michie, 2010). Interventions built on TPB, however, led to substantially larger effects compared to the other theories (Webb et al., 2010).

The CT messages are developed by analyses of cognitive determinants of behavior and formulating feedback messages tailored to these determinants (Dijkstra & De Vries, 1999). Furthermore, individual characteristics of a person can be taken into account (i.e., demographics), which results in relevant and highly individualized information that is more likely to attract attention (De Vries & Brug, 1999). Personalization and feedback have been shown to be effective working mechanisms of CT interventions (Dijkstra, 2005). CT interventions have been proven to be efficacious in changing health risk behaviors and their determinants (Krebs et al., 2010; Noar, Benac, & Harris, 2007), but

effect sizes, although statistically significant, are often only small to medium (Krebs et al., 2010). This raises the question whether the right strategies were used to target the health behavior and this specific group. There are methods available to target determinants at several levels (Bartholomew et al., 2011), but relatively little is known regarding how to translate these methods into strategies incorporated into Web-based CT interventions. A review has shown that the most commonly used behavior change techniques included providing information about consequences of behavior, prompting self-monitoring, identifying barriers, and providing problem solving skills, but those associated with the largest effects on behavior in Web-based interventions were stress management and general communication skills training (Webb et al., 2010). Other effective strategies were modeling, relapse prevention/coping planning, facilitating social comparison, goal setting, action planning, and feedback on performance (Webb et al., 2010). Furthermore, Web-based CT interventions can reach many people, but tend to have high drop-out rates (De Vries et al., 2012; Elfeddali et al., 2012; Kohl et al., 2013). This problem is common in eHealth effect studies and results in less power to reveal potential effects (Eysenbach, 2005). Some studies investigated the effects of invitations to and incentives of surveys to reduce drop-out rates (Edwards et al., 2009; Göritz, 2005, 2006) and suggest that using incentives, short questionnaires and personalization of the invitation might be effective in increasing response rates. Yet, there is scarce knowledge about how to design an intervention to target that problem. Therefore, this issue should be addressed when developing Web-based CT interventions.

Although previous research has clearly identified determinants of adolescent binge drinking (Courtney & Polich, 2009; Jander, Mercken, Crutzen, & Vries, 2013; Wilks et al., 1989), to change these determinants some methods are more or less suitable depending on the target group and the way the intervention is delivered (Bartholomew et al., 2011). Therefore, this study has two goals: first, we aim to identify the most suitable strategies for Web-based interventions aimed to change determinants and to reduce binge drinking among 16- to 18-year-old adolescents; strategies that may target adolescents' personal factors, as they have been found to be important determinants of binge drinking (Cooper, 1994; Kuntsche et al., 2005; Marcoux & Shope, 1997), as well as their parents, who still have considerable influence on their children's alcohol intake during this age period (Spijkerman et al., 2008; R. Turrisi, J. Jaccard, R. Taki, H. Dunnam, & J. Grimes, 2001b; Van der Vorst et al., 2005). Second, we aim to identify strategies that can reduce drop-out of adolescents and parents in Web-based CT interventions.

## Methods

We conducted a three-round Delphi study during a five-month period (Figure 3.1). A Delphi study is a method used to structure a group communication process in order to reach consensus to a complex problem (Linstone & Turoff, 1975). Although the number of rounds required is disputed, it appears that the majority of studies prefer either two or three rounds (Linstone & Turoff, 1975; Mullen, 2003). A three-round method is advantageous, since factors for which no clear consensus has been reached in the second round are offered another time to respondents for a critical review concerning their importance. During each round experts were invited to respond to a specific set of questions. The rounds were iterative in nature and each round took about 10 to 15 minutes to complete. Experts received an e-mail inviting them to participate in an Internet Delphi study. The e-mail contained a link to the online questionnaire. Two weeks after the first invitation a reminder was sent to non-responders, followed by a second reminder if needed after three weeks. Invited experts came from both research and practice backgrounds, to get a broad overview of the existing knowledge from both fields. These experts had experience with alcohol prevention projects or projects to reduce alcohol use for adolescents and young adults. They were invited to indicate whether their expertise involved interventions and studies about binge drinking adolescents targeting adolescents, those targeting parents, or both (Table 3.1).

In order to facilitate examination of the data and analyses and support accurate replication attempts to contribute to future meta-analyses (Crutzen, Peters, & Abraham, 2012; Peters, Abraham, & Crutzen, 2012), all study materials (i.e., questionnaires, data, syntax, and output of the analyses) are available at [www.sciencerep.org/14](http://www.sciencerep.org/14).

**Table 3.1:** Field of expertise indicated by the experts

Field of expertise	First round	Second round	Third round
Interventions and studies about binge drinking adolescents targeting adolescents	28%	45%	41%
Interventions and studies about binge drinking adolescents targeting parents	5%	3%	3%
Both	67%	52%	56%

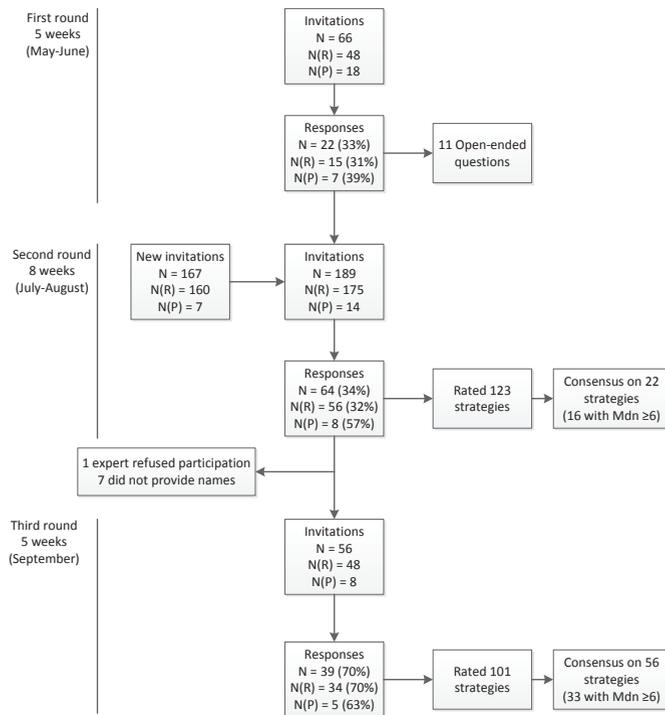
### First round

The first round consisted of open-ended questions. Four main topics were covered with two to three sub-questions per topic. In order to prompt the experts to think of successful strategies, we first asked for all possible factors that determined binge drinking in adolescents. This technique, called elicitation, is often used to identify salient

beliefs underlying behavioral determinants (Fishbein & Ajzen, 2010) (a list of the identified determinants can be found in the tables 1 through 3 in the appendix 1). The first three topics were about parenting practices/styles/actions, environmental factors, and motivational factors that influence binge drinking and had an identical structure. We then asked the following question: “What are, according to your expertise, effective parenting practices/styles/actions to reduce binge drinking in 16- to 18-year-old adolescents?” Subsequently, we asked: “How would you translate your knowledge about parenting practices/styles/actions into strategies to be used in a Web-based intervention aimed at parents to reduce adolescents’ binge drinking?” If participants indicated that they had experience with interventions targeting parents to reduce adolescents’ alcohol use, they were asked: “According to your expertise, changing which factors have been shown to be especially effective in an intervention aimed at parents to reduce alcohol consumption in adolescents?” The last topic was related to factors to reduce drop-out in interventions targeting adolescents and interventions targeting parents.

We invited 66 international experts to answer the questions from the first round of the Delphi study. Experts with research backgrounds were identified through a search using Google Scholar, PsycINFO and PubMed. If researchers previously published at least three articles on topics that we considered relevant (alcohol, prevention, adolescents, parents, or interventions), they were considered experts in this field. We then conducted a Google search to obtain further information about them on their institute Web sites (e.g., field of expertise, e-mail address) and invited them to participate. We also invited experts with practical backgrounds because they are often actively involved in implementing and conducting interventions, and have thus more experience in the application of interventions in the field. We reached them by approaching established national institutes that are very active in preventing alcohol and drug use (e.g., Trimbos Institute and Mondriaan Verslavingzorg). Eventually, 22 experts from six countries (Australia, Iceland, Sweden, The Netherlands, the United Kingdom, the United States) (33% response rate) filled out the questionnaire (Figure 3.1).

All answers given by the experts in the first round were categorized into a list of factors and strategies. First, all answers to one question were listed. Second, all double items were deleted. Finally, semantically similar items were taken together. The first step was done by one researcher only. Two more researchers were involved in the second and third steps. Consensus on the final list of items was reached through discussion (Crutzen et al., 2008). The entire research team approved the final questionnaire.



**Figure 3.1:** Overview of the process of the Delphi rounds

(R) = experts from research

(P) = experts from practice

(%) = response rates to invitations

## Second round

All experts from the first round were invited to participate in the second round. In addition, we searched Google Scholar, PsycINFO and PubMed to identify more experts in the relevant fields, as well as abstract books from relevant conferences (e.g., European Health Psychology Society (EHPS) and Kettil Bruun Society (KBS)). Of the 189 identified and invited experts, 64 from 11 countries (Australia, Brazil, Canada, Germany, Norway, Portugal, Sweden, Switzerland, The Netherlands, the United Kingdom, and the United States) responded to our request to participate in the second round (Figure 3.1).

Because we were mainly interested in the strategies to change determinants, we only asked for determinants in the first round to elicit the eligible strategy.

Experts from the second round were presented a list with all strategies to reduce binge drinking and strategies to reduce drop-out that were identified during the first round

and to indicate the importance of each strategy using a seven-point Likert scale ranging from 1 (not important at all) to 7 (extremely important).

The data were analyzed by calculating the median score (Mdn), to indicate the importance of every strategy, and the interquartile deviations (IQD), to get an impression of the degree of consensus of the experts on the strategy (Jones & Hunter, 1995). The median score can be defined as the score that falls exactly in the middle of a group of scores, meaning that exactly one half of all obtained scores lies above and the other half of all scores lies below this median score. In this study a median score of  $\geq 6$  is considered important. The IQD is a measure used to express the degree of consensus obtained, with a higher IQD referring to a smaller degree of consensus. When using a seven-point scale, IQDs with a value of  $\leq 1$  (more than 50% of the opinions fall within one point of the scale) indicate good consensus (Linstone & Turoff, 1975).

### **Third round**

All experts that participated in the second round were invited to take part in the third and final round of the Delphi study. One expert refused participation in the final round and seven experts did not provide their names in the questionnaire. We therefore invited 56 experts in the final round, 39 of whom completed the questionnaire (Figure 3.1).

The questionnaire, including the feedback about median and IQD for each item from the second round, was sent to the participants to re-rate their answers from the prior round. Of all items, 17.9% had an  $\text{IQD} \leq 1$  and were taken out of the questionnaire. This resulted in the third round questionnaire consisting of 101 questions.

### **Ethics approval**

Ethical approval of the Regional Medical Ethics committee in the Netherlands was not necessary because participants in this study were not “subjected to procedures or required to follow certain rules of behavior” (CCMO, 2010).

### **Results**

During the first round a number of determinants of adolescent binge drinking were identified. For these determinants, the experts defined strategies to change that determinant in order to reduce binge drinking. These strategies, including the results of the second and third rounds, are listed in Tables 3.2-3.5.

In the first round, 70 factors that determine binge drinking in adolescents, 40 strategies targeting parents, and 47 strategies targeting adolescents were identified. With regard

**Table 3.2:** Results for items related to effectiveness of strategies to reduce binge drinking in 16 to 18 year old adolescents in an intervention targeting parents

Strategy	Second round N=64		Third round N=39	
	Mdn	IQD	Mdn	IQD
Advise parents not to provide adolescent child with alcohol	6	2	6	2
Provide normative information (e.g., actual figures) to parents about adolescent drinking	5	1.5	5	1
<i>*Advise parents to have clear and consistent rules</i>	7	1	-	-
Give parents the opportunity to communicate with other parents to have the same kind of rules	5	2	5	2
Present different parenting styles and its relation with drinking and other variables that relate to positive youth development	5	1.25	5	2
<i>*Provide approaches to communication (particularly conflict resolution)</i>	6	1	-	-
<i>*Demonstrate an authoritative parenting style as opposed to authoritarian and permissive parenting styles</i>	6	2	6	1
Present evidence regarding the efficacy of the authoritative approach in a way that is palatable for parents	5	2	5	2
Describe ways of using authoritative parenting styles	6	2	6	1.50
Encourage parents to spent time with their adolescents	6	2	6	1.50
Advise parents to talk to their adolescent children regularly about things that interest the adolescent	6	1.75	6	2
<i>*Provide parents with evidence that delaying introduction to alcohol consumption helps protect their adolescent children from alcohol-related harms</i>	6	2	6	1
<i>*Give immediate and tailored feedback to the parents</i>	6	1.25	6	1
<i>*Demonstrate more or less effective communication styles</i>	6	1	-	-
Build communities on special topics (celebration of 16th birthday)	5	2	4	2
Educate parents about negative consequences for the development of the brains until age 24	5	2	5	2
Emphasize short term negative effects of alcohol on adolescents	5	2	5	2
<i>*Advise parents to get to know the whereabouts of the adolescent</i>	6	2	6	1
<i>*Advise parents to get to know the friends of the adolescent</i>	6	2	6	1
Advise parents to conduct family bounding activities (e.g., having evening meal together)	6	2	6	2
Make clear to parents that their own youth habits differ from the current youth habits	5	1.75	5	2
Advise parents to have clear expectations towards the adolescent not to drink alcohol	6	2	6	1.25
Advise parents to communicate about expectations not to drink alcohol towards the adolescent	6	2	6	1.25
Emphasize that communication between parent and child has to be firm	5	2	5	2
<i>*Emphasize that communication between parent and child has to be consistent</i>	7	1	-	-
<i>*Emphasize that communication between parent and child has to be kind</i>	6	1	-	-

## CHAPTER 3

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<i>*Emphasize that communication between parent and child has to be open</i>	6	1	-	-
Emphasize that communication between parent and child has to be healthy	6	2	6	2
<i>*Emphasize that communication between parent and child has to be from positive quality</i>	6	2	6	1
Advise parents to come to agreements with their adolescent child regarding alcohol consumption	5	2	5	1.50
Advise parents to be a good role model (do not drink (much) in presence of the adolescent)	6	2	6	1.25
Advise parents to monitor the alcohol consumption of their adolescent child	5	1	-	-
Advise parents not to serve alcohol at home	4	3	4	2
<i>*Emphasize the importance of responsive parenting (parents who expect a lot from their adolescent child and provide them with a sense of self-efficacy)</i>	6	1	-	-
<i>*Consistent adolescent management practices (balancing the two dimensions of 'care' and 'control') regarding alcohol consumption</i>	6	2	6	0.75
<i>*Advise parents to have active interest in the adolescents life</i>	6	2	6	1
Advise parents to conduct activities that the adolescent enjoys	5	1.75	5	1
<i>*Advise parents to instruct older siblings not to provide their younger siblings with alcohol</i>	6	1	-	-
<i>*Emphasize that family can continue to be a moderating influence throughout adolescence and even young adulthood because parents usually affect long term goals and values</i>	6	2	6	1
<i>*Strengthen parents self-efficacy towards making agreements and setting rules</i>	6	2	6	1

Mdn: median scores

IQD: interquartile deviation

-: these items had an IQD $\leq$ 1 in the second round and did not reappear in the third round

Strategies that are in italics and marked with an asterisk were identified as important (Mdn $\geq$ 6) and experts had reached consensus on (IQD $\leq$ 1)

to reducing drop-out, 17 and 19 strategies were identified for adolescents and parents, respectively. In the second round, experts reached consensus ( $IQD \leq 1$ ) on 16 strategy items that were considered important ( $Mdn \geq 6$ ). In the third round, experts reached consensus on 33 important items. Both rounds taken together delivered a consensus of 49 out of 123 items (39%).

### **Strategies targeting parents**

Concerning strategies for interventions that target parents, experts agreed on eight important items during the second round and another 10 items during the third round (Table 3.2). The strategies considered relevant can be categorized into the following: 1) parenting practices like setting rules, communication about alcohol, and monitoring of the child, and 2) parenting styles, such as being responsive and interested in the child.

### **Strategies targeting adolescents**

A further goal of this study was to identify strategies to reduce binge drinking in adolescents in an intervention aimed at adolescents; these results are depicted in Table 3.3. Experts agreed on three important strategies during the second round and on another four during the third round. Most prominent were strategies to increase refusal skills. Other strategies were related to coping with negative emotions, dealing with drinking in social situations, and developing decision-making skills.

### **Strategies to reduce drop-out of adolescents**

Concerning drop-out of adolescents, experts agreed on one important strategy during the second round and another 12 strategies in the third round. During the second round, experts only agreed on the importance of incentives. During the third round, strategies related to design and content of the intervention and the importance of reminders were emphasized (Table 3.4).

**Table 3.3:** Results for items related to effectiveness of strategies to reduce binge drinking in 16 to 18 year old adolescents in an intervention targeting adolescents

Strategy	Second round N=61		Third round N=35	
	Mdn	IQD	Mdn	IQD
Present dramatic portrayals that adolescents can identify with	4	2.75	4	1.50
Provide normative data regarding peer drinking	5	2	5	2
Lessen the “coolness” factor of drinking: use role models that are cool without alcohol	5	2	5	2
Place an emphasis on how adolescents make meaning of their own drinking and how that relates to their own drinking (e.g., “this happens to others but not to me”)	5	2	5	1
Adolescents should be reminded that the choice to drink is theirs and theirs alone	5	2	5	1.25
Explain why choosing not to drink is a good choice	5	1.75	5	1
Add or remove alcohol cues in a pictorial scenario to demonstrate how social environmental cues can manipulate alcohol consumption	5	2	5	1
Use prevalence overestimates reduction (present their own use, their perception of peer use and actual peer use of every 100 peers)	5	2	5	2
Role playing games creating your own avatar	4.50	3	4	2
Present social situations and ask them how they would react and present the different (positive and negative) consequences	5	1	-	-
<i>*Provide the opportunity to try out different reactions and their consequences in social situations</i>	6	1	-	-
Show a movie with victims that have been significantly affected by drinking (for example road accidents)	3	2	2	1
Improving skills in dealing with general life issues	6	3	6	2
Encouraging adolescents’ interests in other activities that do not involve alcohol consumption	5	2	5	1
Increase knowledge about detrimental effects of alcohol before the age of 24 years	4	2.75	5	1.25
<i>*Increasing refusal skills (ability to say “no”)</i>	6	1	-	-
<i>*Increase self-efficacy over their ability to refuse to engage in binge drinking</i>	6	2	6	0
<i>*Increase their levels of perceived control whether or not they could refuse to engage in binge drinking</i>	6	1.25	6	0
<i>*Train self-control (the ability to set limits for oneself)</i>	6	2	6	0.50
Provide knowledge about the harm of binge drinking / negative consequences of alcohol	5	2	5	1
Increasing the sense of risk through emphasizing the short term consequences	5	1.50	5	1
Provide accurate information about alcohol expectancies	5	2	5	1
<i>*Provide ways to cope with negative mood states other than drinking</i>	6	1	-	-
Stress that there are alternatives to alcohol and binge drinking	5	2	5	1
Focus on how adolescents make meaning of their own drinking (arguments that adolescents use to defend their alcohol consumption)	5	2	5	1
Show good graphic vomit shots	1	2	1	0

Show them embarrassing behavior due to binge drinking	2	3.75	2	2
Develop planning and communication skills	5	2	5	1
<i>*Develop decision making skills</i>	5	1.25	6	1
Giving advice to others on the topic	4	2.50	3.50	1
Emphasize the benefits of positive choices	5	2	5	1.25
Check out their personality and tailor the intervention on this personality: fearful personality	4	3	4	2
Check out their personality and tailor the intervention on this personality: having negative thinking patterns	5	3	4.50	1.75
Check out their personality and tailor the intervention on this personality: sensation seeking personality	6	2	6	2
Check out their personality and tailor the intervention on this personality: impulsive personality	6	2	5.50	2
Discriminate motives to drink and tailor intervention on these: drinking to deal with negative emotions (coping motives)	6	2	5	2
Discriminate motives to drink and tailor intervention on these: drinking to enhance positive emotions (enhancement motives)	6	2	5.50	2
Discriminate motives to drink and tailor intervention on these: drinking to be social (social motives)	6	2	5.50	2
Discriminate motives to drink and tailor intervention on these: drinking to conform to the group (conformity motive)	6	2	5	2
Changing adolescents' positive attitude towards binge drinking	5	2	5	1
Creating awareness of ambivalence (balance between positive and negative consequences of drinking)	5	2	5	2
Strengthening those aspects that are already seen by the adolescent as positive consequences of not drinking	5	1	-	-
Strengthening those aspects that are already seen by the adolescent as negative consequences of drinking	5	1	-	-
Emphasize the possibility of getting high status by acting healthy	5	3	5	1.25
Stimulate action planning skills on preventing binge drinking	5	2	5	1
Stimulate to plan moderate drinking beforehand (e.g., special events or holiday)	5	2	5	1
Encouraging the adolescents' sense of autonomy and self esteem	5	2	5	1

*Mdn: median scores*

*IQD: interquartile deviation*

*-: these items had an  $IQD \leq 1$  in the second round and did not reappear in the third round*

*Strategies that are in italics and marked with an asterisk were identified as important ( $Mdn \geq 6$ ) and experts had reached consensus on ( $IQD \leq 1$ )*

**Table 3.4:** Results for items related to importance of several factors to reduce drop out of adolescents in a Web-based intervention to reduce binge drinking in 16-18 year old adolescents

Strategy	Second round N=56		Third round N=34	
	Mdn	IQD	Mdn	IQD
<i>*Monetary incentives</i>	6	2.25	6	0.50
<i>*Non-monetary incentives (e.g., movie tickets)</i>	6	1	-	-
<i>*Reminder per e-mail</i>	6	2.75	6	0.25
<i>*Reminder per sms (text message)</i>	6	2	6	0.25
<i>*Engaging graphics</i>	6	3	6	1
<i>*Self-assessment with personalized feedback</i>	6	2	6	1
<i>*Use of highly relevant material</i>	6	2	6	0
<i>*Attractive design</i>	6	2	6	0.25
<i>*Inspiring topics</i>	6	2	6	0.25
<i>*Using language that relates to the adolescents</i>	6	2	6	1
<i>*Use as little text as you can get away with</i>	6	2	6	0.50
<i>*Use as much interaction as possible</i>	6	2	6	0.50
Use of humor	5	3	5	1.50
<i>*Engrossing Web site</i>	6	1.75	6	0
The use of the Web site should be addictive itself	4	3	4	1.75
Give points to earn (e.g., game component)	5	2	5	2
Set little goals to achieve during the intervention	5	1	-	-

*Mdn: median scores*

*IQD: interquartile deviation*

*-: these items had an IQD $\leq$ 1 in the second round and did not reappear in the third round*

*Strategies that are in italics and marked with an asterisk were identified as important (Mdn $\geq$ 6) and experts had reached consensus on (IQD $\leq$ 1)*

### Strategies to reduce drop-out of parents

Concerning drop-out of parents, experts agreed on four important strategies in the second round and seven in the third round. Here the important strategies were related to the content and design of the intervention (e.g., usability, feasible recommendations, tailoring the intervention) and the use of reminders (Table 3.5).

**Table 3.5:** Results for items related to importance of several factors to reduce drop out of parents in a Web-based intervention to reduce binge drinking in 16-18 year old adolescents

Strategy	Second round N=56		Third round N=34	
	Mdn	IQD	Mdn	IQD
Monetary incentives	5	3	5	1.75
Non-monetary incentives (e.g., movie tickets)	5	2	5	1
<i>*Reminders per e-mail</i>	6	2	6	1
<i>*Reminders per sms (text message)</i>	6	2.50	6	0.75
<i>*Use of highly relevant material</i>	6	2	6	0.50
<i>*Interesting topics</i>	6	2	6	0
<i>*Ensuring that they realize that doing this will make a difference</i>	6.5	1	-	-
<i>*Use of language that does not sound pompous or may be interpreted as condescending</i>	6	2	6	1
<i>*Make clear that it is understood that parents are the best experts when it comes to their children and that parents want what's best for their children and that being a parent can be extremely difficult</i>	6	2	6	0
<i>*Recommendations need to be realistic and "do-able"</i>	6.5	1	-	-
Engrossing Web site	5	2	5	0.25
The use of the Web site should be addictive itself	3	3.50	3	2
Compelling set of lessons	5	2	5	1
<i>*Make the need for the intervention salient to parents</i>	6	2	6	0
Attractive design	5	1	-	-
<i>*Usability</i>	7	1	-	-
<i>*Tailored</i>	6	1	-	-
Tips / reaction from an expert	5	2	5	1
Parents should have the possibility to communicate with each other (e.g., forum)	5	2	5	1.50

Mdn: median scores

IQD: interquartile deviation

-: these items had an  $IQD \leq 1$  in the second round and did not reappear in the third round

Strategies that are in italics and marked with an asterisk were identified as important ( $Mdn \geq 6$ ) and experts had reached consensus on ( $IQD \leq 1$ )

## Discussion

The aim of this Delphi expert study was to gather expertise on effective strategies to be used in Web-based CT interventions to reduce binge drinking in 16- to 18-year-old adolescents. Some of the important strategies that could be used in an intervention targeted at parents are already described in the literature like specific parenting practices such as monitoring the adolescents' whereabouts and friends (Beck, Boyle, & Boekeloo, 2003; Borawski, Ievers-Landis, Lovegreen, & Trapl, 2003; Kim & Neff, 2010), and being a responsive and interested parent (Baumrind, 1971). Results from previous studies regarding communication about alcohol, which was also considered important by our experts, are more heterogeneous. Some studies found a positive effect of communication on alcohol consumption (Spijkerman et al., 2008; Turrisi et al., 2001a), others show no effect of communication or even detrimental effects (Ennett et al., 2001). Our experts highlighted specific aspects of communication other than just frequency. They recommend that communication should be consistent, kind, open, and of positive quality. One study (Spijkerman et al., 2008) found indeed a difference in quality and frequency of communication about alcohol use, with quality being negatively associated with alcohol use and frequency being positively associated. To obtain more insight about which aspects of communication are useful in this context, more research is recommended (Van der Vorst et al., 2005). Nevertheless, when advising parents about communication with their children about alcohol, attention should be paid to communication being of good quality, open, kind, and consistent, as indicated by the experts in this study, rather than very frequent. Furthermore, experts in this study placed a high importance on setting clear and consistent rules which is in accordance with previous research (Spijkerman et al., 2008; Van der Vorst et al., 2005; Van Der Vorst et al., 2006). However, what kinds of rules (e.g., zero tolerance rules, rules that are in line with the health guidelines, rules that are self-set by parents) have a different effect in reducing alcohol use in a target group that is legally allowed to purchase alcohol in comparison with other countries where this is illegal is still unclear. To our knowledge, no research has yet been conducted to entangle this problem. Finally, our experts reached consensus on the importance of emphasizing that the family continues to have influence throughout adolescence and young adulthood and that parents' self-efficacy toward making agreements and setting rules should be strengthened. Applying these recommendations in Web-based interventions could mean creating a Web site for parents where they can obtain information about the importance of setting rules and communicating with their adolescent about alcohol and how to do this. To make this information as personalized and relevant as possible, computer-tailoring strategies could be used, thus assessing current communication and rule setting with the help of questionnaires and then providing the parents with personalized feedback based on their answers. These computer-tailored feedback messages could be either text-based or video-based, as both have been proven to be effective; however, video messages are

preferred as they have been shown to be slightly more effective compared to text-based messages (Stanczyk et al., 2014).

Regarding effective strategies targeting adolescents to reduce binge drinking, experts agreed on the importance of giving adolescents the opportunity to try out different reactions and their consequences in social situations, increasing refusal skills and perceived control in adolescents, and providing opportunities to cope with negative emotions in other ways than drinking. The Social Cognitive Theory (SCT) (Bandura, 2001) assumes that self-efficacy is a very important factor that influences whether people perform a specific behavior. Self-efficacy can be increased by, for example, enactive mastery experience, modeling, or verbal persuasion (Bartholomew et al., 2011). In enactive mastery experience individuals are confronted with different situations that increase in difficulty. They try to master them and receive feedback on their performance. One possibility is to confront adolescents with social situations in which alcohol is available and increase the difficulty by adding people and pressure to drink alcohol to the situations. This could be simulated in a Web-based intervention by using animations or videos that allow users to make choices that lead to different scenarios that result from their choices. Using modeling as a technique in Web-based interventions could be implemented by using short videos that show how other adolescents successfully refuse alcoholic drinks. Verbal persuasion techniques could be implemented by showing videos of adolescents that explain how they refuse drinks and encourage the adolescent that he or she also has the capability of refusing drinks and resisting peer pressure. Interventions that focused on preventing alcohol use in young adolescents (11 to 14 years of age) found that teaching techniques to manage social influences and pressure to drink and offering alternatives to alcohol (Perry et al., 1996) are effective in reducing alcohol use (Komro et al., 2001). Several other studies have shown that making coping plans was predictive for long-term lifestyle change in rehabilitation patients after discharge (Sniehotta et al., 2005) and increased abstinence rates in quitters from smoking (Van Osch, Lechner, et al., 2008). These studies indicate that coping plans might be helpful in maintaining a healthy lifestyle and preventing unhealthy behavior, like binge drinking, if adolescents formulate coping plans for situations that are difficult for them.

Another goal of this Delphi study was to identify effective strategies to reduce drop-out as this constitutes a major problem to Web-based interventions. Gathering this expertise is very important, as there is little research available on effective strategies to reduce drop-out. For interventions aimed at adolescents, experts reached consensus on different strategies that can be divided into three categories: 1) providing incentives (non-monetary and monetary); 2) creating an appealing content (setting small goals to achieve during the intervention; using engaging graphics; offering self-assessment with personalized feedback; using highly relevant material, attractive designs, and inspiring

topics; using language that relates to the adolescents; providing as little text and as much interaction as possible; designing an engrossing Web site); and 3) sending reminders (e-mail and text messages). Generally, we can discriminate two kinds of drop-out. The first is intervention drop-out, meaning that participants drop-out during the intervention, and thus are not fully exposed to the intervention content which can negatively affect public health impact of the intervention (Eysenbach, 2005). The other form is drop-out at follow-up assessment, thus participants not returning to a follow-up assessment. This form of drop-out diminishes the possibility to reveal possible effects (Eysenbach, 2005). Both forms are problematic to intervention trials. Some of the strategies mentioned by the experts can either be used to reduce both forms of drop-out (e.g., providing incentives for completion of the intervention and for returning to the follow-up assessments), but other strategies work better to reduce one form of drop-out (e.g., using engaging graphics in the intervention to reduce intervention drop-out). The results regarding intervention content, which would be useful to reduce intervention drop-out, are of particular importance as limited experimental research has been conducted to test the effect of the content and layout of an intervention on drop-out rates. Most importantly, when creating a Web-based intervention, developers and researchers should collaborate closely with the target group to ensure that the chosen material is attractive, inspiring, and relevant. Methods to do this could be focus group interviews or a panel of the target group that evaluates all materials and provides feedback. Web-based interventions should be pilot tested and usability tests should be conducted in order to see how the intervention is used and understood and to get immediate feedback regarding which parts are appreciated and which not. Using computer-tailoring strategies will make the intervention much more personalized and relevant; however, in order to use the right language, motivational interviewing (MI) techniques (Miller & Rollnick, 2013) could be more appropriate. Although motivational interviewing usually is provided through personal contact between a professional therapist and a client, motivational interviewing techniques have already been successfully used in Web-based interventions to promote physical activity (Friederichs, Bolman, Oenema, Guyaux, & Lechner, 2014; Friederichs et al., 2013). Through the use of computer tailoring, where responses are tailored to the answers given in the program, a dialog between the program and the user can be simulated (Bickmore & Giorgino, 2006; Del Hoyo-Barbolla, Kukafka, Arredondo, & Ortega, 2006). One of the recommendations is to use a combination of open-ended and multiple choice questions for the MI questions. Open-ended questions can stimulate simple reflection and enable autonomy support while automated feedback messages to multiple choice questions can stimulate skillful reflections (Friederichs et al., 2013). An experiment with an avatar to strengthen the social relationship with the user was not associated with higher intervention impact (Friederichs et al., 2014). Recently, games for education and health promotion purposes, so-called “serious” games, have been developed and tested. The results concerning knowledge acquisition and attitude and

behavior change are promising (Connolly et al., 2012; DeSmet et al., 2014). They further seemed to increase intrinsic motivation in adolescents (Papastergiou, 2009; Tüzün et al., 2009), which is an important factor for continued intervention use.

When it comes to reducing drop-out in interventions aimed at parents, similar strategies can be used as experts again came up with many strategies relating to the content of the intervention and emphasized the importance of using reminders (e-mail or text messages). With regard to the content, experts mentioned the following strategies: ensuring parents realize following the intervention would make a difference; providing realistic and feasible recommendations; tailoring the intervention; using highly relevant material; providing interesting topics; using language that does not sound pompous or may be interpreted as condescending; ensuring parents they are the experts when it comes to their children; acknowledging that being a parent can be extremely difficult; and making the intervention salient to the parents. In addition to the earlier suggestions (i.e., collaborate closely with target group, use tailoring or motivational interviewing techniques), parents might also benefit from an approach based on goal-setting theory (Locke & Latham, 1994) in order to make realistic and feasible recommendations. This could be designed by creating a tool in which parents can choose from a series of sub-goals (e.g., have a first conversation with my child about alcohol, come to an agreement with my child about the amount of alcohol he/she is allowed to drink, make my rules clear to my child and explain consequences of noncompliance). For every sub-goal, further guidance can be provided regarding how to reach the goal, either text-based or, preferably, video-based (Stanczyk et al., 2014). Other research thus far has shown that using a tunneled Web site, where visitors are more guided and have less control, increased the time spent on the Web site, number of pages visited, and knowledge gained compared to a Web site where the visitor could move freely (Crutzen, Cyr, & Vries, 2012). Furthermore, there is some literature available about methods to increase response to postal and electronic questionnaires. A review (Edwards et al., 2009) of this literature identified some effective strategies: giving non-monetary incentives; offering survey results; using shorter questionnaires; personalizing electronic questionnaires by addressing the participants by name, using a picture and white background on the invitation; using interesting (relevant to participants) questions; sending reminders after the initial invitation; including a statement that others had responded; and setting a response deadline. Providing the incentive together with the questionnaire, rather than after the questionnaire was completed, increased response rates (Edwards et al., 2009). Despite these effective methods, many methods to increase response rates have not proven to be effective, including monetary incentives for online questionnaires (Edwards et al., 2009), contingent versus unconditional incentives (Görizt, 2005), or offering cash lotteries (big and small amounts) as incentive (Görizt, 2006). However, these results relate to survey research and not intervention research. Most of the strategies that have

been evaluated on effectiveness are related to invitations or reminders to respond to a questionnaire, or incentives that participants received. More research is needed to test whether attractive, relevant, and interesting content can also reduce drop-out during an intervention. In particular, experimental research is needed, as most studies thus far were based on observational research (Edwards et al., 2009; Göritz, 2005, 2006), which does not allow conclusions about causal relationships.

Given the vast amount of mentioned strategies by the experts it becomes clear that there are many possibilities to decrease drop-out rates in Web-based interventions, but only few have been proven to be effective. Although it may seem wise to combine several strategies in order to increase their impact on retention rates, more experimental research is also needed to test unique and potential interaction effects of these strategies.

### **Limitations and Strengths**

Finally, we noticed that experts only agreed on a few important strategies to reduce binge drinking in adolescents in interventions targeting adolescents (7 out of 47) compared to interventions targeting parents (18 out of 40). We checked whether this could be an artifact of the sample selection, but researchers of parent-based interventions were not oversampled. Therefore, this finding could indicate that adolescents are a particularly difficult target group and that only a few strategies have proven to be effective. We included experts with research and practice background to get a broad overview of the existing knowledge from both fields. It would be interesting to compare strategies from researchers and practitioners to look for similarities and differences. Unfortunately, our sample of practitioners was too small to make meaningful comparisons, but we would recommend this for future research.

We also want to mention that the response rate from the first two rounds compared to the last round was relatively low (33% and 34% compared to 70%, respectively). Yet, comparable response rates have been reported in other Delphi studies (De Vet, Brug, De Nooijer, Dijkstra, & De Vries, 2005; Schneider, Osch, & Vries, 2012). The increase from the second to the third round may indicate that once experts agreed to participate in this study, this was likely to predict continued participation. Furthermore, there is no clear indication about decent panel sizes or acceptable response rates (Mullen, 2003), so our goal was to reach saturation of information in the first round. We reached this goal with the answers provided by 22 experts participating in the first round.

**Conclusion**

This Delphi study identified strategies that can be used in a Web-based CT intervention to reduce binge drinking in 16- to 18-year-old adolescents and strategies to reduce drop-out rates from these interventions. The results of this explorative study can be used to inform future interventions.



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# Chapter 4

## **Parents' influence on alcohol use among 16- to 18-year-old Dutch adolescents: impact of alcohol specific rules and communication**

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Based on:

Jander, A., Mercken, L., Crutzen, R., Candel, M., de Vries, H. (submitted). **Parents' influence on alcohol use among 16- to 18-year-old Dutch adolescents: impact of alcohol specific rules and communication.**

## Abstract

The aim of this study was to determine whether parental alcohol specific rules and communication have a beneficial effect on alcohol use among 16- to 18-year-old Dutch adolescents, who were, at the time of this study, legally allowed to buy and consume low-strength alcoholic beverages. Furthermore, we assessed whether the effects of rules and communication varied when parents were present or absent. In total, 499 Dutch parents and their 16- to 18-year-old child were included in the analyses. Questionnaires assessed adolescents' weekly alcohol consumption and binge drinking, as well as alcohol consumption, alcohol-specific rules and the communication of parents. Structural equation modeling was used to test the relationships between parental alcohol use, rule setting, and communication on adolescent weekly alcohol consumption and binge drinking. The results indicated that stricter the rules concerning alcohol use were associated with less weekly consumption ( $p < 0.001$ ) and binge drinking ( $p < 0.001$ ) in adolescents. Communication was positively related to weekly alcohol use ( $p < 0.001$ ) and binge drinking ( $p < 0.001$ ), thus indicating that more communication was associated with more use of alcohol. These effects were equally strong in situations where parents were present as well as when they were absent, thus suggesting that parental influence persists even in situations where they are not present.

## Introduction

Excessive alcohol use, particularly at a younger age, is associated with negative consequences such as physical altercations, injuries (Swahn et al., 2004), dating violence, smoking, the use of illicit drugs (Miller et al., 2007), poor school performance, and cognitive deficits (Miller et al., 2007; Zeigler et al., 2005). In the Netherlands, 57% of the 16-year-old and 62% of the 17- to 18-year-old adolescents engaged in binge drinking (drinking five or more glasses of alcohol during a single occasion) in the previous 30 days (Verdurmen et al., 2011). Before January 1, 2014, Dutch adolescents were allowed to buy low-strength alcoholic beverages (i.e., beverages with an alcohol percentage by volume of  $\leq 15\%$ ) when they turned 16 (Government, 2014). Thus, for many years, Dutch families had to deal with a situation in which their children could buy low-strength alcoholic beverages without the permission of a parent. However, legally these young people were not considered to be an adult until they turn 18 years old and parents were still responsible for their child's health and behavior. Rules concerning alcohol use were often absent after adolescents turned 16 because, according to parents, their influence on the child at this age was very limited (e.g., the child was legally allowed to buy alcohol). Parents felt that the child would refuse to obey their rules anyway, especially when parents were not present (Jander et al., 2013).

However, perceived parental permissiveness of alcohol use was related to higher levels of alcohol use among adolescents (i.e., who were 18 to 19 years old), and perceived parental disapproval of drinking was associated with lower levels of heavy episodic drinking (Wood et al., 2004). This finding indicates that parental influences on adolescent drinking can still extend until young adulthood in a setting where they are legally not allowed to use alcohol (e.g., the United States). Rules, thus, can have beneficial effects on adolescent alcohol use. Therefore, it is probable that this beneficial effect could also be present in our target group.

Previous findings regarding the communication of parents and children about alcohol are mixed. Some studies report beneficial effects (Mares, van der Vorst, Engels, & Lichtwarck-Aschoff, 2011; Turrise et al., 2001a), whereas others find no effect or detrimental effects (Ennett et al., 2001; Reimuller, Hussong, & Ennett, 2011), but only when the communication contained permissive messages (Reimuller et al., 2011). In line with this, one study suggests that it is the quality, rather than the frequency of the communication that prevents adolescents from heavy drinking (Spijkerman et al., 2008). Parental disclosure of personal negative experiences with alcohol was also positively associated with adolescent drinking (Handley & Chassin, 2013). However, parents disclosing more negative experiences were also the parents with higher levels of drinking. Finally, as the ideas about acceptable amounts of alcohol that the adolescent could drink differed between adolescents and parents (Jander et al., 2013), it is possible that parents

and adolescents do not communicate clearly, or not at all, when the adolescent grows older. Thus, it is interesting to investigate the effect of communication on alcohol use in 16- to 18-year-old adolescents.

The social cognitive theory (Bandura, 1986) suggests that children learn by observing the behavior of role models, such as parents, as demonstrated in other studies (Duncan, Duncan, & Strycker, 2006; Hellandsjo Bu et al., 2002). Therefore, it is likely that parental alcohol use influences adolescent drinking but, as parental drinking is also related to less engagement in alcohol-specific parenting practices such as setting rules (Van Der Vorst et al., 2006) and communication (Ennett et al., 2001), this influence could be direct as well as indirect (i.e., mediated via rules and communication).

A concern of parents regarding setting rules and communicating with their children about alcohol use is that they cannot control the adolescents' drinking because there are many possibilities and situations to drink alcohol outside of the supervision of the parent (e.g., in a bar, at others' homes, etc.) (Jander et al., 2013). However, it is possible that parents exert some influence in situations where they are not present, as previous studies indicated that parental influence on alcohol use continues during college (Turrisi et al., 2001a; Turrisi et al., 2000). To our knowledge, little is known about whether the influence of communication and rules on underage adolescent alcohol use differs in situations in which parents are present or absent. Therefore, we want to investigate whether or not this concern of parents is justified. More importantly, little is known about the effects of rules and communication in a context, where the minor adolescent is legally allowed to buy and drink alcohol.

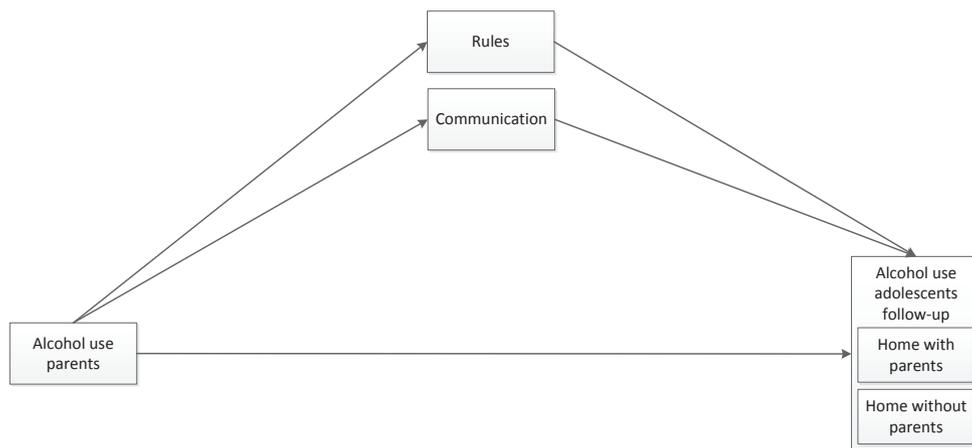


Figure 4.1: conceptual model

The current study, therefore, focuses on the following research questions (Figure 4.1): 1) How do rules and communication affect adolescent drinking when the adolescent is legally allowed to buy alcohol?; 2) Is there a direct relationship between parental drinking and adolescent drinking and is this relationship mediated by alcohol-specific rules and communication?; and 3) Does the effect of rules and communication differ in drinking situations where parents are present or absent?

## Method

### Participants and procedure

In order to obtain parent and adolescent dyads, we approached parents via an online access panel (i.e., a panel of people who have expressed a willingness to participate in online surveys) (www.Anniksystems.com). One parent received an e-mail invitation to participate in a study on alcohol consumption. Before they started to fill out the questionnaire, the parent was made aware that their adolescent child's opinion was also required for this study. Parents responded to a questionnaire concerning their alcohol use and alcohol-specific parenting practices (i.e., rules and communication). After the parent finished the questionnaire, their 16- to 18-year-old child was invited to fill out a questionnaire about alcohol use. If the child was not present at that moment, he or she could return to the questionnaire at a later point in time.

Adolescents and parents responded to the first questionnaire in September 2012. In order to investigate possible mediating effects, we included a three-month follow-up questionnaire to assess adolescents' current alcohol use.

### Adolescent measures

*Weekly alcohol consumption* was measured by two questions at baseline and during three-month follow-up. Adolescents indicated, for each day of the past week whether or not they drank alcohol and, if they did, how many standard glasses (Lemmens, 1994) of alcohol they consumed. Based on this information, we calculated the total amount of alcohol they drank in the past week (Lemmens, Tan, & Knibbe, 1992).

*Binge drinking* (i.e., having four to five or more glasses of alcohol on one occasion for a girl/boy) in the previous 30 days (Wechsler, 1995) was assessed at baseline and follow-up with an open-ended question that asked adolescents how many binge-drinking occasions they had in the previous 30 days. Adolescents were identified as binge drinkers if they reported at least one binge-drinking occasion (1=binge drinker, 0=non-binge drinker).

We assessed, at baseline, how much alcohol adolescents usually drink in two different *drinking situations*: drinking at home (own home or others' home) with parents present and drinking at home (own home or others' home) with parents absent. If adolescents indicated that they never drink in the situation(s), then the number of glasses was set to zero. All other adolescents indicated with an open-ended question how many standard glasses (Crutzen & Knibbe, 2012; Lemmens, 1994) they usually drink at a single occasion in the particular situation.

Furthermore, we assessed gender (0=male, 1=female), age, educational level, nationality, and religion (Catholic, Protestant, Muslim, no religion, other religion) at baseline. The educational level (0=low – secondary vocational education; 1=high – pre-university education) and nationality (0=non-Dutch, 1=Dutch) were dichotomized.

### **Parental measures**

To assess the *alcohol use* of parents at baseline, we used the Quantity-Frequency index (Spijkerman et al., 2008). We asked on how many days during the week (Monday through Thursday) and on the weekend (Friday through Sunday) they typically drank alcohol during the past six months. We further assessed how many standard glasses of alcohol they typically consumed on one of these days during the week and on the weekend. Week consumption was calculated by multiplying the number of glasses by the number of days that parents drank alcohol (Spijkerman et al., 2008).

We assessed *alcohol-specific rules* at baseline by using a 10-item scale (Van der Vorst et al., 2005) to assess whether or not parents had set clear rules concerning alcohol use (e.g., “How often is your child allowed to drink one glass of alcohol when you or your partner are at home?”). Parents could give an indication by using a five-point scale ranging from 1 (“never”) to 5 (“very often”). We added one question to assess rules about binge drinking resulting in an 11-item scale ( $\alpha=.93$ ). We recoded the scale scores so that higher scores indicated stricter rules and then calculated the mean score. To assess *communication* about alcohol, we used an 8-item scale (Ennett et al., 2001), that covered eight different areas of communication about alcohol, such as encouraging the child not to use alcohol and talking with the child about how to resist peer pressure ( $\alpha=.93$ ). As our target group was legally allowed to buy alcohol, we reformulated the questions from “not using alcohol at all” to “using not too much alcohol”. Answers were given on a five-point scale that ranged from 1 (“never”) to 5 (“daily”). We calculated the mean score; higher scores indicated more frequent communication.

All questionnaires, data, syntaxes, and output of this study are available at <https://osf.io/p3m8s/>

## Analyses

Descriptive statistics and attrition analyses were conducted by using IBM SPSS Statistics 20.

Structural equation modeling (SEM) was conducted by using Mplus 7 (Muthén & Muthén, 2012). The comparative fit index (CFI) and Tucker-Lewis index (TLI) were used to provide model fit information (values  $\geq .95$  indicate good model fit). In addition, we report the root mean square error of approximation (RMSEA), which is an index of lack of fit in a model in comparison to a perfectly saturated model (values  $\leq .06$  indicate good model fit) (Hu & Bentler, 1999).

Figure 4.1 depicts the models for testing the effects of rules and communication on alcohol consumption. The model consists of four manifest variables: parental drinking behavior, rules, communication, and adolescent alcohol use at follow-up. Since rules and communication are not independent, the error term of these variables were correlated. As covariates we added gender, age, educational background, nationality, religion, and adolescent alcohol use at baseline. All covariates were allowed to influence rules, communication, and parental and adolescent alcohol use. We tested this model with two different outcome variables; first, with alcohol consumption in the previous week, and second, with binge drinking as dichotomous outcome measures. For both outcome measures we added an indirect effect to test the mediating effect of parental alcohol use through rules and communication on week consumption and binge drinking.

Figure 4.1 also depicts the model for testing the effects of rules and communication when parents were present or absent. To answer this research question, we used situation-specific alcohol use at home with and without parents as an outcome variable. To test for differences in the effect of rules and communication on adolescent drinking behavior in the two situations, the associations were constrained to be equal and the -2 loglikelihood of the unconstrained model was subtracted from the -2 loglikelihood of the constrained model to calculate the  $\chi^2$ . A significant  $\chi^2$  would imply a different effect of rules and communication on drinking with or without parents. In this model, we also correlated the error terms of rules and communication, as well as the error terms of the two drinking situations, since neither was considered to be independent.

The results of the statistical analyses were declared significant if  $P$ -values  $\leq 0.05$ .

## Results

### Descriptive statistics and attrition analyses

At baseline, 784 parents and 526 adolescents responded to the questionnaire. After data cleaning (i.e., discharging incomplete entries, checking for unreliable answers on variables and the time it took for participants to complete the questionnaire), 499 parent/ adolescent pairs remained. At follow-up, 343 adolescents responded (i.e., a response rate of 68.6%). Attrition analyses revealed no significant differences between responding and non-responding adolescents at follow-up on socio-demographics (gender, age, educational background, nationality, religion) and alcohol use at baseline. The descriptives of all measurements are summarized in Table 4.1. Correlations of the model variables can be found in Table 4.2.

**Table 4.1:** Descriptive statistics of the sample

<b>Adolescents</b>		
Male	249 (N)	49.9 (%)
High educational background	257 (N)	51.5 (%)
Dutch	486 (N)	97.4 (%)
Age (mean, SD)	16.84	0.82
Catholic	95 (N)	19 (%)
Protestant	92 (N)	18.4 (%)
Islamic	8 (N)	1.6 (%)
Other religion	7 (N)	1.4 (%)
No religion	297 (N)	59.5 (%)
Binge baseline	200 (N)	40.1 (%)
Binge follow-up	126 (N)	36.8 (%)
Week consumption baseline (mean, SD)	1.95	3.73
Week consumption follow-up (mean, SD)	2.22	3.58
Drinking in presence of parents	376 (N)	75.4 (%)
Amount of glasses consumed in presence of parents (mean, SD)	1.67	2.29
Drinking in absence of parents	309 (N)	61.9 (%)
Amount of glasses consumed in absence of parents (mean, SD)	1.73	1.98
<b>Parents</b>		
Male	180 (N)	36.1 (%)
Communication (mean, SD)	2.05	0.75
Rules (mean, SD)	3.95	0.67
Alcohol consumption (mean, SD)	5.18	6.39

*N*=total number; *SD*=standard deviation

Table 4.2: Pearson correlations between model variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Gender	-	-.03	-.02	.04	.07	.10*	-.10*	-.06	-.24**	-.14*	-.16**	-.17**	-.08	-.15**
2 Age		-	-.08	-.02	-.05	-.18**	-.06	-.06	.16**	.07	.03	.10*	.15**	.10*
3 Education			-	-.11*	.01	-.01	-.05	.01	.02	.02	-.08	-.11*	-.11*	.01
4 Nationality				-	-.10*	.05	-.09*	.04	.03	.05	.05	.06	.03	.07
5 Religion					-	.04	.07	-.12**	-.04	-.02	.02	-.05	.00	-.02
6 Rules						-	-.056	-.24**	-.42**	-.36**	-.32**	-.39**	-.40**	-.38**
7 Communication							-	.01	.24**	.24**	.19**	.22**	.19**	.21**
8 Alcohol use parents								-	.20**	.22**	.21**	.12**	.15**	.14**
9 Week consumption (FU)									-	.49**	.31**	.38**	.31**	.40**
10 Binge drinking (FU)										-	.40**	.46**	.43**	.45**
11 Parents present											-	.52**	.33**	.31**
12 Parents absent												-	.47**	.47**
13 Binge drinking													-	.41**
14 Week consumption														-

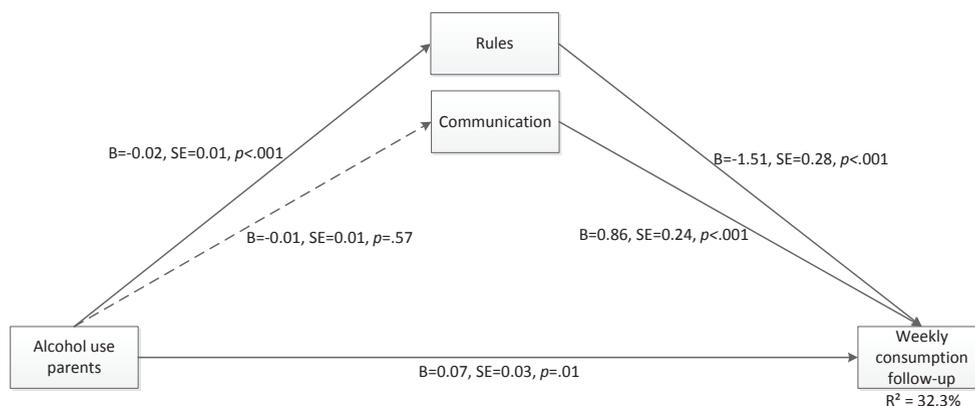
FU = assessed at follow-up; \*  $p < .05$ ; \*\*  $p < .01$

### Influence of rules and communication on week consumption and binge drinking

We had saturated models, therefore the model fit information for all tested models indicated perfect model fit (CFI=1.000; TLI=1.000; RMSEA=0.000).

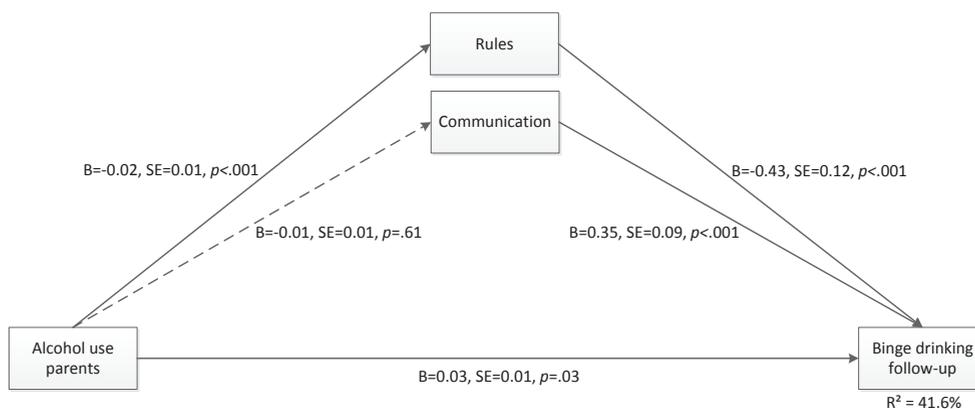
Both paths between rules and the two outcome variables' week consumption and binge drinking were negative and significant (Figures 4.2 and 4.3). Stricter rules were associated with less weekly alcohol use of the adolescent and also it was less likely that the adolescent engaged in binge drinking in the previous 30 days. Communication was positively associated with week consumption and binge drinking, thus indicating that the more communication about alcohol took place, the more the adolescent drank and the more likely they were to have engaged in binge drinking. The more alcohol parents consumed, the more lenient they were in setting rules, but parental alcohol consumption had no effect on the communication about alcohol with the child. Finally, we found a direct positive effect of parental alcohol use on adolescent week consumption and binge drinking.

To test whether the effect of parental alcohol use on adolescent drinking behavior was mediated through rules and communication, we performed a test of indirect effects by using a bootstrapping method with 500 samples. The sum of indirect effects was significant for week consumption ( $B=0.028$ , CI (0.014-0.052)) as well as binge drinking ( $B=0.007$ , CI (0.002-0.014)). Only the indirect path through rules was significant for week consumption ( $B=0.030$ , CI (0.017-0.053)) and binge drinking ( $B=0.008$ , CI (0.004-0.014)). The indirect effects of communication on week consumption ( $B=-0.002$ , CI (-0.012-0.004)) and binge drinking ( $B=-0.001$ , CI (-0.005-0.002)) were not significant.



**Figure 4.2:** Paths with week consumption at three months follow-up as outcome

$B$  = unstandardized estimate,  $SE$  = standard error,  $p$  =  $p$ -value. Dashed arrows are non-significant.



**Figure 4.3:** Paths with binge drinking at three months follow-up as outcome

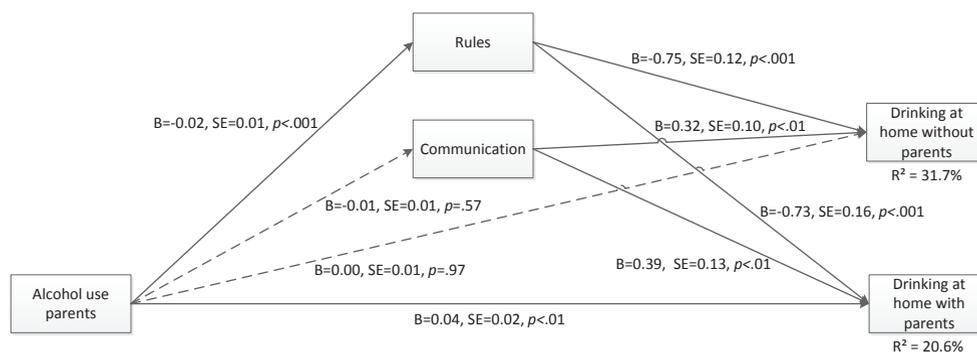
$B$  = unstandardized estimate,  $SE$  = standard error,  $p$  =  $p$ -value. Dashed arrows are non-significant.

So, the effect of parental alcohol consumption on the child's drinking behavior three months later was only mediated through rules and not through communication.

### Influence on drinking with absent or present parents

Rules were negatively related to alcohol consumption in both situations, indicating that stricter rules resulted in less alcohol use in situations where parents are present as well as absent (Figure 4.4). Communication about alcohol was positively associated with drinking in both situations. The more parents talked with their children about alcohol, the more children consumed, regardless of whether parents were present or absent. Furthermore, there was a direct effect of parental alcohol use on the alcohol consumption of the child in situations where parents are present but not when they are absent. In the latter situation parental alcohol consumption had no direct effect on their child's alcohol use. Finally, the more the parents drank themselves, the more lenient they were with providing rules.

To test whether the magnitude of associations of rules on drinking behavior in the two situations was the same, we constrained the associations between rules and the two situations to be equal. The Chi-square difference test turned out to be non-significant ( $\chi^2 = 0.01, P = 0.92$ ), which means that the effect of rules on drinking does not differ between situations where parents are present or absent. The same applied to the effect of communication on drinking in the two situations. Here the Chi-square test was also non-significant ( $\chi^2 = 0.228, P = 0.63$ ).



**Figure 4.4:** Paths with the two different drinking situations as outcome variable

$B$  = unstandardized estimate,  $SE$  = standard error,  $p$  =  $p$ -value. Dashed arrows are non-significant.

## Discussion

An important finding of this study is that having stricter rules concerning alcohol use was associated with lower levels of weekly alcohol consumption and binge drinking occasions in adolescents, which is in line with previous studies (Van der Vorst et al., 2005; Van Der Vorst et al., 2006). However, previous studies focused on the effect of rules on younger adolescents, who had not yet reached the legal buying age for alcohol. Our findings suggest that parents also keep exerting influence on their child's drinking behavior after the child is legally allowed to buy alcohol. Parents should, therefore, be encouraged to continue setting rules after the child has reached the legal buying age. All models also revealed a positive association between communication about alcohol and adolescent week consumption and binge drinking. This is comparable to findings in an earlier study (Ennett et al., 2001). However, in general the effects of communication on alcohol use are mixed (Ennett et al., 2001; Ryan et al., 2010; Turrisi et al., 2001a). Another study (Spijkerman et al., 2008) found that quality of communication was negatively associated with alcohol use and positively associated with frequency. The question remains as to whether more communication about alcohol causes an increase of alcohol consumption or vice versa. Even though we have a longitudinal design with alcohol consumption measured three- months after baseline, more research is needed to unravel causal relationships between communication and adolescent alcohol use to make recommendations for interventions.

A direct effect of alcohol consumption of the parent on alcohol consumption and binge drinking of the child was found, suggesting a modeling effect of parental drinking on the drinking behavior of the child. We further found an indirect effect of parental alcohol consumption through rules on adolescent week consumption and binge drinking. The more parents drank themselves, the more lenient their rule-setting tendencies were and,

consequently, the more alcohol the adolescent drank and the higher the likelihood was of having a binge-drinking occasion in the past 30 days. Nevertheless, the positive effect of rules was stronger than the modeling effect of parents, emphasizing the relevance of setting rules, regardless of parental alcohol use.

Most notably, contrary to parental assumptions that rules are useless when they are absent (Jander et al., 2013), our findings indicate that setting rules had an evenly strong beneficial effect on drinking in situations where the parent is present as well as absent. In both situations the stricter the rules about alcohol consumption were, the less the adolescent drank. However, data concerning the drinking situation were measured as baseline as well, thus limiting the conclusions regarding direction of effect. Parental authority regarding alcohol use and cigarette use has been affirmed by 80% of a sample of sixth and eighth graders (Jackson, 2002). Although this sample was considerably younger than adolescents in the current study, it is likely that most adolescents still recognize the authority of parents regarding alcohol consumption as another study showed that parents exert influence on the adolescent drinking behavior prior to entry into college (Wood et al., 2004). Furthermore, we found a modeling effect of parental alcohol use on adolescent alcohol use only in situations where the parents are present and not when they are absent. The modeling effect of parents is, thus, absent when parents are absent, but setting rules still had a beneficial effect on adolescent alcohol use. Finally, the explained variances are higher in drinking situations without parents. This could indicate that there are other factors that better explain adolescents' alcohol use in situations where parents are present such as, for example, whether parents offer alcoholic drinks. These results are important for future interventions targeting parents to decrease alcohol use in adolescents because our data eliminates the concern of parents that setting rules has no effect when the child is drinking outside of their presence.

As already mentioned in the introduction, the legal situation in the Netherlands concerning the buying age of alcohol changed on January 1, 2014. The legal buying age has been increased to 18 years. This has some effect on the availability of alcohol because underage adolescents cannot legally buy alcohol in bars, grocery markets, or liquor stores any longer. The situation at home, however, is not affected by the new legislation, as they do not concern private settings. Many parents have alcohol at home and the adolescent is allowed to consume it (Jander et al., 2013). Furthermore, when comparing the drinking situations, we explicitly asked for the drinking situation at home, with and without parents. It is, therefore, likely that the results of our study are still valid within the context of a higher legal buying and drinking age. However, definitive answers need to be provided by empirical testing of this assumption.

**Limitations**

Our sample of respondents consisted of mainly Dutch nationality and was either Catholic, Protestant or had no religious affiliation. This may not be representative for the Dutch population as 21.1% of the Dutch population in 2013 consisted of immigrants (Centraal Bureau voor Statistiek, 2013a). Of all immigrants, more than half are from non-western countries, mainly from Turkey and Morocco. Immigrants from these countries are mainly Muslim and, thus, are not permitted to drink alcohol at all. However, we asked for nationality so that we could not verify whether people with Dutch nationality are also of Dutch ethnicity. Further, although we have a longitudinal design with follow-up measurements of adolescent drinking behavior after three months, the nature of our data does not allow for conclusions about causal relationships because we did not conduct a randomized controlled trial.

**Conclusion**

Our study results suggest that setting rules has a beneficial effect on adolescent alcohol use and binge drinking, whether or not parents are present in the situation. Future interventions should, therefore, encourage parents to set rules concerning alcohol use.

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# Chapter 5

## **A Web-based computer-tailored game to reduce binge drinking among 16- to 18-year-old Dutch adolescents: development and study protocol**

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Based on:

Jander, A., Crutzen, R., Mercken, L., de Vries, H. (2014). **A Web-based computer-tailored game to reduce binge drinking among 16 to 18 year old Dutch adolescents: development and study protocol.** *BMC Public Health*, 14, 1054.

**Abstract**

**Background:** In the Netherlands, excessive alcohol use (e.g., binge drinking) is prevalent among adolescents. Alcohol use in general and binge drinking in particular comes with various immediate and long-term health risks. Thus, reducing binge drinking among this target group is very important. This article describes a two-arm Cluster Randomized Controlled Trial (CRCT) of an intervention aimed at reducing binge drinking in this target group.

**Methods:** The intervention is a Web-based computer-tailored game in which adolescents receive personalized feedback on their drinking behavior aimed at changing motivational determinants related to this behavior. The development of the game is grounded in the I-Change Model. A CRCT is conducted to test the effectiveness of the game. Adolescents are recruited through schools and schools are randomized into the experimental condition and the control condition. The experimental condition fills in a baseline questionnaire assessing demographic variables, motivational determinants of behavior (attitude, social influences, self-efficacy, intention), and alcohol use. They are also asked to invite their parents to take part in a short parental component that focusses on setting rules and communicating about alcohol. After completing the baseline questionnaire, the experimental condition continues playing the first of three game scenarios. The primary follow-up measurement takes place after four months and a second follow-up after eight months. The control condition only fills in the baseline, four, and eight month follow-up measurement and then receives access to the game (i.e., a waiting list control condition). The effectiveness of the intervention to reduce binge drinking in the previous 30 days and alcohol use in the last week will be assessed. Furthermore, intention to drink and binge drink are assessed. Besides main effects, potential subgroup differences pertaining to gender, age, and educational background are explored.

**Discussion:** The study described in this article gives insight into the effectiveness of a possible solution for a prominent public health issue in the Netherlands, which is binge drinking among 16- to 18-year-old adolescents.

## Background

Before January 1, 2014, Dutch adolescents were allowed to buy low-strength alcoholic beverages (with an alcohol percentage by volume  $\leq 15\%$ ) when they turned 16. This age limit has just recently been increased to 18 years for any alcoholic beverage (Government, 2014). Alcohol use among Dutch adolescents is very high compared to other European countries as on average 57.4% of the 16-year-old and 61.9% of the 17- to 18-year-old adolescents engaged in binge drinking (drinking 4/5 or more glasses of alcohol on one occasion for girls/boys) at least once in the previous month (Verdurmen et al., 2011). Alcohol use, particularly during adolescence, has various consequences for the adolescent's physical, social- and intellectual health, such as physical fighting, being injured (Swahn et al., 2004), experiencing sexual assaults, dating violence, unwanted pregnancies, smoking and using illicit drugs (Miller et al., 2007; Stolle, Sack, & Thomasius, 2009; Testa & Livingston, 2009), decreased school performance, brain damage, and cognitive deficits (Miller et al., 2007; Zeigler et al., 2005). To date, most studies have focused on adolescents younger than 16 years (Jones et al., 2008; MacPherson et al., 2010; Marcoux & Shope, 1997; Ryan et al., 2010; Van der Vorst et al., 2005) or young adults older than 18 (Clapp & Shillington, 2001; Courtney & Polich, 2009; Ham & Hope, 2003), and not on the target group in our study, which is 16- to 18-year-old adolescents.

The Internet has become a medium many people worldwide use to search for all kinds of health related and non-health related information. A promising way to change health related behaviors using the Internet is by means of Web-based computer tailoring (CT), where participants receive highly personalized feedback on their behavior or related socio-cognitive determinants (e.g., attitude, self-efficacy) (De Vries & Brug, 1999). Web-based interventions have the possibility to reach large numbers of people, and have repeatedly proven to be effective in changing various health behaviors and their determinants (Krebs et al., 2010; Noar et al., 2007; Riper et al., 2009). However, these interventions also suffer from a major drawback which is drop-out of intervention participants during the intervention (De Vries et al., 2012; Elfeddali et al., 2012; Kohl et al., 2013). Further, effect sizes are often small to medium (Krebs et al., 2010). In an attempt to maximize effectiveness of an intervention to reduce alcohol use and binge drinking in Dutch 16- to 18-year-old adolescents with the shortcomings of CT interventions in our mind we started with conducting three different studies as formative research for the development of our intervention: a focus group study, an expert Delphi study and a questionnaire study. In the following paragraphs we briefly describe these studies' aims and the results as background information for the development of the intervention.

Focus group interviews were conducted with 16- to 18-year-old adolescents, and with parents of 16- to 18-year-old adolescents. The aim of the interviews was to obtain insights into the determinants of alcohol use and particularly binge drinking among adolescents that were, at the time of this study, legally allowed to buy low-strength alcoholic beverages. Prominent findings from this study (Jander et al., 2013) were that the most important drinking situations were at a party, in a bar, and being together with friends. Although adolescents did not feel direct pressure to drink, they reported that when alcohol is available and friends are around, then there is a certain pressure to drink. Furthermore, we found a discrepancy between what adolescents thought about acceptable amounts of alcohol that their parents would approve and what parents said. Adolescents thought that their parents are just fine with their alcohol consumption as long as they do not get drunk or show visible signs of drunkenness (e.g., vomiting). Parents, on the other hand, said that the acceptable limits of alcohol that their child is allowed to drink were around two glasses of alcohol. This discrepancy reveals that the communication concerning alcohol use between parents and their child is unclear. Regarding the interviews with the parents, the most important findings were that parents were aware of the negative consequences of alcohol use in adolescents, but in general stopped setting rules about alcohol use when their children turned 16. The mostly given reasons for stopping to set rules were that parents thought, prohibiting, or limiting alcohol use would be useless because alcohol was easily available in grocery stores, the child could buy alcohol without permission of the parent, and that the children are not always present and their alcohol use in these situations thus not controllable to the parent.

Subsequently, in a three round Delphi expert study (Jander, Crutzen, Mercken, & De Vries, 2015), we asked experts in the field of alcohol use among adolescents, what strategies could be used to successfully decrease alcohol use among adolescents in a Web-based computer-tailored intervention. We were interested in two aspects: strategies in interventions that targeted adolescents directly, and interventions that were targeted at parents with the aim to reduce alcohol use among adolescents. Main conclusions from this study were: adolescents should be given the opportunity to try out different reactions and observe the consequences of these reactions; they should be provided with refusal skills; and they should be given opportunities to cope with negative emotions in another way than drinking. For the parents the main conclusions were: parents should be advised to have clear and consistent rules; to communicate with the adolescent about alcohol use; and finally to monitor the friends and whereabouts of the adolescent. Being responsive and interested as a parent was another important feature that the experts pointed out. In addition, we asked the experts to come up with strategies to decrease drop-out of Web-based CT interventions. The experts mentioned strategies like using incentives and reminders to reduce drop-out of adolescents, but

they also made suggestions about design and content of the intervention, such as the use of highly relevant material and personalized feedback, providing little text and much interaction, using an attractive design, and language that relates to the adolescent.

Finally, based on the results of the focus groups, previous research, and the I-Change Model we developed a questionnaire. The I-Change Model integrates insights from various social cognitive, social-ecological, and self-regulation theories (De Vries, Eggers, & Bolman, 2013; De Vries et al., 2003). The questionnaire was used to identify the most important determinants of alcohol use and binge drinking among adolescents (not published), but also to investigate the influence of rules and communication about alcohol on the child's alcohol use. Results from this study indicated that stricter rules were associated with less alcohol consumption and less binge drinking occasions (Jander et al., submitted for publication). More importantly, the results showed that the protective influence of rules on drinking behavior of the child was the same in situations where the parents were present, as in situations where the parents were absent, implying that the concern of parents that they cannot influence drinking behavior because they cannot control the child all the time may be unnecessary.

The goal of the current article is to give a detailed description of the development and components of the intervention, as well as a protocol for the two-arm Cluster Randomized Controlled Trial (CRCT) to test the intervention's effectiveness. Based on the focus group study (Jander et al., 2013) and the Delphi study (Jander et al., 2015) we decided to develop a Web-based game for adolescents, in which we embedded computer-tailored feedback on behavior and motivational determinants. A game might be an attractive tool to keep adolescents motivated (Prensky, 2003) and offer some degree of interaction, as recommended by the experts, and thus reduce drop-out. For the parents we designed a Web site on which they had the opportunity to get computer-tailored feedback on communication and setting rules concerning alcohol use.

## Methods

### Development process

Several brainstorm sessions were conducted with the research team and students, health communication experts, and ICT and game design students and experts to obtain insight into possibilities, what is already available, and used successfully. Wishes of the target group were also identified during the focus group interviews (Jander et al., 2013). Finally, we talked with several serious gaming companies about our ideas. After deciding on one serious gaming company to work with we started a Facebook page where we invited a convenience sample of 24 adolescents to befriend us and join the "Facebook panel" group. We presented all material that we and the gaming company developed to

this panel and received feedback that we could use to improve the material. All panel members were between 16-18 years old. The panel consisted of eight boys and sixteen girls. Twelve adolescents came from pre-university education and the other twelve had a secondary vocational education background. We contacted the panel ten times during the development process, to present them with new material, or ask them for feedback regarding certain aspects of the game (e.g., its name, screenshots and characters of the game, realistic scenario's after drinking too much alcohol, realistic advices for adolescents that are trying to drink less in tempting situations, layout and design of the first version of the game etc.). For complete and thoroughly participation in all ten rounds the adolescent received a gift card worth €35.

We also invited a convenience sample of parents to join a similar panel, where we presented material for the parental Web site. In total 14 parents participated in this panel. We asked them to visit the Web site and give us feedback on layout and design of the Web site, usability and the content. We furthermore asked them to give us feedback on an example of a tailored letter that parents in the intervention would receive after responding to a questionnaire. We finally asked them through which methods we could reach parents to invite them to the intervention. The parents also received a gift card worth €35.- after completing participation.

### **Theoretical model**

The theoretical model underlying the computer tailoring component of this intervention was the Integrated Behavioral Change (I-Change) model (De Vries & Brug, 1999; De Vries et al., 2013; De Vries et al., 2003), as this model has previously successfully used in computer-tailored interventions (Schulz et al., 2013; Smit et al., 2012). Features that distinguish the I-Change Model from traditional models such as the Theory of Planned Behavior (Ajzen, 1991) is that the model acknowledges a pre- and post-motivational phase in the behavior change process as well as predisposing and information factors that influence the development of cognitions and behavior. The pre-motivational phase is characterized by motivational determinants (i.e., attitude, social influences and self-efficacy) and awareness factors (i.e., knowledge, risk perception, cues to action). Intention is the factor that is most proximal to behavior. When a person is ready to actually change behavior, action plans (exact plans what to do in a predefined situation to perform a certain behavior) help the individual to do so. If behavior change has taken place the person is in the post-motivational phase and coping plans (plans how to cope with difficult situations) are important for maintaining the behavior change (De Vries et al., 2003; Van Osch, Lechner, et al., 2008; Van Osch, Reubsaet, et al., 2008). Predisposing factors (i.e., behavioral factors, psychological factors, biological factors, social and cultural factors) and information factors (i.e., message, channel, source) also belong to the pre-motivation phase.

## Study design

We conduct the study on Dutch schools of higher secondary education and lower secondary and tertiary education because this is the most convenient place to reach adolescents. Thus, a CRTTC, with one experimental and one waiting-list control condition randomized at school level, is used to test the effectiveness of the intervention to reduce binge drinking among 16- to 18-year-old adolescents. Originally, the study consisted of a baseline measurement in October 2013 followed by the intervention and a six months follow-up measurement (April 2014). In the beginning of 2013 the Dutch government started a debate about rising the legal buying age for adolescents from 16 years to 18 years per January 1, 2014. Because our target group comprises Dutch adolescents aged 16 to 18 years, we decided to adapt the original planning, in order to avoid that the adolescents in our intervention were legally allowed to buy alcoholic drinks at baseline and were no longer allowed to buy alcohol at the follow-up measurement. Deciding to delay the baseline measurement until January 2014 after the new law was implemented, had consequences for the follow-up measurement as well. The current study is school based and a six months follow-up after baseline would fall into the summer holidays of the schools, we decided to do the primary follow-up a little earlier, after four months. Because we are also interested in the effects of the intervention after a longer time period we also included a secondary eight-month follow-up after the summer holiday. Unfortunately, a part of our target group will then be graduated so we will not be able to do the second follow-up in schools, but rather have to reach the adolescents outside school.

### *Sample size estimation*

The sample size estimation is based on a 10% reduction in binge drinking occasions in the preceding 30 days in the experimental group compared with the control group. Since adolescents will be nested in schools a CRCT is needed. Using a conservative approach with an effect size of 0.2, an ICC of 0.02, power of .80, significance level of 0.05, and considering drop-out of 50% of adolescents at primary follow-up, we aim to include 34 schools at baseline.

### *Participants*

Participants of this study are adolescents aged 16 to 18 years. Participants are recruited by sending letters containing flyers with short information about the newly developed intervention using a game to reduce binge drinking among adolescents to schools of higher and lower secondary and tertiary education in the Netherlands. The schools can get more information on the intervention Web site, or contact the researchers directly via telephone or e-mail. After a couple of weeks, if the school has not responded to the letter yet, schools are called and asked if they had received the letter and if they would

like to get more information about the intervention. If they register to participate in the study, they are randomly assigned to either a control or experimental condition. Schools are not blind to their condition because the experimental schools have to schedule a total of three lessons (two lessons in January/February for the baseline questionnaire and three game scenarios and one for the follow-up measurement in May/June) for the current study, while control schools just have to schedule two lessons (one lesson in January/February for the baseline questionnaire and one for the follow-up questionnaire in May/June). Schools also have to sign and return a consent form, in which they indicate to agree to take part in a scientific study. Before the adolescents can start with the questionnaire they also have to give informed consent to participate in this scientific study, by checking a box. If adolescents refuse to give consent, they are informed that without consent they cannot participate in the study.

#### *Ethical approval and trial registration*

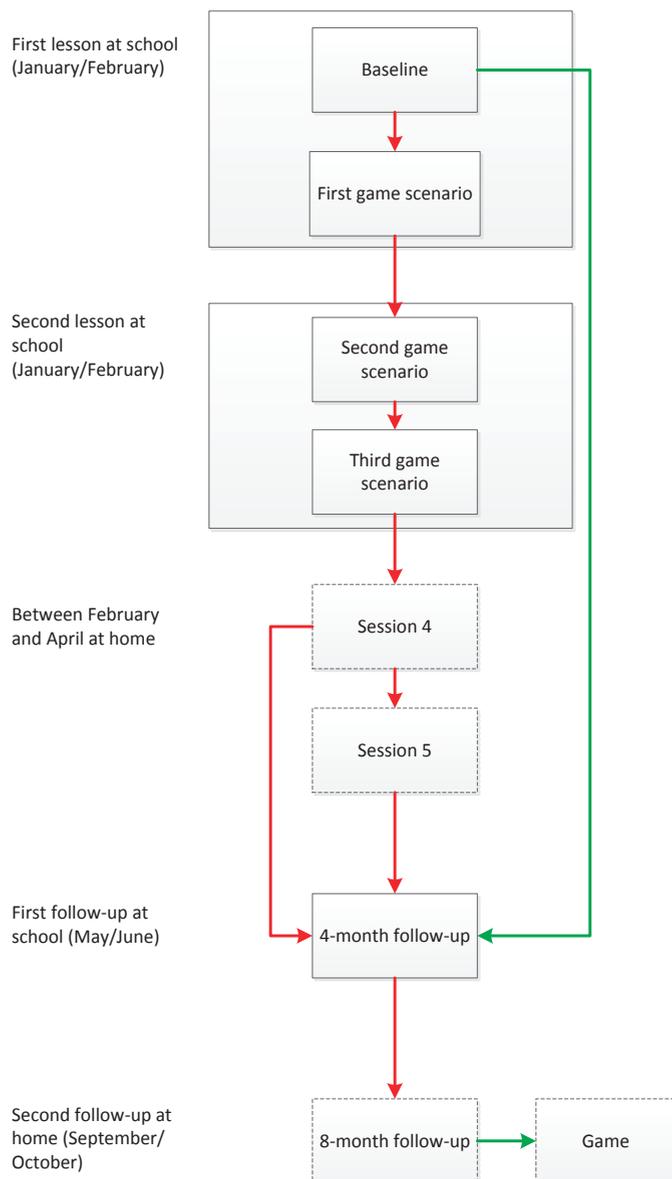
The study protocol was approved by the Medical Ethics Committee of Atrium Orbis Zuyd (METC number: 12-N-104) and the study was registered at the Dutch Trial Register (NTR4048).

### **Intervention**

To enter the intervention, adolescents go to the intervention Web site and create an account. In the account they select their school, which will lead them into the correct routing for the control or experimental condition. The intervention consists of five sessions. A baseline questionnaire followed by three different game scenarios (i.e., sessions 1-3), a fourth session in which adolescents can accept a challenge to drink less at an upcoming drink event, and finally a session to evaluate the challenge (Figure 5.1). The control condition fills in the baseline questionnaire only, while the experimental condition continues with the first game scenario.

### **Baseline**

First, adolescents have to give consent to participate in this study and then start with responding to a baseline questionnaire, assessing demographics (gender, age, educational background, family composite), alcohol use in the past week, binge drinking in the last 30 days, and situation specific alcohol use (for three situations: drinking in a bar, drinking at a party, and drinking at home) motivational determinants (attitude, modeling, social norm, perceived pressure, self-efficacy, action plans), and intention to decrease alcohol use. After the baseline questionnaire the adolescents in the experimental condition immediately start with the first out of three game scenarios (Sessions 1-3).



**Figure 5.1:** Flowchart of the intervention

*Red line: routing experimental condition, green line: routing control condition, dashed boxes: intervention parts that have to be done at home.*

## Game scenarios

All scenarios start the same: the adolescent wakes up in the morning after a night of partying and does not remember what happened the last night. Goal of the game is to find out what happened. This is also reflected in the title of the game “Watskeburt?!” (Dutch slang for what happened?!). There are three different drinking situations outlined in the game, one per scenario (Table 5.1). The order of the scenarios is also tailored so that the adolescent starts with the drinking situation that he/she indicated in the baseline questionnaire that he/she drinks the most alcohol in.

**Table 5.1:** Description of scenario's

Game scenario	Drinking location	What happened?
1	In a bar	Lost wallet and cell phone
2	At a party	Embarrassing pictures of him/her taken and put on Internet
3	At a friends' place	Fell with bike on way back home, hurt knee and lost keys

## Feedback

In every scenario, the adolescents get questions and computer-tailored feedback on an in-game cellphone (Figure 5.2) displayed at two moments during each scenario. The methods we use in the tailored feedback vary a little depending on the message, but usually we start with repeating the respondents answer to enhance self-monitoring, we then confirm correct assumptions with positive feedback or correct wrong assumptions with new information. We provide a personal tone in the messages and show sympathy to enhance commitment (Dijkstra & De Vries, 1999).

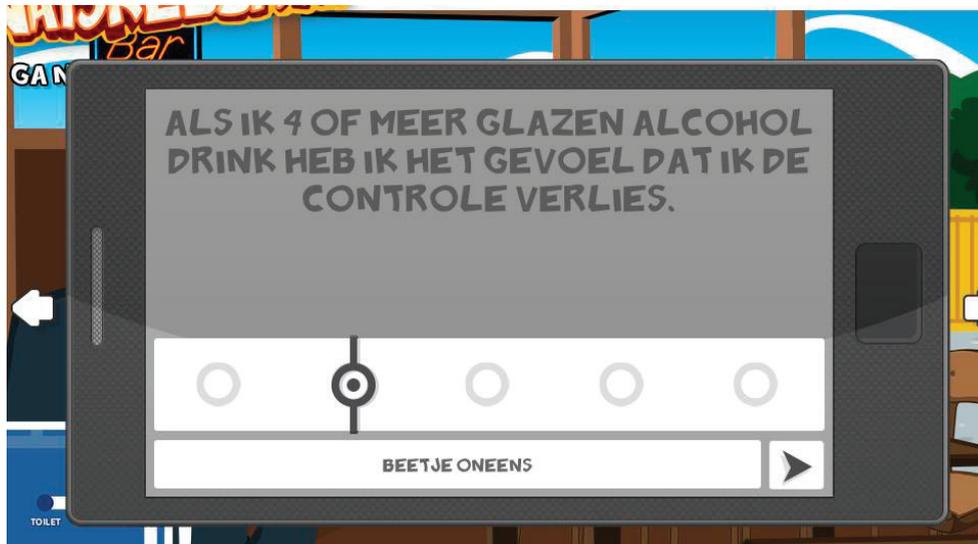
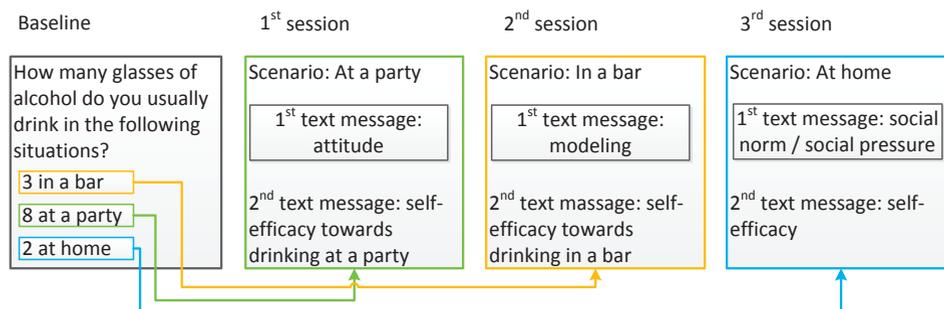


Figure 5.2: Example of a question about attitude on the in-game cell phone

The questions and feedback of the first text message in every scenario are presented in a fixed sequence independent of the scenario. In the first text message of the first scenario the adolescent gets questions about the pros and cons of binge drinking and receives feedback on his or her overall attitude and then for every pro and con specifically. In these feedback messages the focus is on providing the participant with general and individual consequences of alcohol in order to change attitude in a more negative fashion. In the first text message of the second scenario the adolescent gets questions and feedback about social modeling of alcohol use and binge drinking. These feedback messages are provided to help the adolescent to choose the right role models, or to encourage them to seek support from friends or family who are not using much alcohol. In the first text message of the last scenario, questions and feedback about social norm and perceived pressure are provided to the adolescent. Feedback is provided with instructions how to resist pressure from friends or family to drink and provides information about perceived approval of drinking from family or friends.

The content of the second text message of every scenario is about self-efficacy and action plans and are specific to the situation outlined in the scenario. This means that in the bar drinking scenario the questions in the second text message assesses self-efficacy not to binge drink in a bar, and then provides the adolescent with specific action plans how to refuse alcohol in a bar situation. In the party situation these questions are specific to self-efficacy to refuse a drink at a party etcetera (Figure 5.3). We chose for this sequence based on the  $\emptyset$  pattern (De Vries & Backbier, 1994) which describes

that people shift towards behavior change through first developing a favorable attitude, experiencing positive social influences and finally developing high self-efficacy towards the behavior.



**Figure 5.3:** Example of routing sessions and game scenarios

*This figure illustrates how the game scenario and second text message is influenced by the answers given in the baseline questionnaire. Colored lines indicate a flexible sequence, black boxes are fixed.*

## Session 4

One week after the last game scenario the adolescents receive an e-mail inviting them back to the intervention to answer a couple of questions about their alcohol use in the previous week. They receive feedback on their drinking behavior compared with their drinking behavior at baseline and receive information whether or not they comply with the national drinking guidelines. This is done in order to raise awareness about their own drinking behavior, as awareness is an important pre-motivational determinant in the I-Change Model (De Vries et al., 2003). They are then asked if they have a drinking event in the upcoming 30 days where they usually drink more than four (if the participant is a girl) or five (if the participant is a boy) glasses of alcohol. If they confirm such an event they are asked if they would like to challenge themselves to drink less than four/five glasses of alcohol on that event. If they accept the challenge, they have to indicate the date on which that particular event takes place and what kind of event it is (e.g., a party, a night out etc.).

After this information they are invited to make their own action plan in order to support them in their attempt not to drink more than four/five glasses of alcohol, or if they do not want to make their own plan, they are given a list of plans and can choose what plan they would most likely follow. Action plans are tools that are important in the action phase of behavior change (De Vries et al., 2003) and can help the adolescent bridge the intention behavior gap. After deciding on a plan, they receive all the feedback from the

previous three sessions to booster their memory. One day ahead of the drinking date they receive an e-mail that prompts them about the drinking event the next day, and that they had accepted a challenge not to drink more than four/five glasses of alcohol. This mail was meant as a prompt to self-monitor their behavior at the drinking event.

### **Session 5**

One day after the drinking event adolescents that accepted the challenge are invited to respond to a short questionnaire about the drinking event. They indicate whether or not they achieved to drink less than four/five glasses of alcohol. If they indicate that they drank more they are asked for the reasons. Adolescents can indicate whether their drinking was mainly influenced by themselves, their surroundings, a combination of both or none of these. Consequently, they receive attributional feedback on the reason, providing them with information about external and internal reasons for behavior and how they can exert some influence on them. In this feedback on performance the adolescent is encouraged to continue trying to reduce the alcohol intake and to use a cue reminder (an object that helps them to remember their goal to drink less alcohol) at the next drink event. Cue reminders have been shown to help adolescents inhibit their alcohol use (Kleinjan, Strick, Lemmers, & Engels, 2012). After that, adolescents can repeat the challenge if they wish to.

### **Invitations and reminders**

When participants create an account, they have to provide their e-mail address. This e-mail address is used to send participants invitations and reminders to participate. The first invitation is send to the participants of the experimental condition who have not completed the three game scenarios that they were supposed to play at school. After a week they receive a reminder. The same procedure happens for both conditions when participants do not complete the first follow-up measurement at school. Eight months after they have created an account, participants are invited to respond to the last follow-up questionnaire. If they do not respond they receive a first reminder after one week and a second reminder after two weeks.

### **Parental component**

Adolescents who take part in the study at school invite their parents to an additional session within the intervention. Adolescents are given the opportunity to enter the e-mail address of one of their parents in the baseline questionnaire. The parent then receives a link to the parent component the next day. If the parent is willing to participate, he/she has to give informed consent by checking a box. The intervention for parents consists of a questionnaire and computer-tailored feedback. In the questionnaire we assess demographic variables (gender, land of birth, family constellation), parenting

styles (involvement, psychological control, monitoring), drinking behavior, acceptable alcohol use of the child, rules concerning alcohol use, communication about alcohol use, and motivational determinants (intention to talk to child and set rules, modeling, social norm, self-efficacy, action plans concerning communication and setting rules).

After responding to all questions the parent receives immediate computer-tailored feedback. First, they receive feedback what kind of parenting styles fits the information they provided and then get information about how the different parenting styles affect drinking behavior in adolescents. Following this, parents get feedback about their attitude, social influences, self-efficacy, and action plans. Furthermore, they get information about how to talk with their child about alcohol and how to set appropriate rules concerning alcohol use.

After parents finish the intervention they can visit a Web site where they can find more general information about alcohol use and effects, and how to set rules and communicate with the child.

### **Measurement instruments**

The following measures are assessed among adolescents.

We measure the following demographic characteristics: gender, age, educational background (higher secondary education, lower secondary and tertiary education), religion (Catholic, Protestant, Muslim, other religion, no religion) and ethnicity (Dutch, Antilles, Belgium, German, Suriname, Moroccan, Turkish, other).

We assess *Weekly drinking behavior* with two questions. Adolescents indicate for each day of the past week if they drank alcohol and, if they did, how many glasses of alcohol they drank. Based on this information we calculate the total amount of alcohol they had been drinking in the past week (Lemmens et al., 1992). We furthermore assess *Binge drinking* (i.e., having 4/5 or more glasses of alcohol on one occasion for a girl/boy) in the previous 30 days (Wechsler, 1995), with an open-ended question asking adolescents how many binge drinking occasions they had in the previous 30 days.

Intention to reduce current alcohol use is measured by two items “Are you intending to generally reduce your drinking on one occasion (e.g., in a bar, at a party etc.)” and “Are you intending to drink less than 4/5 glasses of alcohol on one occasion (e.g., in a bar, at a party etc.)”. Answers can be provided on a five-point Likert scale (1=absolutely will not; 5=absolutely will).

Four items measuring pros (e.g., “Binge drinking helps me having fun with friends”) and four items measuring cons (e.g., “Binge drinking makes me feel out of control”) of binge drinking are used to assess attitude. Participants indicate their answer on a five-point Likert scale (1=absolutely disagree; 5=absolutely agree). The items were derived from another study (Migneault et al., 1997) using eight pros and cons. After pre-testing the questionnaire, only four important pros and cons remained in this study.

Social influences are assessed by three concepts: social modeling, social norm, and perceived pressure. *Social modeling* is assessed by asking participants how often (1=never; 4=very often) people in their direct environment (i.e., parents, siblings, (best) friend(s), boyfriend/girlfriend) drink alcohol and engage in binge drinking. *Social norm* is measured for each person in their direct environment (i.e., parents, siblings, (best) friend(s), boyfriend/girlfriend) by one item “My (e.g., girlfriend) thinks that ... 1=“I am certainly not allowed to binge drink” to 5=“I am certainly allowed to binge drink”. Perceived pressure is assessed by “Did you ever feel pressure to drink 4/5 or more glasses of alcohol by your ...?” for each person in their direct environment answered with 1=never and 5=always.

Self-efficacy is measured by ten items. Each item assesses whether participants feel able not to binge drink in a certain difficult situation (situations that would usually trigger binge drinking, e.g., “How easy or difficult is it for you to drink less than 4/5 glasses of alcohol if you are at a party?”). Participants can indicate their answer on a five-point Likert scale (1=very difficult; 5=very easy).

We provide participants with 21 different action plans that they could perform in order to make it easier not to binge drink in difficult situations (e.g., “Alternate alcoholic drinks with non-alcoholic drinks”). Participants indicate on a five-point Likert scale how likely it is that they will perform each action plan (1=will I certainly not do; 5=will I certainly do).

### **Primary and secondary outcome**

Primary outcome of this study is the reduction in binge drinking occasions in the previous 30 days at four month follow-up. The secondary outcome concerns reduction in alcohol use in the previous week and intention to reduce alcohol use and binge drinking. We will furthermore look at reduction in excessive drinking (i.e., drinking 10 or more glasses of alcohol on one occasion in the previous week) (Best, Manning, Gossop, Gross, & Strang, 2006). Our main focus will be the outcome measures at four month follow-up. Secondly, we will also use the outcome measures at eight month follow-up. Additional analyses explore potential sub group differences concerning the effectiveness of the program between gender, age, and high and low educated groups.

**Process evaluation**

To assess level of personalization and appreciation we ask the participants after every game scenario if they thought the feedback and the game were useful, realistic, and personally relevant. Answers can be provided on a four point Likert scale (e.g., 1=very unrealistic; 4=very realistic). Furthermore, they rate every advice and the game with a school grade (1=very bad, 10=excellent).

**Statistical analyses**

General descriptive statistics will be used to describe the baseline characteristics of the participants. As the adolescents are nested in schools we will use a multilevel regression approach with three levels to assess the effects of the intervention on behavior. The first level is the repeated measures within the participants (baseline and two follow-up measurements), the second level is the pupils and the third level is the schools, where the pupils are nested. Linear regression will be used to analyze the effects of the program on week consumption and intention and logistic regression will be used to analyze the effects on binge drinking and excessive drinking. As covariates we will include condition, age, gender, educational background, religion, and the outcome variable on baseline. Moderation analyses will be performed to assess different effects for low and high educational level, age, and gender.

**Discussion**

This study protocol describes a study to test the effectiveness of an intervention aimed at reducing alcohol use and specifically binge drinking among 16- to 18-year-old Dutch adolescents. Reducing alcohol use at an adolescent age is of particular importance, not only because of the immediate dangerous consequences of alcohol, such as getting into fights or unwanted pregnancies (Miller et al., 2007; Swahn et al., 2004), but also to reduce the risk of long term damages of the brain (Zeigler et al., 2005) and reducing the risk of becoming alcohol dependent later in life (Grant & Dawson, 1997; Hingson, Heeren, & Winter, 2006). Thus, reducing alcohol use at an adolescent age also reduces the risk of more long-term public health problems.

An important problem of computer-tailored interventions is that they suffer from high drop-out rates (De Vries et al., 2012; Elfeddali et al., 2012; Kohl et al., 2013). To minimize this, we followed the principles of social marketing (Evans, 2006) and conducted studies with the target group (Jander et al., 2013) and invited various experts to reflect on important issues for program development (Jander et al., 2015). This formative work revealed that the intervention should be presented in a very attractive, interactive way, hence a game. Using serious games (games with the goal

to educate the gamer) to educate people about health behavior have been shown to increase motivation, knowledge, and to change health behaviors (Connolly et al., 2012; DeSmet et al., 2014; Papastergiou, 2009; Tüzün et al., 2009), thus the idea of a game seems a suitable solution. Furthermore, we collaborated with the target group in the development of the game and intervention material (i.e., the adolescent Facebook panel and parent panel). Involving the target group in the developmental process of the intervention enabled us to build a program that took into account the wishes and preferences of the target group right from the beginning. Finally, we pilot tested the intervention at five schools to test the feasibility of the recruitment strategy, the design, and the content of the intervention. Based on this pilot, we shortened the game and had the feedback messages shortened and rewritten by a professional writer to make them more appealing to our target group. The revised version of the intervention will be used in the trial described here.

Taken together, this study will give insights into the effectiveness of the intervention to reduce alcohol use among 16- to 18-year-old adolescents and whether the development process of the game limited drop-out in the trial.



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# Chapter 6

## **Effects of a Web-based computer-tailored game to reduce binge drinking among Dutch adolescents: a cluster randomized controlled trial**

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Based on:

Jander, A., Crutzen, R., Mercken, L., Candel, M., de Vries, H. (in press). **Effects of a Web-based computer-tailored game to reduce binge drinking among Dutch adolescents: a cluster randomized controlled trial.** *Journal of Medical Internet Research*

## Abstract

**Background:** Binge drinking among Dutch adolescents is among the highest in Europe and leads to serious health consequences. Few interventions so far have focused on 15- to 19-year-old adolescents. Yet, as binge drinking increases significantly during those years, it is important to develop binge drinking prevention programs for this group. Web-based computer-tailored (CT) interventions can be an effective tool for reducing this behavior in adolescents, as such interventions have been used successfully to reduce other unhealthy behaviors. To make this intervention more attractive to adolescents, the CT intervention was embedded in a serious game.

**Objective:** To assess whether a Web-based CT intervention is effective in reducing binge drinking in 15- to 19-year-old Dutch adolescents. Secondary outcomes are the reduction in excessive drinking and overall consumption during the previous week. Moreover, personal characteristics associated with program adherence are investigated.

**Methods:** A cluster randomized controlled trial was conducted among 34 Dutch schools of either lower secondary education and vocational training or higher secondary education. Each school was randomized into either an experimental (N=1622) or a control condition (N=1027). Baseline assessment took place in January and February 2014. At baseline, demographic variables and alcohol use were assessed. Follow-up assessment of alcohol use took place four months later, in May and June 2014. After the baseline assessment, participants in the experimental condition started with the intervention consisting of a game about alcohol in which CT feedback regarding motivational characteristics was embedded. Participants in the control condition only received the baseline questionnaire. Both groups received the four-month follow-up questionnaire, which was filled in by 456 (28.1%) adolescents from the experimental and 368 (35.8%) adolescents from the control group (total: N=824, response rate: 31.1%). Effects of the intervention were assessed using logistic regression mixed models analyses for binge drinking and excessive drinking and linear regression mixed models analyses for weekly consumption. Factors associated with intervention adherence in the experimental condition were explored by means of a linear regression model.

**Results:** The intervention was effective in reducing binge drinking among adolescents aged 15 ( $P=.03$ ) and among 16-year-old adolescents when they followed at least two intervention sessions ( $P=.04$ ) but not for older adolescents. Interaction effects between excessive drinking and educational level ( $P=.08$ ) and between weekly consumption and age ( $P=.09$ ) were found; however, in-depth analyses revealed no significant subgroup effects for both interaction effects. Additional analyses revealed that prolonged use of the intervention was associated with stronger effects for binge drinking. Yet, overall adherence to the intervention was rather low. Analyses revealed that being Protestant,

being female, being younger, having a higher educational background, and being a non-binge drinker were associated with adherence.

Conclusion: The intervention was effective for 15- and 16-year-old adolescents concerning binge drinking, the main outcome. No effects for older adolescents or other alcohol outcomes were detected. Apparently, prevention messages may be more effective for those at the start of a drinking career, whereas other methods may be needed for those with a longer history of alcohol consumption. Unfortunately, using game elements did not realize optimal levels of intervention completion.

## Introduction

Alcohol use in adolescents and specifically dangerous drinking practices such as binge drinking (drinking 4/5 or more glasses of alcohol in one occasion for a girl/boy) and excessive drinking (drinking 10 or more glasses of alcohol on one occasion) (Best et al., 2006) are associated with detrimental long and short-term consequences. Alcohol use is the cause of 26% of all deaths in males and 10% of all deaths in females in ages 15-29 in Europe (Anderson & Baumberg, 2006). Also, short-term consequences like physical fighting and injuries (Swahn et al., 2004), dating violence, unintended pregnancies, and illicit drug use (Miller et al., 2007; Stolle et al., 2009; Testa & Livingston, 2009) are severe and influential experiences for adolescents. Particularly, the influence of alcohol on the developing brain can lead to serious brain damage, cognitive deficits, and learning disabilities (Bava & Tapert, 2010; Clark et al., 2008; Zeigler et al., 2005).

In the Netherlands in 2011, 57.4% of the 16-year-old and 61.9% of the 17- to 18-year-old adolescents reported that they had engaged in binge drinking at least once in the previous 30 days (Verdurmen et al., 2011), with significantly more boys reporting binge drinking (70.5%) than girls (53.1%). Compared to other European countries, this is relatively high (Hibell et al., 2009). Moreover, a Dutch survey from 2013 shows that of the 16-year-old adolescents who reported drinking alcohol in the previous month, 79.9% also reported binge drinking (De Looze et al., 2014). However, these data were collected when adolescents were allowed to buy alcoholic beverages with an alcohol content of less than 15% when they turned 16 (this changed as of January 1, 2014). Still, these adolescents grew up in an environment where drinking from the age of 16 was acceptable and relatively common (Verdurmen et al., 2011), as the previously mentioned surveys show. Hence, targeting adolescents' motivation to decrease alcohol use and binge drinking is important.

Changing alcohol use in adolescents could be achieved with the help of Web-based computer-tailored (CT) interventions (Schulz et al., 2013). In the Netherlands, 97% of the 12- to 65-year-old population has access to the Internet (Centraal Bureau voor Statistiek, 2013b). Differences in access between Dutch social classes range from 92% for lower educated adolescents to 99% for higher educated adolescents. Web-based CT health interventions thus have the potential to reach many people from various social classes and ages. These interventions provide the opportunity to tailor health messages to individual characteristics of the recipient (e.g., demographics and motivational variables), which result in highly personalized and relevant messages that are more likely to attract attention (De Vries & Brug, 1999). CT interventions have repeatedly been shown to effectively change various health behaviors and their determinants (Kohl et al., 2013; Krebs et al., 2010; Lustria et al., 2013), although their effect sizes are generally small to medium. However, Web-based CT interventions suffer from high

drop-out rates (e.g., one study reported 37% drop-out after six months (Schulz et al., 2013), another even 72% drop-out after 12 months (Elfeddali et al., 2012), the average adherence rate to Web-based health interventions is 50% (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012)) with at least two negative consequences. First, high drop-out rates during the intervention result in non-exposure to the intervention leading to reduced public health impact. Second, high drop-out rates also result in less power to reveal intervention effects at follow-up because people who drop out during the intervention are also not likely to participate in a follow-up assessment (Eysenbach, 2005).

This is related to a general difficulty to engage adolescents in health interventions (Crutzen et al., 2011; Pate et al., 2003). Yet, using serious games (i.e., games with the goal to educate people rather than merely entertain them) (Connolly et al., 2012; DeSmet et al., 2014) to change health behaviors, could lead to more attraction and participation (Papastergiou, 2009; Tüzün et al., 2009), increased knowledge, and changed attitudes and behavior (Connolly et al., 2012; DeSmet et al., 2014). Consequently, our study employed a serious game as a method to provide computer-tailored feedback.

Furthermore, parents still play an important role in preventing adolescents from drinking too much alcohol. Studies have shown that setting clear rules (Van der Vorst et al., 2005; Van Der Vorst et al., 2006) and good quality communication with the child about alcohol (Spijkerman et al., 2008; Turrisi et al., 2001a) has positive effects on the child in terms of less alcohol consumption. However, another study suggests that communication between parents and adolescents is virtually absent when Dutch adolescents turn 16 (Jander et al., 2013). Therefore, we also provided computer-tailored feedback to parents concerning how to set clear and consistent rules with regard to alcohol use and how to communicate clearly with their child about alcohol.

The aim of this study was to test the effectiveness of a Web-based CT intervention after four months to reduce binge drinking (i.e., drinking 4/5 glasses of alcohol for a girl/boy on one occasion) in 15- to 19-year-old Dutch adolescents; as a secondary outcome, we also assessed the effects of the intervention on excessive alcohol use (i.e., drinking 10 or more glasses of alcohol on one occasion) and alcohol consumption during the previous week (i.e., the sum of glasses consumed during the previous week). We furthermore assessed differential intervention effects concerning age, gender, and educational level.

## Methods

### Study design

As of January 1, 2014, the legal age to purchase alcohol increased to 18 years (Government, 2014), which had some implications to our study design. Originally, the baseline assessment was planned for October 2013 and the follow-up assessment for April 2014. However, we did not want to have the legal change in between the baseline and follow-up assessment, therefore we decided to start with the baseline assessment after the law came into effect in January 2014. Furthermore, we decided on a four-month follow-up assessment instead of six, as a six-month follow-up assessment would have fallen into the summer vacation period and adolescents not present at schools.

We conducted a cluster randomized controlled trial (CRCT) (trial registration number: NTR4048), randomizing Dutch schools of either lower secondary education and lower vocational training or higher secondary education into an experimental and a control condition. The experimental condition received the online intervention in the form of a game that contained computer-tailored feedback. The control condition only filled in the online baseline questionnaire. Both groups were given an online follow-up assessment after four months, responding to the same questionnaire as used in the baseline assessment. The study took place in the Netherlands, between January and June 2014.

### Participants and procedure

Adolescents were recruited in schools. Information letters addressed to teachers and coordinators of the highest grades at secondary education schools (grades 4, 5, and 6) and at vocational training schools were sent via postal mail. These information letters informed the teachers about the intervention and provided contact details and the address of the study Web site, so schools could obtain more information and subscribe to the study. All eligible schools in the Netherlands (approximately 600 schools) received an invitation. If schools did not respond, they were called two to three weeks later. Schools were randomly assigned to either the experimental or control condition after their consent to participate in the study. Schools were not blind to their condition, as experimental schools had to plan three lessons for the intervention (one lesson for the baseline assessment and first game session, a second lesson for the second and third game session, and a third lesson for the four-month follow-up assessment) and control schools had to plan two lessons (the baseline assessment and four-month follow-up).

Approximately three weeks before the intervention started, teachers were provided with a letter containing more information about the procedure, privacy, and confidentiality.

All adolescents in the classes were provided with a letter at the day of the intervention, to avoid that they would start with the intervention prematurely. The letter informed the adolescents that all their answers in this study would never be shared with teachers, parents or any other third person; would be used for research purposes only; would be analyzed anonymously; and that they could end participation at any point in time. They were also made aware that at the end of the study, they would participate in a lottery for 300 gift vouchers worth 25€ each. Adolescents were, furthermore, provided with a letter for their parents. In this letter, the parent was informed that their child participated in an online alcohol intervention at school, and the parent was invited to visit a separate Web site specifically for parents, where they could take part in the parental component of the intervention. When starting with the intervention, teachers asked the adolescents to visit the study Web site and create an account. They were routed to the according condition (either control or experimental) based on the school they attended. Before starting with the baseline questionnaire, all adolescents had to give informed consent by checking a box on the first page of the Web site where informed consent information was provided. If they did not wish to participate, or refused to provide informed consent, they could check a box stating “I do not wish to participate in this study”, were thanked and could close the intervention Web site.

### **Inclusion criteria**

Our main target group was adolescents aged 16 to 18 years. Since we were recruiting the adolescents in schools, we also included younger (15 years) and older (19 years) adolescents because they are often in the same class. Schools had to provide the adolescents with individual access to a computer with Internet connection.

### **Intervention**

The idea of a game instead of a purely text-based computer-tailored intervention was first brought up by adolescents during focus group interviews (Jander et al., 2013). During the development of the intervention, all materials and questions concerning the game (e.g., its name, screenshots and characters of the game, realistic scenario's after drinking too much alcohol, realistic advices for adolescents that are trying to drink less in tempting situations, layout and design of the first version of the game etc.) were presented to a Facebook panel. This panel consisted of a convenience sample of 24 16- to 18-year-old adolescents, who provided us with feedback on those materials. The feedback was used to adapt the game to match the desires of the target group as closely as possible. After the development was completed, the game was pilot tested at five schools to test the feasibility of the recruitment strategy, the design, and the content of the intervention. In total, 481 adolescents played the first game session and provided us with feedback about appreciation, comprehension, attractiveness, and level

of personalization of the game. They were also asked about what they liked and what they did not like about the game. Based on this pilot, we shortened the game and had the feedback messages shortened and rewritten by a professional writer to make them more appealing to our target group. Originally, only the first game session was offered in the school and the adolescents were asked to continue with the game at home. After reviewing the feedback and the pilot data we decided to make some changes to the design and offer all three game sessions within the school setting.

The intervention, Alcohol Alert, consisted of an online baseline questionnaire, after which the adolescents played three sessions of the game “What happened?!” In these game sessions, the adolescent wakes up after a night of partying and does not remember what happened the night before. The goal of this two-dimensional game was to find out what happened. Each of the game sessions depicted one of the most common drinking situations for adolescents (i.e., drinking at home, drinking in a bar, drinking at a party). The sequence of the three game sessions was tailored and dependent on how many glasses of alcohol the adolescent indicated to typically drink in each of these situations. The adolescent started with the drinking situation in which he or she indicated drinking the most alcohol. Thus, if the adolescent indicated to typically drink three glasses at home, five glasses at a party, and six glasses in a bar, he or she would start with the bar scenario first, followed by the party scenario and finally the home scenario. Each session started in the bedroom where the adolescent wakes up. The adolescent quickly discovers that something is wrong, for example, in one session the wallet is missing. The adolescent then navigates through different places in the game and talks to people he or she meets and gets clues about what happened last night (Figure 6.1).



Figure 6.1: Screenshot example from the game

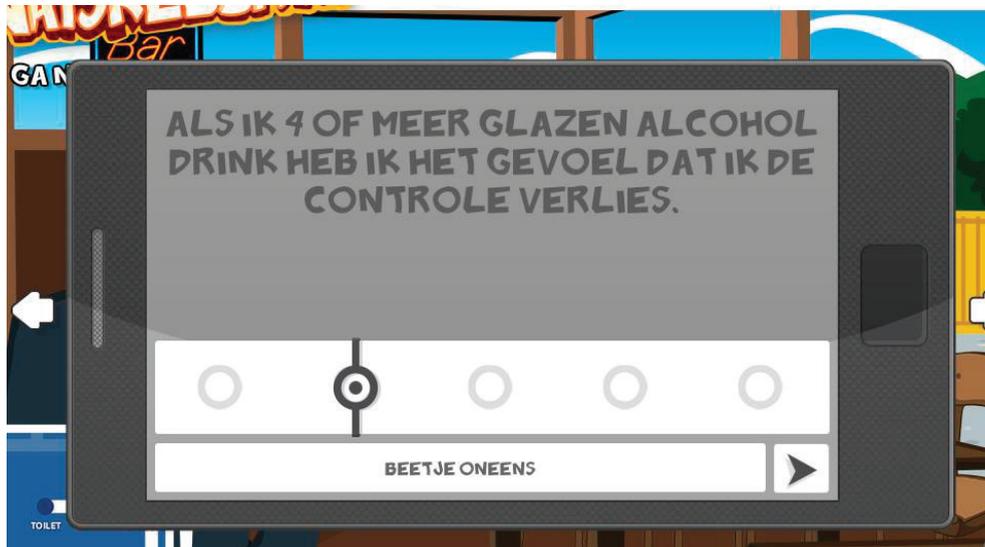


Figure 6.2: Screenshot example of the in-game cellphone

During the game sessions, the adolescent received questions and feedback on an in-game cell phone (Figure 6.2). These questions and feedback were based on the I-Change Model (De Vries et al., 2003), an integrated model based on theories such as the Attitude-Social influence-self-Efficacy (ASE) Model (De Vries & Mudde, 1998), the Theory of Reasoned Action (TRA) (Fishbein, 1979), the Theory of Planned Behavior (TPB) (Ajzen, 1991), the Social Cognitive Theory (SCT) (Bandura, 1986), the Health Believe Model (HBM) (Janz & Becker, 1984), the Precaution Adoption Model (Weinstein, 1988), and the Transtheoretical Model (TTM) (Proschaska et al., 1993). The I-Change model attempts to explain motivational and behavioral change and has been successfully used to design and evaluate health interventions previously (Elfeddali et al., 2012; Schulz et al., 2014; Stanczyk et al., 2014). The questions and CT feedback were based on the relevant concepts of the I-Change model (attitude, modeling, social norm, perceived pressure, and self-efficacy). Within the game, this was operationalized by presenting the in-game cell phone twice during every game session. The first presentation during the first game session, the adolescents were asked questions about their attitude towards binge drinking and received immediate feedback to change attitude towards a more negative attitude. The first time the in-game cell phone was presented in the second scenario, questions about modeling of alcohol use and binge drinking were asked (i.e., who of the family and friends engage in binge drinking), and feedback was provided to help the adolescents to choose the right role models. The first time the cell phone was presented in the third scenario, questions concerning the social norm (i.e., if parents and friends approve of drinking) and perceived pressure (i.e., whether the adolescents perceives pressure to binge drink from family or friends) were posed and the feedback

messages tried to encourage adolescents to persist that pressure. The second time the cell phone was presented during each scenario questions about situation specific self-efficacy were posed (hence, in the bar scenario adolescents were asked how difficult it is for them not to binge drink in a bar). Feedback was provided to enhance self-efficacy and the adolescent was provided with action plans that he or she could use in the particular situation. We decided on this sequence based on the  $\emptyset$  pattern (De Vries & Backbier, 1994) which describes that people shift towards behavior change through first developing a favorable attitude, experiencing positive social influences, and finally developing high self-efficacy towards the behavior.

The content and methods used in the feedback messages varied depending on the message, but usually, the answer of the respondent was repeated to enhance self-monitoring, correct assumptions were confirmed with positive feedback, and wrong assumptions were corrected with new information. All messages had a personal tone to show sympathy and to enhance commitment (Dijkstra & De Vries, 1999). For example, the attitude questions assessed the pros (e.g., “Binge drinking helps me relax and connect easily with other people.”) and cons (e.g., “Binge drinking makes me feel like I am losing control.”) of binge drinking. The adolescent immediately receives feedback on his or her overall attitude and for every pro and con specifically. In these feedback messages the focus is on providing the participant with general (e.g., “alcohol inhibits your brains natural inhibition system”) and personal (e.g., “You might say or do things that you regret later”) consequences of alcohol in order to change attitude in a more negative fashion. For more information about the content of the feedback messages we refer to our study protocol (Jander, Crutzen, Mercken, & de Vries, 2014). Adolescents received two reminder e-mails to finish the game sessions if they did not do so at school, the first after one week and the second after two weeks. A week after the third game session, the adolescents were invited to revisit the intervention and received two reminder e-mails, the first after one week and the second after two weeks if they did not return. In this fourth session, which was not part of the game, alcohol use during the last week was assessed and the adolescents were provided with feedback about their use compared to Dutch drinking guidelines. Following this, the adolescents were asked if they had an event in the upcoming 30 days (such as a party, wedding, etc.) where they usually drink four (for girls), five (for boys), or more glasses of alcohol on such an occasion. If they responded positively, they were asked if they wanted to challenge themselves to drink less than they usually would. If again they responded positively, they were asked to indicate the date of the event and how many glasses they wanted to drink at most. They could then make their own action plans how to achieve their goal, or they could indicate from a list of action plans which one they would most likely follow to achieve their goal. If adolescents indicated that they had no event in the upcoming 30 days, or that they did not wish to participate in the challenge, they only received an advice how action plans

could help them in the future to prevent binge drinking if they wish to do so. At the end of the fourth session all adolescents were provided with the feedback they received during the game in order to booster their memory. One day before the drinking event they were reminded by e-mail that they accepted a challenge to drink less alcohol than they usually would for the event the next day. Two days after the event they were again invited to come back to the Web site to indicate if they met their goal. Reminder e-mails were sent after one and two weeks if they did not return. If they indicated they had been drinking more than they had planned, they received feedback on how to do better next time and were then given the opportunity to repeat the challenge. If they indicated that they had not exceeded their drinking maximum, they received congratulations and the intervention was over. For a detailed description of the development and the content of the intervention, we refer to the study protocol of this study (Jander et al., 2014).

After four months, the adolescents in both conditions responded to the online follow-up questionnaire in school. If they did not finish the follow-up assessment at school, they received two reminders to do so, one and two weeks after the official deadline for the schools.

### **Parental Component**

In order to involve parents into the intervention, a separate component for parents was added to the intervention. During the development, a convenience sample of 14 parents provided us with feedback on the layout, usability, and content of the parental component. At baseline, adolescents in the experimental condition were asked to enter the e-mail address of one of their parents. Parents then received an e-mail inviting them to a separate Web site, where parents responded to a short questionnaire and could also receive computer-tailored feedback on how to set appropriate rules concerning alcohol use and how to communicate with the child about alcohol use. If the adolescent did not know the e-mail address of the parent, or did not wish to send an e-mail to the parent they could refuse to do so. They were informed that the letter they received for their parents contained all the information about the parental component and an instruction how to participate. A detailed description of the parental component can be found in the study protocol (Jander et al., 2014).

### **Measures**

#### *Demographics*

At baseline we assessed gender (0=female, 1=male); age (in years); educational level (1=higher secondary education, 0=lower secondary education and vocational training); religion (Catholic, Protestant, Muslim, other religion, no religion); and ethnicity (Dutch,

Antilles, Belgium, German, Suriname, Moroccan, Turkish, other, later dichotomized into 0=non-Dutch, 1=Dutch).

*Binge drinking, excessive drinking, weekly consumption*

We assessed different forms of alcohol use at baseline and at four-month follow-up. We assessed binge drinking, the primary outcome, with an open-ended question (“How often did you drink 4 (for girls) /5 (for boys) or more glasses of alcohol on one occasion in the previous 30 days?”) (Wechsler, 1995). Binge drinking was later dichotomized (0=reported no binge drinking, 1=reported binge drinking). Furthermore, we assessed alcohol use in the previous week with two questions. “On which days during the past week did you drink alcohol?” (Monday to Sunday, I haven’t drank in the past week, I never drink any alcohol). If they indicated that they drank at least one day during the past week, they were asked how many glasses of alcohol they drank on each of the drinking days. Weekly consumption was calculated by counting the total number of glasses they drank in the past week (Lemmens et al., 1992). Finally, someone was characterized as an excessive drinker if they had at least one drinking occasion with 10 or more glasses of alcohol (Best et al., 2006) during the previous week. Weekly consumption and excessive drinking were considered as secondary outcomes (Jander et al., 2014).

*I-Change concepts (attitude, modeling, social norm, perceived pressure, self-efficacy)*

For a description on how these concepts were assessed we refer to the study protocol (Jander et al., 2014). Reliability and validity information about these concepts are presented in table 6.1. The eigenvalue presents an estimate of the explained variance and should be at least >1 (Kaiser, 1960). The McDonald’s hierarchical omega is an estimator for factor saturation regarding the general factor; the value is a less biased alternative to Cronbach’s Alpha (Dunn, Baguley, & Brunnsden, 2014). Both indices support comprehensive assessment of questionnaire quality (Peters, 2014).

**Table 6.1:** Eigenvalues and omega of the I-Change concepts

Scale	Eigenvalue	Omega	Alpha
Pros	3.09	0.87	0.90
Cons	2.55	0.78	0.81
Modeling Alcohol Use	2.75	0.68	0.74
Modeling Binge drinking	2.67	0.46	0.72
Social Norm	4.37	0.83	0.92
Perceived Pressure	4.69	0.85	0.94
Self-efficacy	6.41	0.81	0.94

*Adherence*

Adherence was assessed by counting the numbers of intervention sessions (not the baseline assessment or follow-up assessment) in which the adolescent participated ranging from 0 (did not participate in a single intervention session) to 5 (participated in all five intervention sessions).

**Power analyses**

The primary outcome was the difference in binge drinking occasions in the preceding 30 days in the experimental group compared with the control group. Based on prevalence data from the time the study was designed, we aimed at reducing reported binge drinking occasions from 70% to 60% in the previous 30 days. We used the Optimal Design Plus Empirical Evidence (Version 3.0) program (Spybrook et al., 2011). Since adolescents were nested in schools, a CRTIC was needed. Using a conservative approach with an estimated ICC of 0.02, power of .80, significance level of 0.05, with approximately 100 students participating per school and considering drop-out of 50% of adolescents at primary follow-up, the program indicated that 30 schools should be included. In order to correct for unequal numbers of students per school we added 14% schools (Candel & Van Breukelen, 2010) and aimed to include 34 schools at baseline.

**Statistical analyses**

This study constituted a design with three levels: repeated measurements, nested within adolescents, nested within schools. The data were analyzed using IBM SPSS 20. Descriptive statistics were used to describe the characteristics of the baseline sample. Differences between the conditions in the baseline sample were assessed using t-tests for continuous variables and chi-square tests for discrete variables. Chi-square tests and t-tests were further used to describe differences between completers and participants who did not return to the follow-up assessment after four months.

To determine the effectiveness of the program we analyzed the data with a logistic regression mixed models analysis for the outcome binge drinking and excessive drinking and a linear regression mixed models analysis for the outcome weekly consumption. These models allow for dependencies among observations obtained for pupils within a school. These analysis models also allow for data missing at random, which is less strict than the requirement of data missing completely at random (Molenberghs & Kenward, 2007). The variables, condition, gender, age, educational level, religion, ethnicity, parental participation, as well as the interaction effects between condition and gender, age, and educational level were entered as covariates into the analyses.

The associations between potential participant characteristics (gender, age, educational level, religion, ethnicity, and binge drinking at baseline) and adherence (i.e., the number of intervention sessions the participant passed through) to the intervention were analyzed using a linear regression model.

Main effects were considered significant if  $P \leq .05$ . Interaction effects were considered significant if  $P \leq .10$ .

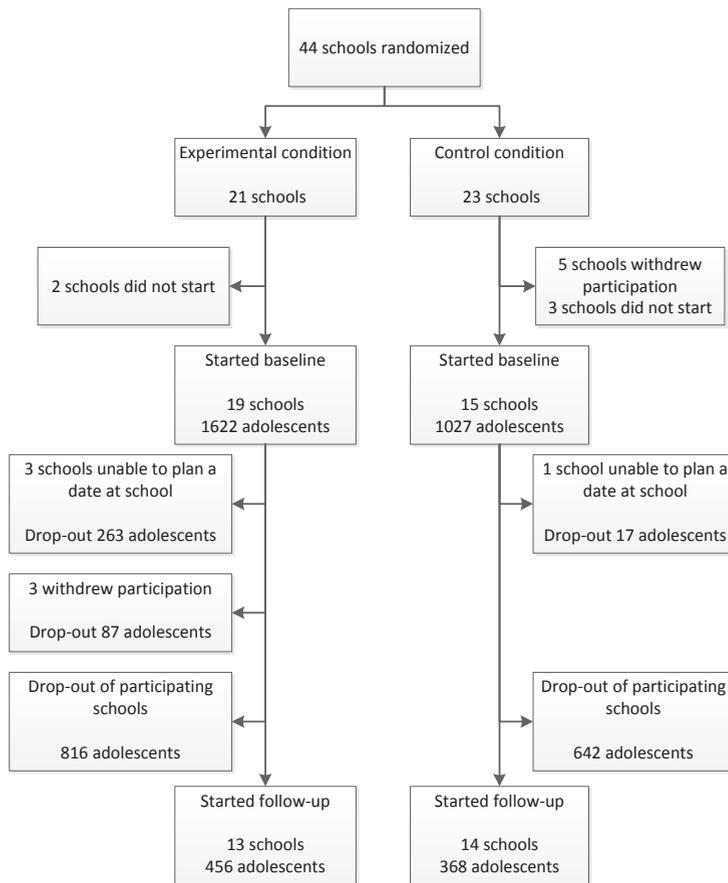
### **Ethics committee approval**

This trial has been reviewed by the Medical Ethics Committee of Atrium Orbis Zuyd, and was classified as research that does not fall under the Medical Research Involving Human Subjects ACT (WMO) and needed no further approval (METC number: 12-N-104).

## **Results**

### **Participation and attrition**

Figure 6.3 depicts a flowchart of the participating schools. In total, 44 schools were randomized into the experimental or control condition. Five schools of the control condition withdrew their participation before the baseline assessment started (two of secondary higher education, one of secondary lower education, one lower vocational training, one secondary education mixed). Three schools in the control condition (all secondary higher education) and two schools in the experimental condition (one lower vocational education, one higher secondary education) did not start with the baseline assessment and did not respond to our phone calls and e-mails. Most schools that dropped-out before the intervention started indicated that they had logistical problems; for example, they had no computer room available to provide every adolescent with his or her own computer. Another school decided after randomization that the topic was too sensitive, and they did not want to do that at school. In total, 2649 adolescents from 34 schools participated in the baseline questionnaire. The adolescents in the two conditions significantly differed from each other in various characteristics. Participants in the experimental condition were significantly younger, consisted of more females, had a higher educational level, more often indicated to be religious and consisted of more participants who never drink, were less often binge and excessive drinkers, and had a lower weekly consumption than participants in the control condition (Table 6.2). Even though 27 schools participated in the four-month follow-up questionnaire, only 824 adolescents (response rate 31.1%) did so. Schools that withdrew participation at the follow-up assessment either reported trouble with finding a date, due to the final exams of the classes, or indicated that the adolescents were not keen to continue with the



**Figure 6.3:** Flowchart of the drop-out of schools

intervention and it was thus decided to stop participation. Drop-out analyses revealed that adolescents returning to the follow-up questionnaire were significantly younger, more often female, had a higher educational level, were more likely to be religious, were more often Dutch, were less likely to be excessive drinkers, less likely to be binge drinkers, and had a lower weekly consumption (Table 6.3).

### Binge drinking

Descriptive analyses showed that at the baseline assessment 758 (46.8%) adolescents in the experimental and 585 (57.0%) adolescents in the control condition reported binge drinking in the previous 30 days. At the follow-up assessment 194 (42.6%) adolescents in the experimental condition and 184 (50%) adolescents in the control condition reported binge drinking in the previous 30 days. Tests whether the returning sample differed

**Table 6.2:** Baseline characteristics and differences at baseline

Variable	Total	Experimental	Control	Baseline difference	P
	N=2649	N=1622	N=1027		
<b>Age (15-19) (mean, SD) (m 16)</b>	16.3 (1.2)	16.0 (1.2)	16.7 (1.2)	t (15.01)	<.001
<b>Gender (m 11)</b>				$\chi^2$ (38.63)	<.001
Male	1395 (52.7%)	766 (47.5%)	629 (61.4%)		
Female	1243 (46.9%)	847 (52.5%)	396 (38.6%)		
<b>Educational level (m 11)</b>				$\chi^2$ (92.58)	<.001
High	1546 (58%)	1056 (65.5%)	490 (47.8%)		
Low	1092 (41%)	557 (34.5%)	535 (52.8%)		
<b>Religion (m 17)</b>				$\chi^2$ (33.23)	<.001
Catholic	610 (23.0%)	407 (25.3%)	203 (19.9%)		
Protestant	180 (6.8%)	133 (8.3%)	47 (4.6%)		
Muslim	165 (6.2%)	82 (5.1%)	83 (8.1%)		
Other	131 (4.9%)	81 (5.0%)	50 (4.9%)		
No religion	1546 (58.4%)	907 (56.3%)	639 (62.5%)		
<b>Ethnicity (m 0)</b>				$\chi^2$ (1.74)	.19
Dutch	2326 (87.8%)	1434 (88.4%)	892 (86.9%)		
Non-Dutch	323 (12.2%)	188 (11.6%)	135 (13.1%)		
<b>Alcohol use</b>					
Never (m 0)	710 (26.8%)	491 (30.3%)	219 (21.3%)	$\chi^2$ (25.36)	<.001
Binge drinking (m 3)	1343 (50.7%)	758 (46.8%)	585 (57.0%)	$\chi^2$ (26.25)	<.001
Excessive drinking (m 18)	245 (9.2%)	116 (7.2%)	129 (12.6%)	$\chi^2$ (21.53)	<.001
Weekly consumption (mean, SD) (m 18)	4 (9.4)	3.4 (8.9)	5.1 (9.9)	t (4.57)	<.001
<b>Parental participation</b>					
Invited by adolescent		199			
Start		91 (45.7%)			
End		76 (83.5%)			

(m X): missing values per variable

**Table 6.3:** Differences of adolescents that returned or dropped-out at follow-up

Variable	Total	Returned	Dropped out	Drop-out difference	P
	N=2649	N=824	N=1825		
<b>Age (15-19) (mean, SD) (m 16)</b>	16.3 (1.2)	16.2 (1.2)	16.4 (1.3)	t (-3.87)	<.001
<b>Gender (m 11)</b>				$\chi^2$ (20.83)	<.001
Male	1395 (52.7%)	381 (46.3%)	1014 (55.9%)		
Female	1243 (46.9%)	442 (53.7%)	801 (44.1%)		
<b>Educational level (m 11)</b>				$\chi^2$ (68.04)	<.001
High	1546 (58%)	579 (70.4%)	967 (53.3%)		
Low	1092 (41%)	244 (29.6%)	848 (46.7%)		
<b>Religion (m 17)</b>				$\chi^2$ (9.55)	.049
Catholic	610 (23.0%)	208 (25.3%)	402 (22.2%)		
Protestant	180 (6.8%)	46 (5.6%)	134 (7.4%)		
Muslim	165 (6.2%)	46 (5.6%)	119 (6.6%)		
Other	131 (4.9%)	31 (3.8%)	100 (5.5%)		
No religion	1546 (58.4%)	490 (59.7%)	1056 (58.3%)		
<b>Ethnicity (m 0)</b>				$\chi^2$ (10.77)	.001
Dutch	2326 (87.8%)	749 (90.9%)	1577 (86.4%)		
Non-Dutch	323 (12.2%)	75 (9.1%)	248 (13.6%)		
<b>Alcohol use</b>					
Never (m 0)	710 (26.8%)	229 (27.8%)	481 (26.4%)	$\chi^2$ (0.56)	.46
Binge drinking (m 3)	1343 (50.7%)	370 (44.8%)	973 (53.4%)	$\chi^2$ (16.74)	<.001
Excessive drinking (m 18)	245 (9.2%)	50 (6.1%)	195 (10.8%)	$\chi^2$ (14.67)	<.001
Weekly consumption (mean, SD) (m 18)	4 (9.4)	2.8 (6.5)	4.6 (10.4)	t (-5.51)	<.001

(m X): missing values per variable

on baseline drinking characteristics, revealed no differences on any of the drinking measures. They did not differ on being a drinker: control  $N=274$  (74%), experimental  $N=322$  (70%);  $\chi^2(1.35) P=.25$ ; not on binge drinking: control  $N=167$  (45%), experimental  $N=203$  (44%);  $\chi^2(0.45) P=.83$ ; not on excessive drinking: control  $N=28$  (7.6%), experimental  $N=22$  (4.8%);  $\chi^2(2.75) P=.10$ ; and not on weekly consumption: control mean=3.2 (SD=6.9), experimental mean=2.4 (SD=6.1):  $t(1.62) P=.11$ . There was a significant interaction effect between condition and age ( $P=.08$ ) (Table 6.5). Age groups were analyzed separately, using the pick-a-point approach (Hayes & Matthes, 2009) by centering the age variable for 15-, 16-, 17-, 18-, and 19-year-olds. This way the whole sample could be used to determine whether the intervention was effective for one or more of the age groups. Information about the binge drinking prevalence at baseline and follow-up per age group are available in Table 6.4. Analyses revealed a significant effect of the intervention in 15-year-old adolescents ( $P=.03$ ). Adolescents in the experimental group reported a significant decrease in binge drinking in the previous 30 days four months after the intervention ended compared to adolescents in the control condition. Adolescents in the experimental group aged 16 also engaged less in binge drinking after four months, compared to the control group. This effect was not significant (OR=0.56,  $P=.07$ ) (Table 6.5), but can be considered a small effect (Rosenthal, 1996). Furthermore, although participation of parents was very low (Table 6.2), we see that when parents participated in the intervention, their participating child reported less binge drinking in the previous 30 days ( $P=.04$ ). A higher educational level ( $P<.001$ ); a lower age ( $P<.001$ ); and being Protestant ( $P=.03$ ), Muslim ( $P<.001$ ), or a member of another religion ( $P=.03$ ) (all analyzed in a model without interaction terms) were significant protective determinants of binge drinking (Table 6.5).

**Table 6.4:** Prevalence rates binge drinking per age group

	Experimental condition		Control condition	
	Baseline	Follow-up	baseline	Follow-up
15	222 (32.2%)	51 (28.3%)	54 (31.2%)	35 (32.7%)
16	255 (53.3%)	71 (45.8%)	153 (50.5%)	57 (44.5%)
17	146 (59.3%)	40 (63.5%)	200 (69.4%)	52 (68.4%)
18	81 (72.3%)	11 (50%)	111 (77.6%)	20 (76.9%)
19	53 (64.6%)	19 (59.4%)	67 (57.3%)	20 (66.7%)
total	757 (47.1%)	192 (42.5%)	585 (57.1%)	184 (50.1%)

### Excessive drinking

At the baseline assessment 116 (7.2%) adolescents in the experimental condition and 129 (12.6%) adolescents in the control condition engaged in excessive drinking. At the follow-up assessment 28 (6.1%) adolescents in the experimental and 37 (10.2%) adolescents in the control condition reported excessive drinking. There was a significant

interaction effect between condition and educational level ( $P=.08$ ). Further analyses revealed, however, no significant subgroup effects for either higher or lower educated adolescents (Table 6.5). Protective determinants of excessive drinking were: being female ( $P<.001$ ), a higher educational level ( $P=.01$ ), and being younger ( $P<.001$ ).

### Weekly consumption

At baseline, adolescents in the experimental condition drank a mean of 3.4 (SD=8.9) standard glasses of alcohol in the previous week. Adolescents in the control condition drank a mean of 5.1 (SD=9.9) standard glasses of alcohol in the previous week. At the follow-up assessment adolescents in the experimental condition reported a mean consumption of 3.3 (SD=7.7) and adolescents in the control condition reported a mean consumption of 4.6 (SD=8.9) standard glasses of alcohol during the previous

**Table 6.5:** Effects of the intervention on binge drinking, excessive drinking and weekly consumption in the complete model

	Binge drinking			Excessive drinking			Weekly consumption		
	OR	P	95% CI	OR	P	95% CI	B	SE	P
Condition (control)	0.40	.01	0.18–0.83	0.48	.13	0.18–1.25	1.82	1.39	.19
Gender (male)	1.11	.24	0.93–1.33	3.69	<.001	2.74–4.97	-2.64	0.36	<.001
Parental participation (yes)	0.60	.04	0.37–0.97	0.78	.61	0.30–2.04	0.83	0.95	.38
Educational level (high)	0.54	<.001	0.38–0.76	0.57	.01	0.37–0.89	2.14	0.71	.002
Age	0.74	<.001	0.68–0.82	0.70	<.001	0.62–0.78	1.30	0.18	<.001
Religion (no religion)									
Catholic	0.99	.91	0.80–1.23	0.92	.58	0.69–1.23	-0.03	0.44	.95
Protestant	1.56	.02	1.08–2.25	1.95	.04	1.05–3.64	-1.06	0.73	.15
Muslim	6.59	<.001	4.00–10.88	1.94	.08	0.93–4.05	-1.26	0.86	.14
Other	1.57	.03	1.05–2.36	1.82	.07	0.95–3.48	-0.88	0.81	.28
Ethnicity (Dutch)	1.22	.25	0.88–1.71	1.50	.10	0.90–2.50	-0.47	0.65	.47
Interaction effects									
Condition*	1.12	.55	0.77–1.62	0.60	.11	0.31–1.13	-1.00	0.74	.17
Gender									
Condition*	1.13	.75	0.54–2.34	2.15	.08	0.91–5.10	-1.96	1.49	.19
Educational level									
Condition*	1.19	.08	0.98–1.43	1.17	.21	0.92–1.48	-0.32	0.37	.39
Age									
Age 15 (control)	0.47	.03	0.24–0.91						
Age 16 (control)	0.56	.07	0.30–1.05						
Age 17 (control)	0.66	.22	0.34–1.28						
Age 18 (control)	0.79	.52	0.38–1.63						
Age 19 (control)	0.93	.87	0.40–2.17						
High educational level				1.48	.57	0.38-5.74			
Low educational level				0.46	.19	0.14-1.49			

Reference category of categorical variables is indicated between the brackets.

week. Although the effects were in the expected direction, no significant effects of the intervention were found for weekly consumption. The analysis only revealed that being female ( $P<.001$ ), having a higher educational level ( $P=.002$ ), and being younger ( $P<.001$ ) (all analyzed in a model without interaction terms) were significant determinants with a protective effect on weekly consumption (Table 6.5).

## Adherence

After the baseline assessment, adolescents in the intervention condition were supposed to start with the first game session. Of 1622 adolescents who were randomized into the experimental condition, only 1097 (67.6%) started with the first game session. Only 467 adolescents (28.8%) returned to the second and only 347 (21.4%) adolescents to the third game session. Just 27 (1.7%) adolescents returned to the fourth session at home, and no one participated in the fifth home session.

Subsequently, to investigate the effects of adherence we decided to rerun the analyses with the subsample of the group that completed the different game sessions. We made three groups: The first group consisted of all adolescents who followed the first game session, the second group consisted of adolescents who also followed the second game session, and the third group did all three game sessions. Descriptive analyses of prevalence of binge drinking per age group, per adherence group can be found in the appendix 2 (Table 1). The effects for binge drinking are summarized in Table 6.6.

**Table 6.6:** results for binge drinking for adolescents that participated in at least one, two or all three game sessions

	At least one session N=1097			At least two sessions N=467			All three sessions N=347		
	OR	P	95% CI	OR	P	95% CI	OR	P	95% CI
Condition (control)	0.31	.003	0.14-0.66	0.14	<.001	0.05-0.37	0.13	<.001	0.04-0.37
Condition*Age	1.34	.007	1.09-1.65	1.77	<.001	1.31-2.40	1.72	.002	1.23-2.40
15	0.41	.01	0.21-0.81	0.24	.001	0.11-0.57	0.22	.001	0.09-0.54
16	0.55	.07	0.29-1.04	0.43	.04	0.20-0.95	0.37	.02	0.16-0.87
17	0.74	.38	0.38-1.45	0.77	.54	0.33-1.78	0.64	.34	0.26-1.60
18	0.99	.98	0.46-2.12	1.36	.54	0.50-3.67	1.10	.86	0.37-3.27
19	1.33	.53	0.54-3.25	2.41	.15	0.73-8.02	1.89	.35	0.50-7.10

Reference category of categorical variables is indicated between the brackets.

Again, we found a significant interaction effect with age for all three groups ( $P=.007$  for adolescents that participated in at least one session;  $P<.001$  for adolescents that participated in at least two sessions;  $P=.002$  for adolescents that engaged in at least three sessions). When engaging in at least one session, 15-year-old adolescents were already benefitting from the intervention ( $P=.01$ ). The effect sizes increased when 15-year-olds adhered longer to the intervention (OR=2.42 after one session, OR=4.10

after two sessions and  $OR=4.60$  after three sessions). A similar pattern can be found in 16-year-old adolescents. There was a significant effect of the intervention after two sessions ( $OR=2.31$ ,  $P=.04$ ) which became stronger after three sessions ( $OR=2.68$ ,  $P=.02$ ). There was no such effect for older adolescents. The analyses for excessive drinking revealed a significant interaction effect between condition and educational level ( $OR=0.42$ ,  $P=.05$ ,  $CI=0.16-1.02$ ) for adolescents that adhered to at least one session. However, the subgroup effects for higher ( $OR=1.15$ ,  $P=.85$ ,  $CI=0.28-4.64$ ) and lower ( $OR=2.19$ ,  $P=.92$ ,  $CI=0.51-9.39$ ) educated adolescents were both not significant. Weekly consumption revealed a similar result with a significant interaction effect with educational level ( $\beta=-0.215$ ,  $P=.09$ ,  $SE=1.27$ ) for adolescents that followed at least one session, but only small and non-significant subgroup effects for higher ( $\beta=-0.19$ ,  $P=.84$ ,  $SE=0.94$ ) and lower ( $\beta=0.17$ ,  $P=.95$ ,  $SE=2.68$ ) educated adolescents. Furthermore, there was a significant interaction effect between condition and age on weekly consumption for adolescents that followed at least two sessions ( $\beta=-0.99$ ,  $P=.05$ ,  $SE=0.52$ ) and for those who followed at least three sessions ( $\beta=-1.03$ ,  $P=.08$ ,  $SE=0.59$ ); however, even though the effects were more positive for the younger age groups, no effect reached a significant level. Finally, significant predictors of adherence were: being Protestant, being female, being younger having a higher educational background, and being a non-binge drinker (Table 6.7).

**Table 6.7:** Predictors of adherence (number of sessions completed by the adolescents)

	$\beta$	S.E.	P
Catholic	0.039	0.049	.052
Protestant	0.097	0.08	<.001
Muslim	-0.049	0.100	.03
Other religion	-0.010	0.095	.62
Gender (female)	-0.046	0.040	.02
Age	-0.138	0.018	<.001
Nationality (not Dutch)	0.023	0.075	.33
Educational level (lower)	0.088	0.044	<.001
Binge drinking (not binge drinking)	-0.066	0.042	.001

Religion was entered as dummy variables (Catholic, Protestant, Muslim, other religion)

Reference category of categorical variables is indicated between the brackets.

## Discussion

In this study, a Web-based CT intervention to reduce binge drinking in 15- to 19-year-old adolescents was tested using a cluster randomized controlled trial. An overall effect of the intervention on binge drinking behavior was not found, but the intervention was effective in reducing binge drinking in 15- and 16-year-old adolescents. No additional effects were found for the secondary outcomes, excessive drinking and week consumption.

That interventions to reduce alcohol use in adolescents are more effective in younger adolescents is in line with previous work (Perry et al., 2002). Our effect sizes suggest that the intervention effect increased when adolescents adhered more to the intervention. This effect was only visible in 15- and 16-year-old adolescents. A reason why the intervention was more successful in younger adolescents could be that younger adolescents tend to be more susceptible to peer influences than older adolescents (Crockett & Petersen, 1993). Particularly in the second and third game session, we focused on social influences, like modeling, social norm, and perceived pressure to drink from family and friends. Younger adolescents may have benefitted more from this than older adolescents. Analysis of the determinants of adherence did furthermore indicate that adolescents who adhered to the intervention were significantly younger in comparison with those who stopped prematurely. If an intervention is not used the way it is supposed to be used, its impact on health and behavior will be very limited and the public health impact probably weakened (Eysenbach, 2005). The high drop-out rate of older adolescents could explain why no effect was detected in their age group. Most adolescents initiate alcohol use between the ages of 11 to 15. The mean age for Dutch adolescents to first try alcohol is 13 years; the mean age for starting to drink alcohol on a weekly basis is 15 years (Verdurmen et al., 2011). A possibility is consequently, that older adolescents may already have developed a kind of habit of engaging in binge drinking and other change methods more focused on changing habits, such as counter-conditioning or stimulus control (Bartholomew et al., 2011) are needed. This might also mean that the real effect of the intervention might be getting stronger after a longer time period as the younger adolescents might not develop such strong habits in the next two years. Another possibility why older adolescents tended to drop-out more could be that the game was not as appealing to those adolescents as it was to younger adolescents. Qualitative process evaluations could give more insights into what adolescents liked, and what they did not like, and thereby provide future interventions with valuable input.

Adherence rates generally were low. There was a clear drop in participation between the baseline assessment and the first game session and another significant drop between the first and second game sessions. The analyses of adherence indicated that females, Protestants, younger adolescents, and non-binge drinkers adhered better to the intervention. Particularly the last finding is not atypical in health promotion. In an intervention targeting multiple lifestyle behaviors (including alcohol use), people who adhered more to the program were also adhering more to the national health guidelines (Schulz et al., 2012). In other words, people who already behaved in a more unhealthy way dropped out earlier in the program. Another study found that people with an unhealthy lifestyle were more likely to visit a health intervention Web site but that people with a healthier lifestyle were more likely to complete the health intervention (Schneider, van Osch, Schulz, Kremers, & de Vries, 2012). Yet, as health

promotion programs are particularly important for groups that do not already have a healthy lifestyle, further research is definitely needed to identify how to better involve binge drinking adolescents. Perhaps more attention needs to be directed towards pre-motivational determinants such as knowledge, cues to action, and risk perception (De Vries et al., 2008; De Vries et al., 2003). Starting an intervention with the focus on these factors and raising awareness that there is a problem with binge drinking, might increase adolescents willingness to reconsider and change their behavior (Prochaska, Redding, & Evers, 2008).

In our intervention we tried to motivate adolescents to adhere to the intervention by designing a serious game that carried computer-tailored advice. Although we did not test the specific effect of the game on motivation (e.g., by comparing it to a non-game intervention), adherence rates were far from optimal. A possible explanation might be that alcohol use is very common among Dutch adolescents (De Looze et al., 2014; Jander et al., 2013; Verdurmen et al., 2011), and adolescents probably do not feel disturbing negative consequences of alcohol yet. They rather experience the positive aspects that come with alcohol use, such as facilitating social interaction, and they might not want to change their alcohol use (Kuntsche et al., 2005). Furthermore, as participation was voluntary, adolescents were aware that they could stop participation at any point, without having to indicate the reasons why. This could have caused adolescents to drop out of the intervention prematurely and is a consequence of the low threshold to participate in Web-based interventions (i.e., it is as easy to start participating but also easy to stop participating).

Another point was that whole schools dropped-out before and during the intervention. The differences in characteristics of adolescents who did not return to the follow-up assessment compared to those who did return (adolescents who dropped out were older, male, and had a lower educational background were less likely to be religious, were more often non-Dutch, were more likely to be binge drinkers, excessive drinkers, and had a higher weekly consumption) can partly be explained by the drop-out of the whole school. Furthermore, comparable characteristics of people who dropped out of the follow-up assessment have been reported in other studies as well (Elfeddali et al., 2012; Schulz et al., 2013; Schulz et al., 2014).

High drop-out rates in Web-based interventions is not uncommon (De Vries et al., 2012; Kohl et al., 2013); therefore, a 50% drop-out rate was taken into account in the power calculation. However, drop-out rates at follow-up were higher than the expected 50%, which could also result in too little power of the analyses to detect possible effects of this intervention (Eysenbach, 2005). Although we sent reminder e-mails to remind adolescents to return to the intervention Web site, there might be possibilities

to increase revisiting numbers. Newer research is focusing on the content and timing (Schneider, de Vries, Candel, van de Kar, & van Osch, 2013) of those reminders and how other prompts such as a text message to a cellphone can remind participants to revisit the intervention Web site (Cremers et al., 2014).

Also important is our finding that parental participation in the parental component was associated with significantly lower rates of binge drinking among adolescents, which might be an indication that the parental component was an important addition to the intervention. However, due to methodological choices in parent recruitment (i.e., adolescents invited their parents to participate) those data are observational rather than experimental and strong claims about the effect cannot be made. It is possible that other factors such as family attachment influenced the positive results. The low participation of parents, however, is notable. On the one hand, just a small proportion of adolescents actually invited their parents to take part in the intervention. That could be an indication that adolescents do not feel the need or do not want to talk about the subject with their parents. On the other hand, of the 199 adolescents who invited their parents, which most likely already is a very selective group of adolescents, only 91 parents actually visited the Web site. Other studies that focused on parent-child communication about risky sexual behavior also reported low attendance rates of parents (Anderson et al., 1999; DiIorio, McCarty, Resnicow, Lehr, & Denzmore, 2007). Generally, interest in Internet-delivered interventions has been shown to be quite low (Bennett & Glasgow, 2009; Kohl et al., 2013). It could also indicate that parents may not feel involved in the alcohol use of their child. This has also come to surface in focus group interviews held with adolescents and parents (Jander et al., 2013), where parents indicated that they stopped talking with their child about alcohol and stopped setting rules when they turned 16. Even after the change in law, there seems to be no immediate change in this parental behavior.

### **Strength and limitations**

A strength of this study is that it is theory-based and was preceded by extensive qualitative and quantitative research. Furthermore, the target group was included and consulted during the whole development process (Jander et al., 2013). However, despite all these efforts to make the intervention as interesting and appealing to the target group as possible, the drop-out rates were very high, which made it very difficult to reveal effects of the intervention. Further, although some significant effects on behavior were found, these effects have to be interpreted with caution because of the drop-out.

In this study, only relatively short-term outcomes of the intervention were assessed. It is advisable to add more long-term assessments to evaluate what the true effects are after twelve or 24 months, or even after a longer time period.

Another limitation is that all outcome measures were based on self-reports, which is more likely to result in greater underestimation of alcohol use compared to daily diaries (Sobell, Cellucci, Nirenberg, & Sobell, 1982). This underestimation is probably mostly caused by forgetting (Lemmens et al., 1992). However, we tried to keep self-reports as accurate as possible, for example, by asking for alcohol use in the previous week and not in a typical week. Furthermore, as the groups were randomized, this underestimation is probably equally distributed among the intervention and control groups and therefore does not influence the overall results of the study.

Finally, adolescents from the experimental and control condition differed on alcohol use (i.e., binge drinking, excessive drinking, and weekly consumption) as well as on several baseline characteristics (i.e., gender, age, educational background, religion) which was probably caused by the relatively high drop-out of schools in the control condition after randomization (five schools withdrew participation before the baseline assessment). There were no differences on baseline drinking measures for the returning sample, but in order to control for the baseline differences of the whole sample they were added in the analyses as covariates.

## **Conclusion**

Computer-tailored feedback can be an effective way to reduce binge drinking in 15- and 16-year-old adolescents. Also, participation of parents in those interventions may be beneficial and more research is needed to increase parental involvement. Further research is needed to increase adherence to eHealth interventions, to implement these interventions in practice, and thereby to increase effectiveness and public health impact.

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# Chapter 7

## General Discussion

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## Aim of this dissertation

The aim of this dissertation was to develop and evaluate an intervention to reduce binge drinking in 16- to 18-year-old adolescents. Almost 80% of all 16-year-old adolescents who reported drinking alcohol in the previous month also reported binge drinking in the same time frame (De Looze et al., 2014). Furthermore, this target group was legally allowed to buy and consume low-strength alcoholic beverages such as beer and wine (Government, 2014), but was still not considered adult (until the age of 18). This legal situation changed during the period of conducting the project described in this dissertation. Therefore, the implications of this change in law for this dissertation will be discussed first. Subsequently, the main findings and implications of the studies preceding the development of the intervention will be described, followed by the evaluation of the intervention itself. This part will be followed by a discussion about the main problems encountered during the evaluation study and suggestions for future research and practice. This discussion will end with a general conclusion.

## Change in law

As of January 1, 2014, the legal situation in the Netherlands regarding alcohol sales to minors changed (Government, 2014). Before this date, adolescents aged 16 were allowed to buy low-strength alcoholic beverages like beer and wine (with alcohol by volume  $\leq 15\%$ ), and all other alcoholic beverages could be purchased at the age of 18. With the new law, adolescents under the age of 18 are not allowed to buy or consume any kind of alcoholic beverage in public places. This change in law brought with it some implications for the development, design, and setting of the evaluation study (Chapter 6) described in this dissertation.

The most important and most influential change that had to be made was an adaption in the trial design. The intervention was implemented in schools and originally, the baseline assessment was planned in October 2013 and the follow-up assessment six months later in April 2014. Schools that would have been randomized into the experimental condition would have received the intervention immediately after the baseline assessment, and schools in the control condition would have received access to the game immediately after the follow-up assessment in April 2014. In this design, all schools would eventually receive the intervention in their classes. However, in order to avoid the law change (and its potential impact on drinking behavior) taking place between the baseline and follow-up assessments, we delayed the baseline assessment till after the law change was in effect.

In the adapted design, the baseline assessment took place in the period of January-February 2014. Since a six-month follow-up would have fallen in July-August, which is

the middle of the summer vacation period in the Netherlands, the follow-up assessment needed to take place in May-June. Because we were also interested in more long-term effects of the intervention, we added a second follow-up at eight months, directly after the summer vacation. This second follow-up assessment took place outside of school since many of the adolescents by that time would be out of school or not in the same classes anymore. In this adapted design with two follow-ups instead of only one, adolescents in the control condition only got access to the game after the second follow-up that took place outside school. As a consequence, the schools were very aware of their condition. This performance bias, which occurs when participants and study personnel have knowledge of the treatment assignment, is very common in health behavior change trials and very difficult to avoid (De Bruin, McCambridge, & Prins, 2014). The performance bias was more pronounced in the adapted design than in the original design. Even though schools were informed before they enrolled that they would take part in a scientific study and would randomly be assigned to one of two possible conditions, the rate of drop out after randomization of schools in the control condition was higher (eight schools) than in the experimental condition (one school) (Chapter 6). We therefore believe that being in the control condition was a reason for schools to withdraw their participation and resulted in differential attrition.

Furthermore, minor changes in the content of the intervention were needed. The drinking situation in the bar depicted in the game was no longer a legal drinking situation for adolescents younger than 18. However, as many adolescents had been allowed to visit a bar before the change in law, the bar situation was a realistic drinking situation. We therefore kept the bar situation and added remarks in the advice in this situation reminding them that drinking in a bar was no longer legal for them. These were the only changes we made, as drinking at a private party and at home were still legally allowed and probable drinking situations for adolescents. Further, as the law change had just gone into effect, adolescents who were 16 or 17 years old were now in a “blurred” transition period. Many of them had been allowed to drink alcohol before January and were now no longer allowed to. It is likely that the change in law did not immediately lead to a change in drinking culture. The Netherlands long had a very permissive culture when it came to drinking, and many surveys have shown that drinking even before the legal buying age of 16 was very common among Dutch adolescents (De Looze et al., 2014; Van Dorsselaer et al., 2007; Verdurmen et al., 2011). Also, adolescents indicated that they often received their first alcoholic drink from their parents long before they turned 16 (Jander et al., 2013). Thus, although policy measures have been taken to reduce alcohol use among Dutch adolescents, our intervention is still very relevant, as it also focuses on situations that are not affected by the law, such as drinking at home and drinking at a party.

## Main findings

Preceding the actual development of the intervention, formative research was conducted to get more insight into determinants of binge drinking in adolescents, what parents thought about alcohol use and binge drinking, and what agreements they had with their children about alcohol use. Furthermore, experts gave their thoughts about effective strategies to reduce binge drinking in adolescents and how to reduce drop-out in interventions targeting binge drinking. All formative studies were conducted in times when 16-year-old adolescents were allowed to buy and consume low-strength alcoholic beverages.

The most important lessons learned were that adolescents indicated that drinking mostly happened in social situations with family or friends, on the weekend, and often at a party, a bar, or at home. Parents stopped setting rules when the adolescent turned 16, and parents and adolescents did not seem to communicate clearly about alcohol anymore. Further, parents thought they had little or no influence on adolescent alcohol use because the adolescent could legally buy and consume alcohol outside of the awareness of the parent (Chapter 2). Experts indicated that parents still play an important role and that setting rules and engaging in good-quality communication should be encouraged in parents. An intervention for adolescents should be interactive, tailored, and attractive in order to be effective and to retain adolescents in the intervention (Chapter 3).

In the preparatory phase, we also received important input from the adolescents during the focus group interviews concerning an intervention to reduce binge drinking (not published in a separate paper). Adolescents indicated that they would prefer an intervention to be interactive and in the form of a game so that it would be fun to follow. Next to using social media and writing e-mails, gaming was what they often did online. Together with the input from the Delphi study, the conclusion was drawn that the intervention should be presented in the form of a game.

Setting rules indeed turned out to be preventive of adolescent alcohol use. Communication was positively correlated with alcohol use, emphasizing that a high frequency of communicating about alcohol is not sufficient to protect adolescents from drinking (Chapter 4). We therefore focused in our advice for parents on the quality of communication, in line with the advice of the experts. We furthermore provided the parents with feedback on how to set appropriate rules concerning alcohol use. The adolescent intervention focused on the three most important drinking situations identified in the formative research: drinking in a bar, drinking at a party, and drinking at home. According to the wishes of the adolescents and the suggestions of the experts, we developed a tailored game to make the intervention as attractive and interactive as

possible. A detailed description of the development and content of the intervention can be found in Chapter 5.

The results of the intervention suggest that the intervention was more effective when adolescents were younger (Chapter 6). An interaction effect between condition and age was found for binge drinking. Further analyses revealed that the intervention was effective in reducing binge drinking in 15- and 16-year-old adolescents. Secondary analyses were performed on the outcome of excessive drinking (drinking 10 or more glasses of alcohol on one occasion during the last week) and revealed an interaction effect between condition and educational level. Unfortunately, further analyses identified no significant subgroup effect. Weekly consumption was not affected by the intervention. Analyses concerning the effect of adherence to the intervention showed that effect sizes increased the longer adolescents adhered to the intervention, emphasizing the importance of interventions being used as they are supposed to be used in order to maximize effectiveness (Eysenbach, 2005). The parental component also seemed to have a beneficial effect on binge drinking in adolescents. However, there are a few problems that should be considered when interpreting the results of the evaluation study. These limitations and their implications for future research and practice are discussed later.

Preliminary results of the 8-month follow-up assessment (not published yet) showed that only 511 participants (response rate 18%) returned to fill in the questionnaire. No main effects of the intervention were discovered. A significant interaction effect was found between binge drinking and age ( $OR=0.83, p=.046, CI=0.69-1.00$ ), and subgroup analyses showed stronger effects in younger adolescents. The results for 15-year-olds ( $OR=1.62, p=.18, CI=0.80-3.27$ ), for 16-year-olds ( $OR=1.34, p=.39, CI=0.68-2.63$ ), for 17-year-olds ( $OR=1.11, p=.777, CI=0.55-2.22$ ), for 18-year-olds ( $OR=0.91, p=.82, CI=0.42-1.97$ ), and for 19-year-olds ( $OR=0.76, p=.53, CI=0.32-1.81$ ) showed a similar trend as in the four-month follow-up. However, no test of subgroup effects delivered significant results due to lack of power. For excessive drinking a significant interaction effect with educational level was found ( $OR=0.40, p=.055, CI=0.16-1.02$ ), but again, subgroup analyses indicated no significant effects either for adolescents with higher educational background ( $OR=0.47, p=.36, CI=0.09-2.34$ ) or for adolescents with a lower educational background ( $OR=0.90, p=.89, CI=0.20-4.01$ ). No further effects were found.

## Parental influences

One important conclusion that can be drawn based on the studies described in this dissertation is that parents matter when it comes to alcohol use in adolescents. There was a noticeable discrepancy between what parents thought about their influence on adolescent alcohol use and what the Delphi expert study and a quantitative study indicated about parental importance. This dissertation thus shows how important parents are and that they were not aware of how much influence they had on their children's alcohol use. The importance of parents in controlling the alcohol use of their children has also been demonstrated in other studies. These studies provide evidence that parental alcohol use constitutes a risk factor for adolescent alcohol use (Hawkins et al., 1997; Webb, Baer, McLaughlin, McKelvey, & Caid, 1991), but it also showed that parents can have a preventive influence on adolescent alcohol use by setting strict rules (Van der Vorst et al., 2005; Van Der Vorst et al., 2006) and monitoring the friends and whereabouts of the adolescent (Wood et al., 2004). This influence even extends until adolescents enter college (aged 18+) (Turrise et al., 2001a; Turrise et al., 2000). It is therefore very important to inform parents and make them aware of their positive influence on the alcohol use of their adolescent children. They should be encouraged to keep setting rules concerning alcohol use. Parents should also always be included in interventions that target alcohol use in adolescents because their participation seems to be of additional value.

## Problems and limitations

### Drop-out

A first limitation of the evaluation study discussed in this dissertation was the high drop-out. Adolescents, classes, and schools could drop-out during the intervention or at the follow-up assessment. Drop-out during the intervention means participants do not finish receiving the intervention content, and missing parts of an intervention can be influential and threatening for any intervention study. For an intervention to be effective, it must be used the way it was supposed to be used, otherwise the public health impact of the intervention is probably weakened (Eysenbach, 2005; Glasgow et al., 1999). Drop-out at follow-up measurements can have an impact on the evaluation of the effect of the intervention on behavior at a certain point in time after the intervention ends. With a high drop-out rate at the follow-ups, the measurement effects of the intervention on behavior are difficult to determine (Eysenbach, 2005). Thus, although the results of our studies indicate that the intervention had no main effect on any of the alcohol measures but only one significant subgroup effect, it is very likely that the real effectiveness could not be determined due to the rate of drop-out. However, the real effectiveness could mean that there is a main effect or other subgroup effect of the intervention that does

not come to the surface due to the drop-outs, as well as the fact that there might be no effect at all of the intervention but that we cannot state this with certainty due to the drop-outs.

### *Drop-out of adolescents*

The drop-out rate during the intervention was higher than expected, as preventing drop-out was a major focus during the formative research and development process of the intervention. The target group was involved in the development process to judge all intervention materials (e.g., name, look and feel, message style) and provided feedback that was used to improve the materials. A game was developed from scratch to serve as a delivery vehicle and to make the computer-tailored intervention more attractive and interactive, as was recommended by the experts from the Delphi study (Chapter 3). Further, the use of games in health prevention studies has been shown to be effective in increasing knowledge, changing attitudes and behavior (Connolly et al., 2012; DeSmet et al., 2014), and increasing adolescents' motivation to participate in an intervention (Papastergiou, 2009; Tüzün et al., 2009). The intervention was pilot tested and further improved according to the feedback. Nevertheless, the use of the intervention in the trial was disappointing. After the baseline assessment, adolescents in the experimental condition should have immediately continued with the first game session. The participation at this point had already dropped, as only 67.6% of the participants in the experimental condition who started the baseline questionnaire started with the first game scenario. The second and third game scenarios took place in the second lesson that the schools had to plan in. Only 28.8% of the baseline participants started the second game scenario, and 21.4% started the third game scenario. Thereafter, the adolescents were invited to come back to the intervention Web site to answer a few questions outside of school. Just 27 people (1.7%) returned for the fourth session, which was a booster session, and the adolescents were asked if they wanted to take part in a challenge to drink less alcohol at their next drinking event. No one visited for the fifth session, which evaluated the challenge if adolescents had accepted it. An analysis of adherence that was performed to investigate the characteristics of those adolescents who adhered to the intervention revealed that females, younger adolescents, Protestants, and non-binge drinkers adhered better to the intervention. The game was not compared with other intervention delivery vehicles, but the conclusion of these numbers is straightforward. The game, which was developed to increase adolescents' motivation to participate and to continue to participate in the intervention, failed in this regard. A possibility is that the game simply was not appealing enough, particularly for older adolescents, as they also dropped out more frequently. Qualitative assessment of the game and usability tests could give more insights into what adolescents liked and what they disliked.

As described earlier, the Netherlands is a very permissive country, and drinking alcohol is not unusual among adolescents (De Looze et al., 2014; Jander et al., 2013; Verdurmen et al., 2011). Alcohol use has even been associated with healthy psychosocial development (Pape & Hammer, 1996; Shedler & Block, 1990), as alcohol serves as a social facilitator. Alcohol “takes the bricks out of the wall” (Vander Ven, 2011); it makes it easier to communicate and socialize with peers. These positive aspects are also very much appreciated by adolescents and are certainly one of the major reasons why adolescents drink alcohol and like drinking alcohol (Jander et al., 2013). Furthermore, adolescents often do not suffer from negative consequences or have not yet experienced any severe short-term consequences of alcohol use. Thus, they do not feel the need to change their alcohol intake. Interventions like the one described in this dissertation are mostly suited for people who are already motivated to change their behavior. Also, from an ethical perspective, this intervention was based on voluntary participation. Adolescents were made aware that they could stop participation at any point in time without giving a reason for their withdrawal. This could explain why 739 adolescents from experimental schools and 531 adolescents from control schools that still participated did not respond to the follow-up questionnaire or any of the reminders that they received to finish the intervention at home.

#### *Drop-out of schools*

Only one school refrained from completing the intervention due to conflicts with parents who did not want their children to take part in the intervention. There was substantial drop-out of schools at follow-up, however. To prevent high drop-out at follow-up measurements, we planned the assessment within schools. Although the idea behind this was to reach and retain many participants, the drop-out rate on this in-school follow-up measurement was very high, too. Out of the 19 experimental and 15 control schools, six experimental schools (350 adolescents) and one control school (17 adolescents) dropped out. Possible explanations for this are discussed in the following paragraphs.

We talked to teachers of schools that dropped out to hear their opinions on the problem. Several issues arose from these conversations. First, adolescents who did not drink any alcohol experienced problems answering the question concerning their attitude toward alcohol, for example. From a theoretical perspective, these questions have to be formulated from the first-person (“I”) perspective (“When I am drinking alcohol I feel out of control”). Although we informed these adolescents that they should answer the questions as if they were drinking, this was experienced as a big problem because they felt it was difficult to imagine doing something that they had not done in real life. The second problem was that adolescents found some of the questions very personal and were reluctant to answer the questions about the alcohol use of their parents, siblings,

and friends. Those questions were important to helping us assess the modeling and social norms of family and friends, however. So obviously there is a gap between how we need to pose the questions to assess a theoretical model satisfactorily and to derive proclamations about the predictive value of these model components on behavior and what adolescents experience as acceptable and possible to answer. The teachers indicated that they had discussions within their classes about the personal nature of many of the questions and that because of these questions many adolescents refused to take part in the intervention. As adolescents in the older age group (15 to 19 years) are generally more opinionated than younger adolescents, and perhaps more likely to tell the teacher if they dislike taking part in an intervention, this could explain why using the school setting to disseminate the intervention did not work out as well as it did in other studies with younger adolescents (Botvin, Griffin, Diaz, & Ifill-Williams, 2001; Simons-Morton, Haynie, Saylor, Crump, & Chen, 2005). In some cases, this was the reason for a whole school to stop taking part in the intervention, whereas in other schools only certain classes stopped the intervention, and some others (where the aforementioned issues were not experienced as big problems) retained in the intervention.

In the pilot study that we conducted within five schools, 481 adolescents participated. The participants were 48% female, 73% had a higher educational background, and 53% reported binge drinking in the previous 30 days. The main feedback points from this pilot study were that the game and the feedback were too long, not very clear, not relevant, or not personal enough and therefore boring. We reacted to this feedback by having a professional writer shorten the feedback messages, making them more relevant, and creating a more personal tone. We also shortened the game by deleting the content that was unrelated to drinking. The points that were mentioned by schools in the evaluation study did not surface during the pilot study.

#### *Drop-out of classes*

Further, particularly schools of higher secondary education experienced trouble finding a date to give the adolescents of the highest grades (grade 5 of senior general secondary education (HAVO), 17 to 18 years, and grade 6 of pre-university education (VWO), 18 to 19 years) the opportunity to respond to the follow-up questionnaire. This was because in the period of May and June, the highest classes have their final exams before leaving school. So the main focus of the schools is to prepare the adolescents for their exams and projects like ours have no priority anymore. The exam period was the reason classes dropped out of the intervention, but in some cases this also meant that whole schools dropped out because they had enrolled only the highest classes.

In conclusion, drop-out in this trial could have been caused by different factors, such as the program being irrelevant for non-binge-drinking adolescents; the schools lacking

interest in revisiting the program, implying a need for a more attractive program; or the schools and adolescents not being convinced of the need to participate in the RCT any longer.

### **Parental participation**

The results of our evaluation study gave an indication that parental participation might also be a protective factor for binge drinking. However, we cannot make strong claims about the effects of parental participation in our evaluation study due to the methodological choices (e.g., parents were only invited by adolescents who were in the experimental condition). We tested this method in a pilot study, with the result that 136 of 481 adolescents (28%) provided the e-mail address of their parents. To increase this response, we also provided all adolescents in the experimental condition of the evaluation study with a letter for their parents that they could take home and give to them if they did not want to invite them via e-mail.

However, during the evaluation study only 199 of a potential 1590 adolescents (12.5%) invited their parents by e-mail to take part in the intervention. We do not have any information on how many adolescents provided their parents with the letter. It was emphasized beforehand that parents would not receive any information about the answers the adolescents gave during the intervention but that we were interested in the parents' opinions about alcohol use and that they would visit a completely different Web site. Nevertheless, adolescents were reluctant to invite their parents. Although we could not obtain the exact reasons for this reluctance, this could be an indication that adolescents do not want to potentially have a discussion about alcohol use with their parents. The fact that parents and adolescents do not communicate clearly about alcohol use also emerged during the focus group interviews (Chapter 2).

The second disappointing conclusion is that of the 199 invited parents we know of, who most likely already belong to a very selective group of parents that are more engaged in their adolescent life, only 91 (45.7%) clicked on the link provided in the e-mail, and only 76 (38.1%) finished the parental component. This might mean that because the change in law had just recently come into effect, Dutch parents remained uninvolved when it came to the alcohol use of their 16- to 18-year-old children. It may also be possible that parents had no interest in an intervention that targets this problem, as interest in Internet-delivered interventions has been shown to be generally very low (Bennett & Glasgow, 2009; Kohl et al., 2013). However, this study does not provide solid ground to make strong claims about parental involvement in adolescent alcohol use. Probably, more time is needed for the change in law to really resonate in family life and rules that parents provide. Additionally, changes in parenting attitudes among Dutch parents may also be needed to create a stronger involvement of parents in these types

of interventions. Other intervention studies focusing on parent-child communication concerning risky sexual behavior in adolescents also reported low attendance rates of parents (Anderson et al., 1999; DiIorio et al., 2007) or problems with recruiting parents (Heinrichs, Bertram, Kuschel, & Hahlweg, 2005). Another review recognizes the problem with non-participating fathers in pediatric psychology research and treatment (Phares, Lopez, Fields, Kamboukos, & Duhig, 2005). One study looked at predictors of enrollment and participation of fathers with Mexican origin and found that enrollment was associated with lower economic stress, higher maternal education, and lower levels of interparental conflict (Wong, Roubinov, Gonzales, Dumka, & Millsap, 2013). Participation in interventions was predicted by lower levels of economic stress and decreased interparental conflict. However, to our knowledge, not much is known about determinants of parental participation in intervention studies focused on reducing alcohol use in adolescents. Future surveys on alcohol use and parental involvement are needed and will hopefully give more insight into how to increase parental involvement.

### **Implications and ideas for the future**

Despite all the efforts that were made to conduct qualitative and quantitative formative research in order to ensure that the intervention would focus on the right determinants and that we would use the right method to change binge drinking, the use and effect of the intervention were disappointing. In the following, some solutions to the problems mentioned before are suggested. First, due to all the external circumstances and the adaptations that we had to make, it might be wise to repeat the study with the original design. This means one baseline assessment in the period of September/October and a six-month follow-up in March/April the next year. Most importantly, the change in law will then already have been in effect for some time, and drinking behavior will probably be stable and the confusing transition period over. However, the question remains whether and how effective the change in law is, as the reduction of tobacco purchases of 13- to 15-year-olds after the tobacco sales ban for adolescents under 16 years old was established in 2003 was mainly explained by a decrease in purchases of non-smokers, whereas purchases of adolescent smokers increased (Verdonk-Kleinjan, Knibbe, Bieleman, de Groot, & de Vries, 2008). Another study of a sales ban in Finland reported a stronger decrease in tobacco purchases eight years after the introduction of a sales ban compared to earlier after the introduction, but sales to underage children still remained high (Rimpelä & Rainio, 2004). Both studies suggest that the complicated mechanisms of punishments in tobacco sales violations could be part of the problem of many small retailers continuing to sell tobacco products to minors (Rimpelä & Rainio, 2004; Verdonk-Kleinjan et al., 2008). However, those studies were conducted on a tobacco sales ban, not an alcohol sales ban. The effects of an alcohol sales ban in the Netherlands need to be investigated in future studies. Further, both conditions

will receive the game within the school setting, which might reduce drop-out of control schools before baseline assessment and thereby reduce differential attrition bias (Crutzen, Viechtbauer, Spigt, & Kotz, 2014). Additionally, if the follow-up measurement takes place earlier in the year, the highest classes in the schools will not already be in the preparation phase for their final exams, which could reduce drop-out of these schools at follow-up. In this way, attrition bias, which is also very common in health behavior change interventions, could also be reduced (De Bruin et al., 2014). Less drop-out due to design issues will facilitate revealing the true effect of the intervention on alcohol use.

### **Motivating adolescents**

One reason for the high drop-out could be that adolescents were not motivated to change their behavior at all. During the intervention, we focused on factors that are associated with the motivational phase of behavior change. Those factors were attitude, social influences, self-efficacy, and action plans (De Vries et al., 2008; De Vries et al., 2003). Changing these factors is necessary to initiate and maintain behavior change.

Yet when adolescents are not motivated to change behavior in the first place, focusing on pre-motivational factors first might be an important preceding step. Pre-motivational factors that are relatively easy to manipulate and change are the awareness factors: knowledge, cues to action, and risk perception (De Vries et al., 2008; De Vries et al., 2003). Methods to influence these factors include consciousness raising, scenario-based risk information, fear arousal, and providing cues (Bartholomew et al., 2011). It is conceivable that our approach should have paid more attention to raising awareness. According to the Transtheoretical Model (Prochaska et al., 2008), consciousness raising is an important first step to move people toward behavior change. It can be achieved by providing information about the subject, causes, consequences, and alternatives of the problem behavior. Consciousness could be raised by, for instance, providing adolescents with information about the working mechanisms of alcohol on the body and brain and its consequences in the short and long terms. Scenario-based risk information, like information about different drinking patterns, their effect on the body and brain, and the circumstances that usually trigger different drinking patterns, should also be incorporated. This may be helpful for constructing a realistic future scenario for adolescents in which drinking might occur (Bartholomew et al., 2011). It is important that the information is placed in a realistic context in which adolescents are confronted with alcohol so that they can recognize the cues in real life (Bartholomew et al., 2011; Godden & Baddeley, 1975). Awareness raising could be incorporated into the game as well. Perhaps this part could even be a stand-alone part of the intervention, like a quiz, short tailored program, or even a video. Regardless of the presentation, the awareness part should also focus on the self-efficacy of the adolescent and response

efficacy of the intervention by emphasizing that there are ways, which will be shown in the intervention, that can help the adolescent to reduce and control alcohol use and its associated consequences. This is necessary to prevent adolescents from getting defensive and not changing their behavior (Maddux & Rogers, 1983) or coming up with counterarguments (Petty & Cacioppo, 2012). After this first step, adolescents might feel more susceptible to the consequences of alcohol use and might be more willing to participate in an intervention and review their own alcohol use critically.

Another important theory that is mainly concerned with motivation as one of the most important factors for behavior change is the Self-Determination Theory (SDT) (Ryan & Deci, 2000). Through focusing on increasing autonomy, competence, and relatedness, SDT-based interventions have been proven to improve health behaviors such as smoking cessation and physical activity (Ryan, Patrick, Deci, & Williams, 2008). One school-based intervention study among adolescents showed that students who were taught by autonomy-supportive teachers increased intentions and self-reported physical activity during leisure time (Chatzisarantis & Hagger, 2009). A meta-analysis about the relationship between SDT and TPB showed strong relationships between the SDT concepts of perceived autonomy support and self-determined motivation on the TPB concepts of attitude, perceived behavioral control, subjective norm, and intention (Hagger & Chatzisarantis, 2009). The study thus advocated the use of an integrated approach in order to maximize the results of the intervention.

### **Operationalization of questionnaires**

Furthermore, the operationalization of questions to assess the different constructs of the theoretical model should be critically reviewed in order to reduce non-drinkers' difficulty answering the questions. Perhaps it is enough to adapt the introduction text and emphasize even more than we already did that they should imagine that they are actually drinking alcohol and binge drinking. If this is still experienced as a problem, it might be possible to reframe the questions in the third person for these adolescents, so that they do not feel the need to think out of their own perspective. Of course, reframing the questions would require additional testing because the validity of the questions would need to be investigated.

Concerning the problem that adolescents felt reluctant to answer questions that they perceived as very personal, the solution to the problem could be to give the whole questionnaire anonymously. In our case, this was not possible because we needed to merge the data from the baseline assessment with the data from the follow-up measurement. Although we guaranteed to the adolescents that all their answers would be treated confidentially and the answers they gave in the questionnaires would be analyzed

anonymously, they probably still felt very traceable. This problem would be less relevant if the intervention became publically available without the research requirements.

### **Using games in future interventions**

A reason why we developed the game was to increase motivation of the adolescents to continue with the intervention. The game purely served as a vehicle to transport the classical text-based CT intervention. Testing the effectiveness of the game was outside of the scope of this research, but the very low adherence rates in this study suggest that the game was not optimal in increasing motivation. However, we do not want to discourage usage of the concept of serious games in eHealth interventions, as other studies testing the effectiveness of serious games have reported some promising results (Connolly et al., 2012; DeSmet et al., 2014; Papastergiou, 2009; Tüzün et al., 2009). Primarily, we want to make some suggestions on how this game could be improved. To start with, the game itself should be tested on effectiveness by comparing it to a non-game intervention group to determine the effect and the size of the effect on motivation and adherence to the intervention. Making the whole intervention a game, without explicitly asking questions concerning attitude and modeling, for example, or providing the adolescents with written advice could probably increase the gaming experience without letting the adolescents explicitly know that we were trying to change their alcohol intake. Translating the concepts that are now explicitly measured into gaming elements could have the advantage that adolescents might be less aware that we were targeting their alcohol use and thus might make them less resistant to participate and less likely to come up with counterarguments (Slater & Rouner, 2002). However, the question remains to what extent and on which level tailoring is still possible if all concepts are translated into a game, with the costs for a game still in a reasonable price range. Yet we still consider tailoring to be a very important element that should not be abandoned in favor of a generic intervention for everyone. That is because adolescents will take different standpoints concerning alcohol use, with some being more sympathetic toward behavior change and others being unsympathetic toward behavior change. It is important to focus on the right determinants (Prochaska et al., 2008) and provide viewpoints and characters that are similar to the adolescents' (Bandura, 1986) in order to achieve behavior change. Tailoring may provide a means to achieve the development of relevant awareness raising and motivational messages. Yet more research remains to be needed on how to best reach unmotivated respondents; attention span to participate in our program was short, which may imply the need for utilizing other communication methods as well. An example may be an approach as used in the popular game SimCity, in which the player takes the role of a mayor and thus takes control of the economic development of a city so that all of his or her decisions impact the wealth of the city. Based on this example, the adolescent could be put in the position of a health worker trying to deal with the consequences of youth alcohol use.

Also, communication methods using either the central or peripheral route to persuasion (Petty & Cacioppo, 1986), depending on the need for cognition of the adolescent, could be considered in interventions, with the idea that once attention is realized via the peripheral route, more serious attempts could be realized via the central route.

Finally, shortening the intervention could also be a way to reduce drop-out during the intervention. Studies have shown that brief interventions can successfully reduce alcohol use and alcohol-related consequences in adolescents (Kypri et al., 2004; Saitz et al., 2007; Walton et al., 2010). Two meta-analytic reviews showed that brief interventions may be equally effective to longer interventions (Bien, Miller, & Tonigan, 1993; Moyer, Finney, Swearingen, & Vergun, 2002). Shorter interventions could have the advantage that they have higher completion rates. A review showed that in questionnaire studies, shorter questionnaires had higher response rates than longer questionnaires (Edwards et al., 2009). This study, however, was a questionnaire study, and not an intervention study with the goal to achieve behavior change. Our analyses revealed slightly stronger effects if adolescents adhered more to the intervention (Chapter 5), indicating that more exposure may lead to a stronger effect of the intervention. Research about the dose-response relationship in therapy also found a positive relationship between the two variables (Draper, Jennings, Barón, Erdur, & Shankar, 2000; Rodondi et al., 2006). Moreover, other eHealth studies have found increased effectiveness of the intervention with more usage of the intervention, thus providing evidence for a dose-response relationship in interventions about nutrition (Moore et al., 2008), weight control (Petersen, Sill, Lu, Young, & Edington, 2008), and smoking cessation (Elfeddali et al., 2012). In conclusion, shortening the intervention might also weaken the desired effect. Moreover, the intervention was designed based on a theoretical model, the ICM (De Vries et al., 2003); formative research was conducted to assess which variables determine alcohol use, and those determinants were integrated in the intervention (Chapter 4). It therefore seems more important to encourage adolescents to use the intervention as it was developed to be used, rather than shortening the game or the intervention content.

### **Involving parents in interventions**

Although we pilot tested the method of inviting parents via their children, the number of invitations sent in the evaluation study indicate that this is not the most successful recruitment strategy to reach parents. When conducting research in schools, it is often possible to ask the school to provide the parental address or to send invitations to parents on behalf of the intervention. Schools of higher and lower secondary education almost always have records of parental addresses, but schools of lower vocational education indicated to us that they often have no records of the parents and no contact with parents as is the case in secondary education. In our study it was also important to match parents with their children in the analyses, which would have

been very difficult if we had sent mail invitations via the schools. Furthermore, it seems easier to involve parents in prevention studies when they already experience problems that the intervention focuses on. Heinrichs et al (2005) therefore recommend focusing on reasons for participation for parents who have not experienced any problems yet (Heinrichs et al., 2005). In a focus group study, parents mentioned being contacted face to face, including parents and children together in the study, providing refreshments, and choosing a location close to home as incentives to participate (Dumka, Garza, Roosa, & Stoerzinger, 1997). However, this is more suitable for interventions that take place in a group setting, rather than Web-based interventions. Therefore, more research is needed on how to best reach and involve parents in Web-based interventions and what the best method is considering the needs of the research (e.g., matched data, anonymity).

### **General conclusion**

There are some promising indications of the effectiveness of the intervention described in this thesis to reduce binge drinking and excessive drinking in younger adolescents. However, due to the high rate of drop-out and thus many missing values in the analyses, these results can only be interpreted with caution. Before trying to implement this intervention on a larger scale, it is advisable to make some changes to the intervention and to re-test the intervention in a randomized controlled trial using the original design and considering the recommendations described above.



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## **Valorization Addendum**

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**Relevance**

Binge drinking (i.e., drinking 4/5 glasses of alcohol for a girl/boy on one occasion) during adolescence is associated with adverse consequences, such as injuries due to (road traffic) accidents, violence, crimes and aggression (Gmel & Rhem, 2003; Graham et al., 2000; Swahn et al., 2004), (illicit) drug use, smoking (Miller et al., 2007), unwanted or unsafe sex (Bonomo et al., 2001), and unintended pregnancies. Moreover, as the brain is not yet fully developed in adolescents, brain damage, impaired learning, and cognitive deficits are particular irreversible consequences of drinking for this age group, and their effects continue during adulthood (Brown et al., 2000; Peterson et al., 1990; Zeigler et al., 2005). Finally, the younger the adolescents are at the onset of alcohol use, the higher their odds of abusing alcohol later in life (Grant et al., 2001). Onset of alcohol use has been further associated with antisocial symptomatology and an elevated risk for stressful life events (e.g., trouble with the police) during adulthood (Irons et al., 2014). Heavy alcohol use thus comes with a lot of serious health, social, and economic consequences. Not only the physical health damages are costly for society (e.g., ambulances that are needed or emergency room admission due to alcohol related injuries), but school drop-out due to alcohol use, alcohol-induced violence and aggression that lead to the destruction of public and private property, and police interventions are associated with high societal costs (Drost, Paulus, Ruwaard, & Evers, 2014). Yet, alcohol is still a widely accepted substance that is part of adult social life. Alcohol has also shown to serve some social functions during adolescence. For example, alcohol use decreases inhibitions, enabling young people to make contact with other people more easily, and thereby improving their social skills (Pape & Hammer, 1996). A responsible handling of alcohol and a reduction of binge drinking at an adolescent age is therefore important.

**Target groups**

Beneficiaries of the product of this dissertation are in the first place adolescents that have or have not started binge drinking, yet, as the goal of the studies conducted during this project was the reduction and prevention of binge drinking among adolescents. Furthermore, teachers and directors of schools could be interested in the results to increase their schools' investment in health promotion and thereby reducing absenteeism and school drop-out due to alcohol. Policy- and lawmakers should be interested as the results could be used as guidelines to develop and implement new policies regarding alcohol use and taking preventive measures to reduce alcohol use.

**Product**

In this dissertation, the development and evaluation of an intervention to reduce binge drinking among 16- to 18-year-old Dutch adolescents is described. Research on alcohol use and interventions to reduce binge drinking are scarce for this age group.

In particular, when adolescents are allowed to buy and consume alcohol, which was the case in the Netherlands when the current intervention was developed. Based on literature and extensive formative research like focus group interviews (Chapter 2) with the target group and a Delphi study with experts (Chapter 3), we developed an online game called “Watskebeurt?!” (Dutch slang for: What happened?) (Chapter 5). In this game, the adolescent wakes up after a night of partying and does not remember what happened the night before. Goal of the game is to find out what happened. While the adolescent is playing the game, a couple of questions appear on an in-game cell phone concerning for example the pros and cons of drinking, perceived pressure from friends and family to drink, and possible difficult drinking situations. They then receive computer-tailored feedback about their attitude, how to handle peer pressure and how to refuse alcohol.

Additionally, a computer-tailored component of the intervention aimed at parents was developed alongside the intervention for adolescents. The goal of the parental component was to provide parents with information and feedback about how to clearly communicate with their child about alcohol and how to set appropriate rules concerning alcohol use. The studies conducted during this project, as well as earlier studies, have shown that parents still play an important role when it comes to regulating their child’s alcohol use. Their own alcohol use, the way they communicate, and the use of strict rules are hereby the most important factors that influence their childrens’ alcohol use (Ennett et al., 2001; Jander et al., 2015; Jander et al., 2013; Spijkerman et al., 2008; Van Der Vorst et al., 2006).

### **Innovation**

So far, computer-tailored health interventions were often purely text-based. Recently, more studies were developed that use video-based messages (Stanczyk et al., 2014; Vandelanotte & Mummery, 2011; Walthouwer, Oenema, Soetens, Lechner, & De Vries, 2013) to increase attractiveness of these interventions. Using games to deliver (health-) education and (health-) information has recently gained in popularity (Connolly et al., 2012; DeSmet et al., 2014). If the goal of a game is to educate people, instead of only entertaining them, it is referred to as a serious game (Connolly et al., 2012). To increase the attractiveness of our intervention we designed a serious game to carry the computer-tailored intervention, which, to our knowledge, has not been done in this format before.

### **Realization**

The game was developed for 16- to 18-year-old adolescents, but has been tested on 15- and 19-year-old adolescents as well, as the intervention was tested in schools and 15- and

19-year-olds were in the classes as well. Effects of the game showed that the intervention can successfully reduce binge drinking in 15- and 16-year-old adolescents (Chapter 6). Effect sizes increased when adolescents adhered longer to the intervention, indicating that complete use of the intervention is important for maximizing the potential public health impact. Effects for older adolescents were, unfortunately, not found. These are somewhat promising results, but before the game can be implemented on a larger scale (e.g., nationally) to benefit as many adolescents as possible, some improvements to the game and the intervention should be made.

Particularly, the focus should be on how to better involve older adolescents to increase effectiveness in those ages, too. A big problem with this kind of interventions is that they are based on voluntariness. Therefore, motivation to change behavior is necessary. Completion rates of the current intervention were very low (Chapter 6). Analyses of adherence showed that older adolescents tended to drop out earlier than younger adolescents, indicating that particularly older adolescents in this study were not motivated to change behavior, or even to consider behavior change. This might be because a health problem and the need to change behavior have not developed yet, but still those adolescents have experienced the benefits of alcohol use (e.g., social rewards). Of course the same goes for younger adolescents, but perhaps a different approach is necessary with older adolescents, meaning that the focus of the intervention should be more directed toward pre-motivational factors in order to increase their willingness to participate in these kinds of interventions. Furthermore, usability studies should be conducted to carefully monitor adolescents' use of the intervention, and to identify which parts of the intervention work well, and what of the game, questions and messages can be improved.

Results of the studies conducted during this project have shown that parents are still important and influential people in adolescents' alcohol use. Results of the parental component also gave an indication that parental participation might be of additional value, but due to methodological choices made in the design (i.e., adolescents had to invite their parents to participate in the study), the parental sample might be biased (e.g., only very involved parents participated), and interpretation of the effect is very difficult and observational in nature. In the future, the effect of the parental component should be evaluated by means of a randomized controlled trial (e.g., adding arms with and without access to a parental component). Furthermore, attention should be paid to how to involve parents in the intervention, as participation rates for parents were very low in this study.

The current product of this dissertation forms a meaningful, important, and in parts effective, innovative tool to solve an important societal problem which is binge drinking

in adolescents. The existing game could be adapted and improved to increase adherence to the game, and thereby increase the effectiveness to reduce binge drinking and to prevent adolescents that have not started binge drinking yet from doing so. The adapted version, of course, will have to be evaluated again in terms of effectiveness as well as intervention use.

After a successful adaption of the game, it could be implemented by using the “gezonde school” (healthy school), an initiative of the National Institute for Public Health and the Environment (RIVM, Rijksinstituut voor Volksgezondheid en Milieu). In this initiative the RIVM offers a diverse range of health interventions targeted at various health behaviors of children and adolescents (e.g., alcohol use, smoking, bullying, nutrition, physical activity) that can be implemented by schools. On the “gezonde school” Web site schools can simply choose an intervention that they think is necessary and feasible to implement in their school. Other national institutes such as the Trimbos Institute, which is concerned with the monitoring, prevention, and treatment of addictions, could also participate in the active implementation of the current game via their network. Dutch municipalities and regional public health authorities (GGD'en) could also adopt and implement the game as they serve as an important access point to reach large parts of the Dutch population. Another possibility for implementation could be via initiatives such as Vision2Health, which offers evidence-based, innovative interventions to improve health and health communication. Finally, implementation could occur directly among the adolescents via social media. In order to make this game successful on social media, it might need an additional social component, something that is worthwhile for the adolescent to share it with their friends. However, this possibility needs a lot of careful research, as it might also backfire in such a way that for example adolescents try to outperform each other on drinking.

No matter in which way the adolescents will get in contact with the game and traverse through the intervention, the benefits for the adolescent and the society will be tangible. Adolescents will engage in less binge drinking and perform better at school, thereby increasing their opportunities later in life. Society will immediately benefit by the reduced costs of the consequences of health services and delinquencies caused by adolescent alcohol use. Long-term benefits for society could be that due to reduced alcohol use, less long-term damage will be done to the brains and young adults will be able to contribute more to society than young adults with permanent brain damage due to alcohol use during adolescence.

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## Appendices

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## Appendix 1

**Table 1:** Effective parenting practices / styles / actions

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**What are, according to your expertise, effective parenting practices / styles / actions to reduce binge drinking in 16-18 year old adolescents?**

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having expectations

Communication

- about expectations not drink alcohol
- firm
- consistent
- kind
- open
- healthy
- positive quality

set (clear and consistent) rules

come to agreements

good role modeling (do not drink (much) in presence of child)

parental monitoring (knowing where and with who the child is)

- know whereabouts
- know friends

Do not serve alcohol at home

Responsive parenting

Child management practices, care and control

Family cohesion/bonding

Family support / co-operation

Active interest in adolescents life

Doing activities that adolescent enjoys

Authoritative warm and firm parenting

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**Table 2:** Social environmental factors

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**What are, according to your expertise, social environmental factors that determine binge drinking in adolescents aged 16-18 years (think of peers, parents, siblings etc.)?**

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parental approval  
peers behavior  
peers attitudes  
parental attitudes  
perceived normative drinking levels among age mates  
older siblings providing alcohol to their younger siblings  
availability (having alcohol at home)  
peer pressure  
parents function as role models (good or bad)  
siblings behavior: older siblings willingness to use substances and their actual use are robust predictors of their young siblings later use  
peer selection: selection of like-minded peers: mutual influence, interdependent  
adolescents who are still non-users are more susceptible to the influence of their parents as models and sources of authority  
young people who enjoy a positive relationship with their parents may be less influenced by substance-using peers and less involved in alcohol using activities  
family can continue to be a moderating influence throughout adolescence and even young adulthood  
parents usually affect long term goals and values  
parental drinking  
activities of adolescent social group  
role modeling in social environment is important (if youth see negative consequences occurring they may be hesitant to join in)  
stress and coping styles puberty peer group  
low image of drinking in moderation  
parents who offer drinks  
Self-efficacy towards making agreements and setting rules

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**Table 3:** Motivational factors

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**What are, according to your expertise, motivational factors that determine binge drinking in adolescents aged 16-18 years? (Think of attitude, self-efficacy etc.)**


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acceptance in a peer group  
 importance of belonging to a group  
 insecurity in a group  
 looking for recognition in a group  
 boost self-confidence (children feel more confident through alcohol)  
 drinking to deal with negative emotions (drinking to cope) is related to alcohol-related consequences  
 drinking to enhance positive emotions (enhancement motives)  
 drinking to be social (social motives) are related to binge drinking  
 positive attitude towards binge drinking  
 low knowledge of consequences about the harm of binge drinking or negative consequences of alcohol  
 mental health  
 worse decision making skills  
 higher peer pressure susceptibility  
 negative attitude about school  
 prior school failure  
 positive drinking expectancies  
 normative expectations of peer drinking and adult drinking  
 high self-efficacy over their ability to engage in binge drinking  
 low levels of perceived control over whether or not they could engage in binge drinking  
 low self-esteem  
 negative self-identity  
 excitement about trying out new things, curiosity  
 planned ahead of time  
 holidays and events encourage binge drinking  
 expectations that older teens and emerging adults drink at a "rite of passage" likely operates as well  
 Personality
 

- fearful
- sensation seeking
- impulsive

 unable to point out personal boarders  
 building up brains has not finished  
 they are short term thinkers  
 emphasize short term risks / benefits  
 positive attitudes towards substance use  
 intention to use  
 not sufficient self-efficacy and skills not to engage in these behaviors  
 quality of coping and social skills (including the skill to say no) are important because young people who set limits for themselves with regard to substance use which also have skill not to be persuaded by others, have a lower risk to develop problematic use such as binge drinking

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## Appendix 2

**Table 1:** Prevalence rates binge drinking per age and adherence group

	At least one session		At least two sessions		At least three sessions	
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up
15	125 (26.5%)	41 (29.3%)	62 (27.6%)	21 (25%)	44 (26%)	14 (20.9%)
16	158 (47.2%)	52 (43.3%)	70 (49.6%)	32 (44.4%)	47 (46.5%)	21 (43.8%)
17	90 (54.9%)	31 (63.3%)	36 (66.7%)	14 (70%)	27 (64.3%)	11 (64.7%)
18	57 (75%)	11 (57.9%)	23 (85.2%)	4 (57.1%)	15 (78.9%)	0 (0%)
19	33 (73.3%)	14 (6.9%)	16 (88.9%)	7 (87.5%)	12 (85.7%)	6 (100%)
Total	463 (42.4%)	149 (42.5%)	207 (44.5%)	78 (40.8%)	145 (42%)	52 (37.1%)

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## Summary

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Dangerous drinking practices like binge drinking (i.e., drinking 4/5 or more standard glasses of alcohol on one occasion for a girl/boy) at an adolescent age can lead to serious short- and long-term consequences, such as aggression, physical fighting, unwanted sex and pregnancies, brain damage and associated cognitive deficits, learning impairment, various kinds of cancer, cardiovascular diseases, liver damage, and addiction. Alcohol use is also associated with social benefits like bringing down inhibitions and thus making it easier to get in contact and socialize with other people. It is also very acceptable to consume alcohol and it has been legal for 16-year-old Dutch adolescents to buy and consume low-strength alcoholic beverages (with an alcohol volume of less than 15%) up until January 1, 2014. Since then, the legal buying age had been increased to 18 years. However, the use of alcoholic beverages in private places, like at home or at a private party, is not affected by the new law. It is thus very likely that Dutch adolescents will have many opportunities to consume alcohol. In this dissertation, studies were conducted to investigate important determinants of binge drinking in 16- to 18-year-old adolescents before the law change went into effect (Chapter 2), important effective strategies to decrease binge drinking in adolescents were identified by international experts (Chapter 3), and the effect of rules and communication of parents towards their adolescent child were investigated (Chapter 4). Finally, the development (Chapter 5) and evaluation (Chapter 6) of an intervention to reduce binge drinking in 16- to 18-year-old adolescents are described.

**Chapter 1** provides an overall introduction to alcohol consumption and the problems associated with it. Web-based computer tailoring is presented as a promising intervention method and the I-Change model as the theoretical model that underlies the intervention that was developed and tested. Furthermore, this chapter gives insight into one of the major drawbacks of Web-based computer-tailored interventions, which is high drop-out, and how we tried to anticipate preventing this problem.

As part of the formative research, we conducted focus group interviews with 16- to 18-year-old adolescents and parents of this target group. These are described in **Chapter 2**. The goal was to get more insight into the situations in which adolescents engaged in binge drinking and what caused their binge drinking. We furthermore wanted to know how alcohol use is handled within the families and how parents thought about binge drinking in adolescents. Results showed that adolescents were mostly drinking on the weekend, together with friends; either in a bar, at home, or at a party. Adolescents also reported that their parents often provided them with their first drink, and that they did not mind that the adolescent was drinking. Parents, however, indicated that alcohol use did bother them, but that they did not feel they could influence the situation anymore, as the adolescent was legally allowed to buy alcohol. They stopped setting clear rules when the adolescent turned 16. The main conclusion from this study was that parents

and adolescents should communicate more clearly about alcohol use and that parents were mostly uninvolved after the adolescents turned 16.

In the Delphi expert study, described in **Chapter 3**, we asked international experts to come up with and rate strategies that can be used to decrease binge drinking among 16- to 18-year-old adolescents by importance. Experts indicated that it is important to involve parents and to encourage them to set strict and appropriate rules concerning alcohol use and to communicate clearly with the child. Adolescents should be provided with skills to refuse alcohol when offered and to provide them with skills to resist peer pressure. We also asked experts about strategies to reduce drop-out from interventions to reduce binge drinking. The most important strategies were that the intervention should be interactive and attractive to adolescents. The use of reminders and incentives was also highly recommended.

The effect of rules and communication on alcohol use in 16- to 18-year-old adolescents was explored in the study described in **Chapter 4**. Results indicated that setting rules had a preventive effect on binge drinking and weekly consumption. Rules seemed to positively influence alcohol use of adolescents even in situations when the child was drinking without the presence of a parent, which was contrary to the parental views expressed in Chapter 2. Furthermore, we found a positive association between communication and binge drinking and weekly consumption, indicating that the more the parents talked to their child, the more alcohol the child used. Previous research has indicated that the quality of communication might be much more important than the frequency of communication. The conclusion of this study is thus that setting rules should be encouraged and clear, good quality communication should be used.

In the development of the intervention, described in **Chapter 5**, we tried to operationalize all the input from the formative research (Chapters 2-4). We developed a game to serve as a vehicle for the computer-tailored intervention. The game was supposed to make the intervention more interactive and more attractive to use. The two-dimensional game took place in the three most common drinking situations of adolescents: in a bar, at a party, or at home with friends. This way, the game should reflect a realistic drinking situation for the adolescents. We included the suggestions of the experts in the computer-tailored feedback provided during the game, and we also developed a Web site for parents where they could receive computer-tailored feedback on how to set appropriate rules and communicate clearly with their child.

This intervention was then evaluated using a cluster randomized controlled trial, described in **Chapter 6**. The trial took place in classes of different schools throughout the Netherlands. There was no overall effect of the intervention on binge drinking

after four months. However, we found a significant interaction effect between intervention group and age on binge drinking, and subgroup analyses revealed that younger adolescents (15- and 16-year-olds) benefited more from the intervention and reported less binge drinking after four months than did older adolescents. Interaction effects between group and educational level on excessive drinking (i.e., drinking 10 or more glasses in one day during the previous week) and between group and age on weekly consumption were found, too; however, in-depth analyses revealed no significant subgroup effects for both interaction effects. Additional analyses revealed that the more adolescents adhered to the intervention, the stronger the effects were for binge drinking. Yet, overall adherence to the intervention was rather low. Analyses of adherence revealed that being Protestant, being female, being younger, having a higher educational background, and being a non-binge drinker were associated with adherence to the intervention.

In the general discussion of this dissertation, presented in **Chapter 7**, the main findings and conclusions of all studies in this dissertation (Chapters 2-6) are described, as well as the problems and limitations of these studies. Implications for future research and practice are discussed, and concrete suggestions are made. The main conclusions were as follows: The intervention showed some promising results; however, the actual interpretation of these effects is hindered by high drop-out (68.9%) in the study, which may be due to the lack of interest in the program and/or a lack of interest in participating in the RCT. A positive impact of the game in motivating adolescents to continue with the game and finish the intervention, although not tested empirically, was not reflected in the drop-out rates. Further, parents do play an important role in adolescent alcohol use, but still seem reluctant to get involved with their child's alcohol use. In the future, more research is needed on how to motivate adolescents and parents and thereby reduce drop-out and increase the public health impact of interventions.



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## **Samenvatting**

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Risicovol drinkgedrag tijdens de adolescentie, zoals bingedrinken (het drinken van vier/vijf of meer glazen alcohol bij één gelegenheid voor meisjes/jongens) kan serieuze gevolgen hebben op korte en/of lange termijn zoals agressie, gevechten, onvrijwillige seks, zwangerschap, schade aan de hersenen, leerbependingen, verschillende soorten kanker, hart- en vaatziekten, leverschade en verslaving. Alcoholgebruik is ook geassocieerd met sociale voordelen zoals het verminderen van inhibities en dus het gemakkelijker contact leggen met andere mensen. Alcoholgebruik is sociaal geaccepteerd en voorheen mochten Nederlandse jongeren vanaf 16 jaar legaal alcoholische drank (met minder dan 15% alcohol) kopen en consumeren. Sinds 1 januari 2014 is deze leeftijd verhoogd naar 18 jaar. Maar dit verbod geldt alleen voor openbare plekken. Bij gevolg is het gebruik van alcoholische drank in de thuisomgeving en op privéfeesten nog steeds toegestaan volgens de wet. Het is dus zeer waarschijnlijk dat jongeren nog altijd voldoende mogelijkheden hebben om alcohol te drinken. In dit proefschrift werd een determinanten onderzoek naar bingedrinken onder 16- tot 18-jarige jongeren uitgevoerd voordat de wet veranderde (Hoofdstuk 2). Verder werden door internationale experts belangrijke strategieën geïdentificeerd om bingedrinken in deze doelgroep te verminderen (Hoofdstuk 3), en werden de effecten van regels en communicatie op het alcoholgebruik van jongeren onderzocht (Hoofdstuk 4). De ontwikkeling van een interventie om bingedrinken onder 16- tot 18-jarigen te verminderen, en de evaluatie hiervan, worden respectievelijk beschreven in hoofdstuk 5 en 6.

**Hoofdstuk 1** geeft een algemene introductie over alcoholgebruik en de daarmee verbonden problemen. Online advies-op-maat wordt gepresenteerd als een veelbelovende strategie met daarbij het I-Change model als het theoretische model waarop de interventie gebaseerd en getest is. Verder geeft dit hoofdstuk inzicht in het grootste probleem van online advies-op-maat-programma's, namelijk uitval, en hoe wij geprobeerd hebben uitval te voorkomen.

Een gedeelte van het voorbereidend onderzoek bestond uit focusgroep interviews enerzijds met 16- tot 18-jarige jongeren en anderzijds met ouders van deze doelgroep. De resultaten van dit onderzoek worden beschreven in **hoofdstuk 2**. Het doel was meer inzicht te krijgen in de situaties waarin jongeren bingedrinken en wat bingedrinken veroorzaakt. Wij wilden ook inzicht krijgen in hoe gezinnen met alcoholgebruik omgaan en hoe ouders over bingedrinken door hun kinderen denken. De resultaten lieten zien dat jongeren meestal tijdens het weekend dronken samen met vrienden, in een kroeg, op een feestje of thuis. Jongeren gaven verder aan dat ze vaak hun eerste alcoholische drank van hun ouders kregen en dat hun ouders het niet erg vonden dat zij alcohol dronken. Ouders daarentegen gaven aan dat ze bingedrinken bij hun kind niet fijn vonden, maar voelden zich enigszins machteloos, omdat hun kind legaal alcohol kon kopen en drinken. Ook gaven ouders aan dat ze waren gestopt met het stellen

van regels toen hun kind 16 jaar oud werd. De hoofdconclusie van deze studie was dat ouders en jongeren niet meer duidelijk met elkaar communiceren en dat ouders zich vaak terugtrekken als hun kind 16 jaar oud wordt.

In de Delphi studie, die in **hoofdstuk 3** beschreven wordt, vroegen wij internationale experts naar strategieën om bingedrinken bij 16- tot 18-jarigen te verminderen en om deze strategieën te ordenen gebaseerd op hoe belangrijk zij deze strategie vonden. De experts gaven aan dat het belangrijk is om ouders te betrekken bij interventies om alcoholgebruik bij jongeren te verminderen en aan te moedigen om strikte regels te stellen en duidelijk met hun kind over alcoholgebruik te communiceren. Jongeren zouden handvatten aangereikt moeten krijgen om drank te kunnen weigeren als het aangeboden wordt en om druk om te drinken te kunnen weerstaan. We waren ook geïnteresseerd in strategieën om uitval te verminderen tijdens dit soort interventies gericht op alcoholgebruik bij jongeren. Als belangrijkste werd gezien dat de interventie interactief en aantrekkelijk zou moeten zijn voor jongeren. Ook werd aangeraden om met herinneringen en beloningen voor deelname aan de interventie te werken.

De effecten van het stellen van regels en het communiceren met een 16- tot 18-jarig kind werden onderzocht en in **hoofdstuk 4** van dit proefschrift beschreven. De resultaten lieten zien dat het stellen van regels beschermend was zowel voor bingedrinken als voor het wekelijks gebruik van alcohol. Regels hadden een positief effect op alcoholgebruik zelfs in situaties waarin de ouders niet aanwezig waren, dit in tegenstelling tot wat de meeste ouders dachten (beschreven in hoofdstuk 2). Verder vonden wij een positief verband tussen communicatie en zowel bingedrinken als wekelijks drankgebruik. Dit betekent dat hoe meer ouders met hun kind over alcoholgebruik spraken, des te meer de kinderen aangaven alcohol te drinken. Eerder onderzoek gaf aan dat de kwaliteit van een gesprek belangrijker was dan de kwantiteit waarmee gesprekken plaatsvonden. De conclusie van deze studie is dus dat ouders aangemoedigd moeten worden om regels met betrekking tot alcoholgebruik te stellen en om een duidelijke, kwalitatief goede communicatie met hun kind te onderhouden/handhaven over alcoholgebruik.

Tijdens de ontwikkeling van de interventie, die in **hoofdstuk 5** wordt beschreven, probeerden wij al het voorafgegaane onderzoek (hoofdstuk 2 - 4) te verwerken. Wij ontwikkelden een spel om het advies-op-maat programma te dragen. Het spel was bedoeld om de interventie interactiever en aantrekkelijker te maken voor de doelgroep. Dit tweedimensionale spel vond plaats in de drie meest voorkomende drink situaties van jongeren: in een kroeg, op een feestje, en thuis met vrienden. Op deze manier werden in de game realistische drink situaties van de jongeren gebruikt. We hebben suggesties van de experts in het advies-op-maat deel ingebouwd en wij ontwikkelden ook een website voor ouders. Op deze website konden de ouders advies-op-maat krijgen over hoe zij

goede en duidelijke regels konden stellen en hoe zij beter en duidelijker met hun kind konden communiceren over alcoholgebruik.

De interventie werd dan in een geclusterd en gerandomiseerd experiment (RCT) in de klassen van verschillende scholen in Nederland getest op effectiviteit. De resultaten hiervan worden beschreven in **hoofdstuk 6**. Er was geen algemeen effect van de interventie na vier maanden. Wij vonden wel dat het effect van de interventie op bingedrinken verschilde per leeftijdsgroep. Subgroep analyses lieten zien dat de interventie bij 15- en 16-jarige adolescenten wel effectief was, terwijl er geen effect meer was voor oudere adolescenten. Wij vonden aanwijzingen dat er verschillen zouden kunnen zijn tussen excessief drinken (het drinken van 10 of meer glazen op een dag in de afgelopen week) en opleidingsniveau en tussen wekelijks gebruik en leeftijd. Nader analyses lieten helaas geen effect voor subgroepen zien. Verdere analyses lieten zien dat hoe langer adolescenten de interventie volgden, des te sterker de effecten op bingedrinken werden. Maar, veel adolescenten volgden de interventie niet zoals deze bedoeld was en vielen vroegtijdig uit. Analyses lieten zien dat jongeren die langer de interventie volgden ook vaker protestant, vrouwelijk, jonger, en hoger opgeleid waren, en vaker geen bingedrinker waren.

In de algemene discussie van dit proefschrift, gepresenteerd in **hoofdstuk 7**, worden de hoofd bevindingen en conclusies van alle studies van dit proefschrift (hoofdstuk 2-6) samen met de limitaties en problemen van deze studies besproken. Implicaties voor toekomstig onderzoek en praktijk worden besproken en concrete aanbevelingen worden gemaakt. De hoofdconclusies waren: de interventie liet sommige veelbelovende resultaten zien. Vooral jongere adolescenten profiteerden van de interventie en een langere deelname leidde ook tot sterkere effecten op gedrag. Maar de interpretatie van deze effecten is moeilijk vanwege de hoge drop-out (68,9%) uit de studie die veroorzaakt kan zijn door gebrek aan interesse voor het programma en/of gebrek aan interesse in de deelname aan een gerandomiseerd experiment. Een positief effect van het spel op de motivatie van adolescenten om de interventie te blijven volgen werd, hoewel niet getest in ons gerandomiseerd experiment, niet weerspiegeld in de hoge drop-out. Verder blijken ouders nog steeds een belangrijke rol in het alcoholgebruik van hun kind te spelen, maar lijken ze tegelijkertijd niet bereid zich veel met het alcoholgebruik van hun kind te bemoeien. In de toekomst is meer onderzoek nodig naar hoe adolescenten en ouders gemotiveerd kunnen worden om deel te nemen aan interventies om bingedrinken onder jongeren te verminderen. Dit is belangrijk, om zo de drop-out uit interventies te verminderen en de impact van public health interventies te verhogen.



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## **Zusammenfassung**

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Gefährliches Trinkverhalten im jugendlichen Alter wie das sogenannte Binge-Drinking (Rauschtrinken) -das Trinken von 4 oder mehr Gläsern Alkohol für Frauen bzw. 5 Gläsern für Männer bei einer Gelegenheit-kann kurz- oder langfristig zu ernsthaften Konsequenzen führen wie zum Beispiel Aggressivität, physische Auseinandersetzungen, ungewollter Sex und ungewollte Schwangerschaften, Schäden für das Gehirn und damit verbundene kognitive Beeinträchtigungen, Lernbehinderungen, verschiedene Arten von Krebs, Herz-Kreislauf-Störungen, Leberschäden und Abhängigkeit. Andererseits wird Alkohol aber auch assoziiert mit sozialen Vorteilen. Durch die enthemmende Wirkung von Alkohol wird zum Beispiel die Kontaktaufnahme mit anderen Menschen erleichtert. Trotz der Risiken ist Alkohol ein gesellschaftsfähiges Genussmittel. Für niederländische Jugendliche war es lange möglich, ab einem Alter von 16 Jahren legal alkoholische Getränke mit einem Alkoholanteil unter 15% (z.B. Bier und Wein) in einem Geschäft zu kaufen und öffentlich zu konsumieren. Am 1. Januar 2014 wurde die Altersgrenze für den Kauf von Alkohol auf 18 Jahre heraufgesetzt. Allerdings gilt diese Erhöhung nur für den Kauf und das Konsumieren des Alkohols im öffentlichen Raum, und so wirkt sich das Gesetz daher nicht auf den Konsum im privaten Umfeld wie zum Beispiel zu Hause oder auf einer privaten Party aus. Es ist also sehr wahrscheinlich, dass niederländische Jugendliche auch weiterhin viele Gelegenheiten haben werden, Alkohol zu trinken. Im Rahmen dieser Doktorarbeit wurden verschiedene Studien durchgeführt, um die wichtigsten Determinanten von Binge-Drinking bei 16 bis 18 Jahre alten Jugendlichen zu bestimmen, bevor die Gesetzesänderung in Kraft trat (zweites Kapitel). Experten identifizierten wichtige Strategien, um Binge-Drinking bei Jugendlichen zu mindern (drittes Kapitel), und der Effekt von Regeln und Kommunikation über Alkoholkonsum zwischen Eltern und ihrem Kind wurde untersucht (viertes Kapitel). Zum Abschluss werden die Entwicklung (fünftes Kapitel) und die Effektivität (sechstes Kapitel) der in dieser Doktorarbeit entwickelten Intervention, den Alkoholkonsum bei 16-bis 18-jährigen Jugendlichen zu senken, dargestellt.

Im **ersten Kapitel** wird in das Thema Alkoholkonsum und die damit einhergehenden Probleme eingeführt. Web-basierte maßgeschneiderte Interventionen werden als eine vielversprechende Methode vorgestellt sowie das I-Change Model als theoretische Grundlage für die Entwicklung der hier beschriebenen Intervention. Weiterhin wird das Hauptproblem von solchen web-basierten maßgeschneiderten Interventionen beschrieben, nämlich Ausstieg aus der Intervention, und unsere Bemühungen, diesen so gering wie möglich zu halten.

Als Teil der vorausgegangenen, formenden Forschungsstudien wurden in Fokusgruppen Interviews mit 16 bis 18 Jahre alten Jugendlichen und Eltern dieser Zielgruppe geführt. Diese werden im **zweiten Kapitel** beschrieben. Ziel dieser Interviews war es, die Situationen, in denen Jugendliche zu viel trinken, und die Ursachen des Binge-Drinking

besser zu verstehen. Weiterhin wollten wir wissen, wie innerhalb der Familien mit Alkohol umgegangen wird und wie Eltern den Alkoholkonsum ihres Kindes beurteilen. Die Ergebnisse dieser Studie zeigten, dass Jugendliche meistens am Wochenende Alkohol trinken zusammen mit Freunden, entweder in einer Bar, zu Hause oder auf einer Party. Die meisten der Jugendlichen berichteten in den Interviews, dass sie ihr erstes alkoholisches Getränk von den Eltern bekamen und dass ihre Eltern nichts dagegen hätten, wenn sie tranken. Die Eltern jedoch gaben an, dass sie den Alkoholkonsum ihres Kindes nicht gut fänden, gingen aber davon aus, keinen Einfluss mehr auf diese Situation nehmen zu können, da ihr Kind legal Alkohol kaufen könne. Viele berichteten auch, dass sie aufhörten, strenge Regeln bezüglich des Alkoholkonsums zu stellen, als ihr Kind 16 Jahre alt wurde. Die Schlussfolgerungen aus dieser Studie waren, dass Eltern und Kinder viel deutlicher über Alkoholkonsum miteinander sprechen müssen und dass Eltern sich sehr oft zurückziehen, sobald das Kind 16 Jahre alt wird.

In der Delphi Experten Studie, die im **dritten Kapitel** beschrieben wird, haben wir internationale Experten auf dem Gebiet von Alkoholkonsum bei Jugendlichen um Strategien gebeten, mit denen man erfolgreich Alkoholkonsum bei Jugendlichen vermindern kann. Diese Strategien sollten sie dann auch auf Relevanz beurteilen. Als sehr wichtig beurteilten die Experten die Strategie, die Eltern in die Intervention einzubinden und sie zu ermutigen, deutliche und angemessene Regeln über Alkoholkonsum aufzustellen und klar und deutlich mit dem Kind darüber zu sprechen. Jugendlichen müssen Hilfestellungen angeboten werden, um mit dem Gruppendruck umgehen zu können. Wir wollten auch wissen, welche Strategien wichtig sind, um den Ausfall aus der Intervention so klein wie möglich zu halten. Am wichtigsten erachteten es die Experten, dass die Intervention interaktiv und attraktiv ist. Auch der Gebrauch von Erinnerungen und Belohnungen für die Teilnahme wurden von den Experten empfohlen.

Die Effekte von Regeln und Kommunikation über den Alkoholkonsum von 16- bis 18-jährigen Jugendlichen wurde ebenfalls erforscht; diese sind im **vierten Kapitel** dargestellt. Das Aufstellen von Regeln hatte einen schützenden Effekt und sorgte für weniger Binge-Drinking und einen niedrigeren wöchentlichen Konsum von Alkohol. Es hatte sogar einen positiven Effekt auf den Alkoholkonsum in solchen Situationen, in denen Eltern nicht anwesend waren. Dies steht im Gegensatz zur Ansicht der Eltern, wie sie im zweiten Kapitel beschrieben wird, dass sie nämlich sowieso keinen Einfluss mehr auf das Trinkverhalten ihres Kindes nehmen könnten, da dieses ohne ihre Zustimmung und Anwesenheit Alkohol kaufen und konsumieren könnte. Eine positive Korrelation wurde auch gefunden zwischen Kommunikation über Alkohol und Binge-Drinking bzw. dem wöchentlichen Alkoholkonsum. Allerdings bedeutet das in diesem Fall, dass häufige Kommunikation zwischen Eltern und ihren Kindern über Alkohol

mit erhöhtem Alkoholkonsum der Kinder einherging. Frühere Forschungsstudien zeigten, dass die Qualität der Gespräche vermutlich viel wichtiger ist als die Quantität. Die Schlussfolgerung dieser Studie war dann auch, dass das Aufstellen von Regeln besonders wichtig ist sowie ein deutliches, qualitativ hochwertiges Gespräch.

Während der Entwicklung der Intervention, welche im **fünften Kapitel** beschrieben wird, wurde versucht, alle Ergebnisse der Vorstudien (zweites bis viertes Kapitel) mit einzubeziehen. Um der Intervention eine attraktive Gestalt zu geben wurde zur Übermittlung des Inhalts ein Spiel entwickelt. Das zwei-dimensionale Spiel spielt die häufigsten Trinksituation von Jugendlichen nach: in einer Bar, auf einer Party und zu Hause mit Freunden. So sollte ein realistisches Szenario für Jugendliche simuliert werden. Die Empfehlungen der Experten wurden in den Interventionsinhalt mit eingearbeitet. Auch für die Eltern wurde eine Website eingerichtet, auf der sie Ratschläge und Tipps über das Aufstellen von angemessenen Regeln und das deutliche Sprechen mit ihrem Kind bekommen konnten.

Im **sechsten Kapitel** wird die Effektivität der Intervention, die in einem randomisierten Experiment getestet wurde, dargestellt. Das Experiment fand in den Klassen verschiedener Schulen in den Niederlanden statt, die sich zur Teilnahme an der Studie bereit erklärt hatten. Insgesamt wurde nach vier Monaten kein Effekt der Intervention auf das Trinkverhalten der Jugendlichen gefunden. Allerdings zeigten die Analysen, dass der Effekt der Intervention auf Binge-Drinking für die einzelnen Altersgruppen unterschiedlich war. Genauere Analysen zeigten, dass jüngere Jugendliche (15- und 16-Jährige) mehr von der Intervention profitierten und von deutlich weniger Binge-Drinking nach vier Monaten berichteten als ältere Jugendliche. Außerdem gab es Anzeichen dafür, dass es unterschiedliche Effekte geben könnte zwischen der Interventionsgruppe und dem Bildungsniveau in Bezug auf exzessives Trinken (das Trinken von 10 oder mehr Gläsern bei einer Gelegenheit) und zwischen Interventionsgruppe und Alter in Bezug auf den wöchentlichen Alkoholkonsum. Allerdings ergaben weitere Analysen keine signifikanten Ergebnisse für eine dieser Untergruppen. Ein weiteres Ergebnis dieser Studie zeigte, dass der Effekt der Intervention auf das Binge-Drinking sich verstärkte, je länger die Jugendlichen an dem Programm teilnahmen. Teilnahmeanalysen zeigten, dass Jugendliche, die jünger, weiblich, protestantisch oder von vorne herein keine Binge-Drinker waren, länger an der Intervention teilnahmen.

In der allgemeinen Diskussion dieser Doktorarbeit, die im **siebten Kapitel** beschrieben wird, werden die wichtigsten Ergebnisse und Schlussfolgerungen aller Studien (zweites bis sechstes Kapitel) besprochen ebenso wie deren Probleme und Einschränkungen. Die Implikationen dieser Studien für zukünftige Studien und Praktiken werden diskutiert und konkrete Empfehlungen werden ausgesprochen. Die wichtigsten Schlussfolgerungen

waren die folgenden: die Intervention ließ einige vielversprechende Ergebnisse erkennen, allerdings wird die Interpretation dieser Effekte behindert durch den hohen Ausfall (68,9%), der durch Desinteresse an dem Programm oder Desinteresse an der Teilnahme an Interventionsstudien an sich verursacht sein könnte. Ein positiver Effekt auf die Motivation der Jugendlichen durch den Gebrauch eines Spiels wurde, obwohl dies nicht wissenschaftlich getestet wurde, angesichts des hohen Ausfalls anscheinend nicht erreicht. Zudem spielen Eltern auch weiterhin noch eine wichtige Rolle beim Alkoholkonsum ihres Kindes; allerdings scheinen sie noch immer zurückhaltend zu sein, sich in den Alkoholkonsum ihres Kindes einzumischen. In der Zukunft sollte sich mehr Forschung darauf richten, wie Jugendliche und Eltern motiviert werden können, an solchen Interventionsprogrammen teilzunehmen, um so den Ausfall aus solchen Programmen zu verringern und den Gesundheitseffekt der Intervention zu steigern.

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## **Curriculum vitae**

Astrid Franziska Jander was born in Münster, Germany, on January 22, 1986. After receiving her Gymnasium diploma (Abitur) from the Lise-Meitner-Gymnasium in Leverkusen, she moved to Maastricht, the Netherlands, to study Psychology at Maastricht University. She obtained her Bachelor's degree in Cognitive Psychology, after which she started a Master's program in Health and Social Psychology. She obtained her 'cum laude' Master's degree in 2010. Shortly after, she started with her PhD project, which is presented in this dissertation, at the Department of Health Promotion at Maastricht University. After finishing her PhD project the Astrid moved to New York City in the United States.

## Publications

Published or in-press

Crutzen, R., Giabbanelli, P., **Jander, A.**, Mercken, L., de Vries, H. (2015). Identifying binge drinkers based on parenting dimensions and alcohol-specific parenting practices: building classifiers on adolescent-parent paired data. *BMC Public Health*, 15, 747.

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