

A randomized clinical trial of a targeted intervention to moderate alcohol use and alcohol-related problems in at-risk adolescents[☆]

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Abstract

This study investigated the effectiveness of a targeted intervention program aimed at at-risk adolescents in a randomized clinical trial design ($N=107$). This program combined intervention methods which have been proven effective in reducing drinking in young adults, such as an expectancy challenge, cognitive behavioral skill training and brief motivational feedback. Additionally, this intervention contained the new element of discussing biological, cognitive and social risk factors for developing alcohol problems. We investigated whether this seven session program was successful in changing cognitive determinants of drinking behavior and consequently in moderating alcohol use and the development of alcohol-related problems in at-risk adolescents. The intervention was effective in changing several of the targeted cognitive determinants. However, despite the changes in these cognitive determinants of drinking, the experimental group did not show a significant difference in decrease of drinking at posttest compared with the control group. The results did not yield support for any differential long term effects of the intervention. We concluded that although the present intervention successfully changed important cognitive determinants of drinking more is needed to change subsequent drinking behavior in at-risk adolescents.

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1. Introduction

Adolescent alcohol abuse is a serious problem. Research has shown that alcohol abuse among adolescents increases the probability of severe short term consequences like forced and unsafe sex, dropping out of school, unemployment, social isolation, and depression (e.g. Newcomb and Bentler, 1989).

[☆] Parts of these data on the short term effects have been presented at the 27th Annual Scientific Meeting of the Research Society on Alcoholism, Vancouver, Canada (2004). Therefore parts of these data on the preliminary short term effects of the intervention have been published in a symposium summary article in *Alcoholism: Clinical and Experimental Research*.

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Furthermore, alcohol abuse during adolescence has negative long term consequences. Research has indicated that an early onset of drinking during adolescence predicts alcohol-related problems later in life (Grant and Dawson, 1997). Additionally, animal research has demonstrated that the long term effects of binge drinking on the adolescent brain differ and are more severe compared with the effects on the adult brain (e.g., Crews et al., 2000; White et al., 2000; White and Swartzwelder, 2004). Moreover, studies involving human adolescents have revealed that alcohol abuse has negative consequences for the maturation of brain regions (e.g., De Bellis et al., 2000), causes impaired neuropsychological functioning (e.g., Brown et al., 2000) and altered processing in executive functioning tasks (Tapert et al., 2004). All these reasons suggest that adolescence is a very

important period to try to moderate hazardous adolescent drinking to safer levels.

Although primary preventive interventions shows protective effects in terms of adolescent drinking (e.g. Botvin et al., 2001; Botvin and Griffin, 2004), there is an additional necessity to develop secondary preventive intervention for adolescents who are, despite all preventive efforts, involved in hazardous alcohol and/or drug use. Although research has provided insight into consequences of adolescent drinking and risk factors for developing alcohol problems, the question remains what comprises an effective targeted intervention to modify drinking in those at-risk adolescents. Until now, research has mainly focused on the development of effective targeted interventions for (young) adults. In diverse adult populations, different forms of targeted interventions have been demonstrated to be modifying adult hazardous health behavior. For example, while in treatment-seeking populations extended interventions showed better outcomes than brief interventions, non-treatment seeking adults receiving a brief intervention effectively reduced alcohol consumption compared with assessment-only controls (Moyer et al., 2002). Since some of those at-risk adolescents could be classified as being somewhere in between non-treatment seeking (e.g. not yet ready to change their hazardous behavior) and treatment-seeking (e.g. being aware of having problems in school and/or at home because of drinking), it might be most effective to use a moderately long targeted intervention program to reduce hazardous drinking. Moreover, cognitive behavioral skills-based interventions and brief motivational feedback have consistently yielded greater support for their efficacy to reduce hazardous drinking in adults compared with educational or information-only interventions (Larimer and Cronce, 2002). Intervention programs which combine social learning and cognitive behavioral principles, such as the Alcohol Skills Training Program (ASTP; Fromme et al., 1994) and the related Brief Alcohol Screening and Intervention for College Students (BASICS; Dimeff et al., 1999), show promising effects of moderating drinking in young adult drinkers. Since at-risk adolescents presumably have similar problems compared with young adults, it might perhaps be most effective to combine cognitive-behavioral skills training with motivational feedback within one intervention program. Furthermore, alcohol outcome expectancies have been shown to have a large influence on subsequent alcohol use (Goldman et al., 1999). Challenging these hazardous alcohol outcome expectancies is an effective method in decreasing drinking in young adults (Darkes and Goldman, 1993, 1998; Wiers et al., 2005). Consequently, changing hazardous alcohol outcome expectancies in at-risk adolescents might positively modify the influence of these risk factors on the subsequent drinking behavior.

Moreover, Wiers et al. (1998) proposed to use another element in targeted interventions to moderate drinking in at-risk adolescents, namely raising awareness for common misconceptions concerning risk factors for developing alcohol problems. Perceived vulnerability or someone's subjective perception of his personal risk is an important factor in predicting behavioral change (Weinstein, 1982). Drinkers are prone to misinterpret risk factors, such as the influence of family history of drinking,

level of response to alcohol, hazardous alcohol outcome expectancies, susceptibility to peer pressure, gender, age of onset, other drug use and externalizing and internalizing problem behavior (Wiers et al., 1998). Although Schuckit (1998) actually proved the opposite to be true, a common misconception is that someone who experiences few negative sedative effect of drinking will have smaller chance of developing alcohol problem. In general, these misconceptions have been shown to be very resilient and to exist in several knowledge domains such as physics, psychology and biology (Wellman and Gelman, 1992). One of the most effective ways to challenge people's current misconceptions is to enhance deep processing strategies by discussing anomalous data and presenting a plausible alternative theory (Chinn and Brewer, 1993). Consequently, educating drinkers in an interactive way about the biological, cognitive and social risk factors for developing alcohol-related problems next to effectively training them in cognitive behavioral skills and enhancing motivation for change may be an effective way to moderate their hazardous drinking.

The current study investigated the effectiveness of the targeted intervention program "Learning to Drink" in a randomized clinical trial design. The aim was to investigate whether this program was effective in changing cognitive determinants of drinking and thus in moderating alcohol use and the development of alcohol-related problems in at-risk adolescents. The program combined intervention methods such as brief motivational feedback and cognitive behavioral skills-based interventions (Larimer and Cronce, 2002) and was partly based on the Alcohol Skills Training Program (ASTP; Fromme et al., 1994) and the related Brief Alcohol Screening and Intervention for College Students (BASICS; Dimeff et al., 1999). It was hypothesized that the targeted cognitive determinants of drinking behavior would effectively change in the experimental group compared with the information-only control group. The perception of risk factors was expected to increase, whereas the positive alcohol expectancies for a large dose of alcohol were expected to decrease as a function of the intervention. Consequently, we hypothesized that this change in cognitive determinants would lead to a moderation of the increase in alcohol use and alcohol-related problems in the experimental group compared with the information-only control group. Finally, we explored if the intervention would be effective over a longer period in moderating alcohol use as well.

2. Method

2.1. Recruitment

High school students of different educational levels were approached to participate in this study. Several different recruitment strategies, such as recruitment through written advertisements, school nurses and youth workers, were used and proved to be largely unsuccessful. More than 7000 adolescents were approached out of which only 22 adolescents were included (the negative response was primarily due to lack of reaction to the advertisement). Direct contact in schools through classroom recruitment talks proved to be a better

strategy in recruiting participants. The aim of these talks was that regular drinking adolescents (drinking alcohol at least once every two weeks) felt impelled to participate in “Learning to Drink”, advertised as a fun program in which adolescents learned to drink alcohol in a healthy way (with the metaphor of learning how to drive a car). Practical information was given on how many sessions the adolescents were to attend, where and when the sessions took place and the monetary incentives that were given. Furthermore, information sheets for the adolescents and their parents were handed out. Out of approximately 2000 distributed information sheets 102 adolescents replied out of which 85 could be included in the program.

2.2. Participants

A total of 107 participants (61 male, 46 female) were included at pretest and randomly divided over the experimental intervention group ($n=53$) and information-only control group ($n=54$). The experimental intervention group and the information-only control group were subsequently divided in small groups of approximately 10 participants. The age of the participants ranged from 14 to 18 ($M=15.51$, $SD=1.01$). On average the participants consumed 9.11 Dutch standard alcoholic drinks per week ($SD=7.85$) (a standard alcohol serving in the Netherlands contains somewhat less alcohol than an English or American standard alcohol serving: 12 vs. 14 g). Out of the 107 participants 77 (71.9%) indicated having one or more binge episodes in the last two weeks.

2.3. Material

2.3.1. Alcohol use

Alcohol use was measured with a shortened version of a Dutch self-report alcohol use questionnaire (Wiers et al., 1997), based on the timeline follow-back method (Sobell and Sobell, 1990). Self-report questionnaires have been proven to be reliable and valid if the soberness of the participant and confi-

dentiality of data are assured (Sobell and Sobell, 1990). Both requirements were fulfilled in this study. At pretest, posttest, six month follow-up and one year follow-up, participants indicated how many standard alcoholic drinks they consumed for each day of the past week. From this alcohol consumption measure the number of standard alcoholic drinks per week, the mean number of standard alcoholic drinks on a week day (Monday to Thursday), the mean number of alcoholic drinks on a weekend day (Friday to Sunday) and the number of binges (five standard alcoholic drinks or more per day) per week were calculated. Each alcohol consumption measure had a moderate internal consistency with Cronbach's alphas ranging from .30 to .50 (see Table 1).

2.3.2. Alcohol-related problems

An index of alcohol-related problems was assessed using an adapted version of the Rutgers Alcohol Problems Index (White and Labouvie, 1989). Previously, it has been shown that a shortened version of the RAPI correlated .99 with the original 23-items version (White and Labouvie, 2000). We used a shortened version of the RAPI which consisted of 17 items related to personal consequences of alcohol use. Participants were asked to indicate on a 5-point Likert scale (ranging from never to daily) how many times they experienced certain problems within the last six months because of their alcohol use. Examples of items are: “Caused shame or embarrassment to someone” and “Not able to do your homework or study for a test. The items were summed to create an index of alcohol-related problems (Cronbach's alpha = .74).

2.3.3. Alcohol outcome expectancies

Participants were asked to fill out a 48 items questionnaire briefly describing situations (e.g. “After studying hard, I relax from drinking a few glasses of alcohol”) that assessed positive and negative expectancies for a low and for a high dose of alcohol (Wiers et al., 1997). Participants had to indicate to what extent they (dis)agreed with each item on a 5-point Likert scale

Table 1

Pearson correlation and Cronbach's alphas for perception of risk factors, alcohol expectancies, alcohol use and alcohol-related problems at pretest

	# Items	α	1	2	3	4	5	6	7	8	9	10
1. Perc. Risk Factors	13	.67	–									
2. Pos. Alc. Exp. LD	16	.88	.02	–								
3. Pos. Alc. Exp. HD	11	.86	.06	.76**	–							
4. Neg. Alc. Exp. LD	11	.86	.25*	.40**	.38**	–						
5. Neg. Alc. Exp. HD	10	.74	.26*	.16	.29**	.62**	–					
6. Alc. Week	7	.49	–.05	.35**	.44**	.15	.06	–				
7. Alc. Week Day	4	.30	.04	.03	.08	.07	.09	.54**	–			
8. Alc. Weekend Day	3	.50	–.06	.38**	.47**	.15	.05	.99**	.39**	–		
9. Alc. Binge	7	.38	–.05	.33**	.42**	.14	.05	.85**	.35**	.86**	–	
10. RAPI	17	.74	–.01	.38**	.52**	.18	.30**	.37**	.11	.39**	.35**	–

Note. Perception of risk factors scores were average scores on an unmarked 100 mm Visual Analogue Scales; all alcohol expectancy scores were average scores on a 5-point Likert scale ranging from strongly disagree to strongly agree; all RAPI scores were average scores on a 5-point Likert scale ranging from never to daily. Perc. Risk Factors=Perception of Risk Factors; Pos. Alc. Exp. LD=Positive Alcohol Expectancies for Low Dose; Pos. Alc. Exp. HD=Positive Alcohol Expectancies for High Dose; Neg. Alc. Exp. LD=Negative Alcohol Expectancies for Low Dose; Neg. Alc. Exp. HD=Negative Alcohol Expectancies for High Dose; Alc. Week=combined number of standard drinks for each day of the week; Alc. Week Day=mean number of standard drinks on a week day; Alc. Weekend Day=mean number of standard drinks on a weekend day; Alc. Binge=combined number of binges per week; RAPI=mean index of alcohol-related problems.

* $p < .05$, two-tailed.

** $p < .01$, two-tailed.

(ranging from strongly disagree to strongly agree). An average alcohol expectancy score was calculated for each of the subscales. Each subscale had a good internal consistency with Cronbach's alphas all above .70 (see Table 1).

2.3.4. Perception of risk factors

Participants were asked to fill out a 14 items questionnaire with statements briefly describing risk factors, such as "somebody who mainly experiences the positive effects of drinking alcohol will have a higher risk of becoming alcohol dependent than somebody who experiences these positive effects to a lesser extent". Participants had to indicate to what extent they (dis)agreed with each item on a 100 mm unmarked Visual Analogue Scale (VAS; ranging from strongly disagree to strongly agree). An average VAS score was calculated as an index for the perception of risk factors (Cronbach's alpha = .67).

2.4. Procedure

After this study was approved by an institutional medical ethical committee, participants were recruited. When active consent was obtained from both the participants and parents, participants were included in the project.

2.4.1. Pretest

The 107 included participants and their parents were invited in small groups (of approximately 10 people) to the bar-lab at Maastricht University. After the parents were accompanied to another room and the confidential and anonymous nature of the data was emphasized, the participants were asked to fill out the alcohol use questionnaire, the questionnaire on alcohol-related problems (RAPI), the alcohol expectancy questionnaire and additional questionnaires on background variables needed for the feedback given in the individual seventh session. Instructions were given on how to fill out the questionnaires and the experimenter was present to answer participants' questions. Meanwhile, the parents in the other room were also asked to fill out several questionnaires (e.g. regarding family history, their own drinking and communication with their son or daughter).

2.4.2. Intervention

The program "Learning to Drink" consisted of a total of seven weekly sessions and of one parent session which took place in a bar lab at the Maastricht University. The seven weekly sessions for the adolescents consisted of six 90 min group-sessions and one final individual motivational interview. The intervention sessions were carried out by four counselors who were all trained in Motivational Interviewing and in using the protocol for this intervention. All the trainers were either master students or graduate students in Psychology.

During the parent session a couple of topics were addressed. First, some background information was given about alcohol use among adolescents. Furthermore, suitable adolescents drinking norms for moderate drinking were given and discussed. Subsequently, it was specified how parents could detect signals of heavy alcohol use and alcohol-related problems and how parents could communicate with their child regarding his

or her alcohol use. Several options of how parents could respond to their child's alcohol use were discussed in an interactive way.

The first session for the adolescent participants contained the introduction to the program. During this session again the definition of standard alcoholic drink was explained. Participants were told how to fill out alcohol diaries which they had to keep during the seven week intervention period.

The second session consisted of a social expectancy challenge (Darkes and Goldman, 1993) which was adapted for mixed-gender group (Wiers and Kummeling, 2004). During this session participants were made to believe they all received an alcoholic drink while actually half of them received a glass containing a placebo. This procedure was adapted for adolescents: participants received one alcoholic drink or placebo instead of two. After the true nature of this procedure was revealed, the informational part of the session focused on social alcohol expectancies vs. the real effects of alcohol. Further, alcohol expectancies in commercials were discussed in an interactive way. Before leaving, participants' blood-alcohol levels were measured with a breathalyzer, and participants signed for the level measured and were instructed to be extra careful given the presence of some alcohol in their blood. After the experiment, no participant was above the legal limit (.5‰).

The third session consisted of a sexual expectancy challenge (Darkes and Goldman, 1993) adapted for mixed-gender group (Wiers and Kummeling, 2004) and for adolescents (participants received one alcoholic drink or placebo instead of two). The informational part of the session focused on sexual expectancies vs. real alcohol effects followed by explanation of the blood alcohol curve and gender differences in the effects of alcohol and in the risks associated with heavy alcohol use (based on BASICS, Dimeff et al., 1999). Again, participants' blood-alcohol levels were measured with a breathalyzer and participants signed for the level measured and were instructed to be extra careful given the presence of some alcohol in their blood. After the experiment, no participant was above the legal limit (.5‰).

In the fourth session drinking norms (based on ASTP approach, Fromme et al., 1994) and decisional balance of light and heavy drinking (Miller and Rollnick, 2002) were discussed. Participants were asked to estimate if they drank more, less or equal amounts of alcohol compared with their peers. After making their estimation, each participant received personalized normative feedback. At group-level it was discussed what the causes were for discrepancies between the estimation of ones own alcohol use compared with others and the actual normative comparison. Finally, the participants were asked what they considered to be the advantages and disadvantages of moderate and heavy alcohol use. The most common advantages and disadvantages of moderate and heavy alcohol use were discussed within the group.

The fifth session dealt with the perception of risk factors for developing an alcohol problem. A new element in the intervention context was the use of a "naïve theory" approach (cf. Chinn and Brewer, 1993): common misconceptions regarding risk factors for developing an alcohol problem were first elicited, then discussed and targeted. Information was given

about risk factors such as family history, alcohol outcome expectancies, externalizing or internalizing personality characteristics and other drug use.

The sixth session consisted of refusal efficacies skills training (based on the ASTP approach, Fromme et al., 1994). Participants were first asked to identify high risk situations in which they usually drink more than planned and write a short script about an actual event that took place in one of these high risk situations. The participants practiced in saying no to alcoholic drinks by role playing one of the high risk situation scripts. Alternative refusal strategies and alternative behaviors to avoid binge drinking were discussed.

The seventh session was an individual session in the form of an adapted motivational interview in which individualized feedback on the adolescent drinking behavior and risk factors was provided (based on the BASICS program, Dimeff et al., 1999). During this individual session various counseling skills were used (such as reflective listening, affirmations, open ended questions and summaries) in order to elicit 'change talk' (Miller and Rollnick, 2002). This created an opportunity for the participants to think and talk about their own alcohol use (also in comparison to their peers), risk factors and high risk situations, the advantages and negative consequences of drinking alcohol. The main objective was to stimulate new thinking on their personal alcohol use which might result in behavioral change.

2.4.3. Information-only control group

After filling out the pretest, participants in the control group received an information sheet about the biological and cognitive effects of alcohol, risk factors for developing an alcohol problem and the negative consequences of heavy drinking. During this seven week period the participants in the control group, as the participants in the experimental group, filled out several self-report questionnaires. They were individually contacted through mail. In an accompanying letter the confidential and anonymous nature of the data were emphasized and the participants were asked to fill out the enclosed questionnaires. Participants were requested to return the filled out questionnaires in a prepaid envelope.

2.4.4. Posttest

Directly after the intervention was finished, the 107 included participants and their parents were individually contacted by mail. In an accompanying letter the confidential and anonymous nature of the data was emphasized and the participants were asked to fill out the enclosed questionnaires (alcohol use questionnaire and RAPI) and return them in a prepaid envelope.

2.4.5. Follow-up after six months and one year

Approximately six months and one year after the beginning of the intervention, participants were again contacted by mail. In an accompanying letter the confidential and anonymous nature of the data was emphasized and the participants were asked to fill out the enclosed in questionnaires (alcohol use questionnaire and RAPI) and to return them in a prepaid envelope.

2.5. Data reduction and statistical analysis

There were several reasons to decide to calculate a drink index score. First, the five alcohol use outcome variables were significantly but only partially correlated (see Table 1). Therefore, they reflect different aspects of adolescents drinking. In order to be able to consider all these different aspects of adolescent drinking at once, we decided to calculate a mean drink index. Secondly, by calculating and log transforming the mean drink index we were able to obtain a normally distributed outcome measure out of five extremely positively skewed outcome measures. Finally, by calculating one mean drink index it was possible to analyze the effectiveness of the intervention with one instead of five different alcohol use outcome measures. This reduced the chances of making a Type I error. We computed the drink index score in three consecutive steps. First, z-scores were calculated for five different outcome measures, namely the number of standard alcoholic drinks per week, the mean number of standard alcoholic drinks on a week day, the mean number of standard alcoholic drinks on a weekend day, the number of binges per week and the total sum score on the RAPI. Subsequently the drink index score was computed by calculating the mean of these five z-scores. Finally, the drink index was log transformed to obtain a normally distributed dependent variable. From now on the log transformed drink index will be referred to throughout the text as the drink index.

All short term effects of the intervention on the targeted cognitive determinants were analyzed around the intervention sessions where the expected changes were to take place. The short term effects of the intervention on the drink index were analyzed from pretest to posttest. The long term effects of the intervention on drink index were analyzed along pretest, posttest, 6-month follow-up and one year follow-up.

3. Results

3.1. Drop out rates

A total of 90 out of 107 participants (84%) stayed in the program and completed the posttest assessments. Out of the 17 participants who dropped out 6 participants belonged to the control group and 11 participants belonged to the experimental group ($\chi^2(1) = 1.86, p = .17$). This indicates that there was no strong evidence for selective drop out. After six months, 82 of the 107 participants (77%) returned the filled out follow-up questionnaires. After one year, 83 of the 107 participants (78%) returned the filled out follow-up questionnaires.

3.2. Short term effects of the intervention

3.2.1. Perception of risk factor

A 2(Time) × 2(Condition) Mixed ANCOVA controlling for age and gender revealed a significant Time × Condition effect for the perception of risk factors, $F(1, 92) = 19.85, p < .001$. The experimental group showed a significant increase in perceived risk factors between the fifth and the sixth session, $t(47) = 5.99, p < .001$, whereas the control group did not, $t(47) = .93, p > .50$.

3.2.2. Alcohol outcome expectancies

A 2(Time)×2(Condition) Mixed ANCOVA controlling for age and gender revealed a significant Time×Condition effect for high dose positive alcohol expectancies, $F(1, 91)=5.72$, $p<.05$. Between the second and fourth session, a significant decrease in high dose positive expectancies was found in the experimental group, $t(49)=-3.35$, $p<.01$. There was no evidence for a significant change in high dose positive expectancies in the control group, $t(44)=.40$, $p>.50$.

Additionally, a borderline significant Time×Condition effect for low dose positive alcohol expectancies was found, $F(1, 91)=3.34$, $p=.07$. The experimental group showed a significant decrease in low dose positive expectancies between the second and fourth session, $t(49)=-3.97$, $p<.001$, the control group did not, $t(44)=-1.07$, $p=.29$.

Finally, there was a significant Time effect for low dose negative alcohol expectancies, $F(1, 91)=13.12$, $p<.001$. Both controls and experimental group decrease their negative alcohol expectancies for a low dose of alcohol between the second and fourth session (see Table 2).

3.2.3. Drink index

A 2(Time)×2(Condition) Mixed ANCOVA controlling for age and gender did not show a significant Time×Condition effect for drink index, $F(1, 86)=1.08$, $p=.30$. The experimental group showed no significant decrease on the drink index compared with the control group (see Table 2).

3.3. Long term effect of the intervention

We analyzed the long term effects of the intervention by constructing a Latent Growth Model (LGM; Meredith and Tisak, 1990) using AMOS 4.0 (Arbuckle and Wothke, 1999). LGM methods are a form of Structural Equation Modeling (SEM) and offer several advantages over traditional methods for

assessing change over time. First, because LGM methods are able to model both inter- and intra-individual variability in change, they can give a more accurate estimation of the differential effect of condition in change over time. Second, because LGM methods can include several measurement points in outcome assessment, they offer maximized information on the individual change over time compared with simple pre- and posttest designs. An additional advantage is that LGM methods can easily handle missing data which might especially useful in the context of analyzing data of randomized clinical trials (see Hess, 2000).

Based on the delta χ^2 test, we decided that the model represented in Fig. 1 fitted the data relatively well compared with more elaborate models, such as a model with a quadratic effect of time. This model was accepted as fitting the data ($\chi^2(7)=9.36$, $p=.28$, RMSEA=.056, CFI=.984). Note that in SEM a non-significant p -value denotes a non-significant misfit of the model to the data and a model is regarded as fitting the data reasonably well when RMSEA<.08 and CFI>.90. As indicated in Fig. 1, the latent factors intercept and slope are extracted from the drink index data across pretest, posttest, 6-month follow-up and 1 year follow-up (i.e. from the drink index at 0, 7, 26 and 52 weeks). These are used as estimates of baseline functioning (intercept) and the increase or decrease of the drink index over time (slope). The double-headed arrow between intercept and slope indicates the association between the individual level of baseline functioning and the individual change over time. By fixing all paths from the intercept factor to each measurement point to 1 and all paths from the slope factor to each measurement point to 0, 7, 26 and 52 this model represents linear growth. By introducing condition as a predictor of intercept and slope, these two latent factors are estimated based on group membership. The path from condition to intercept tests if the experimental group differs from the control group in baseline functioning. This is the main effect of condition. The path from condition to slope tests if individual growth within

Table 2
Means and standard deviations of alcohol drink index across measurement points

	Pre-test		S2		S4		S5		S6		Post-test		FU 1		FU 2	
	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
Perc. Risk Factor							61.3	60.4	71.3	61.0						
							(9.5)	(14.3)	(13.2)	(14.6)						
Pos. Alc. Exp. LD			3.1 (.6)	2.8 (.8)	2.8 (.7)	2.7 (.8)										
Pos. Alc. Exp. HD			2.8 (.8)	2.6 (.8)	2.6 (.8)	2.7 (.9)										
Neg. Alc. Exp. LD			1.9 (.6)	1.8 (.6)	1.7 (.6)	1.7 (.6)										
Neg. Alc. Exp. HD			1.8 (.5)	1.9 (.6)	1.8 (.5)	2.0 (.7)										
Alc. Drink Index	-.1 (.7)	.9 (.9)									-.1 (.6)	.1 (.8)	-.1 (.6)	.1 (.9)	-.2 (.5)	.2 (.1)

Note. Perception of risk factors scores were average scores on an unmarked 100 mm Visual Analogue Scales; All alcohol expectancy scores were average scores on a 5-point Likert scale ranging from strongly disagree to strongly agree; S2=Intervention Session 2; S4=Intervention Session 4; S5=Intervention Session 5; S6=Intervention Session 6; FU 1=Follow-up after 6 months; FU 2=Follow-up after one year; E=Experimental Group; C=Control Group; Perc. Risk Factor=Perception of Risk Factors; Pos. Alc. Exp. LD=Positive Alcohol Expectancies for Low Dose; Pos. Alc. Exp. HD=Positive Alcohol Expectancies for High Dose; Neg. Alc. Exp. LD=Negative Alcohol Expectancies for Low Dose; Neg. Alc. Exp. HD=Negative Alcohol Expectancies for High Dose; Alc. Drink Index=mean standardized index score of the combined number of standard drinks for each day of the week, the mean number of standard drinks on a week day and on a weekend day, the combined number of binges per week and the mean index of alcohol-related problems.

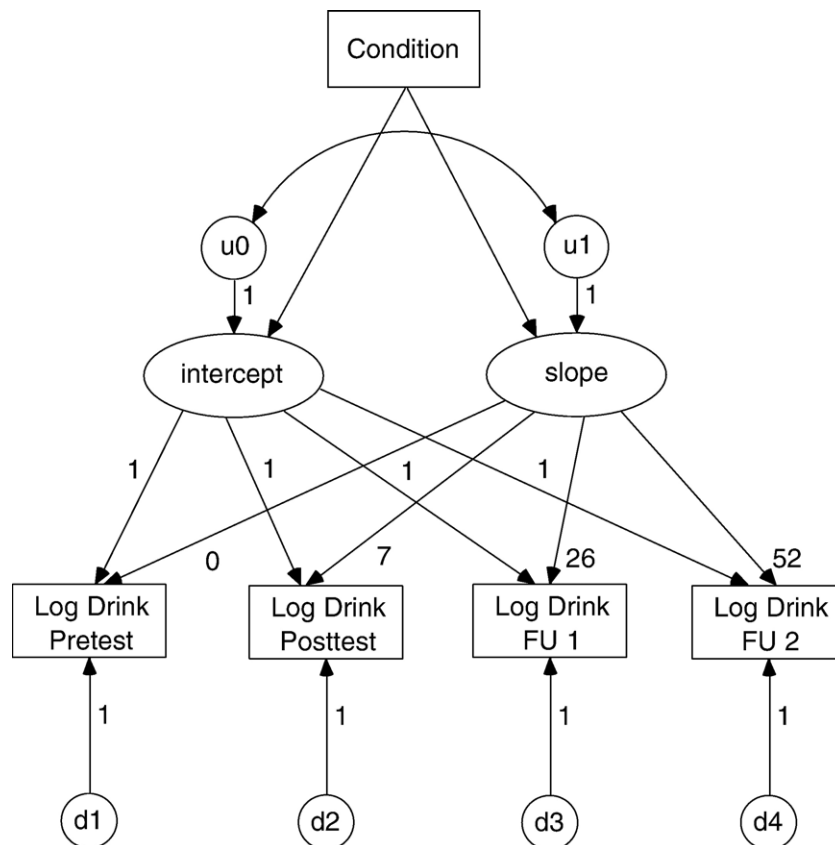


Fig. 1. Latent Growth Model for log drink index scores. The labels mark path coefficients that were constrained across assessment points. Condition=control or experimental group; Intercept=baseline log drink index; Slope=change log drink index; Log Drink Pretest=log drink index score at pretest; Log Drink Posttest=log drink index score at posttest; Log Drink FU 1=log drink index score at six month follow-up; Log Drink FU 2=log drink index score at one year follow-up.

the experimental group differs from individual growth in the control group. This is the interaction between time and condition we are primarily interested in.

The regression weights in Table 3 show that there was a negative but non-significant effect of condition on intercept ($B = -.120$, $p = .39$) and slope ($B = -.003$, $p = .27$). This means that the two treatment conditions did not significantly differ with respect to their baseline functioning and change of the drink index over time. So, there was no main effect of condition, and no interaction between time and condition. Furthermore, the main effect of time was also non-significant ($B = .003$, $p = .14$). The initial level of drink index was significantly different from zero ($B = -.209$, $p = .03$).

The variances of the latent variables u_0 and u_1 were significantly different from zero ($\text{var}(u_0) = .369$, $p < .001$; $\text{var}(u_1) = .000$, $p < .001$), meaning that there was between-individual variability in the initial level of and change in drink index. These two variables were negatively and significantly correlated ($\text{covar}(u_0, u_1) = -.002$, $p = .04$), so participants with a higher initial drink index showed a significantly lower increase in drink index over time than participants with a lower level of initial drink index. Finally, the variances of the latent variables u_1 – u_3 were all significantly different from zero, meaning that there were other factors that contribute to the variability in the drink index scores at the first three time points than those used in the model.

4. Discussion

This study investigated the effectiveness of the targeted intervention program “Learning to Drink” in a randomized clinical trial design. The aim was to investigate whether this program was successful in changing the targeted cognitive

Table 3
Summary of the parameter estimates in the Latent Growth Model ($N = 107$)

	Estimate	S.E.	p
Regression weights			
Intercept	-.209	.097	.031
Slope	.003	.002	.141
Condition	-.120	.138	.385
Condition \times Slope	-.003	.003	.273
Variances			
d_1	.246	.055	***
d_2	.266	.052	***
d_3	.133	.030	***
d_4	.038	.055	.492
u_0	.369	.071	***
u_1	.000	.000	.011
Covariances			
$u_0 \leftrightarrow u_1$	-.002	.001	.043

Note. Condition=control or experimental group; Intercept=baseline log drink index; Slope=change log drink index.

*** $p < .001$.

determinants of drinking behavior, such as perception of risk factors and alcohol expectancies. Subsequently, we hypothesized that this change in cognitive determinants would lead to a moderation of the increase in alcohol use and alcohol-related problems in at-risk adolescents. The intervention was effective in changing several of the targeted cognitive determinants: there was a significant increase in the perception of risk factors for developing alcohol-related problems and a significant decrease of positive alcohol expectancies for a high dose of alcohol in the experimental group compared with the control group. Despite the changes in these cognitive determinants of drinking, the experimental group did not show a significant difference in decrease of drinking at posttest compared with the control group. The results did not yield support for any differential long term effects of the intervention. So, although the intervention focused on changing determinants of drinking behavior, the subsequent decrease in drinking behavior was not obtained.

The fact that we did not observe the expected change in the subsequent outcome behavior, might reflect that targeting these cognitive determinants alone is not enough to elicit meaningful changes in at-risk youth. Although cognitive behavioral skills-based interventions and brief motivational feedback have been proven to be effective in reducing hazardous drinking in (young) adult populations (Larimer and Crouce, 2002), these strategies might be less effective in at-risk adolescents populations. This reduced effectiveness in these at-risk adolescent populations might be explained by the differential response to alcohol in adolescents and adults. During adolescence not so much the negative sedative effects, but especially the positive arousal effects of drinking are being experienced (NIAAA, 2005). Therefore, these adolescents might feel they do not have sufficient reason for changing their drinking behavior. Furthermore, these intervention strategies might be less effective in these at-risk adolescent populations, because adolescents drinking behavior might be more influenced by other processes than deliberate processes such as alcohol outcome expectancies and awareness of risk factors for developing alcohol problems. It has been suggested that alcohol-induced brain damage in the pre-frontal cortex during adolescence might lead to reduced executive functioning (e.g. Crews et al., 2000). In turn, reduced executive functioning might lead to less deliberate control and more automatically induced behavior (Payne, 2005).

However, given a number of limitations, these results should be interpreted with some caution. First, a weakness in the design was the difference in contact hours between the experimental intervention group and the information-only control group. However, it was ensured that the time spent on filling out questionnaires was equal in both groups. Secondly, the absence of a long term effect of the intervention could be due to the fact that the controls also had to fill in numerous questionnaires on their alcohol use and alcohol-related problems. Research has shown that any form of self-monitoring may affect the behavior that is being monitored (measurement reactivity). Indeed, several studies have shown that monitoring ones alcohol use has moderating impact on the subsequent alcohol use (e.g. Miller et al., 1995). This could serve as a post-hoc explanation for the fact that both the control and experimental group did not

show the anticipated increase in drinking over time. Since the usual pattern within this age group in the Netherlands is an increase of alcohol use over time (Poelen et al., 2005), the fact that no such significant change over time was found might indeed indicate that both the current intervention and the assessment have had a moderating influence on subsequent alcohol use. In this interpretation the assessment of the control group which might have served as a minimal intervention could have been equally effective as the intensive treatment condition. This hypothesis could be tested in a follow-up research by including a no or minimal assessment control condition. Thirdly, the absence of a long term effect of the intervention could be due to the fact that the current sample was too small to detect subtle differences in changes in alcohol use or alcohol-related problems between the experimental and control group. It could be that subgroups within this young population profit from this intervention, however this could not be analyzed adequately given the limited power. Indeed, previous research has shown that specific subgroups defined on the basis of personality profiles benefit from different intervention strategies (Conrod et al., 2000). Possibly, that with a larger sample size a differential effectiveness of the intervention for different subgroups could be shown. Yet, the small sample size seemed to reflect another more fundamental problem of this program; the apparent difficulty of this program is to attract at-risk adolescents to participate.

The results of this study suggest that the clinical significance of this intervention was small, given the fact that this intervention could not attract large numbers of at-risk adolescents and was not able to induce meaningful changes in drinking behavior in at-risk adolescents. Although the intervention was effective in changing cognitive determinants of drinking, this did not lead to the expected decrease in drinking behavior. This might suggest that research on the moderation of hazardous drinking in at-risk youth should not only focus on the explicit deliberate processes, but should also take into account that more automatic processes have a strong influence on drinking behavior in at-risk adolescents. Indeed, implicit alcohol associations have been shown to predict a unique part of the variance of subsequent alcohol use in students (Stacy, 1997) and in high-risk adolescents (Stacy et al., 1996) after controlling for explicit alcohol expectancies. Differences in implicit arousal associations with alcohol dissociated between heavy and light drinkers and explicit alcohol expectancies differed from the implicit association with alcohol (Wiers et al., 2002). In addition, interventions seem to have differential effect on implicit and explicit alcohol-related cognition (Wiers et al., 2005). Directly or indirectly influencing these automatically activated alcohol associations might be the next step in the development of targeted intervention programs (Wiers et al., 2004).

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