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Effectiveness of a selective alcohol prevention program targeting personality risk factors: Results of interaction analyses ☆

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ABSTRACT

Aim: To explore whether specific groups of adolescents (i.e., scoring high on personality risk traits, having a lower education level, or being male) benefit more from the Preventure intervention with regard to curbing their drinking behaviour.

Design: A clustered randomized controlled trial, with participants randomly assigned to a 2-session coping skills intervention or a control no-intervention condition.

Setting: Fifteen secondary schools throughout The Netherlands; 7 schools in the intervention and 8 schools in the control condition.

Participants: 699 adolescents aged 13–15; 343 allocated to the intervention and 356 to the control condition; with drinking experience and elevated scores in either negative thinking, anxiety sensitivity, impulsivity or sensation seeking.

Measurements: Differential effectiveness of the Preventure program was examined for the personality traits group, education level and gender on past-month binge drinking (main outcome), binge frequency, alcohol use, alcohol frequency and problem drinking, at 12 months post-intervention.

Intervention and comparator: Preventure is a selective school-based alcohol prevention programme targeting personality risk factors. The comparator was a no-intervention control.

Findings: Intervention effects were moderated by the personality traits group and by education level. More specifically, significant intervention effects were found on reducing alcohol use within the anxiety sensitivity group (OR = 2.14, CI = 1.40, 3.29) and reducing binge drinking (OR = 1.76, CI = 1.38, 2.24) and binge drinking frequency ($\beta = 0.24$, $p = 0.04$) within the sensation seeking group at 12 months post-intervention. Also, lower educated young adolescents reduced binge drinking (OR = 1.47, CI = 1.14, 1.88), binge drinking frequency ($\beta = 0.25$, $p = 0.04$), alcohol use (OR = 1.32, CI = 1.06, 1.65) and alcohol use frequency ($\beta = 0.47$, $p = 0.01$), but not those in the higher education group. Post hoc latent-growth analyses revealed significant effects on the development of binge drinking ($\beta = -0.19$, $p = 0.02$) and binge drinking frequency ($\beta = -0.10$, $p = 0.03$) within the SS personality trait.

Conclusions: The alcohol selective prevention program Preventure appears to have effect on the prevalence of binge drinking and alcohol use among specific groups in young adolescents in the Netherlands, particularly the SS personality trait and lower educated adolescents.

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1. Introduction

Preventure is a selective prevention programme with a personality-targeted approach. It targets young adolescents with two risk factors for heavy alcohol consumption: early-onset alcohol use (Grant & Dawson, 1997; Hawkins et al., 1997) and personality risk for alcohol abuse (e.g. (Rutledge & Sher, 2001)). Preventure has proven to be effective in Canadian, British and Australian studies when offered to high-school students (Conrod, Stewart, Comea, & Maclean, 2006; Conrod, Castellanos, & Mackie, 2008; Conrod, Castellanos-Ryan, & Mackie, 2011). In a recent

study on the effectiveness of Preventure in The Netherlands, no program effects were found when looking at the incidence of alcohol use at the follow-up points separately (Lammers et al., 2015). By modelling the development of alcohol use over time using latent growth modelling, positive program effects were found. The exposure to the intervention resulted in significantly less growth in binge drinking and binge drinking frequency over the whole group of young adolescents (Lammers et al., 2015). In the current post hoc analyses of the Dutch Preventure study, we explored whether certain theory-based high risk groups would benefit more from the Preventure intervention than others.

Specific characteristics of study participants may moderate the relationship between the Preventure intervention and substance use behaviours (Conrod et al., 2008; Conrod et al., 2011; Kreamer, Wilson, Fairburn, & Agras, 2002). The risk moderation hypothesis suggests that prevention programs should be more effective in high-risk groups compared to lower risk groups. On the basis of previously reported moderators in the literature (Conrod et al., 2008; Kuntsche, Knibbe, Gmel, & Engels, 2006; Verdurmen, Koning, Vollebergh, van den Eijnden, & Engels, 2011), we specifically examined participants' personality traits, educational level and gender as possible moderators of intervention effects.

Two personality dimensions were previously found to be predictive of heavy alcohol use and alcohol use disorders, namely (1) an impulsive sensation seeking dimension, and (2) a behavioural inhibition dimension (Conrod et al., 2006). These two broad personality dimensions are either more proximal to alcohol use and misuse or they map onto specific motivational processes underlying alcohol use or misuse (Conrod et al., 2006). The impulsive sensation seeking dimension is related to drinking problems through negative affect coping motives. In contrast, the inhibition dimension is associated with positive affect related drinking, which is in turn associated with heavier drinking and drinking problems (Conrod et al., 2006). Within these two dimensions, Conrod and colleagues (Comeau, Stewart, & Loba, 2001; Sher, Bartholow, & Wood, 2000) distinguished four personality profiles at higher risk of developing alcohol problems: sensation seeking (SS), impulsivity (IMP), anxiety sensitivity (AS) and negative thinking (NT). Both anxiety sensitive and hopeless individuals showed higher levels of alcohol use and drinking problems (Sher et al., 2000; Conrod, Pihl, & Vassileva, 1998; Stewart, Peterson, & Pihl, 1995; Krank et al., 2011). Sensation seekers were found to drink earlier, at greater frequency, and they were at risk of heavy alcohol use (binge drinking) (Sher et al., 2000; Castellanos-Ryan, Rubia, & Conrod, 2011; Krank et al., 2011). Impulsive individuals showed an increased risk of early alcohol and drug use (Krank et al., 2011; Shin, Hong, & Jeon, 2012; Walther, Morgenstern, & Hanewinkel, 2012). Consistent with the Canadian, British and Australian studies (Conrod et al., 2006; Conrod et al., 2008; Conrod et al., 2011), we hypothesised that Preventure would be effective in reducing binge drinking rates among the sensation seekers' trait, and reducing drinking rates and problem drinking among the anxiety sensitivity and negative thinking personality traits (Conrod et al., 2006).

A unique feature of the education system in the Netherlands is that the population of secondary school pupils is divided into different education levels and there are important differences in substance use behaviours between adolescents from lower and higher educational backgrounds (Sallona et al., 2008; Spijkerman, Van den Eijnden, & Huiberts, 2008; Verdurmen et al., 2012). For example, a great proportion of pupils from lower education levels report binge drinking; 75% of pupils aged 13–15 with preparatory vocational training (lower educational level) engage in binge drinking, compared to 56% of students with pre-university education (higher educational level) (Verdurmen et al., 2012). In other Dutch prevention trials, (Verdurmen et al., 2011; Koning et al., 2009; Verdurmen, Koning, Vollebergh, van den Eijnden, & Engels, 2014), education level was found to moderate intervention effects. Because binge drinking is more common among pupils from lower

educated levels, and previous trials indicated that lower educated students might benefit more from alcohol prevention programmes (Koning et al., 2009), we hypothesised that Preventure would be more effective in reducing binge drinking in the group of lower educated students at follow-up compared to students with a higher education level.

Finally, boys and girls have different drinking patterns. For instance, boys tend to drink more frequently and are more engaged in binge drinking compared to girls (Verdurmen et al., 2012), at least at the time this trial was conducted. In general, externalizing risk factors, such as low self-regulatory capacities, are more common among boys (Chassin, Pitts, & Prost, 2002; Hill, White, Chung, Hawkins, & Catalano, 2000) and internalizing factors, like low self-esteem, are more present among girls (Chassin et al., 2002; Colder, Campbell, Ruel, Richardson, & Flay, 2000). Furthermore, girls are more likely to use substances as a way to cope with stress, while boys are more likely to use out of enhancement motives (Kuntsche et al., 2006). Because the intervention matches those differences expected for the personality types, we expected boys and girls to benefit both from the Preventure program.

With the exploration of these certain theory-based high risk groups, the Preventure programme can possibly be implemented more effective and more tailored into the Dutch school setting.

2. Method

2.1. Study sample

A total of 100 schools were selected randomly from all public secondary schools in The Netherlands (N = 405). Sixty schools fulfilled the inclusion criteria: 1) at least 600 students, 2) <25% of students from migrant populations, and 3) no special education. Fifteen schools (25%) were willing to participate. A screening survey was carried out among all students attending grade 8 and grade 9 in the participating schools. The students who reported to have drunk at least one glass of alcohol, and scored more than one standard deviation above the sample mean on one of the four personality risk scales were classified as belonging to a risk group (Woicik, Stewart, Pihl, & Conrod, 2009). In total, 4844 students participated in the screening, and 699 students participated in the study (see Fig. 1). Analyses revealed no significant differences in prevalence or demographic characteristics between consenting and non-consenting students. Randomization occurred at school level to avoid contamination between conditions. Parents and students provided active informed consent to participate in the intervention part of the study. The study was approved by the Medical Ethical Commission for Mental Health (METIGG). The design, including the power analyses, is described in more detail in earlier reports (Lammers et al., 2011; Lammers et al., 2015). The trial is registered in The Netherlands Trial Register (NTR1920).

A total of 581 students (83%) completed follow-up measures after 2 months, 552 students (79%) after 6 months and 530 students (76%) at the 12-month follow-up. The students who only completed the screening questionnaire (7% of all respondents) were more likely to have a lower level of education than those who completed at least one of the three follow-up questionnaires (53% vs. 34%, $\chi^2(1) = 8.20$, $p < 0.004$).

2.2. Intervention

Preventure is a brief intervention using motivational interviewing strategies and cognitive behavioural skills training, that is tailored to one of the four personality profiles (Conrod et al., 2011; Conrod et al., 2013). It focuses on changing coping strategies rather than substance use specifically. The intervention involved two 90-minute group sessions, carried out at the participants' schools, during school hours. Group-sessions were supported by student manuals, in which thoughts and exercises could be logged. In the first group session, psycho-educational strategies were used to educate students about the target

personality variable, and the associated problematic coping behaviours, such as risky behaviour, and substance misuse. Students were motivated to explore ways of coping with their personality through a goal-setting exercise. In the second session, participants were encouraged to identify and challenge personality-specific cognitive thoughts that lead to problematic behaviours. Students assigned to the control group received no further intervention.

2.3. Treatment integrity

The intervention was provided by three qualified counsellors and two co-facilitators. The counsellors were observed by a supervisor at their first two group sessions at each school, and were provided with feedback through four peer reviewing meetings during the implementation. Eighty percent (80%) of participants were present for the first intervention session and 71% for the second session. In total, 71% of the students followed both group sessions. Students who did not attend both group sessions (29%) were more likely to have recently been binge drinking (59% vs. 45%) ($\chi^2(1) = 5.12$, $\rho < 0.024$) and were more likely to skip one or more of the follow-up measurements ($\chi^2(1) = 25.87$, $\rho < 0.0001$) than students who attended both group sessions.

2.4. Outcome measures

2.4.1. Baseline assessment

The baseline questionnaire included demographic variables: age, sex, year of level, ethnicity and level of education. For baseline screening, the Substance Use Risk Profile Scale (SURPS; (Woicik et al., 2009)) was used, which distinguishes four personality profiles. Each profile is assessed using five to seven items that can be answered on a 4-point scale. Studies in both adolescent and adult samples in several countries have shown that this scale has good internal reliability, convergent and discriminant validity, and adequate test–retest reliability (Krank et al., 2011; Woicik et al., 2009; Malmberg et al., 2012). All four subscales demonstrated good internal consistency in the current sample (Cronbach's $\alpha = 0.84$ for NT, 0.72 for AS, 0.69 for IMP and 0.66 for SS). These reliability estimates converge with those from previous research (e.g. (Malmberg et al., 2012; Jaffee & D'Zurilla, 2009)) and are satisfactory for short scales (Loewenthal, 1996).

2.4.2. Primary outcome measure

The primary outcome was binge drinking at 12 months follow-up measurement, assessed with the question 'How many times have you had five or more drinks on one occasion, during the past four weeks?', with the answer categories 'none', '1', '2', '3–4', '5–6', '7–8' and '9 or more'. Because the binge drinking variable was skewed to the low end, the item was recoded into a binominal variable (0 = 'none'; 1 = '1 or more').

2.4.3. Secondary outcome measures

Alcohol use was assessed by 1-month prevalence (Engels, Knibbe, & Drop, 1999) at 12 months follow up measurement by asking: 'In the past four weeks, did you drink any alcoholic beverage(s)?' Alcohol use was recoded into a binominal variable (0 = 'none'; 1 = '1 or
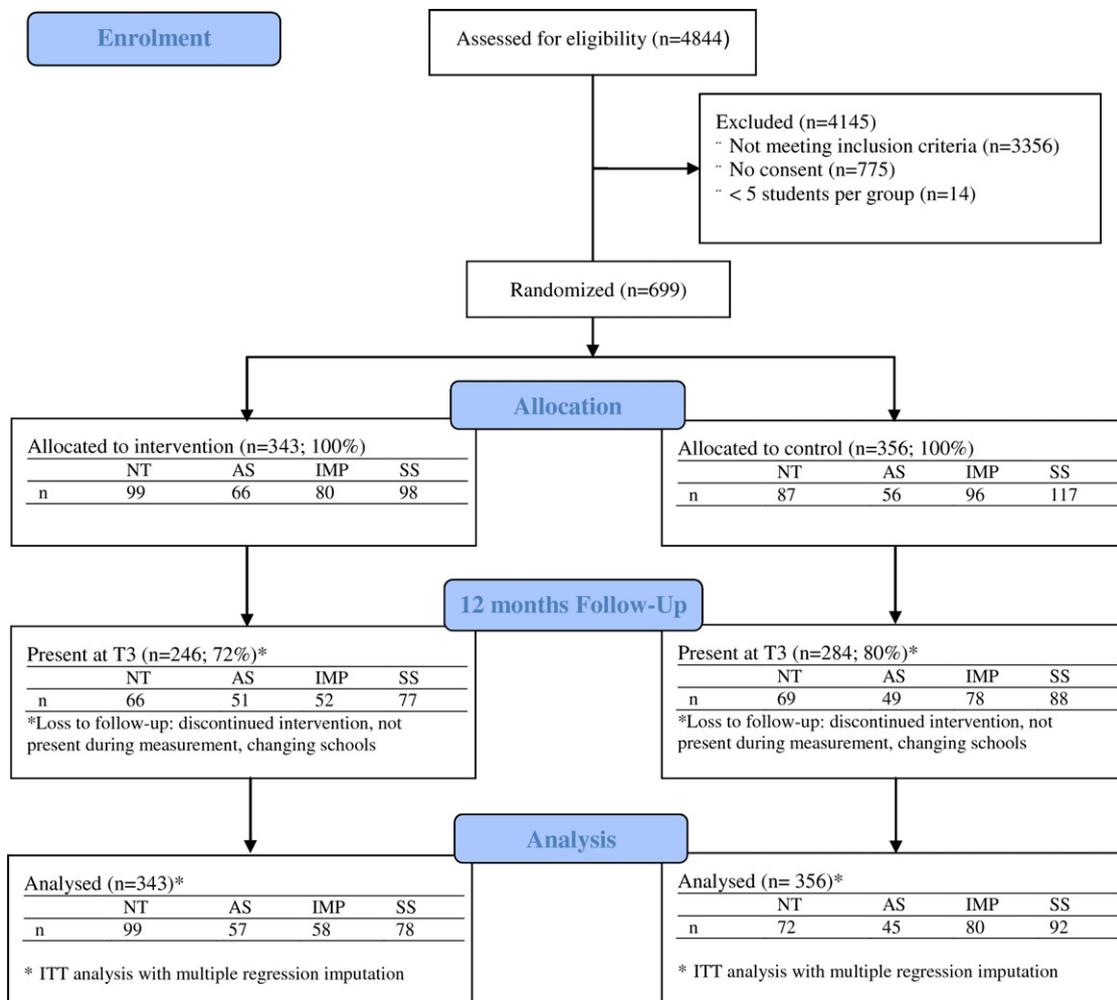

Fig. 1. Flow diagram of recruitment and progress throughout the study.

more'). Binge drinking frequency was assessed with the same question as binge drinking. Frequency of alcohol use was assessed with the question 'In the past four weeks, how often did you drink one or more alcoholic beverage(s)?', ranging from 0 to 40 or more times. The binge drinking frequency and alcohol frequency items were log-transformed to approximate a normal distribution. To assess drinking problems, the abbreviated Rutgers Alcohol Problems Index (RAPI) (White & Labouvie, 1989) was used. Participants could indicate on a scale ranging from 0 (never) to 5 (>6 times) how often they experienced each of 18 alcohol-related problems during their life. Item scores were summed. Because the variable was skewed, the item was recoded into a binominal variable (0 = 'absence'; 1 = 'presence'). The original RAPI has been well validated for use with both clinical and community adolescent samples (White & Labouvie, 1989; Wiers, 2008).

2.5. Statistical analyses

Descriptive analyses were conducted to examine whether randomization resulted in a balanced distribution of demographic and outcome variables over the two conditions. The randomization resulted in an uneven distribution in terms of age, sex and level of education. Hence, these variables were included as covariates in all subsequent analyses. As the intervention condition showed higher binge drinking at baseline than the control condition, binge drinking was also used as covariate. To correct for the potential non-independence (complexity) as well as clustering of the data, the TYPE = COMPLEX procedure in Mplus was used [cf (Malmberg et al., 2012)]. Next, to determine the effect of the intervention on the alcohol use outcomes we made use of the intention to treat principle (ITT) [cf (Verdurmen et al., 2011; Malmberg et al., 2010)]. Missing data were imputed using multiple regression imputation in Mplus 6.11 (Muthén & Muthén, 1998). To examine moderation effects of different high-risk groups, intervention interaction analyses were conducted with the variables sex, level of education and the four personality traits AS, NT, IMP and SS, for all the primary and secondary outcome measurements. To test for interaction effects, we computed product terms of study condition with the variables sex, level of education and the four personality traits AS, NT, IMP and SS, respectively. Interaction effects were included separately in the regression analyses [cf (Conrod et al., 2006)]. The level of statistical significance was set at p-value < 0.05. We chose not to correct for multiple testing seeing that this is the first time the Preventure Programme was tested in the Netherlands and the interaction analyses are therefore of a more exploratory nature. Valuable information on potential subgroups for which the program could be more effective would be lost if we correct for multiple testing. The effects of the intervention condition were compared to the effects of the control condition using multivariate regression analyses in Mplus 6.11. For the dichotomous variables we used logistic regression analyses, with ML and the CATEGORICAL ARE option (reported in OR). For the continuous variables regression analyses were used, with the MLR estimator (reported in β). The main effects of the variables involved in interaction analyses were also included in the models assessing interactions, as were all covariates. Furthermore, post hoc latent growth analyses were conducted to examine the effect of Preventure on the linear increase in alcohol use. A latent-growth model approaches the analysis of repeated measures from the perspective of an individual growth curve for each subject; each growth curve has a certain initial level (intercept) and a certain rate of change over time (slope) (Duncan, Duncan, Strycker, Li, & Alpert, 1999). In this latent growth model, the alcohol outcome slope was regressed on the Preventure intervention condition variable, controlled for the other outcome measures and the covariates age, sex and education. The fit of the models was reported by χ^2 and, because with large sample sizes the χ^2 is often significant, we also reported the CFI, TLI and the RMSEA.

3. Results

3.1. Descriptive analyses

Descriptive analyses revealed significant differences between the experimental conditions with regard to sex ($\chi^2(1) = 5.96$, $\rho = 0.015$), age (t (697) = 2.98, $\rho < 0.003$) and level of education ($\chi^2(1) = 24.77$, $\rho < 0.001$). The intervention condition included more girls, slightly younger students and more students with a low education level. Furthermore, the students in the intervention condition were more likely to engage in binge drinking at baseline ($\chi^2(1) = 10.43$, $\rho < 0.001$) than the students in the control condition (see Table 1).

3.2. Moderators

Interaction analyses examined if adolescents' personality traits, level of education or gender moderated the relationship between the intervention condition and substance use. Significant Intervention x Personality Group interactions were found for anxiety sensitivity (AS) and sensation seeking (SS) for binge drinking, binge drinking frequency and alcohol use at 12 months post-intervention (see Table 2). For NT and IMP, the intervention effects were not significant. Intervention × education level analyses indicated significant interaction effects on binge drinking, binge drinking frequency and alcohol frequency. Young adolescents with lower education were less engaged in binge drinking, and used alcohol less frequent than adolescents with higher level of education, after receiving the intervention (see Table 3).

No significant interaction effects were found for the outcome variable problem drinking, and no significant interaction effects were found for boys and girls.

3.3. Intervention effects on growth over time

Analyses were conducted to examine the effect of Preventure on the linear increase in alcohol use among subgroups, by means of a latent-growth curve approach. The intercept and slope for binge drinking (intercept = 1.22, $p < 0.001$ and slope = 0.50, $p < 0.001$) and binge drinking frequency (intercept = 1.05, $p < 0.000$ and slope = 0.58, $p < 0.000$) were significant, indicating that levels of binge drinking and binge drinking frequency increased over time. The fit between the model and the data was excellent for both binge drinking (χ^2 [N = 699] = 403.691, $p < 0.001$; RMSEA = 0.024 (0.000–0.068), CFI = 0.996, TLI = 0.994) and binge drinking frequency (χ^2 [N = 699] = 14.048, $p < 0.02$; RMSEA = 0.060 (SD = 0.005), CFI = 0.986, TLI = 0.979).

For sensation seekers, there was a significant effect of the intervention on the binge drinking slope ($\beta = -0.07$, $p = 0.02$), and binge

Table 1
Baseline demographic characteristics of intervention and control condition.

Outcome	Measure	Intervention	Control	
n = 699		Mean (SD)/%	Mean (SD)/%	*p*-Value
Demographics	Male	47%	57%	<0.015
	Age	13.9 (0.98)	14.1 (0.77)	<0.003
	Dutch	87%	87%	n.s.
	Low level of education	43%	26%	<0.001
Alcohol use	Total group	60%	59%	n.s.
	NT	55%	59%	n.s.
	AS	52%	49%	n.s.
	IMP	70%	60%	n.s.
	SS	62%	62%	n.s.
Binge drinking	Total group	49%	37%	<0.001
	NT	47%	36%	n.s.
	AS	46%	35%	n.s.
	IMP	51%	42%	n.s.
	SS	52%	34%	<0.01

Note. NT = negative thinking; AS = anxiety sensitivity; IMP = impulsivity, SS = sensation seeking.

Table 2
Interaction effects personality traits on alcohol outcomes at 12-month follow-up (T3) among alcohol users at baseline.

		Binge drinking		Alcohol use		Problem drinking		Binge drinking frequency		Alcohol frequency	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	β (SE β)	p	β (SE β)	p
AS	Sex	0.96 (0.69, 1.33)	0.81	0.55 (0.38, 0.79)	0.00	0.89 (0.60, 1.32)	0.56	0.03 (0.03)	0.40	−0.06 (0.04)	0.11
	Age	1.40 (1.07, 1.83)	0.01	1.60 (1.14, 2.25)	0.01	1.53 (1.18, 1.99)	0.00	0.14 (0.05)	0.00	0.18 (0.05)	0.00
	Edu	0.90 (0.75, 1.09)	0.28	1.04 (0.72, 1.50)	0.74	1.17 (0.97, 1.41)	0.10	−0.09 (0.04)	0.04	−0.03 (0.05)	0.53
	Cond	0.95 (0.60, 1.50)	0.81	0.80 (0.44, 1.44)	0.45	1.00 (0.65, 1.54)	0.99	−0.01 (0.05)	0.78	−0.02 (0.05)	0.68
	AS	0.64 (0.38, 1.10)	0.09	0.47 (0.28, 0.78)	0.00	0.95 (0.54, 1.68)	0.86	−0.09 (0.05)	0.05	−0.12 (0.04)	0.00
	CxAS	0.98 (0.44, 2.18)	0.96	2.14 (1.40, 3.29)	0.03	0.81 (0.37, 1.78)	0.59	0.03 (0.05)	0.52	0.08 (0.04)	0.04
NT	Sex	1.01 (0.94, 1.09)	0.76	0.61 (0.42, 0.88)	0.01	0.92 (0.61, 1.38)	0.68	0.04 (0.03)	0.18	−0.04 (0.04)	0.32
	Age	1.16 (1.03, 1.31)	0.01	1.57 (1.13, 2.19)	0.01	1.55 (1.18, 2.02)	0.00	0.14 (0.05)	0.00	0.17 (0.05)	0.00
	Edu	0.95 (0.85, 1,06)	0.32	1.03 (0.81, 1.30)	0.80	1.17 (0.97, 1.41)	0.09	−0.09 (0.05)	0.05	−0.02 (0.05)	0.69
	Cond	0.97 (0.86, 1.09)	0.64	0.88 (0.47, 1.65)	0.69	1.03 (0.65, 1.64)	0.90	−0.02 (0.05)	0.78	−0.01 (0.06)	0.82
	NT	0.99 (0.90, 1.09)	0.87	1.13 (0.68, 1.87)	0.64	1.10 (0.75, 1.61)	0.62	−0.03 (0.04)	0.46	0.01 (0.04)	0.85
	CxNT	1.03 (0.89, 1.20)	0.66	1.02 (0.89, 1.18)	0.76	0.96 (0.84, 1.09)	0.52	0.02 (0.06)	0.69	0.03 (0.05)	0.56
IMP	Sex	1.02 (0.76, 1.37)	0.91	0.58 (0.41, 0.83)	0.00	0.91 (0.61, 1.34)	0.63	0.04 (0.03)	0.20	−0.04 (0.04)	0.23
	Age	1.41 (0.91, 2.18)	0.01	1.60 (1.14, 2.23)	0.01	1.54 (1.19, 1.99)	0.00	0.09 (0.03)	0.00	0.17 (0.05)	0.00
	Edu	0.90 (0.75, 1.09)	0.29	1.03 (0.82, 1.30)	0.80	1.17 (0.98, 1.40)	0.09	−0.05 (0.02)	0.04	−0.02 (0.05)	0.65
	Cond	0.87 (0.53, 1.43)	0.59	0.98 (0.51, 1.87)	0.95	0.87 (0.58, 1.29)	0.48	−0.03 (0.06)	0.64	0.00 (0.06)	0.99
	IMP	1.14 (0.74, 1.75)	0.55	1.34 (0.74, 2.44)	0.33	0.92 (0.47, 1.81)	0.81	0.04 (0.05)	0.47	0.02 (0.05)	0.65
	CxIMP	1.05 (0.93, 1.20)	0.42	0.96 (0.82, 1.13)	0.61	1.07 (0.92, 1.25)	0.36	0.05 (0.06)	0.33	−0.00 (0.06)	0.95
SS	Sex	1.04 (0.77, 1.41)	0.80	0.58 (0.39, 0.86)	0.01	0.91 (0.57, 1.44)	0.69	0.04 (0.03)	0.20	−0.04 (0.04)	0.26
	Age	1.41 (1.06, 1.86)	0.02	1.59 (1.14, 2.20)	0.01	1.54 (1.18, 2.01)	0.00	0.14 (0.05)	0.00	0.17 (0.05)	0.00
	Edu	0.91 (0.67, 1.24)	0.34	1.03 (0.82, 1.30)	0.79	1.17 (0.97, 1.41)	0.09	−0.09 (0.05)	0.06	−0.02 (0.05)	0.70
	Cond	1.06 (0.72, 1.57)	0.77	1.03 (0.55, 1.96)	0.92	0.96 (0.64, 1.44)	0.85	0.03 (0.04)	0.41	0.03 (0.05)	0.54
	SS	1.21 (0.77, 1.90)	0.42	1.14 (0.68, 1.94)	0.61	1.02 (0.62, 1.69)	0.93	0.06 (0.04)	0.10	0.06 (0.04)	0.15
	CxSS	1.76 (1.38, 2.24)	0.04	0.68 (0.31, 1.46)	0.32	1.01 (0.53, 1.92)	0.98	0.24 (0.05)	0.04	−0.08 (0.05)	0.06

Note. Adjusted for cluster effects. AS = anxiety sensitivity, NT = negative thinking, IMP = impulsivity, SS = sensation seeking. OR = odds ratio, CI = confidence interval, β = standardized logistic regression coefficient, Edu = education, C = condition.

drinking frequency slope ($\beta = -0.10$, $p = 0.03$). This indicates that adolescents with the personality trait SS who received the intervention increased their binge drinking behaviour less than those adolescents with the same personality trait in the control condition. The fit between model and data was good for both binge drinking (χ^2 [N = 699] = 29.095, $p < 0.03$; RMSEA = 0.033 (0.000–0.091), CFI = 0.981, TLI = 0.964) and binge drinking frequency (χ^2 [N = 699] = 33.571, $p < 0.01$; RMSEA = 0.039 (SD = 0.016), CFI = 0.982, TLI = 0.967). No significant effects were found on the intercepts and slopes for the outcome measures alcohol use and drinking problems, nor for the other personality traits IMP, NT and AS.

4. Discussion

In a previous study on the effectiveness of Preventure in the Dutch setting, no program effects were found when looking at the incidence of alcohol use at the follow-up points separately (Lammers et al., 2015). By taking the development of alcohol use over time into account, significant program effects were found over the whole group of young adolescents (Lammers et al., 2015). In the current secondary analyses of the Preventure programme, we explored whether certain theory-based subgroups would benefit more from the Preventure intervention than others. The interaction analyses revealed that the Dutch Preventure intervention

had beneficial effects for young adolescents with the personality traits anxiety sensitivity and sensation seeking. Adolescents scoring high on SS seemed to benefit most from Preventure when it comes to binge drinking and binge drinking frequency outcomes. Adolescents scoring high on AS benefit most from Preventure with regard to the outcome alcohol use at 12 months post-intervention. Post hoc latent growth analyses revealed that the intervention resulted in significantly less growth in binge drinking and binge drinking frequency over 12 months' time within adolescents scoring high on SS. In our study we used both regression analyses and latent growth analyses. Combining these two approaches increased the reliability of the outcome measurements and provided a more complete picture of the intervention effects of the Preventure programme. In order to meet the CONSORT statement we used regression analyses as the primary analyses, and the latent growth analyses as post hoc analyses.

The findings of the current study are in line with previous studies of Conrod and colleagues. According to trials among Canadian and British young adolescents (Conrod et al., 2006; Conrod et al., 2008), Preventure was particularly effective in preventing the incidence of binge drinking in those students with an sensation seeking personality, and preventing alcohol use among students with an anxiety sensitivity personality, after four and six months post-intervention. Consistent with the British trial (Conrod et al., 2011), the Preventure programme had an impact in reducing the relationship between SS and the growth in binge drinking

Table 3
Interaction effects education on alcohol use outcomes at 12-month follow-up (T3) among alcohol users at baseline.

	Binge drinking		Alcohol use		Problem drinking		Binge drinking frequency		Alcohol frequency	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p	β (SE β)	p	β (SE β)	p
Sex	1.01 (0.93, 1.09)	0.83	0.58 (0.40, 0.84)	0.00	0.91 (0.61, 1.37)	0.66	0.04 (0.03)	0.18	−0.04 (0.04)	0.25
Age	1.44 (1.11, 1,88)	0.01	1.65 (1.21, 2.26)	0.00	1.55 (1.19, 2.03)	0.00	0.15 (0.05)	0.00	0.18 (0.05)	0.00
Condition	0.88 (0.70, 1.11)	0.28	0.47 (0.12, 1.88)	0.28	0.83 (0.30, 2.37)	0.74	−0.14 (0.09)	0.11	−0.15 (0.13)	0.25
Education	0.90 (0.76, 1.06)	0.20	0.89 (0.67, 1.18)	0.43	1.14 (0.89, 1.46)	0.30	−0.16 (0.06)	0.01	−0.09 (0.06)	0.15
Cond × Edu	1.47 (1.14, 1.88)	0.04	1.32 (1.06, 1.65)	0.05	1.06 (0.075, 1.51)	0.74	0.25 (0.09)	0.04	0.47 (0.11)	0.01

Note. Adjusted for cluster effects. OR = odds ratio, CI = confidence interval, β = standardized logistic regression coefficient, Cond = condition, Edu = education.

after 12 months. No significant effects were found for the personality traits impulsivity (IMP) and negative thinking (NT) at the different follow-up points, nor did the intervention significantly impact the relationship between the personality traits IMP, NT and AS, and the growth in binge drinking, which is in line with the findings of Conrod et al. (Conrod et al., 2006; Conrod et al., 2008; Conrod et al., 2011).

So, consistent with the Canadian and British trials, there was some evidence that intervention effects for AS were stronger in relation to alcohol onset measures, and intervention effects for SS were more consistently revealed for binge drinking outcomes. The personality-specific intervention was effective in reducing the drinking behaviour that is most problematic for each personality type. These findings provide further support for the necessity of personality targeting interventions for preventing alcohol misuse among young adolescents.

No significant effects were revealed on problem drinking for the personality traits. We expected these to be present particularly among the AS and NT personality traits. Conrod and colleagues only found effects in reducing problem drinking at the longer term, after 24 months post-intervention (Conrod et al., 2011; Conrod et al., 2013). This may implicate that curbing the growth of drinking in early onset drinkers may delay the onset of problem drinking over the longer term. Future research is needed to examine outcomes beyond 12 months post-intervention to see whether the intervention is effective for alcohol-related problems at later ages for AS and NT.

Because of the different education levels within the Dutch school system, we tested the differences between students receiving education at a 'high level' (e.g. pre-university education) and students receiving education at a 'lower level' (e.g. vocational training). Conrod et al. (Conrod et al., 2006; Conrod et al., 2008; Conrod et al., 2011; Conrod et al., 2013) did not distinguish between different levels of education, because of the different school systems in Canada and England. In our study, the significant effects were found mainly among students with lower-level education. It seems that students in this education category benefit more from the intervention than students with higher education, perhaps because they are more engaged in alcohol drinking and binge drinking than students with higher level of education (Verdurmen et al., 2012). These findings are consistent with findings from a previously tested Dutch alcohol parent and student prevention program. In this study moderation effects were found for educational level on heavy weekly alcohol use, indicating that lower educated adolescents profited more from the alcohol intervention than students with a higher education level (Verdurmen et al., 2011; Koning et al., 2009). Our results can be interpreted as indicating that Preventure is most effective among young adolescents at a lower level of education, and is best suited for this type of education. Consistent with previous studies of Conrod and colleagues (Conrod et al., 2006; Conrod et al., 2008; Conrod et al., 2011; Conrod et al., 2013), and as expected, no significant moderation effects were found for gender.

4.1. Limitations

The current study has some limitations. First, our study was confined to students who voluntarily participated in the intervention and for whom parental consent was obtained. Fifty-two percent of the potential participants did not consent or failed to obtain parental consent. For the group of students who were identified as high risk based on the screening, no differences were found on demographic variables or the prevalence of alcohol use between those who participated in the study and those who did not provide consent. However, the group of students who participated can be a selective group, because they can differ on other characteristics which were not measured. The results may therefore not be generalizable to the whole group of students who are screened positive for one of the personality traits. Second, the use of self-reports might have led to measurement errors, due to situational and cognitive influences (Brener, Billy, & Grady, 2003). To overcome situational influences (e.g. social desirability) and to optimize

measurement validity, we guaranteed full confidentiality (anonymity) to our participants (e.g. (Koning et al., 2009; Del Boca & Darkes, 2003)). Third, the intervention and control conditions differed at baseline on sex, age, level of education and binge drinking status. The intervention condition included more girls, slightly younger students and more students with a low education level, and the students were more likely to engage in binge drinking. Randomization at school level is probably responsible for this unequal distribution. Therefore, cluster level effects were accounted for in the analyses. A possible solution for future trials might be to randomize within schools, although one should be careful to avoid contamination effects.

Preventure has been evaluated in different countries (Conrod et al., 2006; Lammers et al., 2015; Conrod et al., 2013), and the results on alcohol misuse appear to be fairly robust. Our results show that the personality targeted Preventure is a promising intervention in the Dutch setting, especially for secondary schools with a lower level of education (vocational schools). Preventure is complementary to universal alcohol prevention programmes. Whereas universal alcohol prevention is most effective in increasing knowledge and changing attitudes among young adolescents in general, selective prevention seems to be more effective in changing alcohol misuse behaviour among high risk young adolescents more specifically. Future research could be focused on populations with a higher proportion of high-risk adolescents, such as the setting of special education or youth with mild mentally disabilities.

References

Brener, N. D., Billy, J. O., & Grady, W. R. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. The Journal of Adolescent Health, 33, 436–457.

Castellanos-Ryan, N., Rubia, K., & Conrod, P. J. (2011). Response inhibition and reward response bias mediate the predictive relationships between impulsivity and sensation seeking and common and unique variance in conduct disorder and substance misuse. Alcoholism, Clinical and Experimental Research, 35, 140–155.

Chassin, L., Pitts, S., & Prost, J. (2002). Binge drinking trajectories from adolescence to emerging adulthood in a high-risk sample: Predictors and substance abuse outcomes. *Journal of Consulting and Clinical Psychology*, 70, 67–78.

Colder, C. R., Campbell, R., Ruel, E., Richardson, J., & Flay, V. (2000). A finite mixture model of growth trajectories of adolescent alcohol use: Predictors and consequences. *Journal of Consulting and Clinical Psychology*, 70, 976–985.

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety-sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors*, 26, 1–24.

Conrod, P. J., Pihl, R. O., & Vassileva, J. (1998). Differential sensitivity to alcohol reinforcement in groups of men at risk for distinct alcoholic syndromes. *Alcoholism, Clinical and Experimental Research*, 22, 585–597.

Conrod, P. J., Stewart, S. H., Comea, N., & Maclean, A. M. (2006). Efficacy of cognitive-behavioral interventions targeting personality risk factors for youth alcohol misuse. *Journal of Clinical Child and Adolescent Psychology*, 35, 490–504.

Conrod, P. J., Castellanos, N., & Mackie, C. (2008). Personality-targeted interventions delay the growth of adolescent drinking and binge drinking. *Journal of Child Psychology and Psychiatry*, 49, 181–190.

Conrod, P. J., Castellanos-Ryan, N., & Mackie, C. (2011). Long term effects of a personality-targeted intervention to reduce alcohol use in adolescents. *Journal of Consulting and Clinical Psychology*, 3, 296–306.

Conrod, P. J., O'Leary-Barrett, M., Newton, N., Topper, L., Castellanos-Ryan, N., Mackie, C., & Girard, A. (2013). Effectiveness of a selective, personality-targeted prevention program for adolescent alcohol use and misuse. *JAMA Psychiatry*, 70, 334–342.

Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction*, 98, 1–12.

Duncan, T. E., Duncan, S. C., Strycker, L. A., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications.* Mahwah, NJ: Erlbaum.

Engels, R. C. M. E., Knibbe, R. A., & Drop, M. J. (1999). Why do late adolescents drink at home? A study on the psychological well-being, social integration and drinking context. *Addiction Research*, 7, 31–46.

Grant, B. F., & Dawson, D. A. (1997). Age at onset of alcohol use its association with DSM-IV alcohol abuse and dependence: Results from the national longitudinal alcohol epidemiologic survey. *Journal of Substance Abuse*, 9, 103–110.

Hawkins, J. D., Graham, J. W., Maguin, E., Abbott, R., Hill, K. G., & Catalano, R. F. (1997). Exploring the effects of age on alcohol use initiation and psychosocial risk factors on subsequent alcohol misuse. *Journal of Studies on Alcohol*, 58, 280–290.

Hill, K. G., White, H. R., Chung, I. J., Hawkins, J. D., & Catalano, R. F. (2000). Early adult outcomes of adolescent binge drinking: Person- and variable-centered analyses of binge drinking trajectories. *Alcoholism: Clinical and Experimental Research*, 24, 892–901 2000.

Jaffee, J. W., & D'Zurilla, T. J. (2009). Personality, problem solving, and adolescent substance use. *Behavior Therapy*, 40, 93–101.

Koning, I. M., Vollebergh, W. A. M., Smit, F., Verdurmen, J. E. E., van der Eijnden, R. J. J. M., ter Bogt, T. F. M., ... Engels, R. C. M. E. (2009). Preventing heavy alcohol use in adolescents (PAS): Cluster randomized trial of a parent and student intervention offered separately and simultaneously. *Addiction*, 104, 1669–1678.

Krank, M., Stewart, S. H., O'Connor, R., Woicik, P. B., Wall, A., & Conrod, P. J. (2011). Structural, concurrent, and predictive validity of the Substance Use Risk Profile Scale in early adolescence. *Addictive Behaviors*, 36, 37–46.

Kreamer, H. C., Wilson, T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical trials. *Archives of General Psychiatry*, 59, 877–883.

Kuntsche, E., Knibbe, R. A., Gmel, G., & Engels, R. C. M. E. (2006). Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive Behaviors*, 31, 1844–1857.

Lammers, J., Goossens, F., Lokman, S., Monshouwer, K., Lemmers, L., Conrod, P., ... Kleinjan, M. (2011). Evaluating a selective prevention program for binge drinking among young adolescents: Study protocol of a randomized controlled trial. *BMC Public Health*, 11, 126. http://dx.doi.org/10.1186/1471-2458-11-126.

Lammers, J., Goossens, F., Conrod, P. J., Engels, R., Wiers, R., & Kleinjan, M. (2015). Effectiveness of a selective intervention program targeting personality risk factors for alcohol misuse among young adolescents: Results of a cluster randomized controlled trial. *Addiction*, 110, 1101–1109.

Loewenthal, K. M. (1996). *An introduction to psychological tests and scales.* London: UCL Press.

Malmberg, M., Overbeek, G., Kleinjan, M., Vermulst, A., Monshouwer, K., Lammers, J., ... Engels, R. C. M. E. (2010). Effectiveness of the universal prevention program 'Healthy School and Drugs': Study protocol of a randomized clustered trial. *BMC Public Health*, 10(541).

Malmberg, M., Kleinjan, M., Vermulst, A., Overbeek, G., Monshouwer, K., Lammers, J., & Engels, R. C. M. E. (2012). Do substance use risk personality dimensions predict the onset of substance use in early adolescence? A variable- and person-centered approach. *Journal of Youth and Adolescence*, 41, 1512–1525.

Muthén, L. K., & Muthén, B. O. (1998–2007). *Mplus user's guide* (5th ed.). Muthén & Muthén: Los Angeles, CA.

Rutledge, P. C., & Sher, K. J. (2001). Heavy drinking from the freshman year into early young adulthood: The roles of stress, tension-reduction motives, sex, and personality. *Journal of Studies on Alcohol*, 62, 457–466.

Sallona, F., Van Dijk, J., Geckova, A. M., Sleskova, M., Groothoff, J. W., & Reijneveld, S. A. (2008). Social inequalities in changes in health-related behaviour among Slovak adolescents aged between 15 and 19: A longitudinal study. *BMC Public Health*, 8, 57.

Sher, K. J., Bartholow, B. D., & Wood, M. D. (2000). Personality and disinhibitory psychopathology: Alcoholism and anti-social personality disorder. *Journal of Consulting and Clinical Psychology*, 103, 92–102.

Shin, S. H., Hong, H. G., & Jeon, S. (2012). Personality and alcohol use: The role of impulsivity. *Addictive Behaviors*, 37, 102–107.

Spijkerman, R., Van den Eijnden, R. J. J. M., & Huiberts, A. (2008). Socioeconomic differences in alcohol-specific parenting practices and adolescents' drinking patterns. *European Addiction Research*, 14, 26–37.

Stewart, S. H., Peterson, J. B., & Pihl, R. O. (1995). Anxiety sensitivity and self-reported alcohol consumption rates in university women. *Journal of Anxiety Disorders*, 9, 283–292.

Verdurmen, J. E. E., Koning, I. M., Vollebergh, W. A. M., van den Eijnden, R. J. J. M., & Engels, R. C. M. E. (2011). Moderating effects of an alcohol intervention targeting adolescents and their parents: Different effects for different subgroups? In I. M. Koning (Ed.), *Prevention of alcohol use in early adolescents: A joint venture of school and parents.* The Netherlands: Utrecht University (Doctoral dissertation).

Verdurmen, J. E., Koning, I. M., Vollebergh, W. A., van den Eijnden, R. J., & Engels, R. C. (2014). Risk moderation of a parent and student preventive alcohol intervention by adolescent and family factors: A cluster randomized trial. *Preventive Medicine*, 60, 88–94.

Verdurmen, J., Monshouwer, K., Van Dorsselaer, S., Lokman, S., Vermeulen-Smit, E., & Vollebergh, W. (2012). *Jeugd en riskant gedrag 2011. Kerngegevens uit het peilstationsonderzoek scholieren [Adolescents and Risk-taking Behaviour 2012].* Utrecht: Trimbos Insitute.

Walther, B., Morgenstern, M., & Hanewinkel, R. (2012). Co-occurrence of addictive behaviours: Personality factors related to substance use, gambling and computer gaming. *European Addiction Research*, 18, 167–174.

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol*, 50, 30–37.

Wiers, R. W. (2008). Alcohol and drug expectancies as anticipated changes in affect: Negative reinforcement is not sedation. *Substance Use & Misuse*, 43, 501–516.

Woicik, P. A., Stewart, S. H., Pihl, P. O., & Conrod, P. J. (2009). The substance use risk profile scale: A scale measuring traits linked to reinforcement-specific substance use profiles. *Addictive Behaviors*, 34, 1042–1055.