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Effectiveness of a selective intervention program targeting personality risk factors for alcohol misuse among young adolescents: results of a cluster randomized controlled trial

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ABSTRACT

Aim The effectiveness of Preventure was tested on drinking behaviour of young adolescents in secondary education in the Netherlands. **Design** A cluster randomized controlled trial was carried out, with participants assigned randomly to a two-session coping skills intervention or a control no-intervention condition. **Setting** Fifteen secondary schools throughout the Netherlands; seven schools in the intervention and eight schools in the control condition. **Participants** A total of 699 adolescents aged 13–15 years participated, 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. **Intervention and comparator** Preventure is a selective school-based alcohol prevention programme targeting personality risk factors. The comparator was a no-intervention control. **Measurements** The effects of the intervention on the primary outcome past-month binge drinking, and the secondary outcomes binge drinking frequency, alcohol use, alcohol frequency and problem drinking, were examined. The primary analyses of interest were intervention main effects at 12 months post-intervention. In addition, intervention effects on the linear development of binge drinking using a latent-growth curve approach were examined. **Findings** Binge drinking rates were not significantly different between the intervention (42.9%) and control group (49.2%) at 12 months follow-up [odds ratio (OR) = 1.05, confidence interval (CI) = 0.99, 1.11]. Intention-to-treat analyses revealed no significant intervention effects on alcohol use (53.9 versus 61.5%; OR = 0.99, CI = 0.86, 1.14) and problem drinking (37.0 versus 44.7%; OR = 1.03, CI = 0.92, 1.10) at 12 months follow-up. The *post-hoc* latent-growth analyses revealed significant effects on the development of binge drinking (β = –0.16, P = 0.05), and binge drinking frequency (β = –0.14, P = 0.05). **Conclusion** The alcohol prevention programme, Preventure, appears to have little or no effect on overall prevalence of binge drinking in adolescents in the Netherlands but may reduce the development of binge drinking over time.

Keywords Adolescence, alcohol use, binge drinking, personality, selective prevention.

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INTRODUCTION

Binge drinking is a persistent problem among young adolescents in the Netherlands. Of the Dutch 12–16-year-olds who drink alcohol, 68% also engage in binge drinking (i.e. consuming five or more alcoholic drinks on one occasion) [1]. In comparison to other European countries, the Netherlands is among the highest-scoring countries with regard to excessive alcohol use [2]. Binge drinking has been associated with an elevated risk of physical injury, brain damage, aggression and high-risk sexual behaviour [3–5]. Several systematic reviews have concluded that universal prevention programmes have small and often inconsistent effects on adolescents' drinking behaviour [6–9]. Meta-analyses of substance use prevention programmes indicated that selective prevention programmes generally yield higher effects than universal programmes (e.g. [6,7]), but the availability of these programmes is limited.

Preventure is a selective prevention programme with a personality-targeted approach. Personality traits that have been linked specifically to alcohol use in young people include depression proneness (negative thinking; NT), anxiety sensitivity (AS), impulsivity (IMP) and sensation-seeking (SS) [10,11]. These four distinct personality profiles have all been associated previously with high and problematic substance use behaviours [11–14]. Both anxiety-sensitive and depression-sensitive individuals showed higher levels of drinking and drinking problems [11,13–17]. Sensation-seekers were found to drink more, and they were at risk of heavy alcohol use [11,12,15]. Impulsive individuals showed an increased risk of early alcohol and drug use [15,18,19].

The Preventure programme specifically targets young adolescents with two risk factors for heavy alcohol consumption: early onset of alcohol use [20,21] and one of the four substance use risk personalities for alcohol abuse (e.g. [22]). The Preventure programme identifies and treats high-risk adolescents, with the aim of preventing or intervening early before the high-risk adolescents engage in risky behaviours and/or these behaviours become problematic. The students that fall within the risk category of early-onset alcohol use, combined with a high-risk personality profile for alcohol abuse, are offered a two-session coping skills intervention that targets their dominant personality profile and is based on cognitive behaviour therapy and motivational interviewing. Preventure has proved effective in Canadian and British studies among high-school students [23–25]. The intervention was effective in reducing drinking rates and problem drinking among the groups scoring high on anxiety sensitivity and negative thinking, and in reducing binge drinking rates among the sensation seekers' group [23]. Two recent studies showed that the intervention reduced drinking and binge drinking levels significantly at 6 months post-intervention, reduced problem drinking symptoms after a 24-month follow-up period [26] and reduced growth in drinking quantity and binge drinking frequency over a 24-month period [27]. The main objective of the present study is to determine the effectiveness of Preventure on reducing drinking behaviour of high-risk adolescents in secondary education in the Netherlands.

METHOD

Study design

The study was a cluster randomized controlled trial (RCT) with two arms. The participants were assigned randomly to either the intervention group (seven schools; $n = 343$) or the control group (eight schools; $n = 356$). Participants were screened during the baseline measurement. Students in the intervention condition attended two 90-minute sessions during school over 2 weeks. The intervention was based on cognitive behaviour therapy and motivational interviewing. The average size of each group session was six individuals. Students in the control condition received no intervention. Three follow-up measurements were conducted at 2, 6 and 12 months after the intervention, using online surveys, administered in the classroom under supervision of a research assistant. The recruitment, inclusion and randomization of the participants (schools and students) began in Spring 2009. The data were collected between September 2010 and December 2011.

Study sample

A total of 100 schools were selected randomly from a list of all public secondary schools in the Netherlands ($n = 405$). Schools were included if the following criteria were met: (1) the school had at least 600 students, (2) $< 25\%$ of students were from migrant populations and (3) the school did not offer special education. A total of 60 schools fulfilled the inclusion criteria, of which 15 schools (25%) were willing to participate. The main reasons for schools not participating were lack of time, participating in other studies and no interest in research in general. Students were eligible if they fulfilled the following inclusion criteria: (1) life-time prevalence of alcohol use (i.e. having drunk at least one glass of alcohol), (2) belonged to one of the four personality high-risk groups for (future) heavy drinking (AS, SS, NT or IMP) and (3) informed consent obtained from the student and his or her parents. For a 15% reduction after 12 months among the students in grades 9/10, a sample size of 183 in each condition was required to test the hypothesis in a two-sided test at alpha = 0.05 and a power of (1-beta) = 0.80. Because of the loss of power due to randomization of schools (and not students) and the increase in error-risk because of applying a multiple imputation procedure to fill in missing values, $183 \times 1.4 = 256$ respondents per condition (intervention and control) needed to be included at baseline. In total, 4844 students from grades 8 and 9 participated in the screening. The students who scored more than one standard deviation above the sample mean on one of the four personality risk scales [28] were classified as belonging to a risk group. In total, 1488 students met the inclusion criteria. Informed consent was obtained from 713 students (47.9%); 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.

Study procedure

Randomization occurred at the school level to avoid contamination between conditions. Allocation of the schools to trial conditions was conducted by an independent

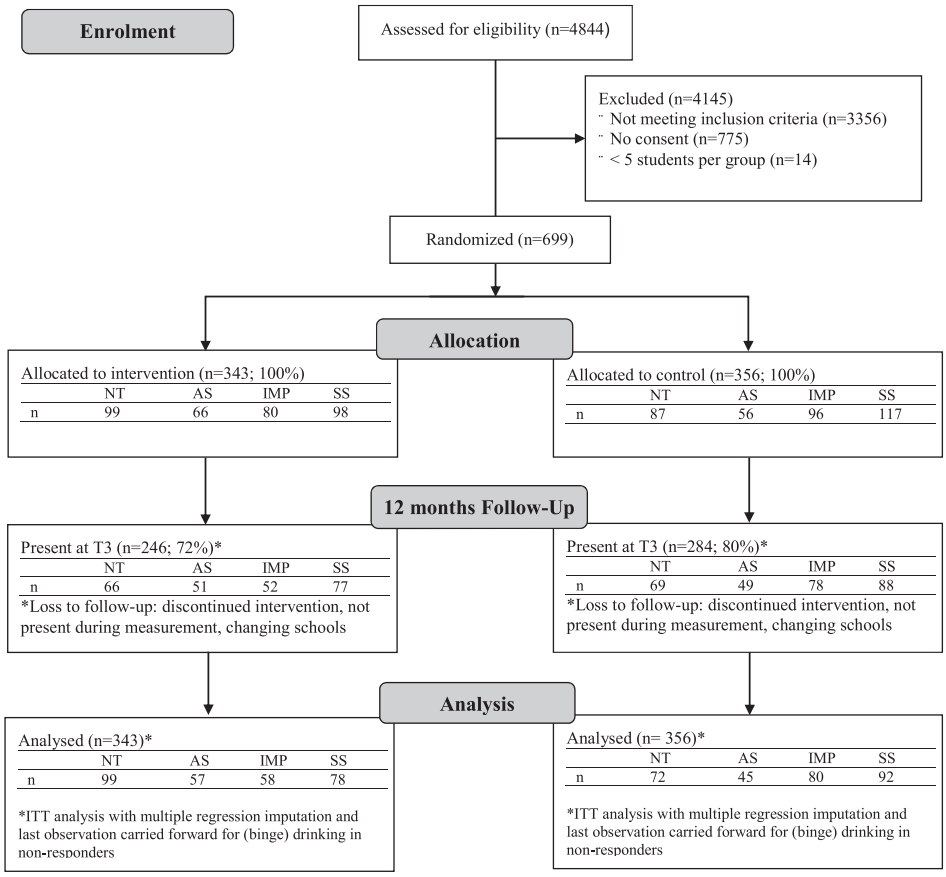

Figure 1 Flow diagram of recruitment and progress throughout the study

member of the research group using a computer-generated allocation sequence. Randomization was carried out using a randomization scheme, stratified by level of education and school size, with the schools as units of randomization. In order to select students, a screening survey was carried out among all students attending grades 8 and 9 in the 15 participating schools. The independent researcher prepared a list of study participants and their allocated condition. Based on this list, the principal investigator prepared the mailings which informed study participants about the study and the intervention they would receive. Adolescents were informed that the data would be processed anonymously, and respondent-specific codes were used to link the data from one time-point to the next. Parents were informed of the study through a letter sent home from the schools asking them to contact the researchers by telephone or e-mail if they did not wish their child to participate in the study (passive informed consent). Parents were told that the intervention was a coping-skills training designed to reduce adolescent risk-taking, with alcohol abuse as an example. 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 trial is registered in the Dutch Trial Register (NTR1920).

Intervention

Preventure incorporates the principles from motivational interviewing and cognitive behavioural therapy and is adapted to different personality profiles for substance abuse: AS, NT, IMP and SS. The intervention is brief, using the effective component of persuasiveness of individualized feedback. Therefore, Preventure provides pupils with personalized feedback on their results from a personality assessment. The intervention also includes cognitive behavioural skills training specifically relevant to each personality profile. The literature has shown that successful cognitive behavioural therapy can lead to reductions in anxiety sensitivity in anxiety patients, depressive cognitions in depressed patients and impulsivity in adolescents with externalizing disorders [29–31].

Intervention condition

The intervention involved two group sessions, carried out at the participants' schools, during school hours. The group sessions were tailored to one of the four personality profiles. Both group sessions lasted 90 minutes and were spread across 2 weeks. The average group size was six people. The intervention used student manuals. In the first group session, psychoeducational strategies were used to

educate students about the target personality variable and the associated problematic coping behaviours, such as interpersonal dependence, aggression, risky behaviour and substance misuse. Students were motivated to explore their personality and 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. The content of the intervention is described in more detail in a study protocol paper [32].

Control condition

Students assigned to the control group received no further intervention.

Treatment integrity

The intervention was provided by three qualified counsellors and two co-facilitators. The counsellors and co-facilitators attended a 2-day training session led by Dr P. J. Conrod and Dr N. Castellanos from King's College, London, who developed the original intervention. Furthermore, all the counsellors had practised the two-group sessions at a school with supervision and feedback. These supervised interventions were run with students from a pilot school, not recruited for the Preventure trial. Also, each counsellor's first two group sessions at the intervention schools were observed by a supervisor who had participated in the Preventure training session. All the counsellors were provided with feedback during four peer-reviewing meetings under the guidance of the same supervisor. At the first group session 80% of participants were present, and 71% at the second group session. In total, 71% of the students followed both group sessions. Students who did not attend both group sessions were more likely to have recently been binge drinking (59 versus 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.

Outcome measures

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 [28]) was used, which distinguishes four personality profiles. Each profile is assessed using five to seven items that can be answered on a four-point scale. Negative thinking (seven items) refers to hopelessness, which might lead to depressive symptoms. The anxiety sensitivity dimension (five items) measures fear of bodily sensations. The sensation-seeking subscale (six items) measures the tendency to seek out thrilling experiences. The tendency to act without thinking is measured by the impulsivity subscale (five items). Studies in both adolescent and adult samples in several countries, including the Netherlands, have shown that this scale has good internal reliability, convergent and discriminant validity, and adequate test–retest reliability [15,16,28]. 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. [16,33]) and are satisfactory for short scales [34].

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').

Secondary outcome measures

Alcohol use was assessed by 1-month prevalence [35] 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 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) [36] was used. Participants could indicate on a scale ranging from 0 (never) to 5 (more than six 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 [36,37]. The abbreviated version correlates well with the original (0.99).

Statistical analyses

First, 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. To correct for the potential non-independence (complexity) as well as clustering of the data, the TYPE = COMPLEX procedure in Mplus was used [cf. 16]. Next, to determine the effect of the intervention on alcohol use outcomes, we made use of the intention-to-treat principle (ITT). To test the robustness of the results, we applied two ITT methods. First, missing data were imputed using multiple regression imputation in Mplus version 6.11 [38]. Secondly, missing data for the outcome variables were imputed by carrying the last observation forward (i.e. binge drinkers at baseline were assumed to still be binge drinkers at 12-month follow-up). The effects of the intervention condition were compared to the effects of the control condition using multivariate regression analyses in Mplus version 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 primary analyses of interest were intervention main effects at 12 months post-test. The level of statistical significance was set at *P*-value < 0.05. Furthermore, by means of a latent-growth curve approach, *post-hoc* analyses were conducted to examine the effect of the Dutch version of Preventure on the linear increase in binge drinking and binge drinking frequency. 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) [39]. In this latent-growth model, the binge drinking outcome slope was regressed on the Preventure intervention condition variable, controlled for the alcohol use intercept and the covariates age, gender and education level. The fit of the models was assessed by the following fit indexes: χ^2, comparative fit index (CFI), Tucker–Lewis index (TLI) and root mean square error of approximation (RMSEA). Due to the sensitivity of the χ^2 goodness-of-fit test to sample sizes, the fit indices CFI, TLI and RMSEA were used. Except for the values of RMSEA (which would be satisfactory if smaller than 0.08), goodness-of-fit values greater than 0.90 are considered an acceptable fit [40]. The χ^2 is thus reported, but because with large sample sizes the χ^2 value is often significant, we also report the CFI, TLI and RMSEA, which point towards a good model fit.

RESULTS

Characteristics of the participants

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. For other drinking measures, no significant differences between the intervention and control conditions were found (see Table 1).

Intervention effects on binge drinking, alcohol use and problem drinking

Tables 2 and 3 present the results of the intervention on the primary and secondary alcohol use outcomes for the intervention and control conditions. Logistic regression analyses revealed no significant effects on any primary or secondary outcome measures at 12 months post-intervention in the ITT sample.

Intervention effects on growth over time

Post-hoc analyses were conducted, by means of a latent-growth curve approach, to examine the effect of Preventure on the linear increase in alcohol use. In this model, the binge drinking slope was regressed on the Preventure intervention variable. The fit between the model and the data was excellent [χ^2 ($n = 699$) $= 403.691$, $P < 0.001$; RMSEA = 0.024, CFI = 0.996, TLI = 0.994]. The intercept and slope for binge drinking were significant (respectively, $\beta 0 = 1.22$, $P < 0.001$ and

Table 1 Baseline demographic characteristics of intervention and control condition.

Outcome $n = 699$	*Measure*	*Intervention* ($n = 343$) *Mean*	*Control* ($n = 356$) *Mean*	*P-value*
Demographics	Male (%)	47 (161)	57 (203)	<0.015
	Age (mean, SD)	13.9 (0.98)	14.1 (0.77)	<0.003
	Dutch (%)	87 (289)	87 (310)	NS
	Low level of education (%)	43 (147)	26 (93)	<0.001
Alcohol use	Total group %)	60 (206)	59 (210)	NS
	NT (%)	55 (189)	59 (210)	NS
	AS (%)	52 (178)	49 (174)	NS
	IMP (%)	70 (240)	60 (213)	NS
	SS (%)	62 (213)	62 (221)	NS
Binge drinking	Total group (%)	49 (168)	37 (132)	<0.001
	NT (%)	47 (161)	36 (128)	NS
	AS (%)	46 (158)	35 (125)	NS
	IMP (%)	51 (175)	42 (150)	NS
	SS (%)	52 (178)	34 (121)	<0.01

NT = negative thinking; AS = anxiety sensitivity; IMP = impulsivity, SS = sensation-seeking; NS = not significant; SD = standard deviation.

Table 2 Effects of Preventure on alcohol use, binge drinking and problem drinking at 12-month follow-up (T3) among alcohol users at baseline.

	Intervention % (n)	*Control % (n)*	*OR (95% CI)*[a]	*P*	*OR (95% CI)*[b]	*P*
ITT sample[c]	(*n* = 343)	(*n* = 356)				
Primary outcome: binge drinking	42.9 (147)	49.2 (175)	1.05 (0.99, 1.11)	0.14	1.11 (1.02, 1.21)	0.17
Secondary outcome: alcohol use	53.9 (185)	61.5 (219)	0.99 (0.86, 1.14)	0.88	0.98 (0.81, 1.17)	0.78
Secondary outcome: problem drinking	37.0 (127)	44.7 (159)	1.03 (0.92, 1.10)	0.85	0.96 (0.86, 1.08)	0.51
ITT sample[d]	(*n* = 343)	(*n* = 356)				
Primary outcome: binge drinking	42.9 (147)	49.2 (175)	1.03 (1.01, 1.04)	0.00	1.07 (1.02, 1.14)	0.00
Secondary outcome: alcohol use	53.9 (185)	61.5 (219)	1.01 (0.99, 1.04)	0.59	0.98 (0.89, 1,09)	0.76
Secondary outcome: problem drinking	37.0 (127)	44.7 (159)	1.05 (0.94, 1.18)	0.36	0.99 (0.88, 1.12)	0.87

[a]Adjusted for sex, age, education and cluster effects. [b]Unadjusted for sex, age, education and cluster effects. OR = odds ratio, CI = confidence interval. [c]Missing data were imputed using multiple regression imputation. [d]Missing data on outcome variables were handled by the last observation carried forward method. ITT = intention-to-treat.

Table 3 Effects of Preventure on binge drinking frequency and alcohol frequency at 12-month follow-up (T3) among alcohol users at baseline.

	Intervention % (n)	*Control % (n)*	β[a]	*SE* β	*P*	β[b]	*SE* β	*P*
ITT multiple imputation[c]	*n* = 343	*n* = 356						
Secondary outcome: binge drinking frequency	42.9 (147)	46.0 (164)	–0.11	0.05	0.16	0.13	0.08	0.18
Secondary outcome: alcohol frequency	45.2 (155)	51.4 (183)	0.01	0.06	0.91	0.01	0.09	0.93
ITT last observation carried forward[d]								
Secondary outcome: binge drinking frequency	42.9 (147)	46.0 (164)	0.11	0.02	0.19	–0.12	0.01	0.18
Secondary outcome: alcohol frequency	45.2 (155)	51.4 (183)	0.03	0.04	0.39	0.03	0.04	0.36

[a]Adjusted for sex, age, education and cluster effects. [b]Unadjusted for sex, age, education and cluster effects. β = standardized logistic regression coefficient. [c]Missing data were imputed using multiple regression imputation. [d]Missing data on outcome variables were handled by the last observation carried forward method. SE = standard error; ITT = intention-to-treat.

$\beta 1 = 0.50$, $P < 0.001$), indicating that the participants on average scored greater than zero on level of binge drinking at baseline and that levels of binge drinking increased over time. A quadratic trend was also tested, but was non-significant and therefore omitted. There was a significant effect of the intervention on the binge drinking slope ($\beta = -0.16$, $P = 0.05$), indicating that adolescents who received the intervention increased their binge drinking behaviour less than those in the control condition. The fit between model and data was excellent [χ^2 ($n = 699$) = 26.190, $P < 0.01$; RMSEA = 0.040, CFI = 0.979, TLI = 0.962]. Furthermore, the intercept and slope for binge drinking frequency were significant (respectively, $\beta 0 = 1.05$, $P < 0.00$ and $\beta 1 = 0.58$, $P < 0.00$). The fit between the model and the data was good [χ^2 ($n = 699$) = 14.048, $P < 0.02$; RMSEA = 0.060, CFI = 0.986, TLI = 0.979]. There was a significant effect of intervention on the binge drinking frequency slope ($\beta = -0.14$, $P = 0.05$), with good model fit statistics [χ^2 ($n = 699$) = 30.228, $P < 0.01$; RMSEA = 0.046, CFI = 0.981, TLI = 0.966]. No significant effects were found on the intercepts and slopes for the outcome measures alcohol use and drinking problems (see Fig. 2).

DISCUSSION

This study evaluated the effectiveness of the selective alcohol prevention programme Preventure in the Netherlands. The main results depended on the analysis-strategy used: on one hand, logistic regression analyses revealed no significant effects on the primary outcome binge drinking, and the secondary outcome measures alcohol use, problem drinking, alcohol and binge drinking frequency at 12 months post-intervention. On the other hand, latent-growth analysis revealed that the intervention overall resulted in significantly less growth in binge drinking and binge drinking frequency over 12 months' time. Thus, while using a traditional approach with one follow-up time-point leads to the conclusion that Preventure is not effective in changing (binge) drinking behaviour; the use of LGC modelling techniques shows a sustaining preventive effect on alcohol use over a 1-year time period. LGC modelling techniques allow for estimation of average growth trajectories of alcohol use over time as well as individual differences in these trajectories [38,41]. The estimation of variances in growth trajectories increases the reliability of outcome measures in comparison with traditional

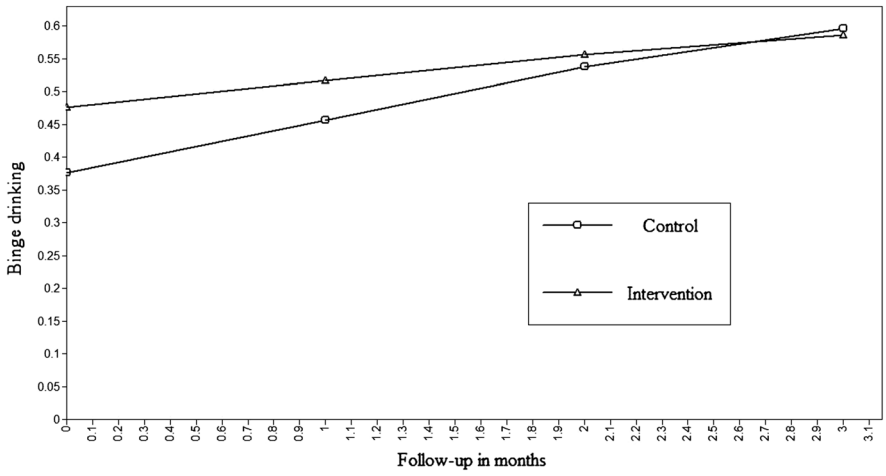

Figure 2 Latent growth trajectories for binge drinking in the past month

statistical techniques, such as regression analyses [42]. Simply relying on an individual time-point to capture an individual's substance use pattern (and an intervention effect) is not state-of-the-art in recent prevention trials (e.g. [27]). To conform to the CONSORT statement we used regression analyses as the primarily analyses, and the latent growth analyses as *post-hoc* analyses.

The findings of the current study are partially in line with previous studies of Conrod and colleagues. According to trials among Canadian and British young adolescents, Preventure was effective in preventing the growth of binge drinking at 4 months [23] and 6 months post-intervention [24]. In our study, no effects on binge drinking were found at 12 months post-intervention. Latent-growth models in Conrod and colleagues' study showed that the intervention delayed the natural increase in binge drinking in the first 6 months after the intervention [24]. The latent-growth models in our study indicated a delay in the increase in binge drinking and binge drinking frequency over a period of 12 months.

In our study, no significant effects were revealed for problem drinking. This is consistent with the Preventure study among adolescents in England (after 6 and 12 months post-intervention). [24] However, in the same study, Conrod and colleagues found intervention effects in reducing problem drinking symptoms at 24 months post-intervention [26]. In the Canadian study, intervention effects on drinking problems were found in the short term (4 months), but this study was conducted among an older student population, in which problematic drinking patterns were more likely to be already established [23]. These previous findings may implicate that curbing the growth of drinking in early onset drinkers may delay the onset of problematic drinking over the longer term. Longer-term follow-up of the current sample might reveal effects on high-risk drinking outcomes typical for older adolescents.

Some differences between conditions in our study and those of Conrod and colleagues should be noted, to give a possible explanation for the differences in effect. First, the British study was aimed at drinkers and non-drinkers, whereas our study was aimed at drinkers only. The Canadian trial was conducted among drinkers only [23], but with an older population, and only short-term effects were measured. Secondly, in Dutch society laws and norms regarding substance use are more liberal, and actual substance use in young adolescence is high compared to other countries; this might have affected the study outcomes. Thirdly, compared to the British studies, the counsellors in our study were less observed and supervised. In our study, each counsellor's first two sessions were observed, whereas in the British trials all the sessions were supervised. This might explain the differences in effects of the Dutch trial and the British trials.

Limitations

The current study has some limitations. First, our study was confined to students who participated voluntarily in the intervention and had parental consent. Fifty-two per cent of the potential participants were lost due to this source of attrition. This procedure could have caused a sample selection bias, because the participating students were probably more motivated than the non-participating students. Secondly, the use of self-reports might have led to measurement errors, due to situational and cognitive influences [43]. To overcome situational influences (e.g. social desirability) and to optimize measurement validity, we guaranteed full confidentiality (anonymity) to our participants (cf. [44,45]). Thirdly, 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. A possible solution for future trials might be to randomize within schools, although one should be careful to avoid contamination effects. Finally, this study did not examine the efficacy of the intervention using a placebo-controlled design. Future research is warranted to compare the outcomes with another evidence-based alcohol prevention programme or with an attention-only control intervention [7].

Based on the more sensitive growth analyses, we may conclude that Preventure in the Dutch setting is a promising intervention to curb the increase in binge drinking among young adolescents up to 1 year after the intervention. Instead of treating youth as uniform, Preventure takes into account the different dispositions of the target group. Preventure is complementary to universal alcohol prevention. Nearly half the target population (young adolescents) belongs to one of the four personality traits, so the Preventure programme would probably enable a relatively large reduction in the prevalence of binge drinking in the total population. The Preventure approach strengthens the prevention efforts to reduce alcohol misuse among young adolescents. 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.

Trial registration

This trial is registered in the Dutch Trial Register (Cochrane Collaboration) as NTR1920.

Declarations of interest

J.L., F.G., M.K. and R.E. declare that they have no conflicts of interest. P.C. is the developer and licensee of Preventure. In 2012 P.C. wrote a chapter for an ERAB (the European Foundation for Alcohol Research) book, 'Underage Drinking', for which she received an honorarium, and also received reimbursement of the travelling costs for a meeting in Brussels. In 2008, P.C. received a research grant from ERAB for a project on social networks and drinking behaviour of adolescents. R.W.'s research is paid primarily by national grant agencies (N.W.O., National Science Foundation, Netherlands; ZON-MW, Medical Research Council, the Netherlands) and university money. In addition, R.W. had EU funding (FP7 AliceRap). His research is not sponsored by tobacco companies. R.W. gave a paid talk for Lundbeck pharmaceutical company, was co-applicant in two awarded grants from ERAB and was also involved in the ERAB/ABMRF Underage Drinking Report (2012). ERAB is an independent foundation paid by the alcohol-industry that awards alcohol-related research after an independent scientific evaluation (peer-reviewed), with guarantee of completely independent scientific expression (in accordance with the Dublin principles), http://www.api.or.at/sp/alcoholpolicy%20dokumente/dublinpriciples.pdf.

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References

1. Verdurmen J., Monshouwer K., Van Dorsselaer S., Lokman S., Vermeulen-Smit E., Vollebergh W. *Jeugd en riskant gedrag 2011. Kerngegevens uit het peilstationsonderzoek scholieren* [*Adolescents and Risk-taking Behaviour 2012*]. Utrecht: Trimbos Institute; 2012.
2. Hibell B., Guttormsson U., Ahlström S., Balakivera O., Bjarnason T., Kokkevi A. *et al. The 2011 ESPAD Report. Substance Use Among Students in 36 European Countries*. Stockholm, Sweden: The Swedish Council for Information on Alcohol and Other Drugs (CAN); 2012.
3. Anderson P. *Binge Drinking and Europe*. London: Institute of Alcohol Studies; 2007.
4. Dawson D. A., Li T. K., Grant B. F. A. A prospective study of risk drinking: at risk for what? *Drug Alcohol Depend* 2008; **95**: 62–72.
5. Gmel G., Rehm J., Kuntsche E. Binge drinking in Europe: definitions, epidemiology, and consequences. *Sucht* 2003; **49**: 105–16.
6. Cuijpers P., Scholten M., Conijn B. *Verslavingspreventie: een overzichtsstudie. Addiction prevention: a retrospective study*. ZonMw: Den Haag; 2006.
7. Foxcroft D. R., Tsertsvadze A. Universal school-based prevention programs for alcohol misuse in young people. *Cochrane Database Syst Rev* 2011; **5**CD009113: DOI: 10.1002/14651858.CD009113.
8. Gottfredson D. C., Wilson D. B. Characteristics of effective school-based substance abuse prevention. *Prev Sci* 2003; **4**: 27–38.
9. Tobler N. S., Roona M. R., Ochshorn P., Marshall D. G., Streke A. V., Stackpole K. M. School-based adolescent drug prevention programs: 1998 meta-analysis. *J Prim Prevent* 2000; **20**: 275–336.
10. Comeau N., Stewart S. H., Loba P. The relations of trait anxiety, anxiety-sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addict Behav* 2001; **26**: 1–24.
11. Sher K. J., Bartholow B. D., Wood M. D. Personality and disinhibitory psychopathology: alcoholism and antisocial personality disorder. *J Consult Clin Psychol* 2000; **103**: 92–102.
12. Castellanos-Ryan N., Rubia K., Conrod P. J. 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. *Alcohol Clin Exp Res* 2011; **35**: 140–55.
13. Conrod P. J., Pihl R. O., Vassileva J. Differential sensitivity to alcohol reinforcement in groups of men at risk for distinct alcoholic syndromes. *Alcohol Clin Exp Res* 1998; **22**: 585–97.
14. Stewart S. H., Peterson J. B., Pihl R. O. Anxiety sensitivity and self-reported alcohol consumption rates in university women. *J Anxiety Disord* 1995; **9**: 283–92.
15. Krank M., Stewart S. H., O'Connor R., Woicik P. B., Wall A., Conrod P. J. Structural, concurrent, and predictive validity of the Substance Use Risk Profile Scale in early adolescence. *Addict Behav* 2011; **36**: 37–46.
16. Malmberg M., Kleinjan M., Vermulst A., Overbeek G., Monshouwer K., Lammers J. *et al.* Do substance use risk personality dimensions predict the onset of substance use in early adolescence? A variable- and person-centered approach. *J Youth Adolesc* 2012; **41**: 1512–25.
17. Shall M., Kemeny A., Maltzman I. Factors associated with alcohol use in university students. *J Stud Alcohol* 1992; **53**: 122–36.
18. Shin S. H., Hong H. G., Jeon S. Personality and alcohol use: the role of impulsivity. *Addict Behav* 2012; **37**: 102–7.
19. Walther B., Morgenstern M., Hanewinkel R. Co-occurrence of addictive behaviours: personality factors related to substance use, gambling and computer gaming. *Eur Addict Res* 2012; **18**: 167–74.
20. Grant B. F., Dawson D. A. Age at onset of alcohol use its association with DSM-IV alcohol abuse and dependence: results from the national longitudinal alcohol epidemiologic survey. *J Subst Abuse* 1997; **9**: 103–10.
21. Hawkins J. D., Graham J. W., Maguin E., Abbott R., Hill K. G., Catalano R. F. Exploring the effects of age on alcohol use initiation and psychosocial risk factors on subsequent alcohol misuse. *J Stud Alcohol* 1997; **58**: 280–90.
22. Rutledge P. C., Sher K. J. Heavy drinking from the freshman year into early young adulthood: the roles of stress, tension-reduction motives, sex, and personality. *J Stud Alcohol* 2001; **62**: 457–66.
23. Conrod P. J., Stewart S. H., Comea N., Maclean A. M. Efficacy of cognitive-behavioral interventions targeting personality risk factors for youth alcohol misuse. *J Clin Child Adol Psychol* 2006; **35**: 490–504.
24. Conrod P. J., Castellanos N., Mackie C. Personality-targeted interventions delay the growth of adolescent drinking and binge drinking. *J Child Psychol Psychol* 2008; **49**: 181–90.
25. Conrod P. J., Castellanos-Ryan N., Strang J. Brief personality-targeted coping skills interventions and survival as a non-drug user over a 2-year period during adolescence. *Arch Gen Psychiatry* 2010; **67**: 85–93.
26. Conrod P. J., Castellanos N., Mackie C. Long-term effects of a personality-targeted intervention to reduce alcohol use in adolescents. *J Consult Clin Psychol* 2011; **79**: 296–306.
27. Conrod P. J., O'Leary-Barrett M., Newton N., Topper L., Castellanos-Ryan N., Mackie C. *et al.* Effectiveness of a selective, personality-targeted prevention program for adolescent alcohol use and misuse. *JAMA Psychiatry* 2013; **70**: 334–42.
28. Woicik P. A., Stewart S. H., Pihl P. O., Conrod P. J. The substance use risk profile scale: a scale measuring traits linked to reinforcement-specific substance use profiles. *Addict Behav* 2009; **34**: 1042–55.
29. Kendall P. C., Braswell L. *Cognitive–Behavioral Therapy for Impulsive Children*. New York: Guilford Press; 1985.
30. McNally R. J., Lorenz M. Anxiety sensitivity in agoraphobics. *J Behav Ther Exp Psychiatry* 1987; **18**: 3–11.
31. Lewinsohn P. M., Steinmetz J. L., Larson D. W. Franklin J.. Depression related cognitions: antecedent or consequences? *J Abnorm Psychol* 1981; **90**: 213–19.
32. Lammers J., Goossens F., Lokman S., Monshouwer K., Lemmers L., Conrod P. *et al.* Evaluating a selective prevention program for binge drinking among young adolescents: study protocol of a randomized controlled trial. *BMC Public Health* 2011; **11**: 126. DOI: 10.1186/1471-2458-11-126.
33. Jaffee J. W., D'Zurilla T. J. Personality, problem solving, and adolescent substance use. *Behav Ther* 2009; **40**: 93–101.
34. Loewenthal K. M. *An Introduction to Psychological Tests and Scales*. London: UCL Press; 1996.
35. Engels R. C. M. E., Knibbe R. A., Drop M. J. Why do late adolescents drink at home? A study on the psychological well-being, social integration and drinking context. *Addict Res* 1999; **7**: 31–46.
36. White H. R., Labouvie E. W. Towards the assessment of adolescent problem drinking. *J Stud Alcohol* 1989; **50**: 30–7.
37. Wiers R. W. Alcohol and drug expectancies as anticipated changes in affect: negative reinforcement is not sedation. *Subst Use Misuse* 2008; **43**: 501–16.
38. Muthén L. K., Muthén B. O. *Mplus User's Guide*, 5th edn. Muthén & Muthén: Los Angeles, CA; 1998–2010.
39. Duncan T. E., Duncan S. C., Strycker L. A., Li F., Alpert A. *An Introduction to Latent Variable Growth Curve Modeling: Concepts, Issues, and Applications*. Mahwah, NJ: Erlbaum; 1999.
40. Bentler P. M., Bonett D. G. Goodness-of-fit procedures for the evaluation and selection of log-linear models. *Psych Bulletin* 1980; **88**: 588–606.
41. Trull T. J., Ebner-Priemer U. W. Using experience sampling methods/ecological momentary assessment (ESM/EMA) in clinical assessment and clinical research: introduction to the special section. *Psychol Assess* 2009; **21**: 457–62.
42. Cunningham J. A., Wild T. C., Cordingley J., Van Mierlo T., Humphreys K. A randomized controlled trial of an internet-based intervention for alcohol abusers. *Addiction* 2009; **104**: 2023–32.
43. Brener N. D., Billy J. O., Grady W. R. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. *J Adolesc Health* 2003; **33**: 436–57.
44. 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. *et al* Preventing heavy alcohol use in adolescents (PAS): cluster randomized trial of a parent and student intervention offered separately and simultaneously. *Addiction* 2009; **104**: 1669–78.
45. Del Boca F. K., Darkes J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction* 2003; **98**: 1–12.