ORIGINAL ARTICLE

Brief, Personality-Targeted Coping Skills Interventions and Survival as a Non–Drug User Over a 2-Year Period During Adolescence

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Context: Selective interventions targeting personality risk are showing promise in the prevention of problematic drinking behavior, but their effect on illicit drug use has yet to be evaluated.

Objective: To investigate the efficacy of targeted coping skills interventions on illicit drug use in adolescents with personality risk factors for substance misuse.

Design: Randomized controlled trial.

Setting: Secondary schools in London, United Kingdom.

Participants: A total of 5302 students were screened to identify 2028 students aged 13 to 16 years with elevated scores on self-report measures of hopelessness, anxiety sensitivity, impulsivity, and sensation seeking. Seven hundred thirty-two students provided parental consent to participate in this trial.

Intervention: Participants were randomly assigned to a control no-intervention condition or a 2-session group coping skills intervention targeting 1 of 4 personality profiles.

Main Outcome Measures: The trial was designed and powered to primarily evaluate the effect of the intervention on the onset, prevalence, and frequency of illicit drug use over a 2-year period.

Results: Intent-to-treat repeated-measures analyses on continuous measures of drug use revealed time × intervention effects on the number of drugs used ($P < .01$) and drug use frequency ($P < .05$), whereby the control group showed significant growth in the number of drugs used as well as more frequent drug use over the 2-year period relative to the intervention group. Survival analysis using logistic regression revealed that the intervention was associated with reduced odds of taking up the use of marijuana ($\beta = -0.3$; robust SE = 0.2; $P = .09$; odds ratio = 0.7; 95% confidence interval, 0.5-1.0), cocaine ($\beta = -1.4$; robust SE = 0.4; $P < .001$; odds ratio = 0.2; 95% confidence interval, 0.1-0.5), and other drugs ($\beta = -0.7$; robust SE = 0.3; $P = .03$; odds ratio = 0.5; 95% confidence interval, 0.3-0.9) over the 24-month period.

Conclusion: This study extends the evidence that brief, personality-targeted interventions can prevent the onset and escalation of substance misuse in high-risk adolescents.

Trial Registration: clinicaltrials.gov Identifier: NCT00344474

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ALCOHOL AND DRUG MISUSE by young people is a significant problem in the United States and Europe. A comparative study[1] on rates of alcohol and drug use among high school students in the United States and across Europe estimated that American and British high school students are similar in their illicit drug use patterns and report among the highest rates of lifetime illicit drug use (41% for American students and 35% for British students) relative to all nations surveyed. More recent findings[2] revealed some concerning trends in drug use among American high school students. First, while rates of lifetime marijuana and cocaine use have decreased over the past 10 years, indicators of more frequent use (eg, past-year, past-month, or daily use) suggest that rates of frequent or repeated use are increasing among high school students. For example, rates of past-month marijuana use increased from 12% in 1992 to 18% in 2006 among high school seniors and from 8% to 14% among 10th graders. Time-trend analyses for British youth suggest similar growth.[1,3,4]

The earlier the age at onset of regular drug use is, the more likely the individual is to develop substance use disorders in adulthood,[5,6] whereby it has been estimated that rates of adult substance abuse and dependence could be reduced by up to 10% with every year that onset of regular alcohol use or illicit drug use is delayed in

adolescence.[5] The school-based approach to drug use prevention is common because it offers a controlled setting for capturing large, culturally unbiased samples of young people and because schools provide an ideal context for early screening and systematic follow-up. However, the evidence base for school-based prevention programs that attempt to delay onset of use or prevent the transition from experimental use to regular substance use is either limited or nonexistent. Three published meta-analyses[7-9] evaluating the overall effect of school-based prevention concluded that the evidence in support of universal programs affecting actual drug uptake or frequency of use is mild. Accordingly, few programs have been sufficiently evaluated to assess effects on actual illicit substance use and fewer show effects beyond the treatment period. Those showing promise tend to be skills-based interventions that involve an interactive component, but they show only mild effects on prevalence of drug use.[7,9] A recent Cochrane review[9] identified only 4 of 29 studies involving randomized controlled trials of school-based prevention that were sufficiently designed and powered to assess effects on actual drug use (many studies evaluated drug attitudes). The 4 studies evaluating 4 different skills-based programs showed a 20% reduction (relative risk ratio=0.80) in uptake of cannabis use and an approximately 50% reduction in rates of cocaine use over a 1-year period relative to a standard curriculum control. However, there was no evidence that these programs had any effect on continuous measures of drug use, suggesting that they are not effective in preventing transition to regular use in experimental users and thus may not be targeting the youth most at risk. Furthermore, number-needed-to-treat (NNT) indices of effect size indicated that only 1 case of cannabis use was prevented for every classroom of children exposed to the intervention (NNT=33). Considering the intensity of these programs (15-30 class sessions), these effects were considered rather mild. Finally, no program was shown to be effective outside the United States, whose unique social context and drug policies might render generalization of findings to other nations problematic. For example, different federal policies toward the illegal classification of cannabis might render prevention more or less difficult.

A recent shift toward more targeted approaches to drug prevention has led to the development of brief, selected, skills-based interventions targeting personality risk factors for substance use.[10-12] Personality factors such as hopelessness, anxiety sensitivity, impulsivity, and sensation seeking have been shown to be concurrent or predictive risk factors for substance misuse in adulthood[13] and adolescence.[11,14-19]

Anxiety sensitivity and hopelessness have been shown to be related to alcohol consumption as a response to managing anxiety[20] or as means of stemming depressed feelings.[17,19] Impulsive personality traits have been robustly associated with antisocial behavior in childhood and adolescence[21] and found to be predictive of alcohol and substance misuse in adulthood.[22] In contrast, sensation or excitement seeking is directly associated with heavy alcohol consumption and binge drinking[14,15] for enhancement reasons.[20]

Three randomized trials have shown that targeting personality in brief coping skills interventions is effective in reducing alcohol and illicit substance use in substance-dependent individuals[10] and in reducing drinking quantity, drinking frequency, and drinking problems in high school– and college-aged drinkers.[11,12] The current Preventure Study is a fourth randomized controlled trial evaluating a school-based, personality-targeted prevention program delivered to younger secondary school students (mean age, 14 years) who for the most part had not yet initiated substance use. The 6- and 12-month drinking outcomes of the first wave of this trial were reported by Conrod et al.[15] The study revealed robust effects on drinking rates, drinking quantity, and frequency and growth in drinking as well as a reduction in psychiatric symptoms to which each personality profile was most susceptible.[15,16] The NNTs were as low as 2, suggesting that for every 2 interventions delivered, 1 case of alcohol misuse was prevented. We now report the primary outcomes of the full Preventure Trial, which involved 2 waves of recruitment, randomization, and assessment of illicit substance use at 6, 12, 18, and 24 months after intervention to provide the necessary statistical power to detect moderate intervention effects on illicit drug behaviors that have a lower prevalence and later onset relative to alcohol use. The current investigation, involving the full Preventure Trial sample of 732 high-risk adolescents randomized to receive a 2-session personality-targeted group intervention or the standard school drug education curriculum, examines the effects of personality-targeted interventions on survival as a non–drug user over a 2-year period and the effects on frequency measures of drug use. We hypothesized that the intervention would significantly extend the time to onset of drug use, that certain personality variables would be more strongly associated with drug use onset (impulsivity specifically), and that stronger intervention effects would be shown for individuals with those personality traits associated with faster progression to drug use.

METHODS

PARTICIPANTS AND PROCEDURE

Twenty-four state-administered secondary schools in London, United Kingdom, were recruited to participate in this study, in which students attending years 9 to 11 (aged 13-16 years; median age, 14 years) were surveyed during class time. Secondary schools in 11 of the 33 London boroughs were sent information on the project. Boroughs were selected based on proximity to the Institute of Psychiatry, King's College London, where the research team was based.

Students were surveyed and invited to participate in personality-targeted interventions if they scored 1 SD above the school mean on 1 of the 4 subscales of the Substance Use Risk Profile Scale[17]: hopelessness, anxiety sensitivity, impulsivity, and sensation seeking. In a minority of cases (<25%), students scored at least 1 SD above the school mean on more than 1 subscale, whereby they were assigned to the personality-targeted intervention for which they showed the most deviance according to *z* scores. Participation in both the survey and intervention phases of the study was voluntary and required both parental consent and student assent. The randomization procedure involved inviting all interested and eligible youth (who met personality criteria and provided signed parental con-

sent) to an information meeting at which they were guided in reviewing the contents of the consent forms. Principles of voluntary participation, confidentiality, and random assignment were explicitly explained, and then youth were asked to pick a piece of paper from a hat containing either the letter *x* or the letter *y* to specify assignment to the control or intervention conditions in a transparent way.[11]

A total of 732 high-risk students were randomized according to a 1:1 randomization scheme to intervention (n=395) or control (n=337) conditions. **Figure 1** shows participant eligibility, randomization, and follow-up attrition. Figure 1 also shows that while 85% of the eligible sample volunteered to participate in the interventions, only half provided parental consent. There were no exclusion criteria other than reporting unreliable data (responding inconsistently across the survey or positively to a sham drug item) at baseline assessment and not providing parental consent. Forty-one adolescents provided unreliable data at 1 of the follow-up assessments and were thus excluded from analyses for that time only or had their data imputed for intent-to-treat (ITT) analyses. **Table 1** provides information on personality scores and drug use rates in the overall screened sample, the subset of participants deemed eligible for the trial based on personality criteria, and the smaller subset of participants who volunteered and provided signed parental consent to participate. Independent samples *t* tests and χ^2 analyses showed that relative to their low-risk counterparts, the adolescents who were selected based on personality criteria reported significantly higher rates of drug use at baseline, confirming the personality selection criteria. While there were small differences between eligible youth who were and were not recruited, there was no evidence of a systematic bias toward recruiting youth with lower risk profiles.

FOLLOW-UP ASSESSMENTS

Follow-up assessments were conducted in school at 6, 12, 18, and 24 months after intervention by research assistants blind to the treatment condition. When participants could not be reached at school, a questionnaire booklet was mailed to their home and they returned the completed booklet by mail. Book vouchers were offered as incentives for returning the questionnaires. Follow-up rates for 6-, 12-, 18-, and 24-month follow-up assessments were 83%, 73%, 62%, and 53%, respectively. A total of 638 participants (87%) were assessed at least once over the 2-year follow-up period, 510 (80%) were assessed at least twice, and 396 (62%) were assessed at least 3 times after intervention. Survival data (drug use uptake) were available for 81% of the baseline non–drug using sample because drug use was most often initiated prior to the adolescent becoming unavailable for follow-up.

MEASURES

The following measures were all included in baseline and follow-up assessments.

Demographic Characteristics

Using a questionnaire similar to one used by Stewart and Devine[18] and by Conrod et al,[11,15] adolescents were asked to provide information on sex, age, grade, and ethnicity using a forced-choice answering procedure.

Personality Risk

The Substance Use Risk Profile Scale[17] is a 23-item questionnaire that assesses levels of several personality risk factors for

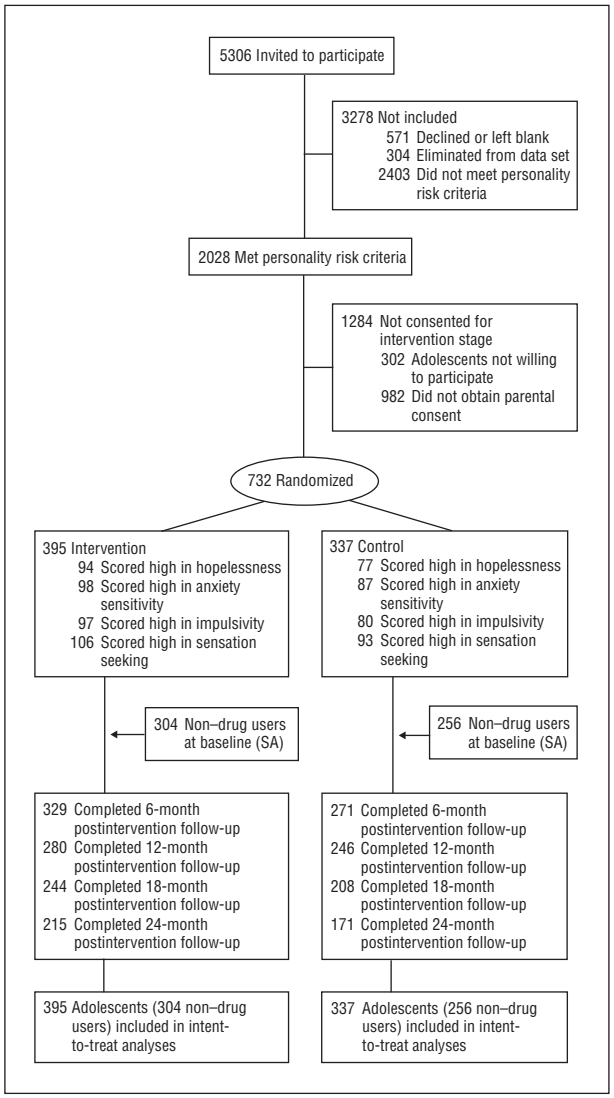

Figure 1. Participant eligibility, randomization, and follow-up procedure. SA indicates survival analysis.

substance abuse or dependence, including hopelessness, anxiety sensitivity, impulsivity, and sensation seeking.[19] This scale has been shown to be sensitive to personality-based individual differences in response to acute alcohol challenge[23] and stress challenge[24] and has been shown to have good concurrent, predictive, and incremental validity (relative to other personality measures) with respect to differentiating individuals prone to reinforcement-specific patterns of drug use.[15,19] In the present sample, each of the subscales appeared to have good internal reliability for short scales, with Cronbach α coefficients ranging from .67 to .77 (α=.77 for hopelessness [7 items]; α=.67 for anxiety sensitivity [5 items]; α=.67 for impulsivity [5 items]; and α=.69 for sensation seeking [6 items]).

Drug Use

Drug use was assessed using the Reckless Behavior Questionnaire,[25] a 10-item measure that asks participants to report how often they have engaged in various risky behaviors over the past 6 months. Three Reckless Behavior Questionnaire items were used to assess the frequency of illicit drug use ("How many times in the last 6 months have you used marijuana [never to >10 times], cocaine [never to >10 times], and other drugs that are

Table 1. Drug Use Rates and Personality Scores for Adolescents[a]

Drug Use or Personality Subscale Score	Sample Surveyed (n=4431)[b]			Eligible Sample (n=2028)[c]	
	Full Sample (n=4431)	Low Risk (n=2403)	Eligible (n=2028)	Declined (n=1296)	Participated (n=732)
Drug use, No. (%)					
Marijuana	714 (16)	**288 (12)**	**432 (21)**	272 (21)	160 (22)
Cocaine	85 (2)	**24 (1)**	**68 (3)**	**52 (4)**	**16 (2)**
Other	214 (5)	**72 (3)**	**142 (7)**	91 (7)	51 (7)
Any	799 (18)	**312 (13)**	**477 (24)**	311 (24)	166 (23)
Subscale score, mean (SD)					
Hopelessness	13.0 (3.5)	**12.1 (2.5)**	**14.0 (4.1)**	14.2 (4.2)	13.9 (4.0)
Anxiety sensitivity	11.5 (2.8)	**10.9 (2.1)**	**12.2 (3.3)**	12.1 (3.3)	12.2 (3.2)
Impulsivity	11.8 (2.8)	**10.9 (2.1)**	**12.9 (3.1)**	**12.7 (3.1)**	**13.1 (3.0)**
Sensation seeking	15.3 (3.4)	**14.4 (2.7)**	**16.4 (3.8)**	**16.1 (3.9)**	**16.9 (3.7)**

[a] Boldface indicates significant group differences.

[b] Results from χ^2 analyses of drug use comparing low-risk vs eligible youth were as follows: marijuana, $\chi^2_1 = 67.40$, $P < .001$; cocaine, $\chi^2_1 = 14.63$, $P < .001$; other, $\chi^2_1 = 55.54$, $P < .001$; and any, $\chi^2_1 = 77.37$, $P < .001$. Results from independent samples t tests on personality measures were as follows: hopelessness, $t_{4429} = 19.4$, $P < .001$; anxiety sensitivity, $t_{4429} = 15.4$, $P < .001$; impulsivity, $t_{4429} = 24.9$, $P < .001$; and sensation seeking, $t_{4429} = 19.7$, $P < .001$.

[c] Results from χ^2 analyses of drug use comparing those who declined participation vs those who participated were as follows: marijuana, $\chi^2_1 = 0.21$, $P = .65$; cocaine, $\chi^2_1 = 4.86$, $P = .03$; other, $\chi^2_1 = 0.02$, $P = .91$; and any, $\chi^2_1 = 0.04$, $P = .84$. Results from independent samples t tests on personality measures were as follows: hopelessness, $t_{2026} = 1.4$, $P = .18$; anxiety sensitivity, $t_{2026} = 0.9$, $P = .37$; impulsivity, $t_{2026} = 2.5$, $P = .01$; and sensation seeking, $t_{2026} = 4.2$, $P < .001$.

not marijuana or cocaine [never to >10 times]?"). The 3 drug-related items were then combined to create a drug use frequency score, dichotomized into yes or no variables, and then added to create a variable of the number of drugs used—a scoring strategy for which there is established validity, particularly with respect to measuring personality-specific aspects of drug use behavior.[26] Finally, we included an additional sham drug item in the Reckless Behavior Questionnaire to detect unreliable self-report. All participants who responded positively on this item were presumed to be overreporting and were excluded from analyses (n=41). Participants responded to all drug-related items in reference to the 6-month period prior to the assessment date. Several studies have found that adolescent self-reports of substance-related symptoms have excellent discriminant validity[27] and predictive validity.[28] This, together with guaranteed confidentiality to participants and the inclusion of the reliability check (sham drug item) in the questionnaire, should contribute to the reliability of these data.

INTERVENTIONS

The brief interventions, which involved two 90-minute group sessions, were manualized and were carried out at the participants' schools. The manuals incorporated a psychoeducational component, a motivational component, and a cognitive behavioral therapy component and included real-life scenarios shared by high-personality-risk British youth in specifically organized focus groups. The interventions were facilitated by chartered counseling psychologists (MSc in counseling psychology) or experienced special needs teachers (postgraduate diploma in education with specialization) and cofacilitators (masters-level research assistants). The interventions were not intended to change personality. Rather, they were designed with the intention to change how individuals with specific personality risk factors cope with their vulnerability. The first sections of the manual involved guiding participants through a goal-setting exercise to increase motivation for behavior change. Psychoeducational strategies were then used to teach participants about the target personality variable (hopelessness, anxiety sensitivity, impulsivity, or sensation seeking) and associated problematic, personality-specific coping behaviors like avoidance, interpersonal dependence, aggression, risky behaviors, and substance misuse. The adolescents were then introduced to the cognitive behavioral therapy model and guided in breaking down a personal experience according to the cognitive behavioral therapy components of an emotional response. All exercises discussed thoughts, emotions, and behaviors in a personality-specific way. The last section of the manuals encouraged participants to identify and challenge personality-specific cognitive distortions that lead to problematic behaviors. For information on treatment integrity, refer to the articles by Conrod et al.[11,15] Most adolescents assigned to the intervention condition (91%) completed both intervention sessions.

DATA ANALYSIS

Sample size was calculated to detect a moderate effect on drug use outcomes, assuming that drug use would be prevalent in 20% to 30% of high-risk youth by the 24-month follow-up. For primary continuous outcome measures, analyses of covariance controlling for baseline demographic variables were used to assess intervention effects on the full ITT sample, which included users and nonusers at baseline (n=732). Interactions between intervention and personality group as well as intervention and baseline drug use status were also investigated. Effect sizes were calculated on log-transformed data for time-specific group differences and within-group change from baseline to each follow-up assessment using the Cohen *d* formula and standard deviation of baseline scores as the standardizing unit.[29] The ITT analyses included all participants initially randomized to intervention or control conditions, whereby missing information for continuous variables was imputed using a full-information maximum likelihood estimation method (SPSS statistical software version 15; SPSS Inc, Chicago, Illinois). This was considered appropriate because attrition rates were comparable across treatment condition, primary substance use outcomes, and demographic characteristics except sex. The drug frequency score and number of drugs used were log transformed to correct for positive skew.

To evaluate the preventive effect of the intervention on drug use onset, survival analyses were conducted on the full ITT sample of baseline non–drug users (n=560), in which missing cases were censored at the time of final nonmissing follow-up based on the assumption that cases were missing at random.

Logistic models with time as a discrete variable and age, sex, ethnicity, and drinking onset as covariates were used to estimate proportional odds and risk factor coefficients for onset of drug use as recommended by Abbott.[30] In a second step, main effects of personality were examined. Then, individual logistic regression analyses were performed to evaluate effects of the intervention on the probability of a drug use event up until each time point using data from the subsample of baseline nonusers who were followed up until onset of drug use or until they were no longer available for follow-up (81%). Odds ratios (ORs) based on logistic regression or survival function models and NNTs based on raw percentages were used as effect size indices for categorical data, with the NNT representing the number of participants needed to be treated in order to prevent 1 additional negative outcome.[31]

RESULTS

Participants' baseline demographic information by treatment condition is presented in **Table 2**. There were no significant baseline differences revealed between the control and intervention groups. The χ^2 analyses and analyses of variance showed that attrition from the study did not differ by treatment condition, drug use, or demographic characteristics, except that girls participated in more follow-up interviews than boys (χ^2_4=48.41; $P<.001$)—5% of girls and 11% of boys were not followed up at any time during the 2-year follow-up period.

Table 2. Demographic Characteristics by Treatment Condition[a]

Characteristic	Participants, No. (%)	
	Intervention (n=376)	Control (n=315)
Age, y		
13	93 (25)	82 (26)
14	193 (51)	153 (49)
15	88 (23)	79 (25)
16	2 (1)	1 (0)
Female (n=471)	249 (66)	222 (71)
In secondary school year 9 (n=394)	226 (60)	168 (53)
Ethnicity		
White (n=277)	153 (41)	124 (39)
South Asian (n=69)	37 (10)	32 (10)
Afro-Caribbean (n=208)	113 (30)	95 (30)
Mixed (n=80)	45 (12)	35 (11)
Other (n=57)	28 (8)	29 (9)
Substance use		
Marijuana	81 (22)	64 (20)
Cocaine	9 (2)	5 (2)
Other	25 (7)	17 (5)
Any	82 (22)	68 (22)
Alcohol	215 (57)	163 (52)

[a] No significant group differences were found for any of the measures at baseline.

CONTINUOUS MEASURES OF DRUG USE

The ITT analyses on the drug use frequency composite and number of drugs used repeated over baseline, 6-, 12-, 18-, and 24-month assessments involved a repeated-measures analysis of covariance with intervention condition, personality group, and baseline drug use status as between-subject factors and sex, age, and ethnicity as covariates. The primary analyses of interest were time × intervention interactions, which were significant for both drug use measures. **Table 3** shows *F* scores and log-transformed estimated means for drug use frequency and number of drugs used in the past 6 months. Analyses of simple time effects within the intervention and control groups indicated that the intervention group showed a significant decrease in drug use frequency scores from baseline to 6 months ($P<.001$; d=0.50) and 24 months (P=.001; d=0.37) (**Figure 2**) and a significant reduction in the number of drugs used from baseline to 6 months ($P<.001$; d=0.67) and 24 months (P=.02; d=0.60). In contrast, the control group showed no change in the frequency of drug use and significant increases in the number of drugs tried from baseline to 12 months (P=.03; d=0.60), 18 months (P=.02; d=0.61), and 24 months (P=.049; d=0.60). Table 3 also presents significance levels for simple group comparisons and effect size calculations for any significant group differences comparing the intervention and control groups at each time. Small effects of intervention on drug use measures were revealed at each follow-up. Three- and four-way interaction effects were not significant, suggesting that the interventions were not differentially effective for specific personality types or for those who had already initiated drug use at baseline.

SURVIVAL ANALYSIS

Marijuana Use

We used ITT logistic regression to estimate the effect of the intervention on the probability of a marijuana use event up to the 24-month follow-up period. Results indicated that over and above the effect of demographic variables and baseline drinking status (β=0.9; robust SE=0.2; P=.001; OR=2.5; 95% confidence interval [CI], 1.7-3.7), the intervention was associated with a nonsignificant trend for reduced odds of taking up marijuana use (β=–0.3; robust SE=0.2; P=.09; OR=0.7; 95% CI, 0.5-1.0). The second step revealed a main effect of impulsive personality on marijuana use uptake (β=0.3; robust SE=0.1; P=.002; OR=1.3; 95% CI, 1.1-1.6). Then, logistic regression analyses on onset of marijuana use by each follow-up period were conducted to investigate time-specific effects of the intervention. Analyses including the same covariates as earlier indicated nonsignificant trends for intervention effects on marijuana use uptake at 18 months (β=–0.3; SE=0.2; P=.12) and 24 months (β=–0.3; SE=0.2; P=.12) (**Table 4**). The NNT calculations on rates of marijuana use uptake by the final 24-month follow-up indicated that for every 18 adolescents who took part in an intervention, 1 case of marijuana use was prevented.

Cocaine Use

The effect of intervention on the probability of a cocaine use event over the 24-month period was inves-

Table 3. Log-Transformed Changes in Drug Use From Baseline to 6, 12, 18, and 24 Months After Intervention[a]

Drug Use	Log-Transformed Change, Mean (SD)					Time × Intervention		Effect of Time Within Group	
	Baseline	6 mo	12 mo	18 mo	24 mo	*F* Score	*P* Value	*F* Score	*P* Value
Frequency						$F_{4,669}$ = 2.86	<.05		
Intervention (n=376)	0.61 (0.08)	0.57 (0.14)[b,c]	0.59 (0.16)[d]	0.59 (0.17)[b]	0.58 (0.16)[b,c]			$F_{4,362}$ = 1.82	.13
Control (n=315)	0.61 (0.07)	0.61 (0.14)[b]	0.62 (0.16)[d]	0.63 (0.18)[b]	0.62 (0.16)[b]			$F_{4,301}$ = 0.43	.78
Cohen *d*		0.29	0.19	0.23	0.25				
No. of drugs used						$F_{4,669}$ = 3.84	<.01		
Intervention (n=376)	0.18 (0.06)[d]	0.14 (0.19)[c]	0.17 (0.19)[d]	0.17 (0.23)	0.16 (0.23)[c,d]			$F_{4,362}$ = 2.74	.03
Control (n=315)	0.17 (0.05)[d]	0.17 (0.20)	0.20 (0.20)[c,d]	0.20 (0.25)[c]	0.20 (0.23)[c,d]			$F_{4,301}$ = 0.48	.75
Cohen *d*	0.18		0.16		0.18				

[a]The means (SDs) are log-transformed total scores, which were estimated with demographic variables (sex, age, and ethnicity). All effects (*F* scores, Cohen *d* values, and *P* values) were calculated on log-transformed variables. In covariate analysis, a significant main effect for ethnicity was found for both drug use frequency ($F_{1,672}$ = 9.68; $P < .01$) and number of drugs used ($F_{1,672}$ = 18.77; $P < .001$) and a significant time × ethnicity interaction was found for both drug use frequency ($F_{4,669}$ = 4.91; $P < .01$) and number of drugs used ($F_{4,669}$ = 5.30; $P < .001$), indicating that white adolescents showed increased drug use at baseline and increasing drug use scores across time. Significant time × baseline drug use interactions for drug use frequency ($F_{4,669}$ = 43.23; $P < .001$) and number of drugs used ($F_{4,669}$ = 58.15; $P < .001$) indicated that adolescents who reported drug use at baseline showed elevated drug use scores across time and that non–drug users at baseline showed increasing scores over time.

[b]Group difference significant at $P < .01$.

[c]Change from the baseline score was significant at $P < .05$.

[d]Group difference significant at $P < .05$.

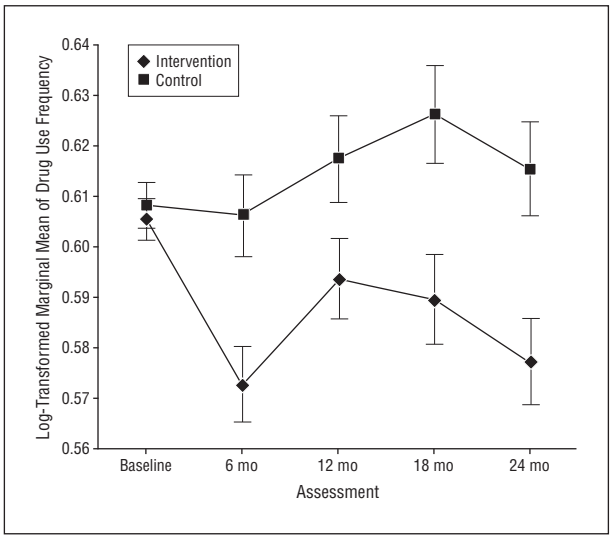

Figure 2. Illicit drug use frequency scores in adolescents randomized to control or intervention conditions.

tigated with survival analysis using logistic regression models in the full ITT sample. Results indicated a significant effect of age (β=0.5; robust SE=0.2; *P*=.03; OR=1.6; 95% CI, 1.0-2.6), being male (β=1.0; robust SE=0.4; *P*=.005; OR=2.8; 95% CI, 1.3-5.7), and intervention (β=–1.4; robust SE=0.4; *P*<.001; OR=0.2; 95% CI, 0.1-0.5) on probability of a cocaine use event over this period. Again, impulsivity scores were shown to be significantly related to shorter time to onset of cocaine use in the second step of the analysis (β=0.4; robust SE=0.2; *P*=.02; OR=1.5; 95% CI, 1.1-2.1). Time-specific logistic regression analyses (Table 4) indicated significant intervention effects on cocaine use uptake at 6 months (β=–1.6; SE=0.7; *P*=.001), 12 months (β=–1.6; SE=0.5; *P*=.001), 18 months (β=–1.6; SE=0.5; *P*=.001), and 24 months (β=–1.4; SE=0.4; *P*<.001). The NNT indicated that for every 10 interventions provided, 1 case of cocaine use was prevented over the 24-month period.

Other Drug Use

Survival analyses using logistic regression models indicated that the probability of an event of other drug use was significantly associated with drinking status (β=0.7; robust SE=0.4; *P*=.047; OR=2.0; 95% CI, 1.0-4.1) and intervention (β=–0.7; robust SE=0.3; *P*=.03; OR=0.5; 95% CI, 0.3-0.9). The second step in this analysis showed that impulsivity scores were related to outcome (β=0.3; robust SE=0.2; *P*=.05; OR=1.4; 95% CI, 1.0-1.9). Logistic regression analyses revealed significant intervention effects on other drug use at 12 months (β=–0.6; SE=0.4; *P*=.06), 18 months (β=–0.6; SE=0.3; *P*=.03), and 24 months (β=–0.6; SE=0.3; *P*=.03). The NNT for other drug use over the 24-month period was 16.

COMMENT

This study is the first of its kind to demonstrate that brief school-based targeted interventions can prolong survival as a non–drug user over a 2-year period. The success of this program is likely due to its selective nature in that only high-risk youth with known personality risk factors for early-onset substance use were targeted. This selective approach allowed us to deliver interventions that were brief, personally relevant, and focused on risk factors directly related to the individual's risk for substance use. As such, the personality-targeted interventions were found to be effective in preventing escalation in the frequency of drug use and preventing experimentation with new illicit substances over a 24-month period relative to a no-intervention control condition. The ORs representing the effect of the intervention probability of drug use events over the

Table 4. Time-Specific Intervention Effects on the Percentage of Adolescents Reporting Drug Use (Nonsurvival)[a]

Drug Use	6 mo	12 mo	18 mo	24 mo
Marijuana				
Intervention	19.0	24.7	26.2	29.7
Control	17.2	26.0	31.2[b]	35.3[b]
OR (95% CI)	1.1 (0.6-1.8)	0.9 (0.6-1.4)	0.7 (0.5-1.1)	0.7 (0.5-1.1)
Cocaine				
Intervention	1.2	2.4	2.8	4.0
Control	5.9[c]	10.3[c]	10.2[c]	13.5[c]
OR (95% CI)	0.2 (0.05-0.7)	0.2 (0.1-0.5)	0.2 (0.1-0.5)	0.2 (0.1-0.5)
Other drugs				
Intervention	4.1	6.9	7.7	10.0
Control	6.1	11.8[b]	13.2[c]	16.4[c]
OR (95% CI)	0.7 (0.3-1.5)	0.5 (0.3-1.0)	0.5 (0.3-0.9)	0.5 (0.3-0.9)

Abbreviations: CI, confidence interval; OR, odds ratio.

[a]Values for the intervention and control groups are reported as the percentage of adolescents. Intervention effects on drug use status were assessed using logistic regression analyses including sex, age, ethnicity, and drinking status at baseline as covariates. The ORs indicate the odds of reporting a drug use event at that time in the intervention group relative to the odds in the control condition, controlling for baseline covariates. An OR of 0.2 indicates 80% reduction in cocaine use rates in the intervention condition, and an OR of 0.5 indicates 50% reduction in other drug use in the intervention condition.

[b]$P < .10$.

[c]$P < .05$.

2-year follow-up were very similar to 1-year outcomes from the most well-established, more intensive, universal school-based drug prevention programs.[9] However, the NNT indices suggest that the approach may be more efficient in producing these effects in that fewer and briefer interventions can be delivered to a subsample of high-risk youth, requiring that only half to one-third the number of students be targeted to prevent a case of drug use (NNT = 10-18).

While another promising approach in targeted drug prevention is brief motivational interviewing with young drug users,[32-35] there is some evidence that this latter approach may be more effective for heavier users[35] and is likely limited in its ability to produce primary prevention of onset or escalation to frequent use such as is demonstrated here for the personality-targeted approach. An important advantage of the personality-targeted approach is that high-risk youth can be selected and targeted before they have initiated substance use, and they can be assisted in preventing onset and escalation to regular and problematic use by managing early behavioral risk profiles. The fact that some of the intervention effects reported in this study were delayed until 18- and 24-month outcomes (ie, marijuana and other drug use) lends support for this interpretation.

STRENGTH OF THE EVIDENCE

The current study represents the fourth reported randomized controlled trial in which personality-targeted interventions were shown to be more effective than no-intervention control[11,15] or placebo control[10,12] conditions in preventing or reducing substance-related behavior. These findings have been reported by 2 independent research groups and involve large samples of youth ranging across a variety of demographic variables in different countries; taken together, they indicate real substantial benefit from the personality-targeted approach for youth drinking behavior.[36,37] The current results also provide, to our knowledge for the first time, promising evidence in favor of the efficacy of this intervention approach for preventing onset and escalation of illicit drug use.

The small effect of the intervention with respect to preventing marijuana use might be related to the fact that adolescents tend to underplay the risks associated with marijuana use relative to use of other drugs[3]; also, it might imply that a drug education component should be added to this targeted intervention approach to additionally address problematic drug attitudes toward this relatively normative behavior. However, all adolescents in this trial were exposed to substantial drug education through the UK standard curriculum and additional boroughwide Drug Education Services, which suggests that future efforts to combine drug education with interventions targeting individual risk factors should consider a more integrated approach in which drug education is also delivered in a personality-targeted way.

LIMITATIONS

This trial did not include a placebo control condition, which would have strengthened the methodological quality of the trial as the intervention was evaluated only relative to a treatment-as-usual control group where all youth are exposed to some form of drug education and generic coping skills information through the standard school curriculum. Two previous placebo-controlled trials involving adult participants showed that personality-targeted interventions result in significantly greater reduction in alcohol and drug use relative to 2 active psychotherapy placebo conditions[10] and relative to 2 nontherapeutic group sessions.[12] Furthermore, despite their prevalence, very few alternative intervention programs have been shown to be effective in preventing substance-related behaviors in youth. This suggests that there is little evidence for a placebo effect on adolescent drug-related behavior produced by adolescents attending generic group sessions.[9]

Another problematic feature of the study was the high rate of attrition, which happened in 2 stages: (1) when parents were asked to actively consent to their child's participation in the trial, and (2) when children were followed up for 2 years after intervention. However, data presented in Table 1 on how the ITT sample differed from all eligible participants showed that there was no systematic bias present in the recruited sample relative to the eligible sample. Furthermore, trial outcomes were evaluated using ITT and non-ITT samples involving at least 3 different ways of managing missing information, including survival analysis, which optimizes the use of all available data (81% in this study). Results were consistent regardless of the method used to evaluate the intervention effect or to manage missing data, suggesting that study attrition did not have a significant effect on the results of this trial.

FUTURE DIRECTIONS AND CLINICAL IMPLICATIONS

The next steps in further establishing the validity of this intervention approach will be the exploration of treatment utility and effectiveness. The majority (85%) of adolescents identified as eligible for inclusion in this trial volunteered to participate in the intervention sessions, suggesting that the program could be easily adopted by schools if appropriate training and resources were made available. One trial that is currently under way, entitled Adventure, will examine the efficacy of personality-targeted interventions when delivered by educational staff and school counselors and involving an opt-out consenting procedure for parents; it will begin to explore more sustainable strategies for implementing this school-based program. Additionally, study of the mechanisms by which this benefit is conferred will enable further refinement of this procedure. Furthermore, it might be worthwhile to investigate whether different selection cutoffs for establishing personality risk will result in more sensitivity with respect to identifying current and future substance users and perhaps those most likely to respond to the intervention. Finally, Castellanos and Conrod[16] previously showed that personality-targeted interventions are effective in reducing psychiatric symptoms to which each personality risk group is most susceptible. It will be important to examine the extent to which interventions targeting younger children with these personality risk factors could also lead to prevention of other mental health problems.

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REFERENCES

1. Hibell B, Andersson B, Bjarnason T, Ahlström S, Balakireva O, Kokkevi A, Morgan M. *The ESPAD Report 2003: Alcohol and Other Drug Use Among Students in 35 European Counties.* Stockholm, Sweden: Swedish Council for Information on Alcohol and Other Drugs and Pompidou Group at Council of Europe; 2004.
2. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. *Monitoring the Future: National Results on Adolescent Drug Use: Overview of Key Findings, 2006.* Bethesda, MD: National Institute on Drug Abuse; 2007. NIH publication 07-6202.
3. Becher H, Boreham R, Emery P, Hinds K, Jamison J, Schagen I. *Smoking, Drinking and Drug Use Among Young People in England in 2000.* Norwich, England: The Stationery Office; 2001.
4. Singleton N, Bumpstead R, O'Brien M, Lee A, Meltzer H. *Psychiatric Morbidity Among Adults Living in Private Households, 2000.* London, England: The Stationery Office; 2001.
5. Grant BF, Dawson DA. Age at onset of drug use and its association with DSM-IV drug abuse and dependence: results from the National Longitudinal Alcohol Epidemiologic Survey. *J Subst Abuse.* 1998;10(2):163-173.
6. Lynskey MT, Heath AC, Bucholz KK, Slutske WS, Madden PAF, Nelson EC, Statham DJ, Martin NG. Escalation of drug use in early-onset cannabis users vs co-twin controls. *JAMA.* 2003;289(4):427-433.
7. Tobler NS, Roona MR, Ochshorn P, Marshall DG, Streke AV, Stackpole KM. School-based adolescent drug prevention programs: 1998 meta-analysis. *J Prim Prev.* 2000;20(4):275-336. doi:10.1023/A:1021314704811.
8. Tobler NS, Stratton HH. Effectiveness of school-based drug prevention programs: a meta-analysis of the research. *J Prim Prev.* 1997;18(1):71-128. doi:10.1023/A:1024630205999.
9. Faggiano F, Vigna-Taglianti FD, Versino E, Zambon A, Borraccino A, Lemma P. School-based prevention for illicit drugs' use. *Cochrane Database Syst Rev.* 2005;(2):CD003020. doi:10.1002/14651858.CD003020.pub2.
10. Conrod PJ, Stewart SH, Pihl RO, Cote S, Fontaine V, Dongier M. Efficacy of brief coping skills interventions that match different personality profiles of female substance abusers. *Psychol Addict Behav.* 2000;14(3):231-242.
11. Conrod PJ, Stewart SH, Comeau N, Maclean AM. Efficacy of cognitive-behavioral interventions targeting personality risk factors for youth alcohol misuse. *J Clin Child Adolesc Psychol.* 2006;35(4):550-563.
12. Watt M, Stewart S, Birch C, Bernier D. Brief CBT for high anxiety sensitivity decreases drinking problems, relief alcohol outcome expectancies, and conformity drinking motives: evidence from a randomized controlled trial. *J Ment Health.* 2006;15(6):683-695.
13. Conrod PJ, Pihl RO, Stewart SH, Dongier M. Validation of a system of classifying female substance abusers on the basis of personality and motivational risk factors for substance abuse. *Psychol Addict Behav.* 2000;14(3):243-256.
14. Sher KJ, Bartholow BD, Wood MD. Personality and substance use disorders: a prospective study. *J Consult Clin Psychol.* 2000;68(5):818-829.
15. Conrod PJ, Castellanos N, Mackie C. Personality-targeted interventions delay the growth of adolescent drinking and binge drinking. *J Child Psychol Psychiatry.* 2008;49(2):181-190.
16. Castellanos N, Conrod PJ. Brief interventions targeting personality risk factors for adolescent substance misuse reduce depression, panic and risk-taking behaviours. *J Ment Health.* 2006;15(6):645-658.
17. Conrod PJ, Woicik P. Validation of a four-factor model of personality risk for substance abuse and examination of a brief instrument for assessing personality risk. *Addict Biol.* 2002;7(3):329-346.
18. Stewart SH, Devine H. Relations between personality and drinking motives in young adults. *Pers Individ Dif.* 2000;29(3):495-511. doi:10.1016/S0191-8869(99)00210-X.
19. Woicik PA, Stewart SH, Pihl RO, Conrod PJ. The Substance Use Risk Profile Scale: a scale measuring traits linked to reinforcement-specific substance use profiles. *Addict Behav.* 2009;34(12):1042-1055.

20. Comeau N, Stewart SH, 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(6):803-825.
21. Tremblay RE, Pihl RO, Vitaro F, Dobkin PL. Predicting early onset of male antisocial behavior from preschool behavior. *Arch Gen Psychiatry*. 1994;51(9):732-739.
22. Caspi A, Moffitt TE, Newman DL, Silva PA. Behavioral observations at age 3 years predict adult psychiatric disorders: longitudinal evidence from a birth cohort. *Arch Gen Psychiatry*. 1996;53(11):1033-1039.
23. Brunelle C, Assaad JM, Barrett SP, Ávila C, Conrod PJ, Tremblay RE, Pihl RO. Heightened heart rate response to alcohol intoxication is associated with a reward-seeking personality profile. *Alcohol Clin Exp Res*. 2004;28(3):394-401.
24. Conrod PJ. The role of anxiety sensitivity in subjective and physiological responses to social and physical stressors. *Cogn Behav Ther*. 2006;35(4):216-225.
25. Shaw DS, Wagner EF, Arnett J, Aber MS. The factor structure of the Reckless Behavior Questionnaire. *J Youth Adolesc*. 1992;21(3):305-323. doi:10.1007/BF01537020.
26. Desrichard O, Denarié V. Sensation seeking and negative affectivity as predictors of risky behaviors: a distinction between occasional vs frequent risk-taking. *Addict Behav*. 2005;30(7):1449-1453.
27. Clark DB, Winters KC. Measuring risks and outcomes in substance use disorders prevention research. *J Consult Clin Psychol*. 2002;70(6):1207-1223.
28. Crowley TJ, Mikulich SK, Ehlers KM, Whitmore AE, Macdonald MJ. Validity of structured clinical evaluations in adolescents with conduct and substance problems. *J Am Acad Child Adolesc Psychiatry*. 2001;40(3):265-273.
29. Kazis LE, Anderson JJ, Meenan RF. Effect sizes for interpreting changes in health status. *Med Care*. 1989;27(3)(suppl):S178-S189.
30. Abbott RD. Logistic regression in survival analysis. *Am J Epidemiol*. 1985;121(3):465-471.
31. Laupacis A, Sackett DL, Roberts RS. An assessment of clinically useful measures of the consequences of treatment. *N Engl J Med*. 1988;318(26):1728-1733.
32. McCambridge J, Strang J. The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomised trial. *Addiction*. 2004;99(1):39-52.
33. Tait RJ, Hulse GK, Robertson SI. Effectiveness of a brief intervention and continuity of care in enhancing attendance for treatment by adolescent substance users. *Drug Alcohol Depend*. 2004;74(3):289-296.
34. Tait RJ, Hulse GK, Robertson SI, Sprivulis PC. Emergency department-based intervention with adolescent substance users: 12-month outcomes. *Drug Alcohol Depend*. 2005;79(3):359-363.
35. Brown SA, Anderson KG, Schulte MT, Sintov ND, Frissell KC. Facilitating youth self-change through school-based intervention. *Addict Behav*. 2005;30(9):1797-1810.
36. American Psychological Association. Criteria for evaluating treatment guidelines. *Am Psychol*. 2002;57(12):1052-1059.
37. US Food and Drug Administration. Center for drug evaluation and research handbook, 1998. http://www.fda.gov/cder/handbook/index.htm. Accessed March 3, 2008.