ORIGINAL ARTICLE

Effectiveness of a Selective, Personality-Targeted Prevention Program for Adolescent Alcohol Use and Misuse

A Cluster Randomized Controlled Trial

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Context: Selective school-based alcohol prevention programs targeting youth with personality risk factors for addiction and mental health problems have been found to reduce substance use and misuse in those with elevated personality profiles.

Objectives: To report 24-month outcomes of the Teacher-Delivered Personality-Targeted Interventions for Substance Misuse Trial (Adventure trial) in which school staff were trained to provide interventions to students with 1 of 4 high-risk (HR) profiles: anxiety sensitivity, hopelessness, impulsivity, and sensation seeking and to examine the indirect herd effects of this program on the broader low-risk (LR) population of students who were not selected for intervention.

Design: Cluster randomized controlled trial.

Setting: Secondary schools in London, United Kingdom.

Participants: A total of 1210 HR and 1433 LR students in the ninth grade (mean [SD] age, 13.7 [0.33] years).

Intervention: Schools were randomized to provide brief personality-targeted interventions to HR youth or treatment as usual (statutory drug education in class).

Main Outcome Measures: Participants were assessed for drinking, binge drinking, and problem drinking before randomization and at 6-monthly intervals for 2 years.

Results: Two-part latent growth models indicated long-term effects of the intervention on drinking rates ($\beta = -0.320$, SE = 0.145, $P = .03$) and binge drinking rates ($\beta = -0.400$, SE = 0.179, $P = .03$) and growth in binge drinking ($\beta = -0.716$, SE = 0.274, $P = .009$) and problem drinking ($\beta = -0.452$, SE = 0.193, $P = .02$) for HR youth. The HR youth were also found to benefit from the interventions during the 24-month follow-up on drinking quantity ($\beta = -0.098$, SE = 0.047, $P = .04$), growth in drinking quantity ($\beta = -0.176$, SE = 0.073, $P = .02$), and growth in binge drinking frequency ($\beta = -0.183$, SE = 0.092, $P = .047$). Some herd effects in LR youth were observed, specifically on drinking rates ($\beta = -0.259$, SE = 0.132, $P = .049$) and growth of binge drinking ($\beta = -0.244$, SE = 0.073, $P = .001$), during the 24-month follow-up.

Conclusions: Findings further support the personality-targeted approach to alcohol prevention and its effectiveness when provided by trained school staff. Particularly novel are the findings of some mild herd effects that result from this selective prevention program.

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ALCOHOL USE IS HIGHLY prevalent and problematic among youth in developed countries[1-5] and has been reported to cost society more disability-affected life-years than any other health risk behavior, accounting for 9% of all deaths of people aged 15 to 29 years.[6] Although many community-based interventions to reduce harm associated with underage drinking have been found to be effective,[7] they involve multilevel commitment and have proven difficult to implement in many contexts.[8] Alternatively, universal school-based prevention programs attempt to enhance resilience in young people by increasing knowledge about the harms of alcohol misuse and promote better coping skills among children and their parents. However, several systematic reviews have concluded that the evidence for such approaches is limited,[9,10] with mild and inconsistent effects on drinking out-

comes and difficulty with implementation.[11-13] They also fail to target known risk factors for substance use disorders, such as family history, behavioral and emotional difficulties, and personality factors.[14]

Recognizing these limitations, research has turned to more selective prevention approaches targeting specific risk profiles.[15,16] The personality-targeted approach involves providing brief, personality-specific coping skills interventions to youth with personality risk factors for alcohol misuse before the natural onset of drinking behavior. Two randomized trials have found that this method of intervention has significant effects on alcohol use, binge drinking, growth in drinking quantity, and frequency and severity of drinking problems.[17-19] This approach is based on the premise that personality-specific skills training to improve management of one's personality vulnerability will reduce the likelihood that alcohol will be used for coping. The previous Preventure trial found that personality-targeted interventions were effective in reducing motivations for drinking that involve coping with negative internal states and reduced problem drinking symptoms during a 2-year period.[20] This trial also found that although the interventions do not result in changes in personality, they change the relationship between personality risk and drinking behavior, suggesting that the interventions might work by changing how young people manage their personality risk.[19]

The current Teacher-Delivered Personality-Targeted Interventions for Substance Misuse Trial (Adventure trial)[21] is a cluster randomized controlled trial of the effectiveness of the Preventure trial when provided by trained school staff in real-world conditions, with the aim of establishing external validity of this prevention program and facilitating its translation to practice.[22] Interim analyses on 6-month drinking outcomes of the Adventure trial were recently published, indicating that the effects were comparable to those in 2 previous efficacy trials.[21] In this article, we report the 2-year primary outcomes of this trial on drinking behavior using more developmentally appropriate statistical strategy, namely, 2-part latent growth models, which have the advantage of modeling both onset and frequency of substance-related behaviors as correlated phenomena and that capture individual differences in trajectories over time.

Herd immunity (defined by John and Samuel[23]) typically refers to the reduced risk for a communicable disease in a general population as a result of a significant portion of the community (herd) being vaccinated. A *herd effect* refers to the indirect protection observed in the unimmunized portion of a population that has been largely immunized. As a secondary objective, we investigate whether this selective alcohol prevention program, which intervenes on 45% of the youth population who score 1 SD above their school mean on any 1 of the 4 personality dimensions of anxiety sensitivity, hopelessness, impulsivity, and sensation seeking, might indirectly benefit the remaining unimmunized low-risk (LR) population within a school. Recognizing the robust effect of peer influences on youth drinking behavior, particularly for youth without personality and mental health risk factors for substance misuse,[24] as a secondary analysis, we evaluate the indirect effect of this selective prevention program on the remaining 55% of age-matched schoolchildren who do not have elevated personality risk and were not provided interventions. Our primary hypothesis predicts that this intervention strategy will prevent the growth and severity of alcohol misuse in high-risk (HR) youth who were targeted in the intervention. Secondarily, we also evaluate the indirect herd effects of the program on LR youth who were not targeted in the intervention.

METHODS

SAMPLE AND PROCEDURE

Schools

All secondary schools (N=148) in 18 London boroughs most proximal to the research center were sent initial recruitment letters for this study in spring 2007, and the first 21 secondary schools to sign up for the study were recruited to the study, representing 14% of the schools that were initially approached. The study followed a cluster randomized design in which schools were allocated to intervention or control conditions according to a computerized randomization procedure; no additional matching was conducted. For schools allocated to the intervention condition, 4 staff members per school were trained during fall 2007 to administer the intervention program to a standard that was deemed acceptable according to a prespecified set of criteria.[21] All schools but one recruited to this trial were state funded. They were located both in densely populated, low-income areas of London and suburban areas.

Adolescents

Participants were the whole year 9 population (mean [SD] age, 13.7 [0.33] years) attending school in September 2007, and the only individual-level exclusion criterion was not being able to provide passive consent from parents or active student assent (see eFigure 1 for recruitment, selection protocol, and retention rates; http://www.jamapsych.com). The sample was ethnically diverse, with 42% of the sample reporting white European ethnic background, which is comparable to the ethnic diversity reported in young London residents.

Eligibility for interventions was determined by identifying HR youth who in the baseline survey scored 1 SD above the school mean on 1 of the 4 subscales of the Substance Use Risk Profile Scale (SURPS)[25]: anxiety sensitivity, hopelessness, impulsivity, and sensation seeking. All HR students who consented to randomization were included in the intent-to-treat analyses regardless of whether they attended the sessions or not. The LR youth were the remaining 55% of the year 9 population who had consented to the study protocol but who did not meet personality risk criteria and, therefore, did not receive interventions. All HR and LR students (N=2643) were invited to participate in follow-up assessments at school at 6, 12, 18, and 24 months after the intervention. Approval for this study was provided by the King's College London College Research Ethics Committee and an independent steering committee.

Masking

This was an open-label trial. However, because of the confidential nature of the selection criteria for the program, intervention assignment was masked from unselected peers and teachers who are not directly involved in the administration of the program, and students participating in interventions were

not informed of the other types of interventions being offered in their school and did not know which of their peers were invited to participate in these other interventions.

MEASURES

Data were collected using self-report questionnaires in a classroom or assembly format during school hours. Recommended methods to maximize the accuracy of participants' self-reports were followed, such as ensuring confidentiality, emphasizing that schools and parents did not have access to data, including illustrations of standard units of alcoholic drinks to enhance accuracy,[26] and including a reliability check (sham items and repeated items across assessments). Quality control of data was conducted by research assistants who were masked to HR status and intervention condition.

The SURPS was used to assess personality along 4 dimensions: anxiety sensitivity, hopelessness, impulsivity, and sensation seeking. This scale has good concurrent, predictive, and incremental validity (relative to other personality measures) with regard to differentiating adults and youth prone to reinforcement-specific patterns of substance use and misuse.[25,27,28] A recent evaluation of the cutoff scores used to select HR youth suggests high sensitivity of this scale (70%-80%) and high specificity of each subscale (70%-80%) in predicting risk for future alcohol and drug misuse, as well as specific mental health problems 18 months later.[27]

Drinking status was determined by asking students the frequency and quantity of drinking in the past 6 months using two 6-point scales ("never" to "daily or almost daily" or "I have never had a full drink" to "10 or more on one occasion"). Binge drinking was assessed by asking students the frequency at which they had consumed 5 or more alcoholic beverages (≥4 for girls) on one occasion in the past 6 months on the same 6-point frequency scale (never to daily or almost daily). Severity of alcohol problems in the past 6 months was assessed using an abbreviated version of the Rutgers Alcohol Problem Index,[29] based on the most frequently endorsed items by adolescents 14 to 16 years old living in London.[17] The reliability check across repeated administrations of drinking items showed high reliability of participants' self-report drinking behavior: across five 6-month assessments during 2 years, participants had high reliability in reporting age when they first tried alcohol (Cronbach α across 5 items = 0.95) and age when they first consumed a full alcoholic drink (Cronbach α=0.92).

INTERVENTION

Training

Facilitators of the interventions were school teachers, mentors, counselors, and educational specialists. They attended a 2- to 3-day training workshop in which the theoretical framework of the personality-targeted approach to prevention was introduced, the evidence base for the program was reviewed, and an overview of the psycho-educational, motivational, and cognitive-behavioral components of the interventions was given. For those trainees without previous training in counseling, a second training day reviewed models of counseling and basic counseling skills (eg, empathy and paraphrasing), basic cognitive behavioral therapy (CBT) principles, and motivational enhance therapy (MET) principles. All trainees completed the third module, which provided instruction on how to administer CBT and MET exercises in personality-specific ways. Trainees also received a minimum of 4 hours of supervision and feedback in running through a full intervention. Supervised interventions were conducted with students who were not recruited to the Adventure trial, and the trainees were evaluated on an 18-point checklist that measured the extent to which facilitators demonstrated a good understanding and application of CBT and MET techniques applied to the 4 personality profiles, covered the specific components, managed the group dynamics, and enabled each student to participate in the session. By the end of the training protocol, 31 staff members (84%) successfully completed the training and qualified as trial facilitators.

Intervention Administration

School-based interventions were administered in winter 2008-2009 and involved two 90-minute group sessions targeting 1 of the 4 personality factors. Trained facilitators in intervention schools were instructed to invite all HR students to participate in group intervention sessions within a 4-month period. When students were unavailable for the first session, facilitators administered the interventions with available students and were encouraged to reschedule subsequent interventions when possible. A total of 574 of the 694 HR participants (83%) in intervention schools received an intervention. A few HR students did not wish to participate (<1%), and the remaining HR students did not receive interventions because of time and resource constraints at the school.

Intervention Content

Four different 2-session interventions were conducted in each school targeting the 4 personality risk dimensions. Students were called from class to attend interventions. They were not provided with feedback on their level of risk at any point in the selection or intervention phases of this trial. Each intervention had an accompanying therapist manual and student workbook that was on average 35 pages in length. Interventions incorporated components from MET[30] and CBT for depression, panic anxiety, and impulsivity but were unique in that they targeted personality traits rather than problems. Alcohol and drug use were a minor focus of the intervention.

Goal-setting exercises were included to enhance motivation to explore new ways of coping. Other modules provided information on the target personality variable and associated risky coping behaviors, such as interpersonal dependence, avoidance, aggression, and substance misuse. Cognitive behavioral principles of behavior regulation were introduced to help participants dissect a personal experience according to the physical, cognitive, and behavioral components of a personality-specific emotional response (eg, panic anxiety, catastrophic thoughts, avoidance in the anxiety sensitivity interventions or getting wound up, not thinking things through, and reacting impulsively for the impulsivity intervention). Participants were encouraged to identify and challenge personality-specific cognitive distortions that lead to personality-specific behaviors (eg, panic or avoidance in the case of anxiety sensitivity or aggression in the case of impulsivity). Treatment fidelity and adherence ratings for this trial are described in a previous publication by O'Leary-Barrett et al.[21]

TREATMENT AS USUAL CONDITION

The control schools did not receive training and did not administer the Preventure interventions. Treatment as usual refers to the statutory drug education supplemental material provided through the regular national curriculum (see Qualifications and Curriculum Authority[31] for minimum standards for statutory drug education in the United Kingdom).

ATTRITION AND MISSING DATA

Two schools recruited to participate in the study were excluded from this trial and the consort diagram in eFigure 1. One control school withdrew from the study after the baseline survey (n = 135), and one intervention school (n = 198) was excluded from the trial after completing training because the school was unable to commit to the full trial protocol. With respect to follow-up rates, one control school had difficulty arranging grade-wide assessment at the 6-month follow-up and another experienced difficulty at the 24-month follow-up, so participants were followed up individually through telephone contact with the research team and mail-in questionnaires, yielding lower follow-up rates than at other time points. Logistic regression analyses on variables representing attrition at each follow-up period revealed that when these schools were omitted from analyses, only HR status predicted attrition (odds ratio [OR] = 0.67, SE = 0.11, $P = .02$). Missing data were replaced using all available data and full information maximum likelihood estimation in SPSS statistical software (SPSS Inc), following the procedure outlined by Kenward and Carpenter,[32] which is considered valid for data missing not at random when less than 25% of a data set is missing, which was the case for this database.

SAMPLE SIZE DETERMINATION

The current trial is 80% powered to detect a moderate intervention by time effect in both HR and LR youth according to the procedure and simulations developed by Heo and Leon[33] to detect intervention by time interactions in longitudinal cluster randomized trials. Accordingly, to detect a standardized between-group mean difference of 0.3 ($P = .05$) in outcomes at the end of the trial with at least 3 measurement occasions, 420 HR students and 420 LR students from 14 schools are required (ie, 30 HR students per school and 7 schools per intervention group). An effect size of 0.3 is comparable to the effect sizes in previous trials of the Preventure program.[17,19,20] To account for 20% dropout during the trial (at the school and individual levels), approximately 17 schools and 100 students per school are required.[17,19,20] Analyses on 6-month outcomes in the HR group are reported in the article by O'Leary-Barrett et al[21] and were only conducted on completion of the 18-month assessment and published on completion of the trial.

STATISTICAL ANALYSIS

For each of 4 separate dependent measures (drinking frequency, drinking quantity, binge frequency, and problem drinking symptoms), 2-part latent growth models were used to model data with a preponderance of zero observations, allowing us to model the effects of the intervention on the probability of engaging in a particular behavior and its effects on frequency or quantity of the behavior when present. These models also allow for the observation of main effects of the intervention across time (reflected in the intercept centered at 6 months) and time-dependent effects of the intervention (reflected in the slope at 6-24 months). In part 1 of the model, the probability of a drinking event in the past 6 months was separated from the rest of the distribution by creating binary variables representing presence or absence of the behavior in the past 6 months. This variable was then modeled through a random-effects probit model in which the probability of use was regressed on an intercept and a growth parameter. In part 2 of the model, the continuous indicators of the behavior (eg, frequency of drinking) were modeled given their onset. We followed the procedure used by Brown et al,[34] testing both linear and quadratic growth functions. Simple effects of significant interactions are reported comparing intervention and control groups at each level of risk. Group estimates for each of the 4 drinking behaviors at each time point were derived according to the method described by Muthen[35] by calculating and then averaging the individual cumulative response probabilities and frequencies for all members of the population using numerical integration (**Figures 1**, **2**, **3**, and **4**).

All continuous outcome variables revealed interclass (cluster) correlations that were below 0.10, meaning that there was little variance at the school level across time. Therefore, cluster was not considered in the 2-part models. However, some effect of cluster was observed for dichotomous outcomes (intraclass correlation coefficient = 0.10), so additional analyses were conducted using multilevel latent growth models to account for the random effects of school on outcome (eTable 2). To derive an estimate of effect size for dichotomous outcomes, ORs, comparing odds of a behavior in an intervention vs control condition, were calculated using the STATA repeated-measures logit model, controlling for cluster, baseline drinking scores, and demographic variables.

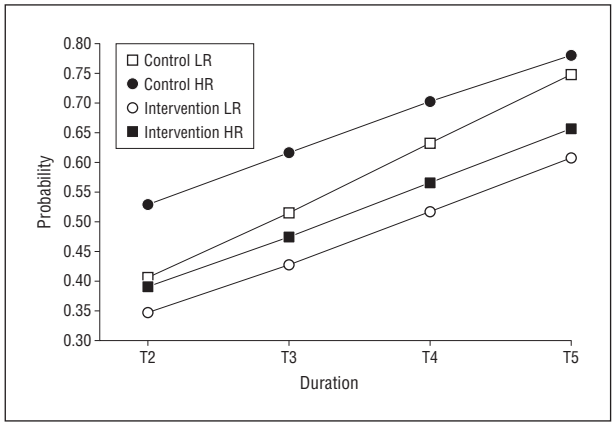

Figure 1. Estimated probability of reporting drinking × frequency of drinking in high-risk and low-risk youth attending intervention and control schools on the basis of 1217 respondents (53.1%) reporting nonuse at 6 months (T2), 1252 (54.6%) at 12 months (T3), 1020 (44.5%) at 18 months (T4), and 934 (40.7%) at 24 months (T5).

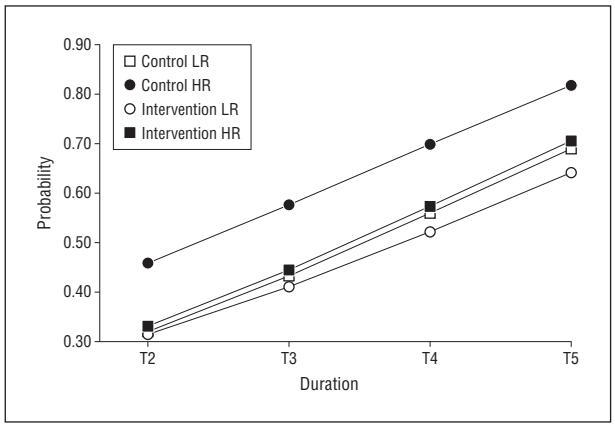

Figure 2. Estimated probability of reporting drinking × quantity of drinking in high-risk (HR) and low-risk (LR) youth attending intervention and control schools. T2 indicates 6 months after intervention; T3,12 months after intervention; T4, 18 months after intervention; and T5, 24 months after intervention.

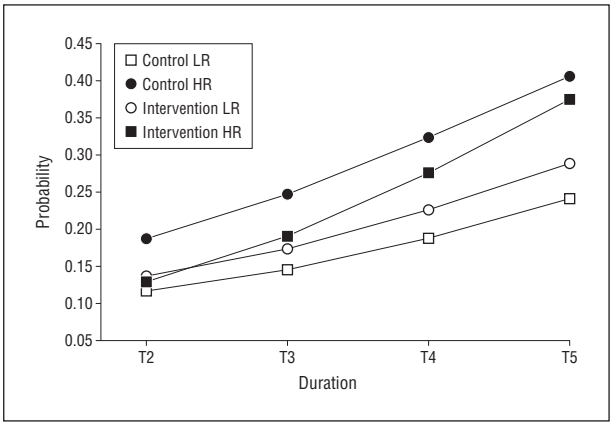

Figure 3. Estimated probability of reporting binge drinking × frequency of binge drinking in high-risk (HR) and low-risk (LR) youth attending intervention and control schools. T2 indicates 6 months after intervention; T3,12 months after intervention; T4, 18 months after intervention; and T5, 24 months after intervention.

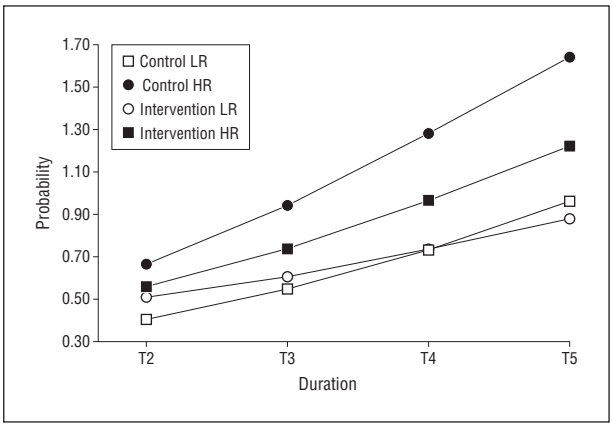

Figure 4. Estimated probability of reporting problem drinking symptoms × severity of problem drinking symptoms in high-risk (HR) and low-risk (LR) youth attending intervention and control schools. T2 indicates 6 months after intervention; T3,12 months after intervention; T4,18 months after intervention; and T5, 24 months after intervention.

RESULTS

BASELINE DIFFERENCES

The mean (SD) age of the sample was 13.7 (0.33) years, with 40.8% of adolescents in the intervention schools and 24.6% of adolescents in control schools reporting white or European ethnic background. Control schools had more boys (57.8%) than intervention schools (53.5%) (x_1^2=7.12, *P*=.05), but baseline substance use variables did not differ between intervention and control schools (**Table 1**).

Table 2 reports results from four 2-part latent growth models for each drinking outcome. Model fits appear in eTable 1. Figures 1 through 4 illustrate estimated probabilities and frequency or severity of each drinking outcome for each of the 4 groups at each follow-up point, controlling for sex, ethnicity, and baseline drinking variables (eFigures 2-5 and eTables 1-3).

In most cases, linear functions representing change in drinking variables resulted in the best-fitting models. However, when the quadratic function was superior, graphic illustration of the differences in estimated scores from these 2 models was indistinguishable; thus, to facilitate interpretation of the data, the linear model is presented and used for group analyses (see eMaterial).

For the drinking frequency model, significant risk and intervention effects at the intercept indicated greater overall postintervention drinking rates in HR relative to LR students and lower drinking rates in the intervention relative to control schools. Simple-effects contrasts at the intercept revealed that during the trial both HR and LR intervention youth reported lower drinking rates relative to their HR and LR control counterparts ($\beta = -0.322$, SE = 0.145, *P* = .03, and $\beta = -0.259$, SE = 0.132, *P* = .049, respectively). The ORs estimated from a logit model indicated that the intervention was associated with 29% reduced odds of drinking during the trial in students attending intervention schools relative to students in control schools (OR = 0.71, 95% CI = 0.51-0.99, *P* = .046). Although the interaction term at the slope was significant, simple-effects analyses did not reveal any significant differences between intervention and control groups on growth in drinking, suggesting that the intervention effects observed at the intercept were maintained across the 24-month follow-up. No significant findings were revealed for the continuous part of the drinking frequency variable, but a significant intervention by risk interaction was revealed for the intercept of the continuous part in the *quantity* of drinking model. Simple-effects analyses revealed that HR youth additionally benefitted from the intervention on quantity of drinking at the intercept ($\beta = -0.098$, SE = 0.047, *P* = .04) and slope ($\beta = -0.176$, SE = 0.073, *P* = .02) relative to their HR control counterparts. Simple contrasts comparing LR intervention youth to LR control youth on quantity of drinking did not reveal significant differences.

The binge drinking model revealed a significant risk by intervention interaction at the intercept of the binge drinking dichotomous measure, which was explained by a significant difference in binge drinking rates at the intercept between HR and LR youth in the control schools ($\beta = -0.400$, SE = 0.179, *P* = .03) and no significant difference between HR and LR youth in intervention schools (*P* = .64). The intervention was associated with a 43% reduced odds of binge drinking during the trial in HR students (OR = 0.57, 95% CI = 0.41-0.80, $P < .001$). Although the risk by intervention interaction at the slope indicates different effects of the intervention on growth in binge drinking in HR and LR groups, simple contrasts indicated that both HR and LR intervention groups had significantly reduced growth in binge drinking rates from 6 to 24 months relative to their control HR and LR counterparts ($\beta = -0.716$, SE = 0.274, *P* = .009, and $\beta = -0.244$, SE = 0.073, *P* = .001, respectively). Together, these results suggest a delayed intervention effect in LR youth that gradually increased from 6 to 24 months such that by the end of the trial the LR intervention group had a 35% reduced odds of binge drinking relative to the LR control group (OR = 0.65, 95% CI = 0.42-1.0, *P* = .05). For the continuous part of the model, a significant interaction at the slope indicated that the intervention was additionally associated with slower growth in frequency of binge drinking in the HR group

Table 1. Baseline Personality Scores and Drinking, Drug Use, and Smoking Behavior in High-Risk and Low-Risk Youth Attending Intervention and Control Schools[a]

Baseline Behavior	High Risk			Low Risk		
	Intervention (n = 588)	Control (n = 437)	F[b]	Intervention (n = 752)	Control (n = 516)	F
SURPS						
Hopelessness	13.82 (4.43)	13.82 (4.11)	0.02	11.86 (2.48)	11.88 (2.48)	0.10
Anxiety sensitivity	12.08 (3.31)	12.09 (3.08)	0.14	10.56 (2.12)	10.46 (2.03)	0.33
Impulsivity	13.66 (3.06)	13.53 (3.06)	0.55	11.45 (2.31)	11.29 (2.23)	1.58
Sensation seeking	17.23 (3.75)	16.84 (3.60)	4.65[c]	15.18 (2.67)	15.01 (2.55)	2.47
Frequency of drinking[d]	0.19 (0.24)	0.17 (0.24)	1.31	0.13 (0.20)	0.13 (0.20)	0.22
Quantity of drinking[d]	0.16 (0.21)	0.15 (0.21)	0.89	0.11 (0.18)	0.11 (0.17)	0.03
Frequency of binge drinking[d]	0.09 (0.18)	0.09 (0.18)	0.01	0.05 (0.14)	0.04 (0.13)	1.75
Problem drinking symptoms[d]	0.98 (0.13)	0.97 (0.12)	1.62	0.94 (0.09)	0.94 (0.09)	1.16
Events, No. (%)						
Drinking	246 (41.8)	166 (38.00)	1.55	238 (31.6)	171 (33.1)	0.56
Binge drinking	128 (21.8)	95 (21.70)	0	106 (14.1)	55 (10.7)	3.26
≥1 Problem symptom	193 (32.8)	140 (32.00)	0.07	159 (21.1)	97 (18.8)	1.05
Illicit drug use	66 (11.2)	50 (11.40)	0.01	46 (6.1)	20 (3.9)	3.11
Smoking	63 (10.7)	51 (11.70)	0.23	29 (3.9)	25 (4.8)	0.73

Abbreviation: SURPS, Substance Use Risk Profile Scale.
[a] Data are presented as mean (SD) unless otherwise indicated.
[b] F statistic is presented except for the events, for which the χ^2 statistic is presented.
[c] $P \leq .05$ for the difference between the intervention and control groups.
[d] Means are on log-transformed scores.

(β = −0.183, SE = 0.092, *P* = .047), and this was not the case for the LR group (β = −0.030, SE = 0.024, *P* = .21).

For the drinking problem model, a significant intervention by risk interaction at the intercept of the dichotomous part was explained by simple effects revealing that HR youth in control schools were more likely to report a problem drinking symptom relative to LR youth in control schools (β = 0.401, SE = 0.126, *P* = .003), and this was not the case in intervention schools (β = −0.032, SE = 0.110, *P* = .77). The overall odds of reporting problem drinking throughout the trial in HR intervention students was reduced by 29% relative to HR control students (OR = 0.71, 95% CI = 0.53-0.94, *P* = .02; OR for LR comparison = 0.96; 95% CI = 0.68-1.35, *P* = .82). The marginal intervention effect at the slope of the dichotomous part was further investigated with simple effects and revealed that intervention was associated with significantly reduced growth in onset of drinking problems in HR students (β = −0.452, SE = 0.193, *P* = .02) and only marginally reduced growth in LR students (β = −0.083, SE = 0.049, *P* = .09). The ORs comparing intervention and control school students on odds of reporting problem drinking symptoms at the end of the trial were 0.58 (95% CI = 0.39-0.86, *P* = .01) for HR students and 0.76 (95% CI = 0.53-1.1, *P* = .15) for LR students. According to the second part of the model, when individuals reported at least one problem drinking symptom, the intervention was associated with higher initial reports of severity but then less growth in severity of drinking problems over time for all students (Table 2).

CONTROLLING FOR CLUSTER EFFECTS IN A MIXED LATENT GROWTH MODEL

A second latent growth model analysis was performed on the dichotomous part of each of the 4 models, while controlling for the random effects of cluster (school). As reported in eTable 2, all significant results are maintained across the 2 sets of models.

COMMENT

TARGETED INTERVENTION EFFECTS

Results of the primary outcomes of this randomized trial indicate long-term benefits of the intervention on drinking outcomes for those HR students selected and randomized to receive brief personality-targeted interventions. Targeted effects of the program were observed on all drinking outcomes and for the duration of the follow-up period, with HR youth in intervention schools reporting 29% reduced odds of drinking, 43% reduced odds of binge drinking, and 29% reduced odds of problem drinking relative to HR students in control schools. The intervention was also found to delay the natural progression to more risky drinking behavior, such as frequency of binge drinking, greater quantity of drinking, and severity of problem drinking in these students. The current findings not only provide replication of the efficacy of this intervention program for HR youth[17,19,20] but also contribute to the evidence in support of its long-term effectiveness when administered by appropriately trained school staff.

HERD EFFECTS

The secondary outcomes of this trial are particularly novel, providing evidence of possible indirect, herd effects of a selective alcohol prevention program on long-term drinking rates and growth of binge drinking and some signs of a marginal herd effect on problem

Table 2. Two-Part Latent Growth Model Examining the Effects of Intervention, Risk Status, and Their Interaction on the Likelihood and Severity of Drinking, Binge Drinking, and Problem Drinking[a]

Variable	Estimate (SE)	Estimate/SE	*P* Value	Estimate (SE)	Estimate/SE	*P* Value
	Dichotomous Part			Continuous Part		
Drink frequency						
Intercept						
Intervention vs control	−0.259 (0.132)	−1.969	.049	−0.009 (0.048)	−1.180	.86
HR vs LR	0.391 (0.147)	2.657	.008	0.096 (0.051)	1.871	.06
Intervention × risk	−0.219 (0.193)	−1.136	.26	−0.063 (0.068)	−0.923	.36
Slope						
Intervention vs control	−0.058 (0.056)	−1.029	.30	−0.020 (0.021)	−0.950	.34
HR vs LR	−0.103 (0.063)	−1.648	.10	−0.022 (0.023)	−0.973	.33
Intervention × risk	0.177 (0.084)	2.113	.04	0.026 (0.030)	0.849	.40
Drink quantity						
Intercept						
Intervention vs control	−0.255 (0.133)	−1.927	.054	0.074 (0.041)	1.788	.07
HR vs LR	0.399 (0.148)	2.700	.007	0.140 (0.047)	3.000	.003
Intervention × risk	−0.229 (0.194)	−1.182	.24	−0.172 (0.063)	−2.741	.006
Slope						
Intervention vs control	−0.058 (0.056)	−1.107	.30	−0.004 (0.020)	−0.194	.85
HR vs LR	−0.112 (0.063)	−1.787	.07	0.011 (0.021)	0.527	.60
Intervention × risk	0.182 (0.094)	2.174	.03	−0.009 (0.028)	−0.324	.75
Binge frequency						
Intercept						
Intervention vs control	0.053 (0.163)	0.328	.74	0.086 (0.054)	1.584	.11
HR vs LR	0.400 (0.179)	2.232	.03	0.126 (0.056)	2.240	.02
Intervention × risk	−0.472 (0.238)	−1.984	.047	−0.153 (0.076)	−1.996	.046
Slope						
Intervention vs control	−0.244 (0.073)	−3.349	.001	−0.030 (0.024)	−1.247	.21
High vs LR	−0.153 (0.080)	−1.910	.06	−0.023 (0.026)	−0.873	.38
Intervention × risk	0.322 (0.106)	3.040	.002	0.043 (0.035)	1.222	.22
Drinking problems (RAPI)						
Intercept						
Intervention vs control	0.129 (0.115)	1.121	.26	0.247 (0.124)	1.992	.046
HR vs LR	0.401 (0.126)	3.170	.002	0.338 (0.129)	2.672	.008
Intervention × risk	−0.368 (0.168)	−2.199	.03	−0.208 (0.170)	−1.228	.22
Slope						
Intervention vs control	−0.083 (0.049)	−1.695	.09	−0.100 (0.055)	−1.820	.07
HR vs LR	0.138 (0.058)	2.388	.02	0.017 (0.053)	0.311	.76
Intervention × risk	0.007 (0.075)	0.092	.93	0.011 (0.073)	0.154	.88

Abbreviations: HR, high risk; LR, low risk; RAPI, Rutgers Alcohol Problem Index.

[a] All models include intercept, demographic variables (sex and ethnicity), and baseline drinking scores as covariates. Intercept of the outcome measure reflects the mean constant in quantity or frequency for any individual across time (6-24 months); slope of the outcome measure reflects any mean deviance from the intercept over time.

drinking symptoms in the longer term. The mechanisms to explain these herd effects are unknown, but one plausible explanation could be that HR youth in intervention schools modeled less drinking and less problematic drinking to their LR peers, who have a later onset of drinking and a less risky drinking profile relative to HR youth. This hypothesis is supported by the findings indicating that intervention effects on binge drinking and problem drinking in LR students were only revealed 6 months after intervention effects on these outcomes appeared in HR students. It is unlikely that herd effects can be explained by contamination effects, in which HR youth might have shared treatment content or their experiences in the treatment sessions with their LR peers, because 2 previous trials of this intervention approach involving within-school randomization of HR individuals to intervention or control conditions found intervention effects comparable to those reported for the current trial.[21] Direct contamination effects from teachers is unlikely because they were not given additional treatment material or manuals to share with LR youth and personality scores were not shared with school staff, thus prohibiting them from being able to make any inference about which intervention might be relevant to a LR student. However, it is possible that training teachers on this intervention approach led to broader shifts in their attitudes, beliefs, and practices toward youth substance use and mental health, which in turn affected students' behavior. The potential herd effects of this targeted program should be further examined in future trials measuring teacher and student attitudes toward drinking, coping skills, and frequency in which youth revisit treatment materials on their own and with their friends. Studies that include social network analyses might also help to test whether the early-onset drinking of HR youth directly influenced the future behavior of LR youth and how the intervention might prevent this from happening.

STRENGTHS AND LIMITATIONS

Strengths of this study include intent-to-treat analyses, long-term and multiple follow-ups, and the use of developmentally sensitive statistical analyses that capture individual differences in trajectories of outcomes and the complex structure of drinking data and control for possible school effects. Limitations of this study could be the lack of methods to corroborate self-report information by youth participants, but the assessment protocol allowed a confidential context for self-report with no consequences to disclosure and precise guidance on how to estimate substance use (eg, providing illustrations of drinking units) and reliability checks embedded in the survey, producing highly valid and reliable substance use data.[26]

This study found that it is feasible to train teachers to administer selective brief interventions, with fewer intervention schools reporting problems or opting to drop out of the trial protocol than control schools. The demonstration that this brief prevention program produced significant effects on the entire year group (29% reduction in drinking rates for all students) allows for comparisons with other evidence-based universal programs and suggests that this approach produces effects comparable to the most evidence-based universal programs.[9] It will be important to evaluate in future research whether possible common and incremental treatment effects can be detected across targeted and universal programs. Considering the enormous costs of alcohol misuse to society and the brief and inexpensive nature of this targeted program, nationwide implementation could potentially translate to substantial savings to the public. Now that a knowledge transfer model (which includes didactic training, supervised practice, and minimal ongoing supervision) has been developed and its effectiveness established, broader dissemination models for this intervention approach should be explored and evaluated.

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