Preventive Medicine 51 (2010) 313–319

Contents lists available at ScienceDirect

Preventive Medicine

journal homepage: www.elsevier.com/locate/ypmed

One-year follow-up evaluation of the Project Towards No Drug Abuse (TND) dissemination trial

Louise A. Rohrbach *, Ping Sun, Steve Sussman

Institute for Health Promotion and Disease Prevention Research, Department of Preventive Medicine, University of Southern California, USA

ARTICLE INFO

Available online 23 July 2010

Keywords:
Translation
Dissemination
Implementation
Prevention
Intervention
Trial
Substance use
Cigarettes
Alcohol
Marijuana

ABSTRACT

Objective. The aims of this trial, conducted 2004–2008, were to examine (1) the effectiveness of Project Towards No Drug Abuse (TND) at the one-year follow-up when implemented on a large scale; and (2) the relative effectiveness of two training approaches for program implementers.

Method. A total of 65 high schools from 14 school districts across the United States were randomized to one of three conditions: regular workshop training, comprehensive implementation support, or standard care control. Physical education and health teachers delivered the program to students (n = 2538). Program effectiveness was assessed with dichotomous measures of 30-day substance use at baseline and one-year follow-up.

Results. When the program conditions were considered in aggregate and compared to controls, the program showed a marginally significant effect in lowering marijuana use from baseline to the one-year follow-up. Significant program effects on hard drug use were achieved for baseline non-users only. There were no differences in the effects of the two program conditions.

Conclusion. Positive outcomes may be achieved by trained teachers when they implement Project TND in real-world high school environments; however, program effects are likely to be weaker than those achieved in efficacy trials. Training workshops may be adequate to build capacity for successful program implementation.

Introduction

Despite research supporting the effectiveness of school-based substance abuse prevention programs (Gottfredson and Wilson, 2003; Skara and Sussman, 2003; Tobler and Stratton, 1997; Tobler et al., 2000) and the availability of federal funds to support their implementation (U.S. Department of Education, 1998), the prevalence of use of such programs in schools across the U.S. remains low (Ringwalt et al., 2009a). Thus, a critical public health challenge is to assure that substance abuse prevention programs are disseminated, adopted, implemented, and sustained once proven effective.

Overall, there is a need for greater attention to the implementation of prevention programs within the context of effectiveness and dissemination trials (Glasgow et al., 2003; Rohrbach et al., 2006). While there is a growing body of research on factors associated with successful prevention program implementation (Durlak and DuPre, 2008; Elliott and Mihalic, 2004; Fixsen et al., 2005; National Research Council and Institute of Medicine, 2009), little is known about how to intervene on these factors in order to preserve or enhance the program effects achieved in efficacy trials (Walsh et al., 2010). For example, studies have demonstrated the importance of building organizational capacity to deliver evidence-based prevention programs through training of program providers (Durlak and DuPre, 2008). The few trials that have compared the relative effectiveness of different models for program provider training have suggested that comprehensive, ongoing training approaches have stronger effects on implementation fidelity and program mediators than do one-shot trainings (Allison et al., 1990; Kelly et al., 2000). At present, little is known about the effects of provider training on longer-term behavioral outcomes (e.g., one-year follow-up or longer).

In the present paper, we report the one-year findings from the dissemination and implementation study of Project Towards No Drug Abuse (TND). Project TND is a nationally recognized substance abuse prevention program that targets high school age youth (Sussman et al., 2002, 2004a). Previously, the program was evaluated in five randomized trials which demonstrated a program impact on adolescents' use of alcohol, tobacco, marijuana, and "hard drugs" at the one-year follow-up (Dent et al., 2001; Sun et al., 2008; Sussman et al., 1998, 2002, 2003; Valente et al., 2007), and an impact on hard drug use at five-year follow-up (Sun et al., 2006). The hard drug use outcome variable, used in all of these evaluation studies, is an index that averages subjects' responses regarding use of stimulants, cocaine, hallucinogens, inhalants, ecstasy, and other drugs (i.e., PCP, depressants, steroids, and heroin).

* Corresponding author. Institute for Health Promotion and Disease Prevention Research, Department of Preventive Medicine, University of Southern California, Keck School of Medicine, 1000 S. Fremont Ave., Unit 8, Alhambra, CA 91803, USA. Fax: +1 626 457 4012.
E-mail address: rohrbac@usc.edu (L.A. Rohrbach).

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doi:10.1016/j.ypmed.2010.07.016

The primary aims of the present (sixth) trial were to examine: (1) the effectiveness of Project TND at the one-year follow-up when implemented on a large scale in real-world high school settings; and (2) the relative effectiveness of two teacher training approaches, a regular training workshop vs. a comprehensive training and implementation support model. In an earlier paper, we reported that both of these training approaches produced effects on hypothesized program mediators relative to controls (Rohrbach et al., 2010). In addition, using a classroom observation procedure to assess implementation fidelity (Rohrbach et al., 2007) we found higher fidelity in the comprehensive, relative to the Regular Training condition (Rohrbach et al., 2010). Here we hypothesized significant reductions in substance use outcomes among students in the program, relative to control schools, and stronger program effects among schools that received the comprehensive, relative to the standard training.

The secondary aim of this trial was to analyze moderation of program effects by students' substance use status at baseline. Previous research has provided some evidence for moderation of program effects by baseline substance use status, with a trend toward greater benefit to higher-risk subgroups (Spoth et al., 2006, 2007; Tobler et al., 2000).

Methods

Experimental design and school selection

A total of 65 high schools from 14 school districts in the United States were recruited as a convenience sample for this study. From 2004 to 2007, we recruited four cohorts of school districts from a pool of districts that contacted us to obtain information about Project TND. To be eligible for participation, school districts needed to have at least three regular or three alternative (continuation) high schools that were willing to be randomly assigned to experimental conditions and implement the program if selected as a program school. Within the eligible districts, we approached high school administrators to determine interest in the study. Of the 65 schools that agreed to participate, 59 were regular high schools and 6 were alternative (continuation) high schools.

Within each school district, participating schools were randomly assigned to one of three conditions: comprehensive implementation support for Project TND teachers, regular workshop training only, or standard care control. Prior to assignment, schools were blocked by enrollment size, student ethnicity, and the percentage of students receiving free or reduced price lunch. Specifically, each group of three schools was aligned using a linear composite of factor scores across a drug use inflate–suppress continuum (Graham et al., 1984), and schools within each triad were randomly assigned to conditions. The final sample included 22 schools in the Implementation Support, 21 schools in the Regular Training, and 22 schools in the Control conditions. Participating schools were not blinded to the experimental condition to which they were assigned.

The school district designated the subject area for program implementation (health or physical education). Within each program school, the project staff collaborated with the administrator to recruit at least one teacher to participate in the training intervention and deliver Project TND to all of his/her students. Two of the teachers' classes were randomly selected to participate in the program evaluation.

In the control schools, students received only the drug abuse prevention activities, if any, provided directly by their school, and two classrooms in the same subject area as that designated for program implementation in the intervention schools were randomly selected for the program evaluation. Students in all experimental conditions were administered a questionnaire at baseline and one year following the completion of program implementation.

Project TND curriculum

The Project TND curriculum targets substance use and violence-related behaviors through the use of a motivation, skills, and decision making approach (Sussman et al., 2004a). The curriculum is comprised of 12 classroom sessions, approximately 45 min each, which are designed to be implemented over a four-week period. Utilizing interactive teaching techniques, the instruction to students provides cognitive motivation enhancement activities, information about the consequences of drug use, correction of cognitive misperceptions, communication and coping skills enhancement, decision making, and tobacco cessation techniques (see Skara et al., 2005 and Sussman et al., 2004b).

Teacher training interventions

Teachers in the Implementation Support and Regular Training conditions participated in a one-day workshop conducted on-site by certified Project TND trainers. The workshop presented an overview of the theoretical and evidence base for the curriculum, provided a detailed instruction about each program lesson, and provided opportunities for teachers to practice delivery of key program activities. Additional components of the Implementation Support intervention were two on-site sessions of coaching from the TND trainer, web-based support (a discussion forum, teaching tips, and downloadable scientific articles), and additional technical assistance from program specialists via telephone and e-mail, on an as-needed basis.

Subjects

All students provided informed assent and parents provided written or verbal informed consent to participate in the study. A total of 4351 students were enrolled in the classes selected for participation (Fig. 1). Of these, 3751 students were consented for participation in the study (86.2% of students in the selected classes). Of those consented, 3346 students took the pretest survey. The one-year follow-up survey was completed by 2563 students (76.6% retention rate). After excluding the 25 subjects with inconsistent self-reported gender between pretest and posttest, the program effects analysis described in the present paper was performed with pretest and one-year follow-up data collected from these 2538 subjects (1085 in the Implementation Support, 772 in the Regular, and 681 in the Control conditions).

At baseline, subjects varied from 13 to 20 years of age (mean age = 14.8 years, SD = 1.1 years). The sample was 46.6% male; 41.1% white, 28.7% Hispanic, 15.8% African American, 3.3% Asian, 7.3% mixed ethnicity, and 3.8% other. The majority of students (94.8%) were enrolled in regular high schools.

Data collection procedures

Baseline and one-year follow-up measures were collected from students using a paper-and-pencil, closed-ended response questionnaire. At both time points, questionnaires were administered solely by the project staff at single classroom sessions during regular school hours. Those absent from the classroom on testing days were left absentee packets, and local school staffs were asked to distribute the questionnaires to the appropriate students and mail the completed questionnaires to the research staff. At the one-year follow-up, students who were no longer enrolled at the high school or who failed to return the absentee questionnaire were contacted by telephone for survey administration. The project staff (previously unknown to the student) telephoned the students at home, read the questionnaire items to them, and recorded their responses in a computer-assisted telephone interview database. Questionnaire items and response categories were identical to the in-school questionnaire format, and subject responses consisted of innocuous words such as numbers, letters, agree–disagree, or true–false. On average, telephone interviews took 15 min.

Measures

Demographic items included age (in years), gender, and ethnicity (coded as non-Hispanic white, Latino/Hispanic, African American, Asian, mixed ethnicity, or other). Substance use items included 30-day use of cigarettes, alcohol, marijuana, and "hard drugs." The hard drug use index summed responses to six items regarding use of cocaine, hallucinogens, inhalants, stimulants, ecstasy, and "other" drugs (i.e., depressants, PCP, steroids, heroin, or "other" drugs) in the last 30 days, with a Cronbach's alpha of 0.95. For each substance use item, there were eight response options, including "0", "1–10", "11–30," "31–50", "51–70", "71–90", "91–100," and "more than 100 times." For data analyses, we created dichotomous variables where the outcome was defined as 'true' if a specific substance was used one or more times in the past 30 days.

These substance use items are the type used in the Monitoring the Future studies (Johnston et al., 2009) and our previous work (Sussman et al., 2002), all of which have shown supporting evidence of adequate test–retest reliability and/or internal consistency (Graham et al., 1984; Needle et al., 1983; Stacy et al., 1990). Due to the common pattern of the low use prevalence of individual illicit substances such as cocaine, hallucinogens, and heroin among adolescents, a hard drug use index has been created to measure outcomes in our previous TND evaluations (Dent et al., 2001; Sun et al., 2008; Sussman et al., 1998, 2002, 2003)

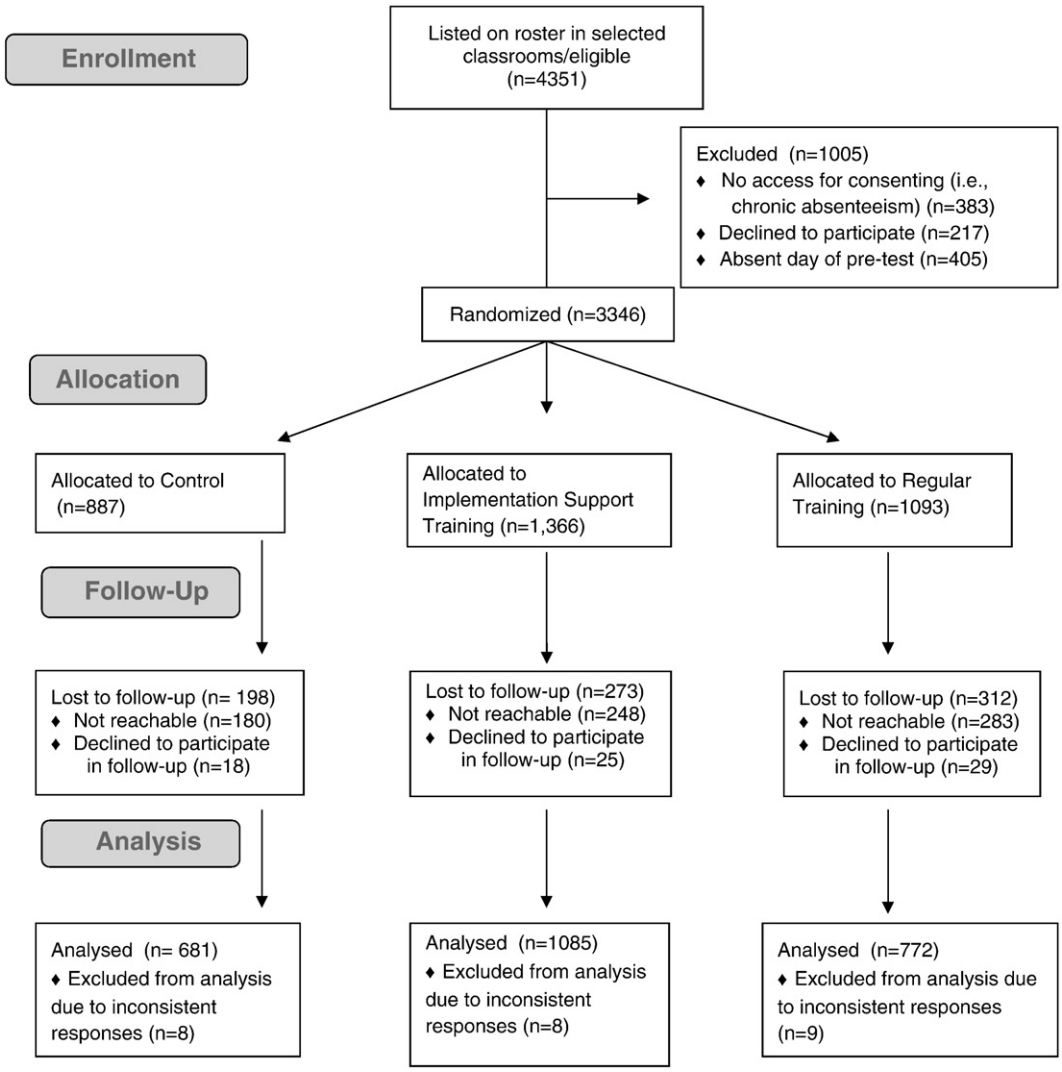

Fig. 1. Flow of study participants.

and numerous drug etiology studies (Agrawal et al., 2004; Chen et al., 2004; Cohen et al., 1993; Farrell et al., 2003).

Statistical analyses

Data analysis for program effects on substance use at the one-year follow-up was completed by using a generalized mixed-linear model (Murray and Hannan, 1990) in the SAS statistical package (SAS Institute, 2009). Because school was the unit of randomization, schools were nested within school districts, and subjects were the observation unit, two-level random coefficients modeling was conducted. School and school district were considered as random factors and experimental condition was considered fixed. In the analysis of program effects for all subjects, for each substance the status of use of that specific substance at baseline was included in the model. Other variables adjusted for in the analysis included age, gender, ethnicity, and a propensity-for-attrition score (to be described later). Before use in the regressions, all continuous subject-level covariates were centered to the grand mean (i.e., the converted variables would have a mean of zero among all subjects, but not necessarily among all schools). As the focus of the study is to evaluate the effects of an intervention that was applied to schools, the need for centering the subject-level covariates to the grand mean was illustrated earlier by Enders and Tofighi (2007) and Paccagnella (2006).

The first set of analyses compared the program students in aggregate with the controls. The second set of analyses consisted of pair-wise comparisons between the two training conditions. In the third set of analyses, we examined program effects on each substance use outcome by subjects' baseline use status (i.e., users vs. non-users of the specific substance). All analyses of program effects utilized an "intention to treat" approach.

Results

Assessment of attrition bias

To assess the potential sample bias due to subject attrition at the one-year follow-up, a comparison was made between the current analytic sample (n = 2538) and the lost-to-follow-up sample (n = 706) on nine key baseline measures. The measures included: age, gender, ethnicity, whether the subject lived with both parents, parents' education level, and the four types of substance use. The comparisons utilized chi-square or t-test models to investigate differences between the two groups of subjects (p value at the 0.05 level). The analyses showed statistically significant incomparability between the lost-to-follow-up and retained subjects with regard to all the variables. Retained subjects were younger (14.7 vs. 15.1 years old), less likely to be enrolled in an alternative/continuation school (4.3% vs. 8.6%), more likely to be living with both parents (66.2% vs. 49.3%), and had parents with a higher level of education. In addition, the retained sample contained more Whites (43.9% vs. 31.1%) and less Hispanics (27.1% vs. 34.5%), and had a lower prevalence of substance use (12.9% vs. 23.5% for cigarette use, 31.4% vs. 38.6% for

Table 1
Summary of variables of interest at pretest among study participants in high schools across the United States, 2003–2008, by experimental condition.

	Experimental condition						p [a]
	Implementation Support Training (n = 1085)		Regular Training (n = 772)		Control (n = 681)		
	Mean	Std	Mean	Std	Mean	Std	
Age (years)	14.8	0.2	15.0	0.2	14.8	0.2	0.52
Gender (% male)	42.1		51.0		44.1		0.07
Ethnicity (%)							
White	44.6		28.3		27.1		0.47
Latino/hispanic	42.1		32.2		25.7		
African American	14.3		15.3		16.5		
Asian	2.5		3.9		2.7		
Mixed	6.7		7.6		7.1		
Other	3.4		4.2		3.7		
Propensity-for-attrition score [b]	0.81	0.02	0.72	0.02	0.78	0.02	0.004
Substance use status in last 30 days (% used)							
Cigarettes	11.9		16.8		11.3		0.053
Alcohol	32.0		29.6		32.0		0.69
Marijuana	12.3		14.0		14.1		0.90
Hard drugs	5.3		6.1		5.4		0.81

Notes.
[a] Significance for test of difference across program conditions.
[b] Propensity-for-attrition at the one-year follow-up survey, predicted by factors assessed at pretest.

alcohol use, 12.6% vs. 24.5% for marijuana use, and 5.5% vs. 9.7% for hard drug use).

The test for a difference in retention rate across conditions was marginally statistically significant ($p<0.10$), with rates of 79.4%, 70.6%, and 76.9% in the Implementation Support, Regular, and Control conditions, respectively. Further analysis confirmed that attrition did not occur differentially across experimental conditions by substance use status (in a model where condition, substance use, and the interaction term between condition and substance use were used to predict attrition status at the one-year follow-up, all p's>0.50 for the interaction terms between condition and substance use status).

To adjust for possible bias introduced by non-random attrition at the one-year follow-up, a 'propensity-for-attrition' score was calculated for each subject retained at the follow-up, and included as a covariate in each of the statistical models (Rosenbaum and Rubin, 1984). This score was calculated among the entire baseline sample by associating the difference in the selected baseline measures to the actual attrition status in a multiple regression analysis, and then assuming the association is also maintained among the subjects retained at the one-year follow-up.

Baseline comparability across experimental conditions

Table 1 presents a summary of variables of the variables of interest at baseline, by experimental condition. Comparability across conditions was achieved for age, ethnicity, and 30-day use of alcohol, marijuana, and hard drug use. However, relative to the other conditions the Regular Training group had a greater proportion of males (51.0% vs. 43.1%, $p=0.05$), a higher prevalence of 30-day cigarette use (16.8% vs. 11.6%, $p=0.01$), and a lower propensity-for-attrition score (0.72 vs. 0.79, $p=0.002$).

Program effects on substance use

Table 2 summarizes the results of the tests for program effects on the subjects overall and by baseline substance use status. Among all subjects, when both training conditions were considered in aggregate

Table 2
Program effects[a] at the one-year follow-up among study participants in high schools across the United States, overall and by baseline substance use status, 2003–2008.

30-day substance use status[c]		Any TND[b] vs. Control		Implementation Support vs. Regular Training	
		Odds ratio	(95% confidence interval)	Odds ratio	(95% confidence interval)
All subjects[d]	Cigarette use	1.00	(0.74–1.34)	1.02	(0.70–1.50)
	Alcohol use	1.01	(0.80–1.26)	0.91	(0.66–1.24)
	Marijuana use	0.77	(0.57–1.04)+	1.02	(0.68–1.53)
	Hard drug use	0.72	(0.47–1.09)	1.27	(0.70–2.32)
Baseline non-users[d]	Cigarette use	0.85	(0.60–1.22)	1.33	(0.83–2.11)
	Alcohol use	1.05	(0.75–1.46)	0.83	(0.57–1.20)
	Marijuana use	0.70	(0.46–1.07)+	1.00	(0.62–1.63)
	Hard drug use	0.61	(0.39–0.96)*	1.13	(0.56–2.30)
Baseline users[d]	Cigarette use	1.46	(0.82–2.58)	0.63	(0.31–1.25)
	Alcohol use	0.93	(0.64–1.35)	1.15	(0.59–2.23)
	Marijuana use	0.87	(0.47–1.62)	1.13	(0.50–2.54)
	Hard drug use	1.30	(0.48–3.51)	1.85	(0.47–1.25)

Notes. +: $p<0.10$, *: $p<0.05$.
[a] Two-level random coefficients modeling was employed in the outcome evaluation. School and district were modeled as random, and experimental condition as fixed effects. The analysis was adjusted for age, gender, ethnicity, propensity-for-attrition score, and use of the specific substance at pretest. All subject-level covariates were centered to grand mean before analysis.
[b] Received either Implementation Support or Regular Training.
[c] The binary substance use status variable was linked to the linear combinations of predictors with a logit link function. "Odds ratio<1" indicates positive program effect in lowering substance use at the one-year follow-up.
[d] 95% confidence intervals for program effects among all subjects were calculated with two-tailed hypothesis tests.

(i.e., any TND) relative to controls, there was a marginally significant reduction in marijuana use from baseline to the one-year follow-up ($p<0.10$). The odds ratio for this program effect is 0.77, which is considered a small effect size (Chinn, 2000). The size of the program effect on hard drug use was comparable (OR = 0.72); however, it approached statistical significance in a one-tailed test only ($p<0.10$). No program effects were found for cigarette or alcohol use.

Analyses of differential effectiveness by baseline substance use status indicated that a marginally significant program effect on marijuana use ($p<0.10$) and a statistically significant effect on hard drug use ($p<0.05$) were achieved for non-users, but no effects were observed for substance users. Pair-wise comparisons between the two training conditions showed no significant differences among subjects overall and by baseline substance use status.

Discussion

The present study is the first to examine the effectiveness of Project TND in the context of a dissemination trial. The early TND efficacy trials and subsequent replication studies demonstrated statistically significant impacts on adolescents' use of cigarettes, alcohol, marijuana, and hard drugs, although the most consistent program effects were obtained for hard drug use (Sun et al., 2006, 2008; Sussman et al., 1998, 2002, 2003). In the present study, no statistically significant main effects were found for cigarettes, alcohol, and hard drug use. However, we found a marginally significant program effect for marijuana use ($p<.10$). As the secondary study aim we examined program effects by substance use status at baseline, and found a statistically significant effect on hard drug use for baseline non-users of hard drugs ($p<0.05$) and a marginally significant effect on marijuana use for baseline non-users of marijuana ($p<0.10$).

These results suggest that the effectiveness of Project TND may be attenuated as the program is widely disseminated and implemented in real-world high school settings. The findings are consistent with several replication studies that have shown weaker, or null effects of efficacious prevention programs when evaluated with different target populations, in different settings, or with different program delivery agents than those in efficacy trials (e.g., Harrington, et al., 2001; Komro et al., 2006; Ringwalt et al., 2009b; St. Pierre et al., 2005). Walsh et al. (2010) have suggested several reasons why attenuation of prevention program effects is highly probable when research moves from efficacy trials to community effectiveness trials to broad dissemination. When programs are "scaled up," often the target population for the intervention is broader, the quality of program implementation is lower, substantial adaptations to the program may occur, and local infrastructure for the program may not be ready to support high-quality implementation. Attention to these factors is critical if the effects of evidence-based prevention interventions are to be preserved, or even enhanced, when the interventions are implemented widely.

Originally, Project TND was developed for alternative high school students, who are at greater risk for substance use and other problem behaviors relative to regular high school students (Grunbaum et al., 2000; Sussman et al., 1995b). To date, most of the evidence for effectiveness of TND has been obtained from trials in which this higher-risk population was targeted (e.g., Sun et al., 2006; Sussman et al., 1998, 2002). Despite early evidence suggesting that the effects of TND may generalize to youth enrolled in regular high schools (Dent et al., 2001), it is possible that the weaker program effects observed in the present study are attributable to the broader range of risk status among students enrolled in regular, relative to alternative, high schools. Also, it is interesting to note that we observed program effects in these regular high school settings only among baseline substance non-users. Earlier TND efficacy studies provided no evidence for moderation of program effects on marijuana and hard drug use by baseline drug use status (Dent et al., 2001; Sussman et al., 1998, 2002). Future research on TND should examine the relative effectiveness of the program on different subgroups of adolescents and in different settings.

Another aim of the present study was to compare two approaches for preparing teachers to implement Project TND with high quality. Contrary to our hypothesis, we found no evidence for improved one-year program outcomes for subjects in the comprehensive, relative to the standard teacher training condition. Even though we observed higher implementation fidelity in classrooms whose teachers received the comprehensive training (Rohrbach et al., 2010), we speculate that the difference between the two training approaches, as implemented, may not have been large enough to enable detection of differences in program outcomes. Our process evaluation indicated that teachers' use of the web-based resources and technical assistance, both designed to be teacher-initiated, was limited. Thus, on-site coaching was the most intensive component of Implementation Support that teachers received. Although non-experimental research has suggested that peer coaching improves the outcomes of diverse types of curriculum innovations (Joyce and Showers, 2002), a recent randomized trial that compared standard workshop training to a coaching intervention plus standard training for an evidence-based prevention program, showed no effect of the coaching on specified program mediators (Ringwalt et al., 2007). In sum, we speculate that the dosage of Implementation Support in the present study may have been inadequate, or the primary component of the Implementation Support intervention may have been ineffective, or both.

One implication of our findings is that more research on training approaches is needed to help guide efforts to broadly disseminate evidence-based prevention interventions. It is a widely held view, among both researchers and practitioners, that providers of evidence-based programs require ongoing support during program implementation in order to ensure successful outcomes. However, much of the evidence that supports the positive relationship between implementation support and fidelity of program implementation is based on non-experimental evaluations of proactive technical assistance and implementation monitoring for evidence-based programs (e.g., Mihalic and Irwin, 2003). Future research should include randomized designs that vary the amounts and modalities for training and studies that examine the processes by which training models affect program implementation and outcomes.

Study limitations

Several limitations of the present study should be noted. First, while the conditions under which TND was implemented were closer to the real world than is typically found in efficacy studies, nonetheless, the fact that schools and teachers were participating in a program evaluation study may have motivated them to implement more of the program sessions or implement them with greater fidelity than if they had not been monitored. Thus, the program effects achieved in the study may be stronger than what would be produced by teachers who were not being evaluated. Also, it is important to point out that the study findings may be generalized only to those high schools that have teachers who are willing to implement evidence-based prevention curricula. Second, data on program outcomes were generated from student self-report surveys, the accuracy of which could not be independently verified. Thus, it is impossible to assess the extent to which such data may be biased. However, past studies have verified the validity and reliability of self-report measures of adolescent substance use (Graham et al., 1984; Needle et al., 1983; Sussman et al., 1995a). Third, we did not collect data on the types of substance abuse prevention program activities that were implemented in the control schools. However, based on a recent survey of substance abuse prevention program implementation nationwide showing scant use of evidence-based programs at the high school level (Ringwalt et al., 2008), it is unlikely that control schools in the present study were receiving effective preventive interventions.

Conclusion

In conclusion, the study results suggest that reductions in hard drug use may be achieved among baseline non-users, and reductions in marijuana use may be achieved among both baseline users and non-users of marijuana, when trained classroom teachers implement Project TND in regular high school settings. However, it appears that attenuation of effects is probable as Project TND is broadly disseminated. The findings also suggest that face-to-face training workshops, a common training model for preparing providers to implement evidence-based prevention programs, may be adequate to build teachers' capacity for successful implementation. More replication studies of prevention interventions and research on training models are needed, as research that increases our knowledge about effective strategies for implementing evidence-based prevention interventions represents the frontier of prevention research (National Research Council and Institute of Medicine, 2009).

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Acknowledgments

This study was funded by a grant from the National Institute on Drug Abuse (No. 1 R01 DA16090), which had no involvement in the study design, collection, analysis, and interpretation of the data, writing of the manuscript, or decision to submit the paper for publication. The authors wish to thank Gaylene Gunning for her project management, and Rachel Grana and Melissa Gunning for their assistance in data collection.

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