Preventing Substance Misuse Through Community–University Partnerships

Randomized Controlled Trial Outcomes 4½ Years Past Baseline

Richard Spoth, PhD, Cleve Redmond, PhD, Scott Clair, PhD, Chungyeol Shin, PhD, Mark Greenberg, PhD, Mark Feinberg, PhD

Background: Substance misuse by adolescents and related health issues constitute a major public health problem. Community-based partnership models designed for sustained, quality implementation of proven preventive interventions have been recommended to address this problem. There is very limited longitudinal study of such models.

Purpose: To examine the long-term findings from an RCT of a community– university partnership model designed to prevent substance misuse and related problems.

Design/setting/participants: A cohort sequential design included 28 public school districts in rural towns and small cities in Iowa and Pennsylvania that were randomly assigned to community–university partnership or usual-programming conditions. At baseline, 11,960 students participated, across two consecutive cohorts. Data were collected from 2002 to 2008.

Intervention: Partnerships supported community teams that implemented universal, evidence-based interventions selected from a menu. The selected family-focused intervention was implemented with 6th-grade students and their families; school-based interventions were implemented during the 7th grade. Observations demonstrated intervention implementation fidelity.

Main outcome measures: Outcome measures were lifetime, past-month, and past-year use of a range of substances, as well as indices of gateway and illicit substance use; they were administered at baseline and follow-ups, extending to 4.5 years later.

Results: Intent-to-treat, multilevel ANCOVAs of point-in-time use at 4.5 years past baseline were conducted, with supplemental analyses of growth in use. Data were analyzed in 2009. Results showed significantly lower substance use in the intervention group for 12 of 15 point-in-time outcomes, with relative reductions of up to 51.8%. Growth trajectory analyses showed significantly slower growth in the intervention group for 14 of 15 outcomes.

Conclusions: Partnership-based implementation of brief universal interventions has potential for public health impact by reducing growth in substance use among youth; a multistate network of partnerships is being developed. Notably, the tested model is suitable for other types of preventive interventions.
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Substance misuse by adolescents and adults is a major public health problem in the U.S., contributing to substantial morbidity, mortality, and behavioral health problems.[1–3] The long-term health consequences of underage drinking and other types of substance misuse, including smoking cigarettes and illicit drug use, are well documented.[2–4] Economic consequences of substance misuse are substantial and especially salient in the context of escalating healthcare costs.[5–7]

Recent epidemiologic data highlight elevated prevalence of adolescent substance use. For example, in 2008,

From the Partnerships in Prevention Science Institute, Iowa State University (Spoth, Redmond, Clair, Shin), Ames, Iowa; and Prevention Research Center, Pennsylvania State University (Greenberg, Feinberg), State College, Pennsylvania

Address correspondence to: Richard Spoth, PhD, Partnerships in Prevention Science Institute, Iowa State University, ISU Research Park, Building 2, Suite 2400, 2625 North Loop Drive, Ames IA 50010. E-mail: rlspoth@iastate.edu.

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58.3% of tenth-graders reported lifetime alcohol use, 31.7% cigarette use, 29.9% marijuana use, and 15.9% other illicit drug use.[8] Epidemiologic research[9–11] also clearly indicates that early initiation predicts later substance misuse, and that delaying initiation and/or the transition to more serious use could accrue substantial public health benefits. Indeed, this research has motivated the development of effective preventive interventions of the types implemented through the partnership model employed in this study.[12–17]

Recent recommendations for addressing substance misuse and other costly health problems include using community-based partnerships or networks linking scientists with community practitioners to provide early, evidence-based interventions.[18–20] However, a frequently cited challenge to this approach is that community health systems often are ill-equipped to do so.[20–23] The current study addresses these problems, employing a partnership model consistent with recent guidelines by Grumbach and Mold[20] emphasizing improved translation of health science into practice,[23] and specifically suggesting partnerships with the Cooperative Extension System. The PROSPER (*PRO*moting *S*chool– university *P*artnerships to *E*nhance *R*esilience) partnership presented herein incorporates many elements of their proposed solution.

Prior reports on the ongoing community-level RCT of PROSPER have demonstrated the potential effectiveness of the key elements specified by Grumbach and Mold's model,[24,25] including effective participant recruitment,[26] maintenance of intervention implementation quality,[27] and sustainability of evidence-based interventions.[28] Earlier findings include positive effects on youth and parent behaviors that contribute to the reduction of problem behaviors like substance misuse[29] as well as reduced substance misuse at the first follow-up assessment.[25] The PROSPER RCT addresses a major gap in the knowledge base, namely, the absence of longitudinal findings on such partnership models.[20]

The objectives of this article are to briefly describe the PROSPER model, present long-term findings from the RCT, and discuss implications for more effective community partnerships. Community-based intervention–control differences were hypothesized to occur for initiation, past-month, and past-year use of a wide range of substances across adolescence.

Methods

Community Selection and Assignment

Twenty-eight community school districts from Iowa and Pennsylvania were recruited into a cohort sequential study involving two successive cohorts of sixth-graders (Cohort 1 and Cohort 2). Communities were eligible to participate if they had (1) a school district enrollment between 1300 and 5200 students and (2) at least 15% of students eligible for free or reduced-cost school lunches. All public schools in the selected communities with relevant grade levels participated in the study. Pairs of communities were matched (blocked) on school district size and geographic location and then randomly assigned to partnership intervention or "usual programming" comparison conditions. Community and participant recruitment procedures are described in detail elsewhere.[26] The baseline sample included 11,960 youth across the two cohorts (90% of all eligible sixth-graders). Figure 1 summarizes sample tracking over the six waves of data collected. The participating universities' IRBs approved the study procedures before recruitment began.

The Community–University Partnership Model

The three-tier PROSPER community– university partnership model guided the selection and delivery of evidence-based interventions (EBIs), as described in detail previously.[24,25] The three components of the PROSPER model consist of (1) local community teams linked with public schools and led by local Cooperative Extension System (CES) staff; (2) a Prevention Coordinator team connected with the land grant university CES; and (3) a team of state-level university researchers. Prevention Coordinators served as liaisons between the community teams and university researchers, providing ongoing, proactive technical assistance to the community teams, consistent with PROSPER model protocols. Community teams involved 8–12 people, including the Cooperative Extension staff team leader, a public school representative co-leader, representatives of local human service agencies, and other local stakeholders (e.g., youth and parents).

Following team formation, local teams selected a universal family-focused program from a menu of three EBIs. Each of the 14 community teams chose the seven-session Strengthening Families Program: For Parents and Youth 10-14 (SFP:10-14). Program selection

was followed by family recruitment and delivery of the program to families of sixth-graders in Cohort 1. During the second year of program implementation, the family-focused program was offered to families of sixth-graders in Cohort 2. Also in the second year, teams selected one of three school-based EBIs for seventh-graders. Life Skills Training and Project Alert were each selected by four teams; All Stars was selected by six. The school-based interventions were then delivered to seventh-graders in Cohort 1. During the second year some intervention communities also elected to implement 7th-grade booster sessions for the family-focused program (8th-grade booster sessions for school-based programs were electively conducted the year following core program implementation). The school-based program was implemented with 7th-grade students in Cohort 2 during the third year. Trained observers indicated that average program content fidelity ranged from 89% to 91% across the family-focused and school-based programs.

Family and School Interventions

The SFP:10-14 is based on empirically supported family risk and protective factor models.[30–33] A total of 1064 families (approximately 2650 family members) in the two cohorts attended at least one session of SFP:10-14, as part of 142 groups in the 14 partnership communities. Notably, attendance was predicted by technical assistance–related variables (e.g., effective collaboration with technical assistants).[26] Of the 1064 families in attendance (representing 17% of all eligible families), 90% attended at least four sessions (15.3% of all eligible families). Earlier articles demonstrate that even modest family program participation levels can achieve community-level effects, likely through positive influences transmitted via peer and parent networks.

Although the family program reached only a subset of the eligible students and families, the school-based component reached nearly all eligible students and, thereby, extended the reach of the intervention effort as a whole. Each of the school-based programs was implemented during class periods, in most cases by a regular classroom teacher, and had 11–15 sessions. These programs promote adolescent skill development and provide knowledge to avoid substance use, including increased accuracy of beliefs about peer substance use norms. The programs are as follows:

1. Life Skills Training (LST),[34,35] guided by social learning theory and problem behavior theory[36–38];
2. Project ALERT, based on the social influence model of prevention[36,39,40];
3. All Stars, also based on social learning and problem behavior theory.[36,37,41]

More detail on these programs can be found elsewhere.[25]

Data Collection

Student data were collected via machine-scored, written questionnaires administered in school during class periods by trained university-based data collectors. To ensure confidentiality, two questionnaire forms (with different item orders) were used and teachers were not permitted to handle or view the completed questionnaires. Pretest assessments were conducted during the fall semester of 6th grade for each cohort of students (in 2002 for Cohort 1). Follow-up assessments for the two cohorts were conducted at 0.5, 1.5, 2.5, 3.5, and 4.5 years past baseline (during spring semesters of the 6th through 10th grades).

Measures

All substance use measures were self-report (see earlier validity support[42–44]); all items were answered using a yes/no format and coded as 1 for *yes* and 0 for *no*. For all individual lifetime substance use measures, including those comprising the initiation indices described below, students were scored 0 until the time at which they first reported use and then 1 thereafter. Because the delivered interventions are intended to help prevent substance initiation and escalation, they are implemented at a point when youth use of most substances is low.

Substance Initiation Index—Gateway. The Substance Initiation Index—Gateway (SII-G) was computed as the sum of three lifetime substance use items: (1) *Have you ever had a drink of alcohol?* (2) *Have you ever smoked a cigarette?* and (3) *Have you ever smoked marijuana (grass, pot) or hashish (hash)?* The SII-G scores ranged from 0 to 3.

Substance Initiation Index—Illicit. The Substance Initiation Index—Illicit (SII-I) was computed as the sum of five lifetime substance use items that ask *Have you ever . . .*: (1) *used methamphetamine (meth)?* (2) *used ecstasy (MDMA)?* (3) *smoked marijuana (grass, pot) or hashish (hash)?* (4) *used drugs or medications that were prescribed by a doctor for someone else?* and (5) *used Vicodin, Percocet, or Oxycontin?* The SII-I scores ranged from 0 to 5.

New user measures. For all individual initiation measures, the number of "new users" was calculated, based on those who did not report lifetime use of a substance at the baseline assessment. The seven new user measures assessed drinking alcohol, drunkenness, cigarette use, marijuana use, inhalant use, methamphetamine use, and ecstasy use.

Past-month and past-year use measures. There were six dichotomous measures of "current" use (versus non-use). These included two past-month items (for gateway substances used at relatively higher rates—alcohol and cigarettes) and four past-year items: drunkenness, marijuana, inhalant use, and methamphetamine use.

Analyses

Point-in-time 10th-grade substance use outcomes were evaluated via multilevel (school/community and individual) ANCOVAs conducted using SAS PROC MIXED and PROC GLIMMIX (for index outcomes and dichotomous outcomes, respectively). These analyses control for school-level clustering resulting from nonindependence of observations within sites (intraclass correlations) that can inflate statistical error rates. State, cohort, intervention condition, block, and risk status were included as factors in the model at the school level (level 2), as were all corresponding higher-level interaction terms. Risk status was defined by the SII-G score at baseline (one if the score was 1 or higher, zero otherwise). The outcome score at pretest and a general child management score (a 13-item student-report measure of their parents' parenting behaviors) were added into the model as individual-level covariates. The latter covariate was added because such parenting behaviors have been shown to be predictive of youth problem behavior outcomes.[29] Restricted maximum likelihood (REML) was applied to estimate variance components in the model.[45] All analyses presented are intent-to-treat analyses and thus include all youth for whom usable data were collected.[46,47] Missing data were han-

dled using full-information maximum likelihood estimation (FIML).[43–52]

Because (1) all observed intervention effects were in the expected direction at the 7th-grade evaluation in this study, and (2) prior evidence of program effectiveness was a criterion for inclusion on the menu of programs, focus is on one-tailed test results. However, *p*-values are reported so that both one- and two-tailed test results can be discerned, allowing for comparisons across studies that use either type of test. Further, *p*-values were not adjusted to control for the overall experiment-wise Type 1 error rate because such an adjustment would likely have masked any interpretable patterns of findings across individual substance outcomes (e.g., differential effects on use of gateway versus more serious substances) through substantial inflation of Type 2 error rates.

Both individual- and community-level effect sizes are reported, as defined by Cohen's d.[53] Community-level effect sizes are reported, because assignment to intervention conditions was at the community level, the interventions were implemented at that level, and related effect sizes are relevant to assessment of community-level public health impact. Community-level effect sizes apply standard effect size calculations to school-level results, using aggregated scores of outcomes within schools from the school-level models.

To clarify the longitudinal pattern of findings since the earlier report on outcomes at the 7th grade, linear slope differences across study conditions in the trajectories of substance use from the 6th to 10th grades (five waves of data) were evaluated using a repeated measures analysis. As was the case for the point-in-time ANCOVAs, the tested model included factors for state, cohort, condition, block, and risk status, with all corresponding higher-level interaction effects. Because of the increased complexity of the model introduced by the additional assessment waves, data were aggregated to the school level for this analysis. An AR(1) auto-regressive model was employed to describe the variance–covariance structure of each outcome across waves of data collected. Analyses were conducted using SAS PROC MIXED with REML.[45]

Results

Sample Quality

Multilevel ANOVAs were conducted to assess pretest equivalence and differential attrition across experimental conditions for a range of sociodemographic factors and all evaluated outcome measures. Results showed no significant pretest differences for any sociodemographic measure (biological parents, target gender, age, grades, school absence, race, free school lunch) or for any of the 15 outcome measures. No significant Attrition × Condition interactions were found at any data collection point prior to the 4.5-year follow-up (10th grade). However, at the 4.5-year follow-up, analyses revealed that control group students who had initiated inhalant use or scored higher on the SII-I at baseline were more likely to have left the study than intervention group students who had done so. Notably, these results can be expected to *reduce* observed intervention effects for those outcomes.

Substance Initiation

Substance initiation indices. Adolescents in the PROSPER intervention condition were compared with those in the control condition using the multilevel ANCOVA analyses, as summarized in Table 1. At the 10th-grade follow-up, 4.5 years past baseline, results showed that both the SII-G and SII-I scores for the intervention group were significantly lower than those for the control group. Both individual- and community-level effect sizes are reported in Table 1. As noted earlier, the latter are considered to be relevant for assessing intervention impact in this context because the partnership-based model is implemented at the community level, with results reflecting expected impacts at that level (across the targeted population).

Individual initiation measures. Results in Table 1 show that all of the new user measures were significantly lower for the intervention group. Relative reduction rates ranged from 5.0% (drinking more than sips of alcohol) to 42.2% (methamphetamine use).

Past-Month and Past-Year Use

Reported past-year use of marijuana, inhalants, and methamphetamine showed significantly lower 10th-grade mean levels in the intervention condition (see Table 1). Relative reductions ranged from 16.6% (past-year marijuana use) to 51.8% (past-year methamphetamine use). Past-month outcomes were not significant.

Longitudinal Growth Results

Results from the longitudinal growth analysis showed a consistent pattern of slower growth in substance use for the intervention group, relative to controls; slope differences, indicated by significant Condition × Time interactions, were found for all substance outcomes, except past-year inhalant use (Table 2). Also reported in Table 2 are significance tests for the main effects of condition (reflecting the overall mean intervention–control difference across data collection points).

Discussion

Results showed significant, positive outcomes across *all types* of substance use. The strongest point-in-time findings were for inhalants, marijuana, and other illicit substance use, including new user rates of inhalants, methamphetamine, and ecstasy, and for past-year use of methamphetamine. When compared to follow-up findings 3 years earlier, this present set of results suggests somewhat stronger outcomes emerging over time. Notably, significant effects on cigarette use emerged at this follow-up (10th-grade new user rates, as well as 6th- to

Table 1. PROSPER community–university partnership effects on substance use outcomes at 4½ years past baseline (10th grade)

Outcome variables	Intervention LS (M [SE])	Control LS (M [SE])	Relative reduction (%)	F-value (1, 12)	*p*-value	Effect size (individual/community)
New user (after pretest) substance use rate						
Drinking alcohol (more than sips)	0.740 (0.014)	0.779 (0.014)	5.0	4.04	0.034	0.773/0.317
Drunkenness	0.514 (0.016)	0.555 (0.016)	7.4	3.44	0.044	0.792/0.488
Cigarettes	0.386 (0.020)	0.444 (0.020)	13.1	4.47	0.028	0.908/0.649
Marijuana	0.276 (0.018)	0.336 (0.020)	17.9	7.29	0.010	0.765/0.537
Inhalant	0.139 (0.009)	0.186 (0.011)	25.1	11.73	0.003	0.774/0.737
Methamphetamine	0.037 (0.005)	0.064 (0.006)	42.2	11.67	0.003	0.338/0.492
Ecstasy	0.048 (0.005)	0.081 (0.008)	40.1	14.45	0.002	0.439/0.648
Lifetime substance user indices						
Gateway Substance Initiation Index	1.640 (0.034)	1.742 (0.034)	—	4.62	0.026	0.108/0.570
Illicit Substance Use Index	0.802 (0.044)	1.019 (0.044)	—	14.40	0.002	0.186/0.721
Past-month use						
Alcohol	0.419 (0.016)	0.446 (0.016)	6.1	1.47	0.124	0.429/0.256
Cigarettes	0.193 (0.016)	0.230 (0.017)	16.1	2.60	0.067	0.427/0.426
Past-year use						
Drunkenness	0.435 (0.018)	0.476 (0.019)	8.6	2.59	0.067	0.650/0.416
Marijuana	0.206 (0.013)	0.247 (0.015)	16.6	7.20	0.010	0.596/0.439
Inhalant	0.040 (0.004)	0.053 (0.005)	24.5	4.37	0.029	0.217/0.419
Methamphetamine	0.013 (0.003)	0.027 (0.005)	51.8	11.80	0.003	0.127/0.498

Note: Presented *p*-values are based on one-tailed tests; two-tailed significance levels can be computed by doubling the reported *p*-values. Community-level effect sizes apply standard effect size calculations (based on Cohen's d) to school-level results, using aggregated scores of outcomes within schools from the school-level models. The average number of students per school in each cohort ranges from 112 to 120, depending on the specific outcome variable. All means are LS estimates.
LS, least squared; PROSPER, Promoting School-University Partnerships to Enhance Resilience

10th-grade trajectories of new user levels and past-month use).

This pattern of results is consistent with those from earlier, longitudinal studies of similar interventions showing diverging trajectories of use between intervention and control groups over time as levels of use increase overall.[13–15] Although results for alcohol use follow the general pattern of stronger results at this follow-up point, some particular alcohol outcomes are relatively weaker (e.g., past-month use, past-year drunkenness) than those for the other types of use. This may be a result of the fact that alcohol is the substance of choice among adolescents, and that a relatively higher percentage of students had already initiated alcohol use at baseline, as compared with other types of substance use that are less normative. Earlier research suggests that the long-term intervention effects are sensitive to baseline levels of use.[14]

These results suggest the public health potential of evidence-based prevention supported by a community–university partnership delivery model. Consistent with key aspects of early intervention,[54] the interventions implemented through this study are designed to intervene during a developmental period that is critical in determining the likelihood of future substance misuse and related problem behaviors. Prior research has demonstrated how this type of early intervention can reduce substance misuse and associated problems into young adulthood,[17] particularly through reduced exposure to opportunities to use substances during adolescence.[12]

Although several researchers previously have noted the failure of research to document the effectiveness of community-based partnerships, recent evidence of success from this and studies of another model[55,56] indicate that such models have great potential when critical features are included, such as a partnership component that entails continuous, proactive technical assistance in collaboration with university-based scientists.

Because findings from the present PROSPER model study are promising, recent funding is supporting research on infrastructure development and dissemination

Table 2. Longitudinal growth effects of PROSPER community–university partnerships from 6th to 10th grades

Outcome variables	Condition			Condition × Time	
	$LS_{(intervention/control)}$ (M)[a]	F-value (1, 12)	*p*-value	F-value (1, 48)	*p*-value
New user (after pretest) substance use rate					
Drinking alcohol (more than sips)	0.45/0.47	1.48	0.124	3.13	0.042
Drunkenness	0.26/0.28	3.71	0.039	5.95	0.009
Cigarettes	0.24/0.28	3.90	0.036	6.30	0.008
Marijuana	0.15/0.18	8.91	0.006	9.89	0.001
Inhalant	0.11/0.13	6.83	0.011	18.34	0.001
Methamphetamine	0.023/0.035	3.91	0.036	7.47	0.004
Ecstasy	0.028/0.044	9.44	0.005	12.06	0.001
Lifetime substance user indices					
Gateway Substance Initiation Index	1.24/1.30	7.46	0.009	7.10	0.005
Illicit Substance Use Index	0.50/0.60	9.33	0.005	16.60	0.001
Past-month use					
Alcohol	0.30/0.32	1.16	0.151	4.53	0.019
Cigarettes	0.14/0.16	3.12	0.051	4.16	0.023
Past-year use					
Drunkenness	0.24/0.26	4.19	0.032	4.93	0.016
Marijuana	0.12/0.14	8.97	0.006	4.09	0.024
Inhalant	0.050/0.061	3.73	0.039	1.92	0.086
Methamphetamine	0.010/0.016	9.42	0.005	7.65	0.004

Note: Presented *p*-values are based on one-tailed tests; two-tailed significance levels can be computed by doubling the reported *p*-values.
[a]Based on mean rates across all data collection points; these means will differ from the 10th-grade means reported in Table 1. All means are LS estimates.
LS, least squared; PROSPER, Promoting School-University Partnerships to Enhance Resilience

strategies for other states, as part of a national partnership network, including plans to expand the menu of evidence-based interventions.[57] Nonetheless, some challenges to widespread model implementation are noteworthy. As indicated in our earlier outcome report,[25] one barrier that needs to be addressed concerns community- and state-level financial resources.

Financial sustainability training is central to the PROSPER model; after 2 years of full start-up and implementation funding, teams were required to obtain additional funding to support continued intervention delivery. Whereas PROSPER teams have been successful in obtaining funds to continue programming, the recent economic downturn, combined with the elimination of some sources of funding (e.g., Safe and Drug Free Schools) has created challenges; proactive technical assistance and additional fund raising training has helped teams surmount related barriers.[28]

Study limitations include issues of generalizability, as this study was conducted in two states in small communities (7000–44,500) and the participants were primarily white. Also, all of the substance use measures are based on self-report; nonetheless, there is support in the literature for the validity of this type of data.[42–44,58]

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