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Original article

Impact of a Positive Youth Development Program in Urban After-School Settings on the Prevention of Adolescent Substance Use

Jacob Kraemer Tebes, Ph.D.[a,*], Richard Feinn, Ph.D.[a], Jeffrey J. Vanderploeg, Ph.D.[a], Matthew J. Chinman, Ph.D.[b], Jane Shepard, Psy.D.[c], Tamika Brabham, M.B.A.[c], Maegan Genovese, M.S.[c], and Christian Connell, Ph.D.[a]

[a]*Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut*
[b]*Rand Corporation & West Los Angeles VA Healthcare Center, Santa Monica, California*
[c]*Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut*

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Abstract

Purpose: Positive youth development (PYD) emphasizes a strengths-based approach to the promotion of positive outcomes for adolescents. After-school programs provide a unique opportunity to implement PYD approaches and to address adolescent risk factors for negative outcomes, such as unsupervised out-of-school time. This study examines the effectiveness of an after-school program delivered in urban settings on the prevention of adolescent substance use.

Methods: A total of 304 adolescents participated in the study: 149 in the intervention group and 155 in a control group. A comprehensive PYD intervention that included delivery of an 18-session curriculum previously found to be effective in preventing substance use in school settings was adapted for use in urban after-school settings. The intervention emphasizes adolescents' use of effective decision-making skills to prevent drug use. Assessments of substance use attitudes and behaviors were conducted at program entry, program completion, and at the 1-year follow-up to program entry. Propensity scores were computed and entered in the analyses to control for any pretest differences between intervention and control groups. Hierarchical linear modeling (HLM) analyses were conducted to assess program effectiveness.

Results: The results demonstrate that adolescents receiving the intervention were significantly more likely to view drugs as harmful at program exit, and exhibited significantly lower increases in alcohol, marijuana, other drug use, and any drug use 1 year after beginning the program.

Conclusions: A PYD intervention developed for use in an urban after-school setting is effective in preventing adolescent substance use.

Keywords: Youth development; After school; Urban; Substance use; Resilience; Propensity scores; HLM

Positive youth development (PYD) is an emerging area of practice and research that emphasizes a strengths-based approach to the promotion of positive outcomes for youth [1]. Such a perspective eschews a view of youth as troublesome and in need of fixing but, instead, emphasizes their resilience and value to others and to their community [2]. Although the PYD perspective initially declined to focus on risk reduction and prevention because these approaches characterize adolescents as having problems, more recently there have been calls for the integration of PYD and prevention science perspectives [3,4]. This integration acknowledges that PYD programs should not only attempt to build competencies and promote resilience, but they should also emphasize the reduction of health-compromising be-

*Address correspondence to: Jacob Kraemer Tebes, Ph.D., Division of Prevention & Community Research and The Consultation Center, Yale University School of Medicine, 389 Whitney Avenue, New Haven, CT 06511.

E-mail address: jacob.tebes@yale.edu

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haviors [4]. The rapprochement between these two approaches is also possible because of recent shifts in prevention science that acknowledge the value of balancing risk reduction with promotive approaches to prevention [5].

Endemic to the PYD perspective is (1) that settings provide essential contexts to promote or impede youth development; and (2) that parents, practitioners, policy makers, and researchers should attempt to identify settings that promote PYD [2,6–8]. One type of setting that has been suggested as especially well suited for PYD interventions is the after-school program [1,7,9].

About 14 million children and adolescents regularly spend after-school time without adult supervision [10], with approximately 4 million of these being 13- and 14-year-olds [11]. In addition, in one study of adolescents in three cities, one third to two thirds of 15- to 19-year-olds reported being involved in some constructive activity after school [11]. Research has shown that unsupervised out-of-school time is associated with various negative youth outcomes [12,13], such as diminished academic and behavioral functioning [13–15] and involvement in risky behaviors, including criminal behavior and substance use [13,16–18]. Adolescent substance use, in particular, has been linked with unsupervised out-of-school time, especially among youth with low levels of parental monitoring [13,15–16,19]. Structured after-school programs for youth have been developed to address the potential risks posed by the lack of adult supervision [9,20,21], particularly for urban youth [9,22,23]. Recent research has also suggested that some after-school programs may reduce substance use among adolescents [9,20,24–26]. However, it remains unclear whether after-school programs using a strengths-based, PYD approach to substance use prevention are also effective, particularly for urban minority adolescents.

The present study examines one such program, the Positive Youth Development Collaborative (PYDC), which specifically targets substance use attitudes and behaviors among urban minority adolescents. This program involves the implementation of an evidence-based curriculum embedded in a comprehensive after-school program based on PYD principles that is intended to prevent substance use.

Methods

Participants

A total of 304 adolescents participated in the study: 149 in the intervention group and 155 in the control group. The final sample of 149 adolescents in the intervention group represented 91% of those eligible to participate in the intervention, and the final sample of 155 adolescents in the control group represented 88% of those eligible to participate in the control group. In the intervention group, adolescents were enrolled in one of five after-school programs—two programs serving middle school youth, and three programs serving high school youth. For the comparison group, adolescents were enrolled in four programs serving middle and high school youth. All programs provided services during the school year (September through June). Programs in each condition took place in neighboring cities in the Northeast about 35 miles apart that were comparable in terms of racial and ethnic composition as well as household per capita income.

Characteristics of the overall sample were as follows: the mean age was 14.5 years (SD, 1.6 year) and 53% were male. In all, 75.7% of participants were African-American, 19.7% Hispanic, 3.9% Caucasian, and less than 1% American Indian and Asian, respectively.

Table 1 shows the pretest characteristics of the intervention and control groups as well as any pretest differences by group. χ^2 tests were used to determine whether the intervention and control groups differed on pretest categorical variables (demographic characteristics, substance use behavior), and independent-samples t tests were used to examine pretest differences on any continuous measures (substance use attitudes). The intervention group contained a significantly higher percentage of girls (57% vs. 37%); was older (14.9 vs. 14.2 years); had a higher grade level (9.4 vs. 8.5 years); had parents with more education (58.6% attended some college vs. 26.9%); were less likely to live with two parents (21.2% vs. 41.7%), and had a significantly higher percentage of adolescents who had ever tried cigarettes (84% vs. 60%) (Table 1).

Intervention

The Positive Youth Development Collaborative (PYDC) is a comprehensive program to promote well-being and prevent substance use among adolescents. The program teaches substance use prevention skills along with participation in health education and cultural heritage activities. The core substance use prevention component of the program is an 18-session curriculum known as Adolescent Decision-Making for the Positive Youth Development Collaborative (ADM-PYDC) [27]. This component is an adaptation of two curricula previously shown to be effective in preventing adolescent substance use in school-based settings: the Yale Adolescent Decision-Making Program [28] and the Positive Youth Development Program [29]. The ADM-PYDC curriculum consists of 18 sessions that cover the following topics: (1) program introduction and overview (one session); (2) understanding and coping with stress, and learning stress-reduction strategies (three sessions); (3) learning the steps of effective decision-making, including: (a) defining the problem, (b) brainstorming alternatives, (c) identifying consequences and risks for each alternative, (d) understanding personal values related to the decision making process, (e) identifying social influences on decision-making such as peer pressure and the media, and how to deal with these when making decisions, (f) learning how

Table 1
Pretest characteristics by condition and any observed differences

	Intervention group n = 149	Control group n = 155	Test statistic	*p* Value
Age				
Mean (SD)	14.9 (1.5)	14.2 (1.6)	$t_{(302)} = 3.67$	<.001
Grade level				
Mean (SD)	9.4 (1.4)	8.5 (1.6)	$t_{(302)} = 5.09$	<.001
Gender				
Female	57.0%	37.4%	$\chi^2_{(1)} = 11.75$	.001
Male	43.0	62.6		
Race/ethnicity				
African American	76.5%	74.8%	$\chi^2_{(3)} = 4.57$	.206
Asian Am./Pac. Islander	.7	.6		
Hispanic	16.8	22.6		
Native American	—	—		
Caucasian	6.0	1.9		
Parent education				
Less than high school	6.9%	19.5%	$\chi^2_{(3)} = 12.78$	.005
High school	34.5	53.7		
Some college	31.0	22.0		
College degree	27.6	4.9		
Living situation				
Both parents/step-parents	21.2%	41.7%	$\chi^2_{(5)} = 13.83$	.017
Mother	57.6	48.3		
Father	6.1	0.0		
Grandparents	3.0	6.7		
Other	12.1	3.3		
Ever drank alcohol				
No	45.6%	52.9%	$\chi^2_{(1)} = 1.60$	.205
Yes	54.4	47.1		
Ever smoked cigarettes				
No	59.7%	83.9%	$\chi^2_{(1)} = 21.98$	<.001
Yes	40.3	16.1		
Ever smoked marijuana				
No	76.5%	76.0%	$\chi^2_{(1)} = 0.01$	.913
Yes	23.5	24.0		

to obtain additional information if needed to make effective decisions, and (g) making one's best decision (seven sessions); (4) learning essential information about tobacco, alcohol, and other drug use (two sessions); (5) applying the decision-making process to one's life through identifying positive personal attributes, dealing with job and school stressors, setting positive goals for healthy living, and enhancing one's social networks and resources (four sessions); and (6) program close and review (one session).

More than one third of the material in the ADM and PYD curricula already overlapped before being combined for the present study (i.e., both included information about stress, tobacco, alcohol, and other drugs, as well as enhancement of social networks and resources). In addition, more than one half of the final curriculum examined was derived from the ADM curriculum that emphasized teaching adolescents effective decision-making skills, particularly in substance use situations. The remainder of the material was drawn from the PYD curriculum that emphasized identifying positive personal attributes and setting goals for healthy living.

Another adaptation of the final ADM-PYDC curriculum was its development for use in urban, after-school settings that serve predominantly African-American adolescents. As part of the curriculum redevelopment process, cultural heritage materials tailored for African-American youth were included from the Aban Aya Youth Project [30], along with cultural materials relevant to Hispanic youth. Middle school and high school versions of the curriculum were also developed to ensure that materials were developmentally appropriate for both early and late adolescents.

The ADM-PYDC curriculum was part of an overall after-school program that included regular field trips to community agencies, civic organizations, businesses, and schools to promote learning about community service and understanding one's cultural heritage. These trips exposed adolescents to a variety of after-school experiences and opened up opportunities for them to receive academic support, counseling services, and vocational support services, as well as to participate in intergenerational programming and to attend community theater. Consistent with youth development principles, adolescents were provided with numerous opportunities to carry out youth-led activities through the program, and to develop positive partnerships with and mentoring by adults who were part of collaborating agen-

cies and organizations. These organizations formed the "collaborative" that is central to the project's identity.

Finally, all program activities were delivered by community group leaders who were provided with more than 12 hours of training in the curriculum and in youth management skills. Group leaders attended bi-weekly group meetings in which supervision was provided by members of the research team.

Control group participants also participated in rich and varied after-school experiences delivered through after-school settings that provided such activities as academic support, counseling services, and recreational activities. These settings also sponsored occasional field trips to community settings for recreational purposes, and held periodic drug education lectures and group discussions facilitated by after-school counselors and guest speakers.

Procedures

Procedures for this study were approved by the university institutional review board governing research concerning human subjects. All adolescents in after-school settings in both conditions were invited to participate in the study through informational and consent letters sent home to parents. Letters were supplemented with follow-up phone calls to parents to ensure that all consent procedures were understood and voluntary. Once parental consent was obtained, individual assent was sought and obtained from adolescents before their study enrollment.

Adolescents completed a pretest interview shortly after entering the after-school program but before curriculum delivery (pretest; October/November), after completing the program (post-test; June/July), and 1 year after the initial interview (follow-up; October/November of the following year). Interviews were conducted in private at after-school sites, community settings, or participants' homes. Each interview required about 30–45 minutes to complete, for which the adolescents received a $40 gift card to a local mall.

Measures

Measures included interview assessments of adolescents' demographic characteristics, substance use attitudes, and substance use behavior.

Demographic characteristics. Demographic characteristics assessed included adolescent gender, age, grade level, race/ethnicity, living situation, family moves in the last year, and parent educational level using a measure developed through the Center for Substance Abuse and Prevention [31].

Substance use attitudes. Two types of substance use attitudes were assessed: 1) risk of harm [31], and 2) drug beliefs [31]. The Risk of Harm scale consisted of a five-item measure derived from the CSAP student survey that measures adolescent perceptions of harm when using drugs. Each item uses a four-point Likert scale ranging from "no risk" to "great risk." The scale used in the present study was a sum of scores for respondent ratings of the risk of harm for the use of alcohol, tobacco, and marijuana. The internal consistency reliability of this scale in the present study was .67, a lower figure than desired but still acceptable. Drug Beliefs is a four-item measure of negative attitudes toward substance use also taken from CSAP student survey [31]. Once again, each item uses a Likert scale with four choices ranging from "not wrong at all" to "very wrong" in response to various attitudes or beliefs about drug use. The overall drug beliefs scale consisted of summed scores of all items. Internal consistency of this summed scale in the present study was .77.

Substance use behavior. Substance use was assessed by having adolescents indicate whether they had used various drugs within the past 30 days [31]. Drugs assessed included: alcohol, marijuana, cocaine/crack, heroin/other opiates, nonprescription methadone, hallucinogens, amphetamines, tranquilizers, inhalants, and other drugs. This question was also asked for cigarettes, chewing tobacco, snuff, and pipe, which were collapsed into a "tobacco" variable for the analyses. Responses to amphetamines, cocaine, heroin, nonprescription methadone, hallucinogens, tranquilizers, or inhalants were collapsed into an "other drugs" category. Finally, a variable called "any drug use" was created for an affirmative response to the use of any of the above drugs.

Data analyses

A multilevel regression model using hierarchical linear modeling (HLM) [32] was used because the structure of the data was longitudinal with respondents providing up to three possible observations of their use/nonuse of substances. A Bernouli-linked function was then used to model the proportion of substance use at each time point. This modeling approach permits use of all data, even with some time points missing (unlike the usual repeated measures approaches) and properly models the correlated observations within each respondent (unlike regular regression). HLM models observations by using separate regression equations for each level. In the present study, the repeated observations within each respondent are considered level 1 and the intervention received for each respondent is represented at level 2. Inspection of the outcome data revealed that the change from pretest to exit to follow-up did not fit a linear trend; therefore, indicator variables representing exit and follow-up were entered rather than one representing time.

As noted earlier, examination of pretest demographics indicated that the intervention and control groups were significantly different on several variables related to outcome. This was not surprising, given that the study used a quasi-experimental, comparative-outcome design with preestablished groups. Because the above variables were likely to be related to drug use attitudes and behavior [33], pro-

pensity scores were calculated to control for these pretest differences [34]. For this study, propensity scores were calculated using logistic regression to predict group membership from the following variables: previous substance use, gender, race, age, parental education, and living situation [34]. These propensity scores were then entered in the HLM model to adjust for the bias between the nonequivalent groups.

Results

Attendance was tracked for all adolescents enrolled in the intervention. Adolescents who attended 50 percent or more sessions were identified as receiving a full intervention dose. Analyses were completed on this "intention to treat" sample as well as a reduced sample of 18 fewer adolescents who did not attend at least one-half of the sessions. The results revealed no significant differences in outcomes between these two intervention samples; thus, the results from the full sample are reported here.

Finally, although attrition for the exit and follow-up assessments was slightly higher for the control group, χ^2 analyses indicated that the differences in attrition between the two conditions were not significant. Attrition at the exit interview was 22.1% for the intervention group and 30.3% for the control group; at the follow-up interview attrition was 37.6% for the intervention group and 42.3% for the control group. Finally, attrition analyses of the pretest scores of substance attitudes and behaviors for those who stayed in or dropped out of the program that compared the two conditions revealed no significant differences by condition.

Substance use attitudes

Figure 1 displays the estimated risk of harm score, and Table 2 shows the estimated regression coefficients from the HLM analysis. There was a significant increase from pretest to exit in the perception of risk of harm for the intervention group compared with the control group ($\beta_{11} = 0.79$, $t_{(704)} = 2.79$, $p = .006$). Both groups showed a significant increase in that score at follow-up compared with pretest ($\beta_{20} = 0.70$, $t_{(704)} = 2.77$, $p = .006$), but this did not differ by group ($\beta_{21} = 0.16$, $t_{(704)} = 0.48$, $p = .63$).

Figure 1 also displays the trajectory of the estimated drug beliefs score over the span of the study, and Table 2 gives the corresponding regression coefficients. Neither group

Table 2
Results from HLM analysis for substance use attitudes

Parameter	Coefficient	S.E.M.	t	Sig.
Risk of harm				
Pretest (π_0)				
Intercept (β_{00})	16.202	0.261	62.05	.000
Intervention (β_{01})	−0.134	0.304	−0.44	.659
Propensity (β_{02})	0.155	0.544	0.29	.775
Exit (π_1)				
Intercept (β_{10})	0.087	0.203	0.43	.666
Intervention (β_{11})	0.794	0.285	2.79	.006
Follow-up (π_2)				
Intercept (β_{20})	0.695	0.251	2.77	.006
Intervention (β_{21})	0.165	0.346	0.48	.634
Drug beliefs				
Pretest (π_0)				
Intercept (β_{00})	4.959	0.229	21.66	.000
Intervention (β_{01})	0.067	0.255	−0.26	.795
Propensity (β_{02})	1.187	0.518	2.29	.023
Exit (π_1)				
Intercept (β_{10})	−0.220	0.163	−1.35	.177
Intervention (β_{11})	0.273	0.212	1.29	.199
Follow-up (π_2)				
Intercept (β_{20})	0.210	0.207	1.02	.311
Intervention (β_{21})	0.06	0.276	0.22	.829

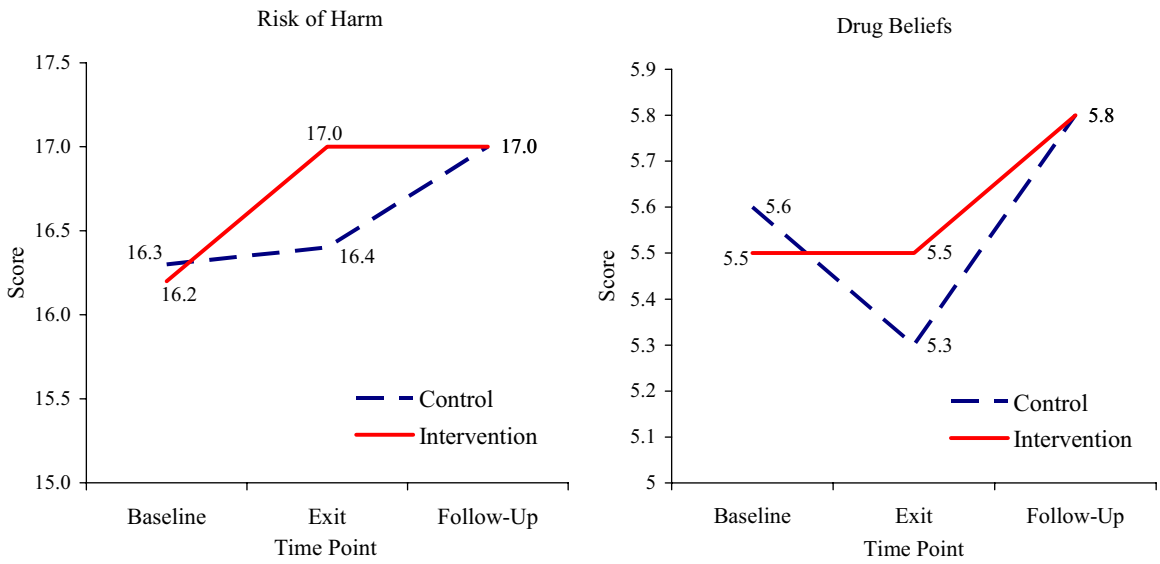

Figure 1. HLM estimated scores for substance use attitudes.

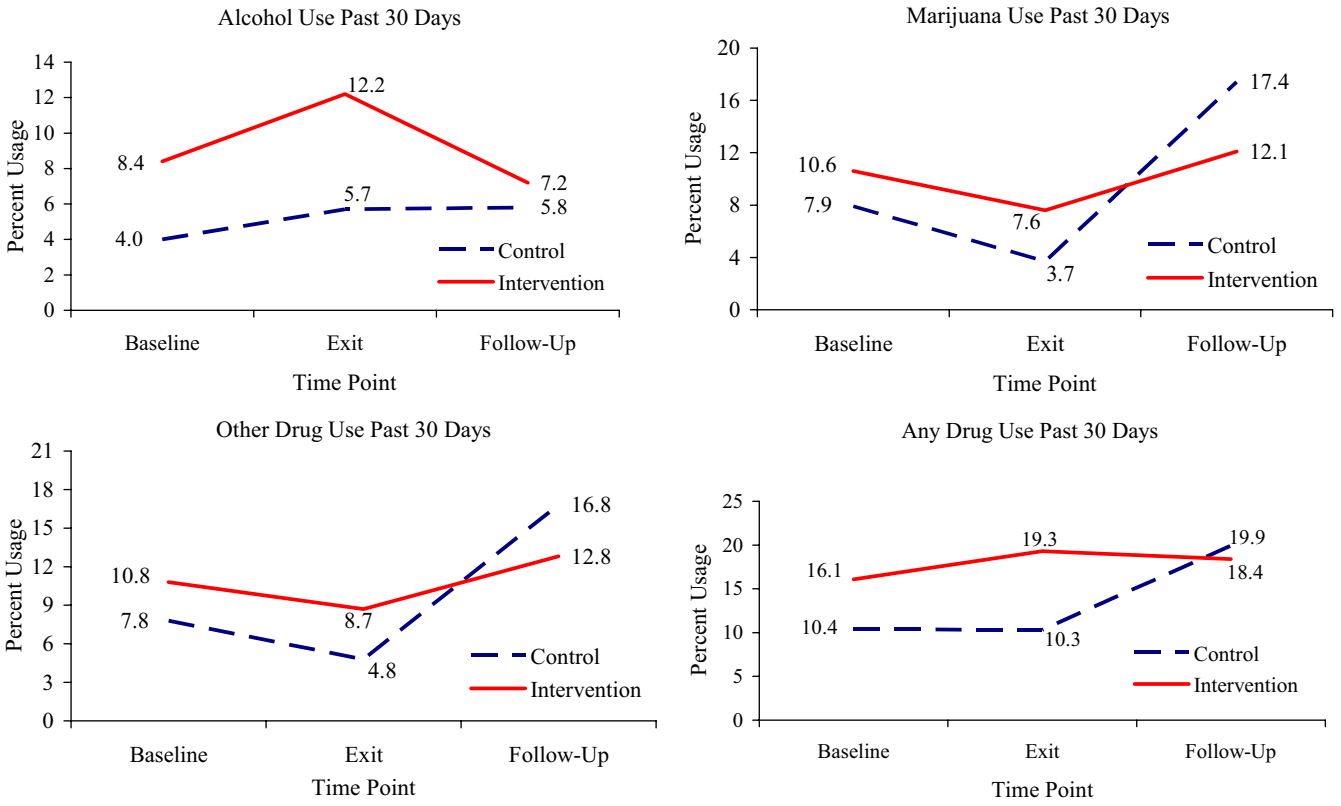

Figure 2. HLM estimated proportions for substance use.

demonstrated a significant change in drug beliefs at exit or follow-up compared with pretest; however, as shown in Figure 1, the intervention group demonstrated a nonsignificant change of 0.5 units at exit ($t_{(704)} = 1.29$, $p = .19$) relative to the control group.

Substance use

Figure 2 displays the predicted probabilities of use/nonuse for various drugs within the past 30 days at each of the three time points assessed, and Table 3 lists the corresponding regression coefficients. The rates of use reported are comparable to those found in the most recent comprehensive national survey of adolescents [35]. Because the number of participants who indicated that they used tobacco in the past month was extremely low across the three assessments, tobacco use was dropped from the analyses.

Alcohol use is shown in the first panel, where there was no significant difference in use from pretest to exit between groups ($\beta_{11} = 0.16$, $t_{(704)} = 0.36$, $p = .72$). However, at follow-up, the change in alcohol use from pretest significantly differed between groups ($\beta_{21} = -1.01$, $t_{(704)} = -2.19$, $p = .029$). The odds of using alcohol from pretest to follow-up was 0.365 (95% CI = 0.15–0.90) for the intervention group relative to the control group; that is, the odds of using alcohol was 63% (1 − .365) less for the intervention group.

As can be seen in the second panel of Figure 2, marijuana use significantly decreased at exit ($\beta_{10} = -1.40$, OR = 0.25 (0.11–0.55), $t_{(704)} = -3.43$, $p = .001$) and increased at follow-up ($\beta_{20} = 2.12$, OR = 8.35 (4.24–16.47), $t_{(704)} = 6.13$, $p < .001$) when compared with pretest. The change in use at exit did not differ by group, but the intervention group showed a decrease in use compared with the control group at follow-up ($\beta_{21} = -1.73$, OR = 0.18 (0.08–0.42), $t_{(704)} = -3.96$, $p < .001$). Although the odds of marijuana use at follow-up increased by a factor of 1.45 ($e^{2.12\ -1.73}$) for the intervention group, the odds of marijuana use increased by a factor of more than 8 (OR = 8.353, or $e^{2.12}$) for the control group.

The third panel of Figure 2 shows the results for using other types of drugs. Once again, there was a significant overall decrease in use at exit compared with pretest ($\beta_{10} = -0.86$, OR = 0.42 (0.21–0.85), $t_{(704)} = -2.42$, $p = .016$), which did not differ by group. However, there was a significant increase in other drug use at follow-up for the control group ($\beta_{20} = 2.14$, OR = 8.49 (4.32–16.66), $t_{(704)} = 6.21$, $p < .001$) only. Although the intervention group also increased in other drug use at follow-up, the increase was significantly smaller ($\beta_{21} = -1.67$, OR = 0.19 (0.08–0.44), $t_{(704)} = -3.86$, $p < .001$).

The last panel of Figure 2 shows the estimated probabilities for using any type of substance (alcohol, marijuana, or

Table 3
Results from HLM analysis for substance use

Parameter	Coefficient	S.E.M.	t	Sig.	OR	95% C.I.
Alcohol						
Pretest (π_0)						
Intercept (β_{00})	−7.366	0.675	−10.92	.000	0.001	0.00–0.00
Intervention (β_{01})	0.324	0.588	0.55	.581	1.383	0.44–4.39
Propensity (β_{02})	5.112	1.129	4.53	.581	166.1	18.1–1528
Exit (π_1)						
Intercept (β_{10})	0.640	0.384	1.67	.096	1.896	0.89–4.02
Intervention (β_{11})	0.164	0.453	0.36	.717	1.179	0.49–2.87
Follow-up (π_2)						
Intercept (β_{20})	0.689	0.387	1.78	.075	1.992	0.93–4.25
Intervention (β_{21})	−1.007	0.461	−2.19	.029	0.365	0.15–0.90
Marijuana						
Pretest (π_0)						
Intercept (β_{00})	−6.340	0.615	−10.31	.000	0.002	0.00–0.01
Intervention (β_{01})	0.207	0.597	0.35	.729	1.229	0.38–3.97
Propensity (β_{02})	3.955	1.149	3.44	.001	52.19	5.45–499
Exit (π_1)						
Intercept (β_{10})	−1.399	0.408	−3.43	.001	0.247	0.11–40.55
Intervention (β_{11})	0.565	0.500	1.13	.259	1.759	0.66–4.68
Follow-up (π_2)						
Intercept (β_{20})	2.123	0.347	6.13	.000	8.353	4.24–16.47
Intervention (β_{21})	−1.727	0.437	−3.96	.000	0.178	0.08–0.42
Other drug						
Pretest (π_0)						
Intercept (β_{00})	−6.380	0.619	−10.30	.000	0.002	0.00–0.01
Intervention (β_{01})	0.251	0.605	0.42	.678	1.286	0.39–4.22
Propensity (β_{02})	3.816	1.163	3.28	.002	45.43	4.62–447
Exit (π_1)						
Intercept (β_{10})	−0.865	0.357	−2.42	.016	0.421	0.21–0.85
Intervention (β_{11})	0.236	0.457	0.52	.605	1.266	0.52–3.10
Follow-up (π_2)						
Intercept (β_{20})	2.139	0.344	6.21	.000	8.487	4.32–16.66
Intervention (β_{21})	−1.670	0.433	−3.86	.000	0.188	0.08–0.44
Any type of drug						
Pretest (π_0)						
Intercept (β_{00})	−5.803	0.553	−10.50	.000	0.003	0.00–0.01
Intervention (β_{01})	0.306	0.529	0.58	.562	1.358	0.48–3.84
Propensity (β_{02})	4.610	1.010	4.57	.000	100.5	13.8–731
Exit (π_1)						
Intercept (β_{10})	−0.010	0.335	−0.03	.978	0.990	0.51–1.91
Intervention (β_{11})	0.527	0.425	1.24	.216	1.694	0.74–3.90
Follow-up (π_2)						
Intercept (β_{20})	1.648	0.336	4.91	.000	5.194	2.69–10.03
Intervention (β_{21})	−1.240	0.424	−2.92	.004	0.289	0.13–0.67

other drugs). Neither group showed a significant change from pretest to exit, but the control group showed a significant fivefold increase in use at follow-up ($\beta_{20} = 1.65$, OR = 5.19 (2.69–10.03), $t_{(704)} = 4.91$, $p < .001$); no such increase was observed in the intervention group.

Discussion

The present study showed that a PYD intervention that included an evidence-based substance use prevention component adapted for an urban after-school setting was effective in preventing adolescent substance use. Adolescents participating in the intervention were significantly more likely to view drugs as harmful at program exit (about 7 months after enrollment), and demonstrated a significantly reduced incidence of past-30-day use of alcohol, marijuana, or other drugs, as well as any drug use 1 year after program enrollment. Although substance use among program participants increased slightly over time, these increases were significantly less than those observed for the control group. Such reductions in the progression of substance use among adolescents have been found to protect against later increased or escalating use, and thus are an accepted indicator of prevention effectiveness [5,36–39].

This study has several implications for practice and research. First, the study involved a collaboration among

several community agencies committed to promoting PYD. Such collaboratives are becoming increasingly common in the youth development field [40], and provide a basis for involving multiple community partners in meaningful roles and relationships with youth. Collaboratives have the potential to expand opportunities for PYD and, thus, community-based prevention practice. Although the present study was focused more narrowly on the prevention of adolescent substance use, the PYD framework provided a useful platform for delivery of a prevention and risk reduction intervention that complemented other after-school activities focused on competence or resilience promotion. Future research should examine how such approaches not only impact problem behaviors, such as substance use, but also how they promote broader competencies and resilience among adolescents.

A related implication of the present study is that both risk- and competency-based interventions can be blended to yield an effective PYD intervention. Different after-school experiences provide different developmental opportunities. For example, research has shown that sports activities provide excellent settings for the development of initiative among youth; faith-based activities emphasize identity development, emotional regulation, and interpersonal development; and service activities are likely to foster teamwork, positive relationships, and social capital [7]. The processes associated with more comprehensive PYD interventions such as that used in this study remain unknown. Future research should assess youth experiences in such comprehensive programs and examine whether they are related to intended outcomes.

Finally, the present study supports the value of adapting interventions to after-school settings that have been previously found to be effective in other contexts. Out-of-school time offers considerable opportunities for both positive developmental experiences [2,7] and problem behaviors [15,17,20]. Interventions for adolescents that have been rigorously evaluated in other contexts to reduce risky behaviors such as substance use are appropriate for use in after-school contexts, as long as they are designed to comply with setting constraints and are tailored to the developmental needs and cultural characteristics of participants. In the present study, a structured, facilitator-led substance use prevention program that was originally developed and implemented in middle schools and high schools was delivered in after-school contexts with necessary developmental and cultural adaptations and was adjusted to conform to a more informal program schedule. Adaptations of similar programs hold promise for use in other after-school settings.

Study limitations

The present study was limited by its quasi-experimental design and the use of self-report data from adolescents. The absence of randomization does not rule out the possibility of a number of internal validity threats, particularly selection, that may have influenced the results. To address this partially, however, pretest differences among groups were accounted for statistically through the computation of propensity scores using pretest demographic and substance use variables. This created a statistical equivalency between groups at pretest so that exit and follow-up differences could be examined with confidence [34]. The high number significant values yielded for the propensity scores in the HLM analyses illustrated the value of controlling for these pretest differences. Another study limitation was the inability to examine the impact of the program on tobacco use because of the extremely low number of adolescents who reported 30-day tobacco use. However, the positive findings demonstrated for reductions in the use of other substances is promising, and suggests that future research should examine the impact of the program on tobacco use. An additional limitation of the present study was the use of self-report measures from adolescents. Although this limitation is real, the data were collected using a semi-structured interview by research staff with considerable previous experience interviewing youth. Although reporting distortions were still possible, they were minimized using this approach. Another limitation of this study was that school- and town-level effects could not be examined in the analyses because they were not crossed in the study design. Future research should examine these issues to determine the differential effectiveness of this intervention by school and town.

In conclusion, the results of this study support the findings of a recent extensive review of PYD programs that showed that such approaches can be effective in the prevention of problem behaviors among adolescents [41], even though the explicit aim of these programs is more often to promote positive behaviors. In the present study, strong and consistent effects were observed in the area of substance use prevention and related attitudes after adolescent participation in a comprehensive after-school program.

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