Use of a Social and Character Development Program to Prevent Substance Use, Violent Behaviors, and Sexual Activity Among Elementary-School Students in Hawaii

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Objectives. We assessed the effectiveness of a 5-year trial of a comprehensive school-based program designed to prevent substance use, violent behaviors, and sexual activity among elementary-school students.

Methods. We used a matched-pair, cluster-randomized, controlled design, with 10 intervention schools and 10 control schools. Fifth-graders (N = 1714) self-reported on lifetime substance use, violence, and voluntary sexual activity. Teachers of participant students reported on student (N = 1225) substance use and violence.

Results. Two-level random-effects count models (with students nested within schools) indicated that student-reported substance use (rate ratio [RR] = 0.41; 90% confidence interval [CI] = 0.25, 0.66) and violence (RR = 0.42; 90% CI = 0.24, 0.73) were significantly lower for students attending intervention schools. A 2-level random-effects binary model indicated that sexual activity was lower (odds ratio = 0.24; 90% CI = 0.08, 0.66) for intervention students. Teacher reports substantiated the effects seen for student-reported data. Dose-response analyses indicated that students exposed to the program for at least 3 years had significantly lower rates of all negative behaviors.

Conclusions. Risk-related behaviors were substantially reduced for students who participated in the program, providing evidence that a comprehensive school-based program can have a strong beneficial effect on student behavior. (*Am J Public Health.* 2009;99:1438–1445. doi:10.2105/AJPH.2008.142919)

Substance use, violent behaviors, and early initiation of sexual activity occur at problem atic levels among American youths.[1–4] Early initiation of substance use and engaging in vio lent behaviors during childhood place children at a greater risk of psychopathology, aggressive behaviors, and continuation of substance use during adolescence and into adulthood.[5–10] National estimates have indicated that approxi mately 43.3% of high school students had con sumed alcohol, 35.9% had been in a physical fight, and 46.8% had engaged in sexual inter course over the previous 12 months.[5] Thus, prevention programs that can reduce the inci dence of such behaviors should provide clear public health benefits.

Appropriately designed and implemented school based prevention programs can prevent or reduce negative behaviors,[2,11,12] but some programs have not been evaluated for efficacy and effectiveness,[9,13] criteria deemed crucial in determining whether a program is ready for widespread adoption by schools.[14,15] Although studies indicate positive treatment effects for school based prevention programs, the magni tude of effects is often modest.[16,17] The average effect size for such programs is 0.20[18] (compa rable to a success rate of 9.5%), suggesting that there is considerable room for improvement in the effectiveness of prevention programs in reducing negative behaviors. In addition, accu mulating evidence indicates that negative be haviors do not exist in isolation from one another,[2,19] so programs that address multiple co occurring negative behaviors are likely to be of greater overall benefit.[20,21]

Our goal was to evaluate the preventive benefits of the Positive Action program, a comprehensive schoolwide social and char acter development program. We hypothe sized that the Positive Action program would result in lower rates of student substance use, violence, and voluntary sexual activity, as measured by student self reports and teacher reports. Previous quasi experimental studies of the Positive Action program[22,23] reported beneficial school level effects on student achievement and serious problem behaviors (e.g., suspensions and violence). We build on previous research by reporting on a matched pair, cluster randomized controlled study.[14] These features of a study are important when examining the scientific credibility of interven tion findings.

METHODS

The Positive Action program intervention took place in 20 public elementary (kinder garten to fifth or sixth grade) schools on 3 Hawaiian islands. Our study followed stu dents who were in first or second grade at baseline (the 2001 2002 academic year) and who stayed in the study schools through fifth grade (the 2005 2006 academic year for the first grade cohort, and the 2004 2005 academic year for the second grade cohort). Students who left study schools during the study period were dropped from the study, and students who joined study schools during the study period were added to the study (without collecting baseline data). Thus, our study also included students who entered the schools at any year during the course of the study and who were in fifth grade at the end of the study. All students responding to the survey regarding substance use, violent behaviors, and sexual activity received active parental consent and completed a question naire in fifth grade soliciting self reports on substance abuse, violent behaviors, and vol untary sexual activity.

Baseline Equivalency

Schools were eligible for the study if they met all of the following eligibility criteria (using data from school report cards for the year 2000, compiled and published by the Hawaii Department of Education): (1) at least 25% of the school's students were receiving free or reduced price lunch; (2) the school was in the lower 3 quartiles of SAT scores among Ha waiian schools; (3) the school was located on Oahu, Maui, or Molokai; (4) the school was a kindergarten to fifth or sixth grade public school (i.e., not a specialized academy, charter, or special education school); and (5) the school had annual student stability rates of more than 80% (i.e., student mobility of less than 20%). There were 111 schools that met those criteria. We then used 2000 school report card data[24] to stratify the eligible schools based on an index that included percentage of students receiving free or reduced price lunch, school size, percentage of student stability, and student ethnic distribution; additional character istics of the school (student teacher ratio and expenditures per student); characteristics of stu dent populations (proportions of gifted, special education, and English as a second language students); and indicators of student behavioral and school performance outcomes (disciplinary referrals, suspension rates, and standardized achievement scores).[25]

Our stratification resulted in 19 strata con taining at least 3 schools that were very similar regarding index indicators. Within each stra tum, we randomly assigned 1 school to the intervention group and 1 other school to the control group until we had 20 study schools 10 intervention and 10 control. Once a stratum had supplied 1 intervention school and 1 control school, no further recruitment was made within the stratum. Control schools were asked to continue with "business as usual" without making any substantial social and character development program reforms. At baseline, no significant differences ($P \geq .05$) existed between intervention and control schools with respect to any of the indicators just mentioned. After school level randomization, we developed random effects models (with students nested within schools) to compare self reported and teacher reported negative student behaviors (i.e., gets into fights, threatens others, physically hurts others, and hits others) at baseline. No significant differences ($P \geq .05$) were observed between reports from control and intervention schools, indicating baseline equiv alency among all schools in the study.

Intervention

The Positive Action program (http://www.positiveaction.net) is a multicomponent school based social and character development program designed to improve academics, stu dent behaviors, and character. It is grounded in a broad theory of self concept[26] and is consis tent with comprehensive theories of health be havior like the theory of triadic influence.[27] the Positive Action program has been described in detail elsewhere,[22,23] but briefly, the full pro gram consists of kindergarten through 12th grade classroom curricula, schoolwide climate changes undertaken by the principal and a Pos itive Action coordinator or committee, and fam ily and community involvement components. The sequenced elementary school curriculum consists of 140 lessons per grade per academic year, offered in periods 15 to 20 minutes long. The total time students are exposed to the program during a 35 week academic year is approximately 35 hours.

Lessons are grouped into 6 major units: self concept, mind and body positive actions (e.g., nutrition, physical activity, decision making skills, motivation to learn), social and emotional actions for managing oneself responsibly (e.g., emotion regulation, time management), getting along with others (e.g., empathy, respect, treat ing others as one would like to be treated), being honest with yourself and others, and self improvement (e.g., goal setting, courage to try new things, persistence). The program encour ages interaction between teacher and student through structured discussions and activities, and it encourages interaction among students through structured or semistructured small group activities, including games, role playing, and skill practice. Principals at each participat ing school received a school climate kit pro viding directions for a schoolwide climate pro gram to promote the core elements of the Positive Action classroom curriculum and to encourage and reinforce positive actions throughout the entire school.[22]

Classroom teachers delivered the inter vention.[28] Before the beginning of each academic year, teachers, administrators, and support staff (e.g., counselors) attended Positive Action program training sessions conducted by the program developer (Carol Allred). The training sessions lasted approximately 3 to 4 hours for the initial year and 1 to 2 hours for each successive year. Booster sessions conducted by the Hawaii based project coordinator were pro vided at least once during the academic year for each school. These lasted approximately 30 to 50 minutes. Additionally, mini conferences were held in February of each year for 5 to 6 leaders and staff (e.g., principals, counselors, teachers) from each of the 10 participating schools. The mini conferences gave participants an opportu nity to share ideas and experiences as well as to get answers to any questions regarding program implementation.

Sample

When students reached fifth grade (aged 10 11 years) they were asked to obtain active parental consent and to provide verbal assent to respond to 11 items asking about substance use (5 items), violent behavior (5 items), and sexual activity (1 item). This request garnered responses from 976 intervention students (50% girls) and 738 control students (50% girls), a response rate of 86%. We assessed differential selection bias by having all students in the study complete a separate negative be haviors scale developed for this study (i.e., blame others for mistakes, copy someone else's work, hit others, tell lies, say things to hurt others feelings, take something that doesn't belong to you, bully other kids, not feel good about who you are, get into fights, feel un happy) in fifth grade, and we compared scale results between students whose parents pro vided active consent and students who did not receive active parental consent. No significant ($\alpha \geq .05$) differences between the 2 groups were observed.

We analyzed descriptive characteristics (e.g., gender, ethnicity) and baseline year (2001 2002) responses to behavior and attitudinal scales that reflect known correlates of early violence and substance use, to determine whether students who dropped out of the study were different at baseline within intervention and control groups (separately) from those who remained in the study after baseline. Additionally, we compared students in the

intervention group with students in the control group who dropped out of the study after baseline.

At year 5, control group students were assessed on the negative behavior scale de scribed in the previous paragraph to examine whether those control group students who were surveyed each of the 5 years were sig nificantly different from those control group students who entered the study after baseline. The results of the analyses (not presented here) indicated no significant differences on the negative behavior scale.

The self identified ethnicities of students at fifth grade were as follows: primarily Hawaiian or part Hawaiian (26.1%), multiple ethnic backgrounds (22.6%), non Hispanic White (8.6%), African American (1.6%), American Indian (1.7%), other Pacific Islander (4.7%), Japanese (4.6%), other Asian (20.6%), other (7.8%), and unknown (1.6%).

Lifetime Prevalence Rates

Student self-reports. Our fifth grade respon dents answered experimenter developed sur vey questions about their lifetime use of substances (5 items; e.g., tobacco, alcohol), involvement in violent behaviors (5 items; e.g., carried a knife, threatened someone), and vol untary sexual activity (Table 1). Students were asked to respond on a scale of 0 to 2 (0=no, never; 1=yes, once; and 2=yes, more than once). Because of the low prevalence rates of the latter 2 responses, each variable was di chotomized (0=no, never; or 1=ever). For the substance use and violent behavior categories, items were then summed to create a count variable (0 5) indicating how many of the 5 behaviors the student had ever performed. Previous studies[29–33] have indicated that self reports of substance use and violent behavior generally provide valid measures of student behavior.

Teacher reports of student behavior. In years 4 and 5 of the study, teachers were asked to report on a scale of 1 to 3 how well each item in a 7 item behavioral checklist described each child in their class (1=not at all, 2=moderately well, 3=very well). The checklist only in cluded items related to substance use and violent behaviors. Four of these items focused on violent behavior (e.g., physically hurts others), and the other 3 related to use or potential use of substances (e.g., smokes cigarettes; Table 1). As with the student items, the affirmative ratings 2 and 3 were collapsed and treated as dichotomies (0=not at all, or 1=well), and the items were summed to con struct a count of observed violent behavior (0 4) and a count for substance use (0 3).

Analyses

To examine the difference in prevalence rates between intervention and control group students, we initially used the dichot omized single items (Table 1) to calculate 2 level logistic models (with students nested within schools) for student and teacher re ports of student behavior. As is typical for students in this age range, frequency distri butions for the negative behavior count scales were skewed, with the majority of students (range=86% 98% across behav iors) reporting zero (i.e., "No, never") nega tive behaviors. Hence, the variance of the outcome scales was much larger than the mean; therefore, we conducted preliminary analyses testing for overdispersion.[34] Overdispersion was taken into account in the Poisson models by including a random effect at the student level, which adds a parameter reflecting unobserved heterogeneity among ob servations (often as a result of unobserved covariates that vary among the units of obser vation).[35]

We used the likelihood ratio test to compare nested models, as well as a 2 level Poisson model and a 2 level Poisson model with an overdispersion parameter. For the substance use count scale for student self reports, the likelihood ratio χ^2 was 347.0 ($P<.001$); for teacher reports, the likelihood ratio χ^2 was 114.72 ($P<.001$). For student self reports on the violent behaviors count scale, the likelihood ratio χ^2 was 293.66 ($P<.001$); for teacher reports, the likelihood ratio χ^2 was 174.85 ($P<.001$). These results indicated that the overdispersion model fit the data better for all scales, so we used the overdispersion model in all subsequent analyses.

For the primary analyses, we used 2 level overdispersion random effects Poisson models to model program effects (student self reports and teacher reports of student behavior) for the substance use and violent behaviors count scales. We included predictors to test for treatment effects (Positive Action program=1), for variations in effects for boys versus girls, and whether a differential treatment effect existed between boys and girls (treatment× gender interaction). For sexual activity data (these data were only obtained by student self report), a 2 level logistic regression model was estimated with the same predictors. The treatment effect test of significance was evalu ated on a *t* distribution with 18 degrees of freedom to account for the unit of randomiza tion (i.e., the school). Additionally, because of the small number of pairs (n=10), the random effects models were conducted as unmatched.[36,37]

We conducted secondary analyses (2 level overdispersion random effects Poisson models) to examine the dose response of program exposure (measured in years) on negative be haviors. We created dummy variables that corresponded with 1 to 2 years and 3 to 4 years of exposure to the program versus no ex posure (i.e., control). We created these cate gories because of the low number of students exposed to only 1 year of the program (n=73) and because girls in the intervention group who were exposed to 3 years of the program reported no voluntary sexual activity.

All analyses were conducted with general ized linear latent and mixed models[35] in Stata version 9.2 (StataCorp LP, College Station, TX). Previous reports from the Positive Action pro gram[22,23] provided empirical support for the expectation of beneficial effects (fewer negative behaviors) from exposure to the program.[38] Hence, we presented all tests of significance as directional (1 tailed, with 90% confidence inter vals reported) given our a priori hypothesis that the program would result in only positive effects and because the practical consequence of finding that the intervention resulted in an in crease in negative behaviors would be the same as finding no difference i.e., the implication would be that schools should not use the program.[39]

Because of the matched pair design and the possibility of bias in the analyses resulting from matched schools,[40] conserva tive follow up paired analyses were conducted to substantiate the estimates from the 2 level unmatched analyses. For that analysis, preva lence rates were collapsed at the school level to calculate the school specific prevalence rate.

TABLE 1—Self-Reported and Teacher-Reported Student Substance Use, Violent Behaviors, and Voluntary Sexual Activity Among Fifth Graders: Positive Action, Hawaii, 2005–2006

	Boys			Girls			Boys and Girls			
	Control Group, %	Intervention Group, %	OR[a] (90% CI)	Control Group, %	Intervention Group, %	OR[a] (90% CI)	Control Group, %	Intervention Group, %	OR[a] (90% CI)	Effect Size[b]
Student self report										
Sample size, no.	366	491		372	485		738	976		
Substance use										
Smoked a cigarette (or used some other form of tobacco)	8.5	5.3	0.66 (0.30, 1.44)	6.7	2.7	0.38 (0.19, 0.76)	7.6	4.0	0.52 (0.31, 0.88)	0.41
Drank alcohol (beer, wine, or liquor)	22.5	12.2	0.48 (0.35, 0.65)	15.2	7.9	0.47 (0.28, 0.79)	18.8	10.1	0.48 (0.34, 0.68)	0.44
Got drunk on alcohol	6.6	1.6	0.24 (0.11, 0.49)	4.0	1.7	0.40 (0.16, 0.98)	5.3	1.6	0.30 (0.15, 0.57)	0.75
Used an illegal drug like marijuana or cocaine	5.5	1.8	0.34 (0.15, 0.78)	2.7	0.4	0.15 (0.04, 0.54)	4.1	1.1	0.28 (0.14, 0.54)	0.82
Got high on drugs	5.5	1.0	0.18 (0.07, 0.45)	1.6	0.4	0.25 (0.07, 0.97)	3.5	0.7	0.20 (0.09, 0.44)	0.99
Violent behaviors										
Carried a knife or razor to use to hurt someone	9.0	2.7	0.27 (0.16, 0.47)	3.2	1.7	0.51 (0.22, 1.17)	6.1	2.2	0.32 (0.18, 0.57)	0.64
Threatened to cut or stab someone	10.1	3.3	0.30 (0.17, 0.51)	4.6	2.3	0.48 (0.25, 0.92)	7.4	2.8	0.36 (0.24, 0.53)	0.62
Cut or stabbed someone on purpose to hurt them	6.0	1.8	0.29 (0.15, 0.56)	1.6	0.4	0.25 (0.06, 1.06)	3.8	1.1	0.29 (0.16, 0.52)	0.77
Carried a gun	18.1	7.0	0.33 (0.21, 0.54)	3.5	2.1	0.58 (0.29, 1.18)	10.7	4.5	0.40 (0.26, 0.62)	0.57
Shot at someone	8.5	2.3	0.25 (0.13, 0.49)	2.4	0.4	0.17 (0.05, 0.61)	5.4	1.3	0.24 (0.14, 0.40)	0.89
Sexual activity										
Voluntary sex with someone of the opposite gender	9.3	1.4	0.14 (0.06, 0.31)	4.6	1.0	0.22 (0.09, 0.56)	6.9	1.2	0.18 (0.09, 0.36)	1.10
Teacher report of student behavior										
Sample size, no.	205	379		209	365		422	760		
Substance use										
Smokes (or may smoke) cigarettes (or uses other form of tobacco)	14.9	7.3	0.42 (0.18, 0.94)	10.7	8.6	0.78 (0.41, 1.50)	12.8	7.9	0.54 (0.28, 1.02)	0.33
Drinks or may drink alcohol	15.6	12.1	0.66 (0.26, 1.67)	10.5	12.5	1.16 (0.63, 2.16)	13.0	12.3	0.81 (0.41, 1.58)	0.04
Uses drugs like marijuana or cocaine	19.7	5.4	0.21 (0.08, 0.53)	15.5	7.5	0.42 (0.10, 1.68)	17.6	6.4	0.27 (0.10, 0.72)	0.69
Violent behaviors										
Sample size, no.	219	393		228	385		447	778		
Gets into a lot of fights	39.3	30.7	0.68 (0.50, 0.91)	26.8	15.3	0.52 (0.34, 0.80)	32.9	23.1	0.63 (0.47, 0.84)	0.30
Physically hurts others	29.7	25.6	0.84 (0.52, 1.35)	23.7	9.9	0.37 (0.19, 0.72)	26.6	17.8	0.61 (0.38, 0.97)	0.31
Threatens others	29.7	21.5	0.64 (0.46, 0.88)	22.4	15.1	0.67 (0.42, 1.07)	26.0	18.3	0.64 (0.47, 0.88)	0.27
Destroys things belonging to others	34.7	21.0	0.47 (0.33, 0.69)	19.3	10.1	0.53 (0.27, 1.05)	26.8	15.6	0.48 (0.31, 0.74)	0.41

Note. OR odds ratio; CI confidence interval. Lifetime prevalence percentages are reported. Student self report item stem: "Have you ever . . . ?" Teacher report of student behavior item stem: "How well does this item describe this child?"

[a]ORs based on a 2 level logistic model (students nested within school) with treatment condition as the sole predictor.

[b]Cox index effect size was calculated as ES $([\ln\{Odds_{Intervention}\}] \times [\ln\{Odds_{Control}\}]) / 1.65$.

Then, a paired sample *t* test (with 10 pairs) was calculated to examine treatment effects.[40] Polychoric correlations comparing student and teacher reports were calculated on the count scales for substance use and violent behaviors. Effect sizes for dichotomous outcomes (Cox index)[41] were calculated on student level data. The Cox index effect sizes were calculated as follows: the difference in the natural log of the odds of the event occurring in the intervention and control groups was divided by 1.65, where the odds were defined as the

proportion of the students having performed the behavior across all students within the intervention and control groups, separately.

RESULTS

Table 1 presents negative behavior prevalence rates from student and teacher reports of student behaviors for boys and girls, the combined rates for intervention and control group students, the 2 level logistic odds ratios, and effect sizes. Comparisons of the individual items indicated that, overall, prevalence rates were lower for intervention group students than for control group students, with a 48% to 86% lower probability of performing a given negative behavior. Corresponding effect sizes from student reports ranged from 0.41 to 1.10, with an average effect size of 0.73 (median=0.75). Effect sizes from teacher reports ranged from 0.04 to 0.69, with an average effect size of 0.34 (median=0.31). Correlations between student and teacher reports were 0.18 and 0.27 for substance use and violent behaviors, respectively.

The estimates for the treatment effect on substance use and violent behaviors (2 level Poisson models) and sexual activity (2 level binary model) are presented in Table 2. The intraclass correlation coefficients for the unconditional models of student self reports were 0.06, 0.05, and 0.28 for violent behaviors, substance use, and sexual activity, respectively, and 0.04 and 0.14 for teacher reports of student violent behaviors and substance use, respectively.[42,43] For substance use, student self reported lifetime prevalence rates were significantly lower for students who received the Positive Action intervention (rate ratio [RR]=0.41; 90% confidence interval [CI]=0.25, 0.66). Teacher report of student substance use was nonsignificant (RR=0.66; 90% CI=0.30, 1.45), with an interaction effect for boys receiving the Positive Action intervention (RR=0.59; 90% CI=0.34, 1.00). For violent behaviors, student self report was significantly lower for students who received the intervention (RR=0.42; 90% CI=0.24, 0.73), with teacher reports confirming this effect (RR=0.54; 90% CI=0.30, 0.77). The 2 level random effects binary model indicated that lifetime sexual activity was lower for students attending Positive Action intervention schools (odds ratio=0.24; 90% CI=0.08, 0.66).

TABLE 2—Predictors of Violent Behavior, Substance Use, and Sexual Activity Among Fifth Graders: Positive Action, Hawaii, 2005–2006

	Substance Use[a]		Violent Behaviors[a]		Sexual Activity[b]	
	RR (90% CI)	*P*	RR (90% CI)	*P*	OR (90% CI)	*P*
Student self report						
Group[c]	0.41 (0.25, 0.66)	.007	0.42 (0.24, 0.73)	.002	0.24 (0.08, 0.66)	.013
Gender[d]	1.69 (1.20, 2.39)	.006	4.44 (2.89, 6.81)	<.001	2.21 (1.33, 3.69)	.006
Group×gender	1.07 (0.65, 1.80)	.402	0.67 (0.35, 1.28)	.158	0.61 (0.20, 1.84)	.233
Teacher report of student behavior						
Group[c]	0.66 (0.30, 1.45)	.187	0.54 (0.30, 0.77)	.004		
Gender[d]	1.54 (1.04, 2.30)	.037	1.55 (1.21, 1.98)	.002		
Group×gender	0.59 (0.34, 1.00)	.052	1.24 (0.90, 1.72)	.137		

Note. RR rate ratio; CI confidence interval; OR odds ratio. The *P* values were 1 tailed.
[a]Overdispersion random effects Poisson estimates.
[b]Two level binary random effects estimates.
[c]Intervention 1; control 0. *P* value evaluated on 18 degrees of freedom.
[d]Boys 1; girls 0.

In support of the 2 level models, the paired sample *t* test results indicated a significant treatment effect for student self report of substance use (*P*=.004) and violent behaviors (*P*=.010), although the finding for sexual activity was nonsignificant (*P*=.073; Table 3). Teacher reports of student behaviors indicated a nonsignificant effect for substance use (*P*=.058) and a significant effect for violent behaviors (*P*=.035).

We observed a dose response trend for both student and teacher reports of student behaviors. Students who had received 3 to 4 years of the program had significantly lower reports than did those students receiving a lower dose of the program of substance use (student self report: RR=0.36; 90% CI=0.25, 0.50; teacher report: RR=0.48; 90% CI=0.24, 0.97), violent behavior (student self report: RR=0.26; 90% CI=0.18, 0.37; teacher report: RR=0.59; 90% CI=0.44, 0.78), and engaging in voluntary sexual activity (student self report: RR=0.11; 90% CI=0.05, 0.26; Table 4).

DISCUSSION

This cluster randomized study extends the positive findings of previous quasi experimental studies of the Positive Action program[22,23]

TABLE 3—Average Rate per School for Substance Use, Violent Behaviors, and Sexual Activity Among Fifth-Graders: Positive Action, Hawaii, 2005–2006

	Control Group, Mean (SD)	Intervention Group, Mean (SD)	*P*[a]
Student self report			
Substance use	0.407 (0.146)	0.227 (0.196)	.004
Violent behaviors	0.351 (0.082)	0.169 (0.180)	.010
Sexual activity	0.065 (0.0502)	0.024 (0.043)	.073
Teacher report of student behavior			
Substance use	0.472 (0.352)	0.247 (0.271)	.058
Violent behaviors	1.247 (0.602)	0.819 (0.335)	.035

Note. Data were calculated from a school level matched pair *t* test for average counts per school (N 20). For the control group, n 10; for the intervention group, n 10.
[a]One tailed paired sample *t* test with 9 degrees of freedom.

TABLE 4—Dose–Response for Violent Behavior, Substance Use, and Sexual Activity Among Intervention-Group Fifth-Graders: Positive Action, Hawaii, 2005–2006

	Substance Use[a]		Violent Behaviors[a]		Sexual Activity[b]	
	RR (90% CI)	*P*	RR (90% CI)	*P*	OR (90% CI)	*P*
Student self report						
Gender	1.74 (1.36, 2.26)	<.001	3.64 (2.69, 5.16)	<.001	2.00 (1.27, 3.14)	0.006
1 2 y of participation	0.73 (0.47, 1.14)	.122	0.58 (0.36, 0.92)	.028	0.42 (0.18, 0.98)	0.047
3 4 y of participation	0.36 (0.25, 0.50)	<.001	0.26 (0.18, 0.37)	<.001	0.11 (0.05, 0.26)	<.001
Teacher report of student behavior						
Gender	1.15 (0.88, 1.50)	.199	1.74 (1.48, 2.05)	<.001		
1 2 y of participation	0.57 (0.27, 1.22)	.111	0.72 (0.51, 1.01)	.054		
3 4 y of participation	0.48 (0.24, 0.97)	.043	0.59 (0.44, 0.78)	.001		

Note. RR rate ratio; CI confidence interval; OR odds ratio. Dose response was calculated based on the number of years of exposure to the Positive Action program. The *P* value was 1 tailed.
[a]Overdispersion random effects Poisson estimates.
[b]Two level binary random effects estimates.

by examining effects on student and teacher reports of student involvement in negative be haviors. Students who received the Positive Ac tion intervention were significantly less likely to engage in substance use, violent behaviors, and sexual activity than were students who did not. The effects sizes averaged 0.73 and 0.34 for student and teacher reports, respectively, corre sponding to a reduction in likelihood of having ever done the behavior ranging from 48% to 86%, compared with students who did not receive the Positive Action intervention.

The observed effects were consistent with (and sometimes stronger than) the effects reported in recent systematic reviews and meta analyses of school based programs tar geting negative behaviors. In these studies, the average effect size was approximately .30[16] for school based substance use programs with in teractive components and ranged from 0.20 to 0.35 for programs targeting aggressive and dis ruptive behaviors,[17] resulting in an average re duction of approximately 17.5% (range=2.3% 45.3%).[44] Hence, the effect sizes (based on student reports) observed in our study fall at the upper end of the effect size continuum,[16] sug gesting that the introduction of a comprehensive schoolwide social and character development program can cause substantial reductions in the prevalence of these negative behaviors during early adolescence.[2,19] The reduction in the odds of students using substances and performing violent behaviors by approximately 58% and of having sex voluntarily by 76% has provided clear public health benefits for the Hawaii school district, particularly in light of the high prevalence rates of middle school and high school youths involved in such be haviors statewide.[3]

The large effects observed here were likely the result of several important features of the Positive Action program. First, the Positive Action program is "interactive" in delivery: it integrates teacher student contact and com munication opportunities for the exchange of ideas, and it uses feedback and constructive criticism in a nonthreatening atmosphere. In teractive methods produce stronger beneficial program outcomes than do noninteractive de livery methods (i.e., those that are didactic in nature).[16] Second, the Positive Action program is a comprehensive approach to prevention that provides the curriculum to all grades in the school at once, involving all teachers, staff, and parents. Third, the Positive Action program is a holistic approach to social and emotional devel opment that addresses the self, emotional regu lation, moral development, decision making, skills development in these areas, and clear identification of which behaviors are positive, rather than focusing solely on the negative as pects of engaging in substance use and violence. Fourth, the program is intensive, with students receiving approximately 1 hour of exposure during a typical week. The magnitudes of the effect size differed between the student and teacher reports; this was most likely a result of teachers' inability to observe the students' behaviors at all times, leading to an underesti mation of how well the item described the student.

The dose response analyses clearly dem onstrate that more exposure to the program decreased the number of reported negative behaviors. Those students who received 3 or more years of the Positive Action program reported 41% to 73% fewer experiences with substance use and violent behaviors and an 89% lower rate of engaging in voluntary sexual activity than did students who received less exposure to the Positive Action program. Re ductions were still observed for students ex posed for 1 or 2 years (although not all of the reductions were significant), suggesting that even a short exposure had a beneficial effect. Exposing youths to the program for an addi tional 1 to 2 years appeared to reduce the negative behaviors by half. Hence, these find ings suggest that an adequate test of the inter vention's potential effectiveness could only be conducted after students had been exposed to the program for 3 or more years. This finding suggests that multiyear trials are necessary to realize the full effect of a comprehensive pre vention program.

This study had some limitations that require attention. First, the reports of negative behav iors were collected only during fifth grade and only for the 2 cohorts followed in the study, and therefore may not reflect the behavior of the entire student body. This limitation was a result of the study design and of restrictions required by the institutional review board that prevented the use of sensitive questions with younger (i.e., fourth grade and below) students.

Second, only students who provided active parental consent and verbal assent responded to the negative behavior items. For the student self report data, it is possible that some kind of selection effect led to a sample that was not typical of all the students in the schools studied. Our empirical tests for such a selection effect found no such difference in the area of negative behaviors. The negative behavior rates reported in this study are consistent with rates reported for children of similar ages across the Hawaii school district[3] and are therefore likely to be representative of actual behavioral in volvement.

Also, the use of a single item to assess voluntary sexual activity is unlikely to capture

all the types of sexual activity that youth engage in. Moreover, the low prevalences of the negative behaviors makes it difficult to determine whether the program would have the same size of effect on older youths (i.e., middle school), when these behaviors become more prevalent. Finally, no adjustment for type 1 error rates in the analyses (as a result of multiple tests) were made, which should be considered when interpreting the significance levels of the findings.

Overall, our findings indicate that the Positive Action program can be effective in reducing multiple problem behaviors simultaneously. Programs such as Positive Action can reduce the burden on school administrators and teachers and ameliorate the demand on limited resources[21] by reducing the rates of multiple problem behaviors. We are unaware of previous studies reporting the effects of prevention programs on the scale presented herein; thus, this study is likely the first to provide evidence that a comprehensive, schoolwide social and character development program can have a substantial impact on reducing problem behaviors of public health importance for more than a thousand students at a time. Although numerous school based prevention programs exist, the Positive Action program is one of the few that has demonstrated substantial effects on multiple negative behaviors. ■

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Contributors

M.W. Beets supervised the study, oversaw statistical analysis, and drafted the article. B.R. Flay conceptualized the study design, acquired the data, and supervised the study. S. Vuchinich, A. Acock, and K. K. Li oversaw statistical analysis. All authors analyzed and interpreted the data and participated in revising the article.

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Carol Allred is the developer of the Positive Action program and owner of Positive Action, Inc, a company that markets the program to schools and communities. B.R. Flay is married to Carol Allred, but has no direct financial interest in Positive Action, Inc. B.R. Flay, initially at the University of Illinois at Chicago, subsequently at Oregon State University, designed the study and obtained research funding. Potential conflicts of interest were managed by (1) data collection by an independent sub contractor (Jonathon Wang, DataWise Hawaii), (2) the supervision and review of statistical analyses by Oregon State University co investigators (A. Acock and S. Vuchinich), and (3) an independent review of the data, results, and report by J. Durlak.

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Human Participant Protection

All assessments and procedures were approved by the institutional review boards of the University of Illinois at Chicago and Oregon State University. Students were asked to obtain active parental consent and to provide verbal assent to participate in the study.

References

1. Botvin GJ, Schinke S, Orlandi MA. School based health promotion: substance abuse and sexual behavior. *Appl Prev Psychol.* 1995;4:167 184.

2. Flay BR. Positive youth development requires comprehensive health promotion programs. *Am J Health Behav.* 2002;26(6):407 424.

3. Pearson RS. *Ka Leo O Na Keiki: The 2003 Hawaii Student Alcohol, Tobacco, and Other Drug Use Study (1987 2003): Hawaii Adolescent Prevention and Treatment Needs Assessment: Executive Summary 2003.* Kapolei: Hawaii Department of Health, Alcohol and Drug Abuse Division; 2004.

4. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. *Monitoring the Future: National Results on Adolescent Drug Use: Overview of Key Findings 2007.* Bethesda, MD: National Institute on Drug Abuse; 2008.

5. Eaton DK, Kann L, Kinchen S, et al. Youth risk behavior surveillance United States, 2005. *J Sch Health.* 2006;76(7):353 372.

6. Gustavson C, Stahlberg O, Sjodin AK, Forsman A, Nilsson T, Anckarsater H. Age at onset of substance abuse: a crucial covariate of psychopathic traits and aggression in adult offenders. *Psychiatry Res.* 2007;153(2):195 198.

7. Merline AC, O'Malley PM, Schulenberg JE, Bachman JG, Johnston LD. Substance use among adults 35 years of age: prevalence, adulthood predictors, and impact of adolescent substance use. *Am J Public Health.* 2004;94(1):96 102.

8. DuRant RH, Smith JA, Kreiter SR, Krowchuk DP. The relationship between early age of onset of initial substance use and engaging in multiple health risk behaviors among young adolescents. *Arch Pediatr Adolesc Med.* 1999;153(3):286 291.

9. Ikeda RM, Simon TR, Swahn M. The prevention of youth violence: the rationale for and characteristics of four evaluation projects. *Am J Prev Med.* 2001;20(suppl 1):15 21.

10. Hallfors DD, Waller MW, Bauer D, Ford CA, Halpern CT. Which comes first in adolescence sex and drugs or depression? *Am J Prev Med.* 2005;29(3):163 170.

11. Limbos MA, Chan LS, Warf C, et al. Effectiveness of interventions to prevent youth violence: a systematic review. *Am J Prev Med.* 2007;33(1):65 74.

12. Wilson DB, Gottfredson DC, Najaka SS. School based prevention of problem behaviors: a meta analysis. *J Quant Criminol.* 2001;17(3):247 272.

13. Flay BR. Efficacy and effectiveness trials (and other phases of research) in the development of health promotion programs. *Prev Med.* 1986;15:451 474.

14. Flay BR, Biglan A, Boruch RF, et al. Standards of evidence: criteria for efficacy, effectiveness and dissemination. *Prev Sci.* 2005;6(3):151 175.

15. Flay BR, Collins LM. Historical Review of school based randomized trials for evaluating problem behavior prevention programs. *Ann Am Acad Pol Soc Sci.* 2005;599:115 146.

16. Tobler NS, Roona MR, Ochshorn P, Marshall DG, Streke AV, Stackpole KM. School based adolescent drug prevention programs: 1998 meta analysis. *J Prim Prev.* 2000;20(4):275 336.

17. Wilson SJ, Lipsey MW. School based interventions for aggressive and disruptive behavior: update of a meta analysis. *Am J Prev Med.* 2007;33(2):S130 S143.

18. Tobler NS, Stratton HH. Effectiveness of school based drug prevention programs: a meta analysis of the research. *J Prim Prev.* 1997;18(1):71 128.

19. Romer D. *Reducing Adolescent Risk: Toward an Integrated Approach.* Thousand Oaks, CA: Sage; 2003.

20. Catalano RF, Hawkins JD, Berglund ML, Pollard JA, Arthur MW. Prevention science and positive youth development: competitive or cooperative frameworks? *J Adolesc Health.* 2002;31(suppl 6):230 239.

21. Botvin GJ, Griffin KW, Nichols TD. Preventing youth violence and delinquency through a universal school based prevention approach. *Prev Sci.* 2006;7(4):403 408.

22. Flay BR, Allred CG. Long term effects of the Positive Action program. *Am J Health Behav.* 2003;27:S6 S21.

23. Flay BR, Allred CG, Ordway N. Effects of the Positive Action program on achievement and discipline: two matched control comparisons. *Prev Sci.* 2001;2(2):71 89.

24. *School Accountability: School Status & Improvement Report.* Honolulu: State of Hawai'i Department of Education Systems Accountability Office; 2006.

25. Dent CW, Sussman S, Flay BR. The use of archival data to select and assign schools in a drug prevention trial. *Eval Rev.* 1993;17(2):159 181.

26. Purkey WW. *Self Concept and School Achievement.* Englewood Cliffs, NJ: Prentice Hall; 1970.

27. Flay BR, Petraitis J. The theory of triadic influence: a new theory of health behavior with implications for preventive interventions. In: Albrecht GS, ed. *A*

Reconsideration of Models of Health Behavior Change. Greenwich, CT: JAI Press; 1994:19–44.

28. Beets MW, Flay BR, Vuchinich S, Acock AC, Li KK, Allred C. School climate and teachers' beliefs and attitudes associated with implementation of the positive action program: a diffusion of innovations model. *Prev Sci.* 2008;9(4):264–275.

29. Single E, Kandel D, Johnson BD. The reliability and validity of drug use responses in a large scale longitudinal survey. *J Drug Issues.* 1975;5(4):426–443.

30. Pechacek TF, Murray DM, Luepker RV, Mittelmark MB, Johnson CA, Shutz JM. Measurement of adolescent smoking behavior: rationale and methods. *J Behav Med.* 1984;7(1):123–140.

31. Hawkins JD, Catalano RF, Kosterman R, Abbott R, Hill KG. Preventing adolescent health risk behaviors by strengthening protection during childhood. *Arch Pediatr Adolesc Med.* 1999;153(3):226–234.

32. Herrenkohl TI, Kosterman R, Mason WA, Hawkins JD. Youth violence trajectories and proximal characteristics of intimate partner violence. *Violence Vict.* 2007; 22(3):259–274.

33. Mason WA, Kosterman R, Hawkins JD, Herrenkohl TI, Lengua LJ, McCauley E. Predicting depression, social phobia, and violence in early adulthood from childhood behavior problems. *J Am Acad Child Adolesc Psychiatry.* 2004;43(3):307–315.

34. Long JS, Freese J. *Regression Models for Categorical Dependent Variables Using Stata.* College Station, TX: Stata Press; 2006.

35. Rabe Hesketh S, Skrondal A. *Multilevel and Longitudinal Modeling Using Stata.* College Station, TX: Stata Corp LP; 2005.

36. Diehr P, Martin DC, Koepsell T, Cheadle A. Breaking the matches in a paired *t* test for community interventions when the number of pairs is small. *Stat Med.* 1995;14(13):1491–1504.

37. Donner A, Taljaard M, Klar N. The merits of breaking the matches: a cautionary tale. *Stat Med.* 2007; 26(9):2036–2051.

38. Gorman DM. The best of practices, the worst of practices: the making of science based primary prevention programs. *Psychiatr Serv.* 2003;54(8):1087–1089.

39. Knottnerus JA, Bouter LM. The ethics of sample size: two sided testing and one sided thinking. *J Clin Epidemiol.* 2001;54(2):109–110.

40. Donner A, Klar N. *Design and Analysis of Cluster Randomization Trials in Health Research.* London, England: Arnold; 2000.

41. Cox DR. *Analysis of Binary Data.* New York, NY: Chapman & Hall/CRC; 1970.

42. Browne WJ, Subramanian SV, Jones K, Goldstein H. Variance partitioning in multilevel logistic models that exhibit overdispersion. *J R Stat Soc A Stat Soc.* 2005; 168(3):599–613.

43. Merlo J, Chaix B, Ohlsson H, et al. A brief conceptual tutorial of multilevel analysis in social epidemiology: using measures of clustering in multilevel logistic regression to investigate contextual phenomena. *J Epidemiol Community Health.* 2006;60(4):290–297.

44. Hahn R, Fuqua Whitley D, Wethington H, et al. Effectiveness of universal school based programs to prevent violent and aggressive behavior: a systematic review. *Am J Prev Med.* 2007;33(2):S114–S129.