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Direct and Mediated Effects of a Social-Emotional and Character Development Program on Adolescent Substance Use.

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Mitigating and preventing substance use among adolescents requires approaches that address the multitude of factors that influence this behavior. Such approaches must be tested, not only for evidence of empirical effectiveness, but also to determine the mechanisms by which they are successful. The aims of the present study were twofold: 1) To determine the effectiveness of a school-based social-emotional and character development (SECD) program, Positive Action (PA), in reducing substance use (SU) among a sample of U.S. youth living in a low-income, urban environment, and 2) to test one mechanism by which the program achieves its success. We used longitudinal mediation analysis to test the hypotheses that: 1) students attending PA intervention schools engage in significantly less SU than students attending control schools, 2) students attending PA intervention schools show significantly better change in SECD than students attending control schools, and 3) the effect of the PA intervention on SU is mediated by the change in SECD. Analyses revealed program effects on both SECD and SU, a relationship between SECD and SU, and the effects of PA on SU were completely mediated by changes in SECD. Future research directions and implications for school-based social-emotional and character development efforts and substance use prevention are addressed.

Keywords: Social-emotional, Substance Use, Adolescence, Longitudinal, Mediation

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Introduction

The use and abuse of licit and illicit drugs among adolescents remains a critical public health problem in the United States. The most recent findings from *Monitoring the Future* (Johnston et al., 2011), an ongoing U.S. nationally representative survey, reveal that by grade 8, approximately 20.0% and 35.8% of adolescents had initiated cigarette and alcohol use, respectively; by grade 12, lifetime prevalence increased to 42.2% and 71.0%, respectively. With respect to marijuana use, lifetime prevalence was 17.3% for grade 8 students and 43.8% for grade 12 students (Johnston et al., 2011). Given that early initiation of substance use (SU) is associated with engaging in other high risk behavior such as early sexual activity (Miller et al., 2007), as well as with adverse effects on development (Masten et al., 2009), academics (Miller et al., 2007; Yamada, Kendix, and Yamada, 1996), and relationships (Masten et al., 2009), there is a critical need for educational and public health interventions that aim to prevent adolescent SU. Moreover, as the etiology of adolescent SU is multifaceted (Cleveland et al., 2008; Petraitis et al., 1998), addressing the problem requires the use of innovative and comprehensive approaches (that involve students, schools, families, and communities). In addition, because economically disadvantaged neighborhoods tend to have higher rates of delinquent behaviors, including SU (Sampson, Raudenbush, and Earls, 1997), there is a particular need for programs that are effective in high-risk communities.

Many traditional efforts to address adolescent SU have focused on proximal causes (Flay, Snyder, and Petraitis, 2009) of SU, with limited success. Recent decades, however, have seen an increase in social-emotional and character development (SECD; Elias, 2009) programs that are comprehensive (i.e., involving families, schools, and the community) in nature. These programs are also known as social-emotional learning (SEL; Weissberg and O'Brien, 2004) or positive youth development (PYD; Catalano et al., 2002; Flay, 2002; Lerner et al., 2009; Lerner, Dowling, and Anderson, 2002; Lerner et al., 2005; Snyder and Flay, in press). SECD programs generally aim to promote positive behaviors while reducing negative behaviors. In a meta-analysis of 213 social and emotional learning (SEL) programs, Durlak and colleagues (2011) found that SEL programs significantly increased social and emotional skills; improved academic performance; improved students' attitudes about themselves, others, and school; improved positive social behaviors; and decreased conduct problems (including SU) and emotional distress. Although further research is needed to understand the mechanisms (e.g., mediation) through which SECD and SEL programs work, they have been shown to succeed when implemented comprehensively and with fidelity (Berkowitz and Bier, 2004; 2007; Durlak et al., 2011).

One area of focus in such programs is social-emotional and character development. The study of SECD has occurred in numerous research disciplines, including general education, moral education, citizen education, and positive psychology (Althof and Berkowitz, 2006; Berkowitz and Bier, 2004; Park, Peterson, and Seligman, 2004). Several concepts are included in definitions of SECD, such as positive interactions with peers, teachers, and parents (Selman, 2003; Schultz, Selman, and LaRusso, 2003); being honest with peers,

teachers, and parents (Park et al., 2004); emotional awareness and regulation (Eisenberg, Champion, and Ma, 2004); self development (King et al., 2005; Lerner et al., 2005); positive traits, such as kindness and hope (Park, 2004); and moral functioning, such as moral values and reasoning (Berkowitz and Bier, 2004), many of which overlap with definitions of social-emotional development (Washburn et al., 2011). For the purpose of this paper, SECD includes positive interactions and feelings associated with these interactions with influential socializing agents such as parents and teachers, as well as social and emotional competence, prosocial interactions, honesty, self-improvement, and self-control (DuBois et al., 2010; Ji, DuBois, and Flay, 2011). SEL and SECD-related programs seek to foster and reinforce these behaviors to create a multitude of positive outcomes among youth.

One example of a SECD program being implemented throughout the U.S. is *Positive Action* (*PA*). *PA* focuses on improving students' positive thoughts, feelings, and actions that are thought to impact outcomes of interest (Flay and Allred, 2010; Flay et al., 2009); that is, a mediated effect. It was expected that *PA* would improve not only a broad array of measurable indicators of development (e.g., SECD), but measureable behaviors (e.g., SU) as well. Previous quasi-experimental and experimental evaluations found significant effects of *PA* on several outcomes. For example, in a quasi-experimental study on 13 schools in a large Nevada school district, schools receiving *PA* had higher achievement scores and fewer violent incidents, disciplinary referrals, and suspensions (Flay, Allred, and Ordway, 2001). Additionally, in a cluster-randomized controlled trial (CRCT) of *PA* in Hawaii schools, which followed students in 20 schools from grade 1 or 2 through grade 5 or 6, students receiving *PA* were less likely to engage in SU behaviors, violent behaviors, or sexual activity (Beets et al., 2009). At the school level, *PA* improved school quality (Snyder et al., 2012) and *PA* schools had higher academic achievement and school performance, as well as less absenteeism and fewer disciplinary referrals and suspensions (Flay and Allred, 2010; Snyder et al., 2010). In the Chicago CRCT (on which this paper is based) students from 14 K-8 schools were followed. Li and colleagues (2011) found that students receiving *PA* reported less SU, violence, and bullying behaviors in grade 5 than control students. Moreover, Washburn and colleagues (2011) found that while SECD-related behaviors decreased over time for both *PA* and control students, *PA* significantly mitigated this decline.

To date, the effects of *PA* on SU in middle school grades (i.e. grade 6 to 8) have not been reported, and SECD has not been examined as a mediator in the *PA*→SU pathway. As such, the purpose of the present study was to examine if changes in SECD mediate the effects of *PA* on reducing SU at grade 8 among U.S. youth living in a low-income, urban environment. We used longitudinal mediation analysis to test the hypotheses that: 1) students attending *PA* intervention schools continued to engage in significantly less SU than students attending control schools, 2) students attending *PA* intervention schools show significantly better change in SECD than students attending control schools and 3) the effects of the *PA* intervention on SU are mediated by the change in SECD.

Method

Positive Action (http://www.positiveaction.net; Flay and Allred, 2010) is a comprehensive, school-wide, SECD program grounded in the theory of self-concept (DuBois, Flay, and Fagen, 2009; Purkey, 1970; Purkey and Novak, 1970) and is consistent with social-ecological theories of health behaviors such as the Theory of Triadic Influence (TTI; Flay and Petraitis, 1994; Flay, Snyder, and Petraitis, 2009). The program posits that students who engage in positive behaviors will have more positive feelings about themselves and subsequent positive thoughts, leading back to more positive behaviors. Moreover, *PA* proposes a link between positive and negative behaviors, with increased positive feelings, thoughts, and actions resulting in fewer negative behaviors (Flay and Allred, 2010).

The *PA* program consists of a K-12 curriculum, of which the K-8 portion was used for this study. The sequenced classroom curriculum consists of over 140 15-minute, age-appropriate lessons taught 4 days per week for grades K-6, and 70 lessons taught 2 days per week for grades 7 and 8. In addition to the student core curriculum, the *PA* program includes teacher training; counselor, family, and community training; and school-wide climate development. The core curriculum consists of the following six content units: self-concept, positive actions for body and mind, social and emotional positive actions focusing on getting along with others, and managing, being honest with, and continually improving oneself. There is no content addressing substance use explicitly.

Design and Sample

Schools participating in this study were drawn from the 483 K-6 and K-8 Chicago Public Schools. Schools were excluded from participation if they: 1) were non-community schools (e.g., charter schools), 2) already had *PA* or a similar intervention, 3) had an enrollment rate below 50 or above 140 students per grade, 4) had annual student mobility rates over 40%, 5) had more than 50% of students who passed the Illinois State Achievement Test (ISAT), and 6) had fewer than 50% of students who received free lunch. These latter criteria ensured the selection of high-risk schools. Using the above criteria, 68 (approximately 14%) schools were eligible to participate, from which seven matched pairs were selected. Funding for the present trial was sufficient for only 14 schools. Schools were matched using a SAS program provided by Mathematica Policy Research (Schochet and Novak, 2003) using the variables that are known predictors of student achievement and problem behaviors, which are primary outcomes of interest of the *PA* program. These matching variables include: ethnicity, percentage of students who met or exceeded criteria for passing the ISAT, attendance rate, truancy rate, percentage of students who received free lunch, percentage of students who enrolled in or left school during the academic year, number of students per grade, percentage of parents reported to demonstrate school involvement, percentage of teachers employed by the school who met minimal teaching standards, and information about school crime rates (Ji et al., 2008). Schools in each matched pair were then randomly assigned to either the *PA* or control condition (Ji et al., 2008). A series of t-tests revealed that the seven pairs of schools did not significantly differ from the remainder of the 68 schools eligible for the study, and the *PA*

and control schools were not significantly different from each other at baseline (see Ji et al, 2008) or endpoint on any of the matching variables.

The Chicago trial of *PA* is the first matched-pair CRCT investigating the effects of *PA* in a low-income, urban environment. The trial was longitudinal at the school level and used a cluster-focused intent-to-treat design with a dynamic cohort at the student level (Vuchinich et al., 2012); we surveyed all students in grade 3 in the fall of 2004 (before receipt of *PA*) and spring of 2005, all students in grade 4 in fall 2005 and spring 2006, all students in grade 5 in spring 2007, all students in grade 7 in fall 2008 and spring 2009, and all students at the end of grade 8 in spring 2010. All 14 schools stayed in the study and in their assigned condition throughout the duration of the study. The total student sample, the sample for the present study, was 1170. Approximately 21% (131) of the original 624 grade 3 students were still present at grade 8, illustrating the high mobility by low-income urban students (Tobler and Komro, 2011). The average number of waves of data per student was 3.1. School enrollment in Chicago schools was decreasing during the years of this study so that by Wave 8, we had approximately 58% of the baseline sample size; sample sizes were 624 and 363 at Waves 1 and 8, respectively. Tables I and II illustrate that *PA* and control schools were comparable at baseline on both school- and student-level indicators, respectively, and remained so at the end of grade 8. Specifically, Table I compares *PA* and control schools on school-level demographics at baseline (2004) and Wave 8 (2010); there were no significant differences on any of these demographics. Table II compares student-level demographics at baseline and Wave 8. Rates of student transitions into ("joiners") and out of ("leavers") study schools were higher for African-American students than for White, Hispanic, and Asian students, and students who transitioned out ("leavers") were older than those who stayed or joined study schools, but there were no significant differences in mobility patterns between *PA* and control schools.

Measures

Social-Emotional and Character Development: SECD, the hypothesized mediator, was measured using the 28-item Child SECD Scale (DuBois et al., 2010; Ji et al., 2011). This scale was adapted from multiple existing measures of social skills (Achenbach, 1991; Bar-On, 2002; Elliott et al., 1988; Goodman and Goodman, 2009; Leffert et al., 1998; Smart, 2003; Walker and McConnell, 1995; Wilson, O'Brien, and Sesma, 2009; Ji et al., 2011). In a study on the same sample as utilized in this paper, Ji et al. (2011) found that six first-order factors of these 28 items (Prosocial Interactions, Honesty, Self Development, Self Control, Respect for Teacher, and Respect for Parent) loaded on a single second-order factor, SECD skills. For this study, an average composite score of the 28 items was created for each of the eight waves, where higher composite scores indicate higher SECD skills. Example items are: "I try to cheer up other kids if they are feeling sad", "I apologize when I have done something wrong", "I speak politely to my teacher", "I keep my temper when I have an argument with other kids", "I listen (without interrupting) to my parents", and "I follow school rules".

Table I Descriptive statistics of school demographics at baseline and endpoint

	2004					2010				
	Control Schools N=299		*PA* Schools N=295		df=12	Control Schools N=171		*PA* Schools N=273		df=12
	M	SD	M	SD	*t*	M	SD	M	SD	*t*
% Male Students	52.64	2.89	52.47	2.11	0.13	52.09	2.42	52.09	2.22	0.00
% of White Students	9.38	14.80	9.07	12.68	0.04	8.57	13.81	7.49	11.53	0.16
% of Black Students	56.49	43.35	53.64	47.26	0.12	56.20	41.64	55.57	47.79	0.03
% of Hispanic Students	31.00	35.20	32.79	36.28	-0.10	31.8	34.06	32.60	38.94	-0.40
% of Asian American Students	2.91	4.30	4.21	6.57	-0.44	3.36	5.94	4.17	7.61	-0.22
% Students with LEP	11.41	14.10	17.04	17.20	-0.67	10.87	11.92	12.87	14.78	-0.28
% Students with an IEP	12.84	5.33	9.46	2.36	1.53	14.76	6.01	12.06	3.73	1.01
% Students Receiving a Free Lunch	81.46	3.81	85.51	4.56	-1.81	94.60	3.92	92.70	6.30	0.68
School Attendance Rate	93.54	1.09	93.74	1.79	-0.25	93.27	1.87	95.03	1.52	-2.01

Note: LEP= Limited English Proficiency, IEP= Individualized Education Plan. None of the above t-tests were significant at the $p< 0.05$ level.

Table II Attrition analysis on student demographics

	2004			2010						
	C Schools	*PA* Schools		C Schools			*PA* Schools			
			test statistic	S	L	J	S	L	J	test statistic
Demographics	N=308	N=316	*p*-value	N=44	N=228	N=217	N=50	N=240	N=265	*p*-value
% Male Students	44.59	47.06	z=-0.60, *p*=n.s.	8.81	63.52	27.67	13.26	55.80	30.94	z=1.02, *p*=n.s.
% of White Students	11.37	12.92	z=0.83, *p*= n.s.	6.82	10.81	7.37	6.25	11.41	9.09	z=-0.25, *p*= n.s.
% of Black Students	57.52	51.25	NA	47.73	62.16	46.32	43.75	52.17	63.64	NA
% of Hispanic Students	26.67	33.75	z=1.69, *p*<.10	45.45	21.62	45.26	45.83	34.24	22.73	z=-0.02, *p*= n.s.
% of Asian Students	4.71	2.08	z=-1.30, *p*= n.s.	0.00	5.41	1.05	4.17	2.17	4.55	z=-0.48, *p*= n.s.
Age										
Mean	8.32	8.30	*t*=0.57, *p*= n.s.	13.98	14.33	13.94	13.94	14.30	14.08	*t*=0.18, *p*= n.s.
SD	0.55	0.59		0.55	0.55	0.79	0.55	0.61	0.75	

Note: S=stayers, L= leavers, J=joiners. NA=not applicable; for ethnicity, Black was used as the reference group. Multinomial logistic regression revealed Black students to be more likely to change schools than White, Hispanic, and Asian students, and leavers to be older than stayers or joiners. Tests for condition effects across gender, ethnicity, and age were all non-significant at both time points.

Responses to these items were on a 4-point scale that allowed students to indicate how often they performed each SECD-related behavior (1= none of the time; 2= some of the time; 3= most of the time; and 4= all of the time). Alphas for the SECD scale were 0.88, 0.90, 0.90, 0.91, 0.90, 0.90, 0.90, and 0.92 for waves 1 through 8, respectively.

Substance Use: Substance use, the outcome of interest, was measured using five items adapted from the Risk Behavior Survey (Centers for Disease Control and Prevention, 2004). Students were asked to indicate if they had ever 1) smoked a cigarette (or used some other form of tobacco), 2) used alcohol (beer,

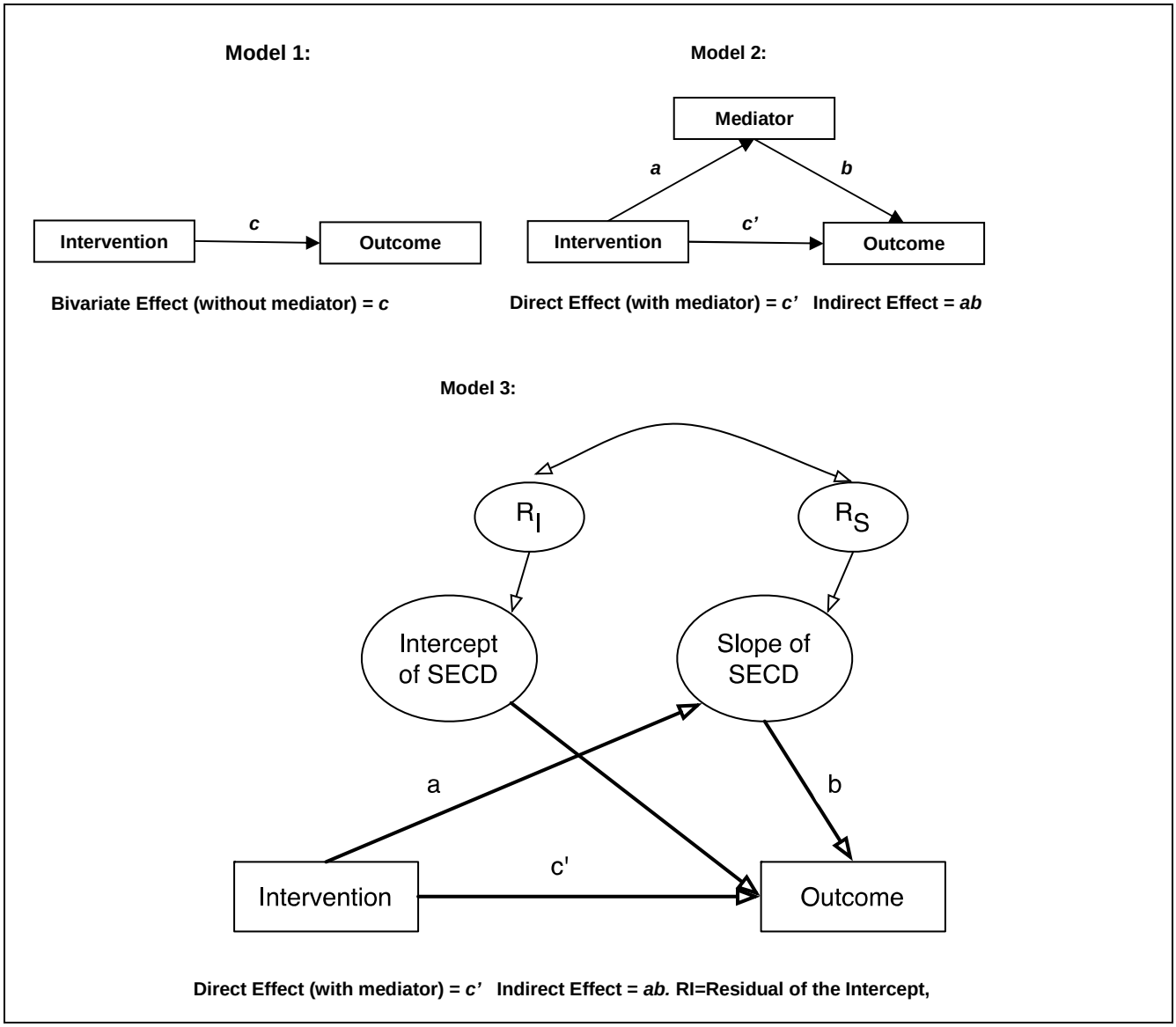
wine, or liquor), 3) gotten drunk on alcohol, 4) used marijuana, and 5) used any more serious drug. Responses to these items were 1= no; 2= yes, once; 3= yes, 2 to 5 times; and 4= yes, more than 5 times. Given the sensitive nature of SU-related questions, the perceived maturity of older (as compared to younger) students, and the rare occurrence of SU among young students, SU questions were first asked at Wave 5, when the students were in grade 5. Similar to the SECD measure, an average of these five items was used to create a composite score, with higher scores indicating more SU. Alphas for the SU scale were 0.71, 0.79, 0.78, and 0.78 for waves 5 through 8, respectively. Program effects on SU at the end of grade 5 were previously reported by Li et al. (2011); we focused our analyses on determining whether these effects were sustained through the end of grade 8.

Analysis

To test for program effects and mediation, we used the framework described by Baron and Kenny (1986) and MacKinnon (2000, 2002, 2008). Figure 1 illustrates a simple model (Model 1) relating an independent variable (X) to a dependent variable (Y), as well as a traditional mediation model (Model 2) where the mediator (M) mediates the effect of X on Y. Model 3 depicts a longitudinal mediation model that was used in the present study.

Model 1 estimates the bivariate effect, (*c*), of X on Y without the mediator included in the model, while Model 3 (or Model 2, for non-longitudinal mediation models) simultaneously estimates the direct effect (*c'*) of X on Y with the mediator included in the model and the mediated effect (*ab*), which consists of the effect of X on M (*a*) times M on Y (*b*) (MacKinnon, 2008). Mediation can be complete, partial, or non-significant (Baron and Kenny, 1986; MacKinnon et al., 2002).

Using longitudinal structural equation modeling (SEM; performed with M*plus* v6.11; Muthén and Muthén, 2011), a conceptual model was specified based on the hypothesis that the slope (i.e., growth/change) of SECD mediated the effect of the *PA* intervention on the observed SU outcome. The small number of clusters (i.e., 14 schools) and the non-normality of the outcome variable (SU), in combination with the technical complexities of mediation testing in a multilevel modeling framework precluded a multi-level SEM analysis (Hox and Maas, 2001; Marsh et al., 2009; Muthén, 1994; Preacher, Zyphur, and Zhang, 2010; Zhang, Zyphur, and Preacher, 2009); however, low intra-class correlations (SU ICC at wave 8 = 0.029; mean SECD ICC across eight waves = 0.057), as defined by Singer and Willet (2003), indicate that this is not a serious issue. Given the non-normality of the SU outcome distribution, we employed bootstrap estimation with 1,000 re-samples (Efron and Tibshirani, 1993); Williams and MacKinnon (2008) found bootstrap estimates to be more accurate and appropriate than standard *z* tests in mediation models. Missing values were handled using full information maximum likelihood estimation (Kenward and Molenberghs, 1998). To test for differences between boys and girls, a binary gender variable (boy = 1) was incorporated in the model as a covariate. Moreover, we tested an interaction term of intervention by gender to explore whether the treatment effect differed between boys and girls (the interaction term was non-significant, so the term was removed from the



Note: Adapted from MacKinnon (2008)

Figure 1 Terminology for the mediation model.

final model for parsimony). Previous research on the same SECD scale for the same sample tested for a quadratic trajectory, but found a linear model provided the best fit of the data (Washburn et al., 2011). Therefore the present study tested a linear model as well.

To test our hypotheses, we employed a two-step process. First, we calculated the bivariate effect of *PA* on the SU outcome without the mediator, change in SECD, present. Second, we included the mediator in the model to calculate direct and indirect effects. Indirect effects were computed as described by MacKinnon (2008).

Our analyses presented several challenges common to school-based prevention research. It was not feasible or appropriate to ask students about substance use at the baseline assessment (when they were only in

grade 3); therefore we were not able to control directly for any initial differences on this measure. Since randomization and matching for the Chicago CRCT occurred at the school level and the intervention has whole-school components, the unit of inference (Donner and Klar, 2004) is the school. That is, the focus of this trial is on the SECD scores and SU levels of the groups of students within these schools. An advantage of this approach is that the substantial individual differences among students can be taken into account when estimating intervention effects using growth-curve models with a random intercept for each student. Our sample size of 14 schools was maintained throughout all eight waves; no schools or pairs were dropped. Because of the school-level focus of the trial, students who left the participating schools were not followed, and consent was obtained for new entrants to the participating schools (Brown et al., 2008; Jones, Brown, and Aber, 2011; Vuchinich, et al., 2012).

To assess the robustness of the results, we conducted sensitivity analyses. We aggregated the data at the school level and used analysis of covariance to compare school-level means on our measures of SECD and SU at wave 8, controlling for school-level means at Wave 1 on SECD and a measure of problem behavior as a proxy control for SU (see Li et al., 2011), respectively. The sensitivity analysis is a way to determine if the trial impact estimates derived from one method (the growth curve model) are "sensitive" to different assumptions. Estimates of intervention effects using a different analysis method (ANCOVA) with different assumptions should be consistent with those of the primary analysis, thus demonstrating that the effect estimates are not sensitive to statistical assumptions and analysis methods. Note that in these analyses there are no missing data (as data are available for all schools at both wave 1 and wave 8), there is control for the same or related measures at baseline, and the analyses are at the school level. A second set of sensitivity analyses treated the outcome of SU as a count variable. We also conducted preliminary analyses of the effects of dosage of *PA* on SECD and SU. We compared program effects for students who stayed in the study schools for the duration of the study (stayers) with students who joined study schools during the study (joiners) and students who left study schools during the study (leavers) (the latter for SECD only, since we did not have grade 8 SU data for leavers).

Results

The Effects of Positive Action on Substance Use and SECD

SECD scores and lifetime prevalence of substance use (ever and more than once) at Wave 8, overall and by specific substance, are presented in Table III. Table III shows that at Wave 8 students in *PA* schools reported a better SECD score and less substance use than students in control schools. Also presented in Table III are the percent relative differences and effect sizes. With respect to percent relative differences, for example, students in *PA* schools were 20-39% less likely to have ever used tobacco, alcohol, or marijuana than students in control schools. Hedges *g* effect sizes, used in preference to the traditional Cohen's *d* due to the small sample size (Hedges and Olkin, 1985), demonstrate evidence of moderate effects of *PA* on overall student SU as well as on each substance analyzed separately (i.e., ever use of cigarettes, ever use and use

Table III Lifetime prevalence (ever and more than once), percent relative difference, and effect size of substance use, overall and by substance, at Wave 8 for students and schools

	Student Level				School Level			
	Control N=170	PA N=193	%RD	ES	Control N=7	PA N=7	%RD	p-value
SECD	-0.07	0.16	7.93%	0.49	2.91	3.093	6.15%	<.01
Substance Use								
Composite	1.5	1.34	-10.67%	-0.27	1.51	1.3	-13.91%	<.01
Count	1.36	0.95	-30.15%	-0.29	1.41	0.88	-38.03%	<.01
Cigarette Use								
Ever	29.03%	20.00%	-31.03%	-0.21	27.23%	17.87%	-34.37%	<.05
> once	12.26%	13.14%	8.33%	0.03	12.46%	8.68%	-30.34%	n.s.
Alcohol Use								
Ever	54.78%	39.43%	-29.09%	-0.35	53.78%	36.72%	-31.72%	<.05
> once	33.12%	17.71%	-45.45%	-0.35	29.29%	16.45%	-43.84%	<.05
Gotten Drunk								
Ever	28.66%	17.05%	-41.38%	-0.29	28.39%	14.39%	-49.31%	<.01
> once	15.29%	8.52%	-46.67%	-0.22	13.78%	8.01%	-41.87%	<.05
Marijuana Use								
Ever	24.36%	15.34%	-37.50%	-0.23	26.22%	13.49%	-48.55%	<.05
> once	16.03%	10.80%	-31.25%	-0.17	17.88%	8.87%	-50.39%	<.05

Notes: %RD = % Relative Difference =[(PA-C)/C]*100. For SECD, the mean difference for control and for PA over time is shown. For SU, the means at Wave 8 are presented. ES = Hedges *g* effect size. Effect size for SECD is for over time, whereas for SU is Wave 8 only. Effect sizes for school-level analyses are not shown because effect sizes based on aggregated or clustered data are typically much larger than corresponding student level effect sizes and well-established standards for gauging their magnitude are not currently available (What Works Clearinghouse, 2008). We instead show the *p*-values from the analyses of school-level data (ANCOVA for SECD and SU, ANOVA for specific SU behavior).

more than once of alcohol and marijuana, and ever gotten drunk and gotten drunk more than once). Sensitivity analyses at the school level indicated similar effects of *PA* on SU (β= -0.639, $p<0.01$) and specific substances (see Table III) as well as on SECD (β=0.621, $p<0.01$) at Wave 8, supporting the findings of our primary analyses.

Table IV presents the statistical tests of the effects of *PA* on SU, the outcome of interest, and of the effects of *PA* on the change in SECD, the hypothesized mediator. As illustrated in the bivariate effect model, students in *PA* engaged in significantly less SU at Wave 8 (β= -0.129, $p<0.05$). A second set of sensitivity analyses treated the outcome of SU as a count variable; results were similar, (B = -7.180, $p<0.01$). In addition, boys reported less decline in SECD over time than girls (β=0.212, $p<0.01$). Finally, the *PA* intervention had a significant direct effect on the slope of the SECD mediator (β=0.254, $p<0.01$); the slope of SECD decreased over time, but *PA* significantly mitigated this decline.

Effects of Positive Action on Substance Use as Mediated by SECD

Table IV also presents unstandardized and standardized results of our mediation model. After inclusion of the change in SECD mediator, the effect of the SECD intercept on SU demonstrated that students

Table IV Summary of the effects of *Positive Action* on SECD, substance use (SU), and SU as mediated by SECD; Unstandardized (B) and Standardized (β) Results (N = 1170)

SECD	B (SE)	B
Intercept	3.590 (0.026)***	
Slope	-0.149 (.010)***	
Correlation of intercept and slope residuals	-0.009 (0.004)	-0.312
Direct Effects		
PA intervention → Slope of SECD	0.043 (0.011)**	0.254
Gender (Boy) → Slope of SECD	0.035 (0.012)**	0.212
Substance Use (SU)		
Direct Effects		
PA intervention→ SU	-0.155 (.065)*	-0.129
Gender (Boy) → SU	-0.124 (.065)†	-0.103
Direct Effects with Mediator		
PA intervention → SU	-0.061 (0.077)	-0.051
Gender (Boy) → SU	-0.083 (0.088)	-0.069
Slope of SECD → SU	-3.484 (1.356)**	-0.442
Intercept of SECD → SU	-0.661 (0.219)**	-0.359
Indirect Effect		
PA → Slope of SECD → SU	-0.115 (.055)*	-0.096

Note: *PA* = *Positive Action*. †p< .10; * p< .05; **p< .01; ***p < .001; all 2-tail. SECD Measurement Model Fit Indices: $\chi^2(43)= 145.44$, p<.001; CFI = 0.899; RMSEA = 0.045.

with higher SECD at Wave 1 had lower SU at Wave 8 (β= -0.359, p<0.001). Additionally, the direct effect of the SECD slope on SU indicated that students with a smaller decline in SECD reported less SU at Wave 8 (β= -0.442, p<0.001). Further, there was a significant indirect effect mediated by SECD (β= -0.096, p<0.05) with no significant direct effect of *PA* on SU remaining, demonstrating complete mediation. Figure 2 presents the standardized mediation model results; mediation model fit statistics indicate adequate fit (χ^2 (43)= 145.47, p<0.001; CFI = 0.899; RMSEA = 0.045).

We also conducted separate mediation analyses for each substance in the SU composite. The effect of the SECD slope on the individual substances indicated that students with less SECD change (and therefore *greater* SECD) reported less tobacco use (β= -0.413, p<0.001), less alcohol use (β= -0.294, p<0.01), less alcohol intoxication (β= -0.274, p<0.01), and less marijuana use (β= -0.457, p<0.001). Gender differences were found only for alcohol use, with boys reporting less alcohol use than girls (β= -0.148, p<0.05).

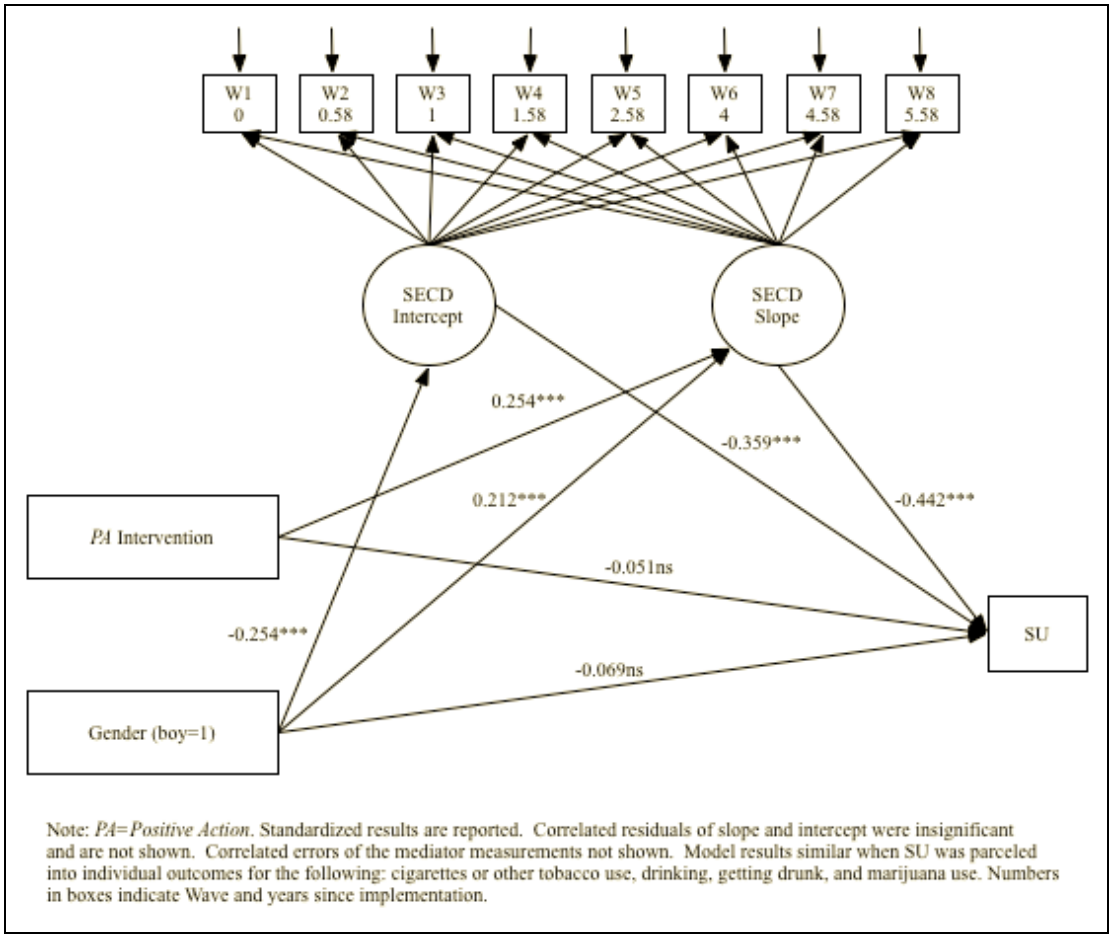


Figure 2 A model of the effects of *Positive Action* on substance use, as mediated by change in SECD.

Additionally, results from the analyses comparing SU and SECD scores between stayers, leavers, and joiners found no differences in SU scores, indicating that those who were stayers (i.e., present at all eight waves and therefore received 6 years of *PA*) did not have significantly lower SU than joiners (average exposure = 1.31 years). Leavers (average exposure = 2.62 years), however, did have significantly lower SECD than did stayers or joiners ($\beta = -0.327$, $p<0.01$).

Discussion

National trends of substance use reported by Johnston and colleagues (2011) compare and contrast with the usage reported by students in this study. Specifically, Johnston and colleagues (2011) reported that by grade 8, 20.0% of students had used cigarettes; prevalence of cigarette use in the present study was 20.0% in *PA* schools and 29.03% in control schools. National drinking rates in grade 8 were 35.8%, while prevalence rates were 39.43% in *PA* schools and 54.78% in control schools. Students in *PA* schools reported lower marijuana use (i.e. 15.34%) compared to control schools (i.e. 24.36%) and national trends (i.e.

17.3%). In general, SU levels were higher than national averages in our control schools, demonstrating the high-risk nature of these low-income, urban schools; the *PA* program successfully contributed to the reduction of SU to levels closer to national averages.

The findings presented here regarding the reduction in substance use are consistent with other universal programs. For example, The Collaborative for Academic, Social, and Emotional Learning (CASEL) reports that SECD and related programs reduce conduct problems, including SU behaviors (Payton et al., 2008). Additionally, the Good Behavior Game (GBG) implemented in grades 1 and 2 has been shown to reduce drug and alcohol dependence in adolescence (Kellam et al., 2008). *PA* is similar to these types of programs; the GBG, however, focuses on regulation of one's behavior, as well as the behavior of classmates. *PA* also involves components that teach about positive thoughts and feelings, providing multiple pathways to reducing negative behaviors. That is, *PA* hypothesizes, and shows in this study, that increased positive thoughts, feelings and actions help reduce negative behaviors such as SU.

This study is the first to provide a test of a SECD mediating mechanism of a SECD program, using longitudinal analysis with a sample of urban-residing youth. We found that students in the *PA* intervention schools reported less SU at grade 8 and had a more gradual decline in SECD than students in control schools, and this slower rate of decline in SECD was related to less SU at grade 8. The findings regarding substance use are consistent with previous research on the *PA* program (Beets et al., 2009; Li et al, 2011). The decline in SECD over time in the present study is consistent with a previous *PA* study (Washburn et al., 2011) that examined three different randomized trials of *PA* (including this one) conducted in geographically distinct locations. In these trials, as in the present study, *PA* significantly mitigated the decline in SECD, such that students in *PA* schools had higher SECD at the endpoints than those in control schools.

A new finding in this paper is that program effects on students who entered study schools during the study obtained as much benefit from the *Positive Action* program as students who were there for the entirety of the study (grades 3-8). This finding suggests that the school-wide components of *PA* alter the school climate sufficiently (Snyder et al., 2012) such that students entering the school quickly conform to the positive reinforcement and the positive student behavior present in that school. In such a climate, they are also likely to more quickly learn the positive social-emotional skills, character development, and positive actions taught in the *Positive Action* program. Students who leave *PA* schools, on the other hand, are likely to be affected less as they may move to schools with climates less supportive of positive behaviors, and are likely to acquire the social-emotional and behavioral patterns present in their new environments.

The present study's results on the effects of *PA* on SECD are also consistent with findings from other SECD-related programs. Durlak and colleagues (2011) found that SEL programs improve behavioral and emotional outcomes, including: social and emotional skills, attitudes about self and others, educational achievement scores, positive social behaviors, conduct problems, and emotional distress. As an example, the Promoting Alternatives THinking Strategies (PATHS) program has been found to improve one's ability to

understand, discuss, and manage emotions, as well as decrease aggression and disruptive, externalizing, and internalizing behaviors (Riggs et al., 2006).

The present study found that boys reported less of a decline in SECD than girls; this finding is inconsistent with previous research (Nantel-Vivier et al., 2009; Carlo et al., 2007). Carlo and colleagues (2007), however, point out that there is limited prior research on gender differences in SECD and its correlates. This suggests that more research is needed, with gender differences as a central focus.

The current study found that girls reported more alcohol use than boys; gender differences for all other substances were not significant. This is consistent with Johnston and colleagues (2011), who have found that since 2002, although grade 8 boys have higher rates of heavy drinking, grade 8 girls have had higher rates of past 30-day alcohol use.

This study is one of the first to provide empirical support for the theory underlying the *PA* program (Flay and Allred, 2010) and adds to the growing body of research on the mechanisms through which SECD-related programs achieve success (Bierman et al., 2008; Liu, Flay, and AbanAya Investigators, 2009; Riggs et al., 2006). These findings highlight the need for more comprehensive and inclusive analyses that may explain the relationships between other mediators and outcomes. Future analyses could also provide a better understanding of the inner workings of SECD-related programs. For example, as previously mentioned, SECD is a construct that includes six domains (Ji et al., 2011). Future studies should examine the role of these domains individually to investigate any possible differences in effects, and test the effects of other intrapersonal characteristics such as emotional understanding, affect, self-esteem, and mental health. Additional research is also needed on the effects of social and environmental mediators, such as teacher or peer bonding, and school climate and sense of community. Testing these and other mediators will provide researchers with a better understanding of the components that are crucial to SECD, and the relationships between these components.

The findings of this study should be viewed in the context of several limitations. Both the mediator and the outcome were measured by student self-report, potentially leading to a method bias (Podsakoff et al., 2003), which can inflate the observed relationships between the variables. Self-reports are also susceptible to social desirability bias; students may exaggerate their substance use in order to feel as if they fit in with their peers, or underreport their substance use knowing society's negative views regarding this behavior. Additionally, the sample for this study was U.S. youth from low-income, urban environments; therefore, the results cannot be generalized beyond this demographic group. Future studies should look at similar patterns in other contexts.

By the use of incentives and extensive reminders and incentives, we obtained Implementation Reports from an average of 75% of teachers at the end of each content unit, and up to 79% of teachers and 100% of school-based *PA* coordinators for the end-of-year implementation survey. These data revealed wide variability between schools in implementation fidelity, especially in early years, with improvements over time. It should also be noted that while schools with SECD-like interventions were excluded from

participation in the study, some control schools did implement SECD-like activities after baseline (Social and Character Development Research Consortium, 2010). This makes our estimates of effect sizes conservative (Hulleman and Cordray, 2009).

The same 28 items were used to assess SECD across the 8 waves. These items have strong face validity for older students, but the variance of the items may be questionable in younger students. Ji et al. (2011), however, found a consistent factor structure across grades. Additionally, there was little variation in the alpha for the scale across the eight waves, suggesting that using the same items across all eight waves (and 6 grades) is appropriate. It is important to note that social and character development can occur in a variety of contexts, such as school, family, or with peer groups (Ji et al., 2011), and the items used refer to contexts that are applicable across the age ranges of students in this study (e.g., friends, school, home). Moreover, evidence suggests that students as young as ten years are able to develop and express distinct facets of SECD (Harter, 1999; Park and Peterson, 2006) and that these facets of SECD may become increasingly differentiated in self-reports, and possibly behavior, as they grow older (Harter, 1999). Therefore, SECD can be assessed at young ages and into adolescence as students develop their understanding of the different aspects of SECD, and how to express these aspects in different ecological contexts (Harter, 1999).

The present study has several strengths. The longitudinal nature of this randomized controlled trial allowed examination of students across elementary and secondary grades. Additionally, this design provided for temporal ordering of *PA* as a cause and lower SU as an effect. Moreover, this study involved a sample of students in a high-risk setting; generating improvements can be particularly difficult in urban areas facing rising poverty rates (DeNavas-Walt, Proctor, and Smith, 2009), health disparities (Braveman and Egerter, 2008), and cuts in social and educational programs (Johnson, Oliff, and Williams, 2010).

This is the first paper to report the effects of the *Positive Action* program on SU in the middle-school grades. Moreover, school-level analyses demonstrated similar results as student-level analyses, strengthening confidence in our findings. The effects of the program on reducing SU in this high-risk population to near national norms, but not lower, leaves a challenge for program developers to improve program efficacy and/or for program implementers to improve program implementation so as to produce a greater impact. The results in this paper are also the first to confirm the theory of the *PA* program, namely that positively influencing SECD-related behaviors leads to reduced negative behaviors, substance use in this case. The empirical evidence of effectiveness of a SECD program in a high-risk population, as demonstrated in the present study, should serve as a call to action for policymakers and school officials who are increasingly challenged to positively impact not only academic achievement, but also behavior and social-emotional and character development (Elias, 2006; Flay and Allred, 2010).

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Brian Flay and David DuBois conceived the study and obtained funding, David DuBois and UIC staff oversaw program implementation, the program developer (Carol G. Allred) provided teacher/staff training, UIC and MPR staff collected all data, Brian Flay and OSU co-investigators and staff conducted data analysis, Kendra Lewis wrote the first draft of the paper, and investigators and staff participated in paper revisions.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Institute of Education Sciences, CDC, MPR, or every Consortium member, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government. Correspondence concerning this article should be addressed to lewiske@onid.orst.edu or brian.flay@oregonstate.edu

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