

Verifying Drug Abuse Prevention Program Effects Using Reciprocal Best Friend Reports

Stewart I. Donaldson,^{1,5} Craig W. Thomas,¹ John W. Graham,²
Judith G. Au,³ and William B. Hansen⁴

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Considerable research suggests that social influences-based drug abuse prevention programming has produced the most consistently successful preventive effects. However, a common criticism of this literature is that most prevention intervention studies rely solely on self-reported substance use. The purpose of this study was to assess the effects of normative education, arguably the most successful component of social influence based prevention programs, on alcohol and cigarette consumption using both self- and reciprocal best friend reports of substance use. Analyses of subsamples of data from 11,995 students participating in the Adolescent Alcohol Prevention Trial revealed that normative education significantly delayed the onset of alcohol use across the eighth, ninth, and tenth grades among public school students. A similar but somewhat less robust pattern was found for cigarette use. These results suggest that self-report bias does not account for previous findings and demonstrate rather convincingly that normative education is an effective drug prevention strategy for public school settings.

KEY WORDS: drug and alcohol abuse prevention; self-report bias; common method variance.

¹Claremont Graduate University.

²Pennsylvania State University.

³Claremont Graduate University.

⁴Tanglewood Research.

⁵To whom correspondence should be addressed at Department of Psychology, Claremont Graduate University, 123 East 8th Street, Claremont, California 91711. e-mail: Stewart.Donaldson@cgu.edu.

INTRODUCTION

Alcohol and other forms of substance abuse continue to hinder the development, functioning, and well-being of millions of adolescents and adults [see U.S. Department of Health and Human Services (DHHS), 1991]. It is widely known that unwanted pregnancy, juvenile delinquency, and failure at school, among other problems, are often associated with adolescent substance use (Hawkins *et al.*, 1992). Interventions that prevent, or at least delay, the onset of substance use are important because the earlier adolescents begin using alcohol and other substances, the more likely they are to abuse drugs as young adults (Anthony and Petronis, 1995; Hawkins *et al.*, 1997; Kandel, 1982; Robins and Pryzbeck, 1985).

Unfortunately, there continues to be a rather large gap between the science and the practice of drug prevention programming. For example, the most popular drug prevention approach in the United States, "Just Say No" or Project D.A.R.E., has reached more than 4.5 million children and adolescents (Rogers, 1993) even though there is now a wealth of scientific evidence suggesting that, in its current form, D.A.R.E. does not prevent alcohol and drug use (see Dukes *et al.*, 1996; Ennent *et al.*, 1994; Oskamp and Shultz, 1998) and may even be harmful under some conditions (Donaldson *et al.*, 1995). There remains a need for theory-driven intervention research to enlighten both practitioners and behavioral scientists about successful strategies for preventing adolescent substance abuse.

In contrast to efforts in the 1960s and 1970s (1) to scare youths, (2) to change an adolescent's character or personality, and (3) to improve self-esteem and the like, we now have an empirically based theoretical framework, the social influences model, to guide the design of prevention programs (Donaldson, 1996; Johnson *et al.*, 1996). That is, it has become quite clear that social influences are a primary reason why adolescents begin using alcohol, tobacco, and other drugs. Because social influence-based programs have shown consistent prevention program effects (Hansen, 1992; Tobler and Stratton, 1997), recent work has focused on sorting out which components of social influence programs are most effective under specific conditions and across settings (cf. Donaldson, 1995).

Normative education is one component of social influence-based programming that has been isolated as effective across several large randomized prevention trials (Donaldson *et al.*, 1994; MacKinnon *et al.*, 1991; Sussman *et al.*, 1995). The theoretical basis for normative education can be traced back to the attitude-belief theory of Ajzen and Fisbein (1973) and the recent formulation of the theory of planned behavior, the problem behavior theory of Jessor and Jessor (1977) as applied to the social cultural model, and social-cognitive learning theory (Bandura, 1977, 1986). In short, beliefs about the prevalence and acceptability of alcohol and drug use have been shown to be

substantial risk factors for the onset of alcohol and drug use. Normative education curricula are designed specifically to combat the influence of “passive social pressures” [e.g., social modeling and overestimation of adolescent alcohol and drug use (cf. Graham *et al.*, 1991)]. Normative education has been shown to be most effective in public school settings where adolescents are likely to overestimate the drug use prevalence and acceptability beliefs of their peers (Donaldson *et al.*, 1995).

Despite rather convincing evidence for the effectiveness of normative education, a common shortcoming of the substance abuse prevention literature in general, and the normative education studies in particular, is the reliance on a single method of measurement (i.e., self-reports of substance use). Self-report measures are common because they are relatively easy to obtain and are often the only feasible way to assess the constructs of interest. The disadvantages are well documented; they are prone to many kinds of response bias (see Campbell and Fiske, 1959; Graham and Collins, 1991; Graham *et al.*, 1993). In general, it is believed that many research participants respond in a way that makes them look as good as possible. Thus, they tend to underreport behaviors deemed undesirable by researchers (e.g., adolescent alcohol and drug use), and they tend to overreport behavior viewed as desirable.

The main purpose of this study is to assess whether prevention effects for social influences-based prevention programs hold up when corroborating evidence is used to verify adolescent alcohol and tobacco use. This is accomplished by examining the effects of normative education making use of both self-report and reciprocal best friend reports of alcohol and cigarette use. While much of the prior research has been focused on eighth-grade substance use, this study examines prevention effects across the eighth, ninth, and tenth grades. Specifically, the following hypotheses are examined.

Hypothesis 1: Significantly fewer public school students who receive normative education will use alcohol in the eighth, ninth, and tenth grades than public school students receiving comparison interventions.

Hypothesis 2: Significantly fewer public school students who receive normative education will smoke cigarettes in the eighth, ninth, and tenth grades than public school students receiving comparison interventions.

METHODS

Participants

Participants were 11,995 students (53% female and 47% male) from 130 school units (52% attending public schools and 48% attending private

Catholic schools) in Los Angeles, Orange, or San Diego County. The sample consisted of 45% European American students, 37% Hispanic students, 13% Asian students, 3% African American students, and 2% identified in other ethnic groups. Each student participated in one of four Adolescent Alcohol Prevention Trial (AAPT) experimental conditions. Each analysis presented in this article is based on a subsample of the AAPT participants. The criteria used to select subsamples are described below.

Adolescent Alcohol Prevention Trial

Data for this study were collected as part of the evaluation of the Adolescent Alcohol Prevention Trial (AAPT), a longitudinal drug prevention intervention assessing the effectiveness of social influence strategies for preventing the onset of adolescent alcohol and cigarette use [for a detailed description of the experimental design, see Donaldson *et al.* (1995)]. Elementary and junior high schools were randomly assigned to one of the four experimental conditions. The first condition, Information About Consequences of Use (ICU), included four lessons about the social and health consequences of alcohol and cigarette use. The second condition, Resistance Skills Training (RT), contained four lessons about consequences of using substances and five lessons to provide adolescents with the behavioral skills necessary to refuse active social pressures (explicit drug offers). This strategy is based on the assumption that adolescents often lack the appropriate social skills to refuse drug offers made by their peers. The third condition, Normative Education (Norm), contained four lessons about consequences of use plus five lessons to combat the influence of passive social pressures by correcting erroneous perceptions about the prevalence and acceptability of adolescent substance use and by establishing conservative group norms. The fourth condition (Combined) included three lessons about the consequences of use, three and one-half lessons on resistance skills, and three and one-half lessons establishing conservative norms. Table I summarizes the 2 × 2 factorial design.

Approximately 50% of the students received one of the four experimental conditions in fifth grade followed by a seventh-grade booster program.

Table I. The Adolescent Alcohol Prevention Trial Research Design

Resistance training	Normative education	
	No	Yes
No	Information only (ICU)	Information + normative education (Norm)
Yes	Information + resistance training (RT)	Information + resistance training + normative education (combined)

The other 50% received one of the four experimental conditions in seventh grade only. In this study, questionnaires administered to the participants in the eighth, ninth, and tenth grades were analyzed.

Self-Report Measures

Alcohol Use. Alcohol use was measured by asking students how many drinks they had in their whole life and in the past 30 days. The lifetime alcohol use item consisted of a 1 = “none or only at religious services” to 8 = “more than 100” response scale. The 30-day alcohol use item consisted of a 1 = “none or only at religious services” to 7 = “more than 20” response scale. Additionally, drunkenness was measured using one item. Students were asked how many times they had ever been drunk on a 1 = “never” to 6 = “more than 20 times” response scale. Each of the items was positively skewed. Therefore, participants answering “none or only at religious services” to any of the questions were classified as not using alcohol (nonuser = 0). Participants answering any use were classified as using alcohol (user = 1). In addition, the three dichotomized measures of alcohol use were used to create an alcohol index. If participants were classified as a user on any of the three items, they were classified as an alcohol user. If the participants reported no use on all three items, they were classified as a nonuser.

Cigarette Use. Cigarette use was measured by asking students how many cigarettes they smoked in their whole life and in the past 30 days. The lifetime smoking item consisted of a 1 = “none” to 7 = “more than 5 packs” response scale. The smoking 30-day item consisted of a 1 = “none” to 6 = “more than one pack” response scale. Again, the distributions of these items were positively skewed. For each question, participants answering “none” were classified as not using cigarettes (nonuser = 0). Participants answering any use were classified as using cigarettes (user = 1). A cigarette use index was created using the same procedure described above for the alcohol use index.

Best Friend Report Measures

At the eighth-, ninth-, and tenth-grade assessments students provided a list of their three best friends in school. A large majority of these friends completed the program and posttests. By using the student’s identification code and their friends’ names, the friends’ self-reported substance use was matched with data from each participant. Because friendship patterns are likely to change over the eighth, ninth, and tenth grades, the matching procedures was conducted at each time period. For some students, data were not available for one or more friends listed.

Next we analyzed the convergence between self-reports and the reports of reciprocal best friends, nonreciprocal best friends (as reported by one of the members of the dyad), second-best friends, and third-best friends. Analyses revealed that the highest level of agreement (convergence) was between participant self-reports and reciprocal best friend reports of substance use. After carefully considering several methods for incorporating the friend reports into an analysis of program effects, we determined that the most straightforward and accurate analyses resulted from using only the reciprocal best friend data. This was largely because it was difficult to establish with certainty that those other than the reciprocal best friends were reporting about the subject's substance use, and the reciprocal best friends are likely to be the most knowledgeable about their friends' substance use. The main tradeoff of this approach is that it maximizes precision at some cost to generalizability. However, only a subsample of participants has any kind of friend report data to begin with, and other analyses have already been published that maximize generalizability with some cost to precision (see Donaldson *et al.*, 1994, 1995).

Perception of Friends' Alcohol Use. Participants were asked how many of their three best friends ever drank alcohol, ever used alcohol in the past 30 days, and had ever been drunk. For each item, the response categories consisted of 1 = "none," 2 = "one friend," 3 = "two friends," and 4 = "three friends" scale. Because the items did not clearly differentiate among first-, second-, and third-best friends, we selected only those participants that responded with "none" or "three friends" as a reliable estimate of reciprocal best friend use. Participants answering "none" were classified as having a best friend who did not use alcohol (nonuser = 0). Participants answering "three friends" were classified as having at least one best friend who uses alcohol (user = 1).

In addition to the three items listed above, a categorical question asking respondents to indicate if their best friend had drunk alcohol in the past 30 days was used. Utilizing the responses from this question and the 30-day alcohol use question described above, a best friend alcohol use composite was created. Participants answering "yes" to either question were classified as having a best friend who used alcohol in the past 30 days, whereas participants answering "no" to both questions were classified as having a best friend who did not use alcohol in the past 30 days.

Perception of Friends' Cigarette Use. Friends' cigarette use was measured by asking participants how many of their three best friends had ever tried smoking cigarettes or used cigarettes in the past 30 days. The response categories for each item also consisted of a 1 = "none" to 4 = "three friends" scale. Participants answering "none" were classified as having a best friend that did not smoke cigarettes (nonuser = 0). Participants answering "three friends"

were classified as having at least one best friend who smokes cigarettes (user = 1). An additional categorical 30-day smoking question was used in the same way the categorical 30-day alcohol use measure was used as described above.

Data Analytic Strategy

To determine if adolescents and their reciprocal best friends who received the normative education component have significantly lower reports of substance use over time, two groups were created from the original four experimental conditions. Participants receiving either information only or resistance training were assigned a 0 for other, and participants receiving either the normative or the combined conditions were assigned a 1 for NORM. Similarly, adolescents who received resistance training were assigned a 1 for the variable RT, whereas those who did not receive resistance training were assigned a 0.

To rule out the threat of self-report bias and to conduct more conservative tests of the hypotheses than has been done in previous research, data from subsamples of participants and reciprocal best friends who agreed on substance use or nonuse were analyzed. For example, a 2 × 2 table was created for each measure comparing the self and best friend responses (see Table II). As presented in Table II, reciprocal best friends who were in agreement about substance use are found in the upper-left quadrant, and reciprocal best friends who were in agreement about nonuse are found in the lower-right quadrant. These were the participants who had their self-reported substance use verified by their reciprocal best friend and were included in the main analyses. For example, there were 2722 participants who had verified reports of alcohol use or nonuse in the eighth grade, 2090 participants during the ninth grade, and 1084 participants during the tenth grade.

Participants whose self-reported substance use or nonuse was not verified were dropped from further analysis because there was no way to determine which report, self- or reciprocal best friend, was accurate. Although the number of participants in any given cell varied considerably across time of

Table II. Framework for Classifying Verified Reports of Alcohol and Cigarette Use

Best friend	Self-Report	
	Yes	No
Yes	Agree (users)	Disagree
No	Disagree	Agree (nonusers)

assessment and type of variable, somewhat surprisingly, the smallest number of participants were consistently found in the self-report—no/best friend—yes cell (on average, less than 8%). This finding suggests that underreporting substance use to avoid looking bad or consequences for using may not be as large a problem as suspected.

To test the main hypotheses and verify if substance use varies as a function of the interventions after controlling for self-report bias, chi-square analyses comparing type of condition (NORM versus Other) or (RT versus Other) with type of substance use (user versus nonuser) were computed at the fifth (pretest for about 50%), seventh (pretest for about 50%), eighth, ninth, and tenth grades. Consistent with the hypotheses, these analyses were conducted separately for adolescents attending the public versus the private Catholic schools. Further, logistic regressions were calculated to confirm the previous analyses and to test for significant interactions. Because the chi-square and logistic regression analyses yielded the same conclusions, there were no significant interactions, and there were no significant differences in pretest use, the main effects of the interventions on the various substance use measures (reported as percentage of users) across the eighth, ninth, and tenth grades are reported in the next section.

RESULTS

Alcohol Use

Public Schools. The results strongly support Hypothesis I: Significantly fewer public school students who received normative education used alcohol in the eight, ninth, and tenth grades than public school students receiving comparison interventions. Using the verified alcohol index, it was found that only 54% of those public school students who had received normative education were using alcohol by the eighth grade [versus 63.2% in the comparison group; $\chi^2(1, N = 842) = 7.32, p < .01$], 77.5% by the ninth grade [versus 85.7% in the comparison group; $\chi^2(1, N = 666) = 7.24, p < .01$], and 84.2% by the tenth grade [versus 91.1% in the comparison group; $\chi^2(1, N = 520) = 5.46, p < .05$]. With two exceptions (30-day alcohol use at ninth grade and drunkenness at tenth grade), this pattern of findings held up across the individual items of 30-day alcohol use, lifetime alcohol use, and drunkenness at the eighth, ninth, and tenth grades. Conversely, for the most part, more public school students who received the resistance skills training intervention reported using alcohol than public school students receiving comparison interventions. For example, using the verified alcohol index, it was found that 84.9% of public school students who had received resistance skills training

Table III. Verified Reports of Alcohol Use as a Function of Normative Education and Resistance Training

Verified report	N	Percentage of users					
		Norm	Other	p	RT	Other	p
Alcohol index							
Public							
8th	842	54.0	63.2	**	58.9	57.6	ns
9th	666	77.5	85.7	**	84.9	76.7	**
10th	520	84.2	91.1	*	90.1	84.0	*
Private							
8th	587	65.1	70.3	ns	65.7	69.3	ns
9th	503	85.8	83.0	ns	82.8	86.2	ns
10th	249	94.9	92.0	ns	92.7	94.4	ns
Alcohol, 30-day							
Public							
8th	1333	9.2	15.1	***	12.7	10.7	ns
9th	871	23.9	29.7	ns	28.3	23.6	ns
10th	580	30.4	37.9	*	37.7	29.5	*
Private							
8th	966	13.4	12.1	ns	10.2	15.8	**
9th	607	32.5	29.4	ns	30.0	31.9	ns
10th	229	55.7	44.7	ns	41.5	60.4	**
Alcohol, lifetime							
Public							
8th	791	47.1	57.3	**	53.0	50.7	ns
9th	572	72.3	82.9	**	81.4	71.2	**
10th	464	81.5	89.0	*	88.9	80.1	**
Private							
8th	511	59.3	63.3	ns	60.2	62.0	ns
9th	445	82.0	79.6	ns	77.6	84.2	ns
10th	219	92.5	89.9	ns	89.7	92.9	ns
Drunkenness							
Public							
8th	1278	4.2	7.7	**	6.1	5.2	ns
9th	772	14.0	21.6	**	18.2	15.1	ns
10th	500	28.3	34.1	ns	35.1	26.1	*
Private							
8th	937	3.2	1.1	*	2.5	1.6	ns
9th	566	12.8	14.8	ns	15.9	11.7	ns
10th	173	33.7	34.5	ns	26.7	44.4	*

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

were using alcohol by ninth grade [versus only 76.7% in the comparison group; $\chi^2(1, N = 666) = 7.21, p < .01$] and 90.1% by tenth grade [versus 84% in the comparison group; $\chi^2(1, N = 520) = 4.39, p < .05$]. A summary of the results is presented in Table III.

Private Catholic Schools. As predicted, there were no significant alcohol use prevention effects of normative education found among students in the eight, ninth, and tenth grades attending the private Catholic schools.

However, fewer private school students who received resistance skills training reported using alcohol than private school students receiving comparison interventions. Significantly fewer private Catholic school students receiving resistance skills training used alcohol in the past 30 days at the eighth [10.2% versus 15.8%; $\chi^2(1, N = 966) = 6.84, p < .01$] and tenth [41.5 versus 60.4%; $\chi^2(1, N = 229) = 8.15, p < .01$] grades. Additionally, the prevalence of drunkenness was significantly lower among tenth-grade private school students receiving resistance skills training than private school students receiving the comparison programs [26.7% versus 44.4%; $\chi^2(1, N = 173) = 5.87, p < .05$].

Cigarette Use

Public Schools. The results also partially supported Hypothesis 2: Significantly fewer public school students who received normative education smoked cigarettes in the ninth and tenth grades than public school students receiving comparison interventions. Using the verified smoking index, it was found that only 22.2% of those public school students who had received normative education were smoking cigarettes by eighth grade [versus 28.7% in the comparison group; $\chi^2(1, N = 1050) = 5.82, p < .05$], 25.1% by ninth grade [versus 39.5% in the comparison group; $\chi^2(1, N = 702) = 16.25, p < .001$], and only 36.9% by tenth grade [versus 45% in the comparison group; $\chi^2(1, N = 480) = 3.20, p < .05$]. There were no significant prevention effects found for public school students receiving the resistance skills training intervention. See Table IV.

Private Catholic Schools. There were also no significant smoking prevention effects of normative education found among students attending the private Catholic schools. Unlike the alcohol use analyses, resistance skills training did not appear to prevent smoking across the various measures and time periods. Again, see Table IV.

DISCUSSION

The results of this study show that prevention effects for social influences-based prevention programs hold up when corroborating evidence is used to verify self-reports of alcohol use and smoking. That is, a plausible rival hypothesis untested in previous studies, that self-report bias accounts for normative education prevention effects, was not supported. Instead, when analyzing verified reports of substance use, significantly fewer public school students who received normative education used alcohol and tobacco in the eighth, ninth, and tenth grades than public school students receiving comparison interventions. This study confirms that interventions which target

Table IV. Verified Reports of Cigarette Use as a Function of Normative Education and Resistance Training

Verified report	N	Percentage of users					
		Norm	Other	p	RT	Other	p
Smoking index							
Public							
8th	1050	22.2	28.7	*	26.5	23.3	ns
9th	702	25.1	39.5	***	32.2	29.0	ns
10th	480	36.9	45.0	*	41.0	40.1	ns
Private							
8th	719	21.5	14.9	*	16.6	20.2	ns
9th	487	42.8	37.7	ns	39.2	41.8	ns
10th	189	56.8	50.0	ns	49.0	58.8	ns
Smoking, 30-day							
Public							
8th	1684	6.3	11.0	***	9.1	7.7	ns
9th	1078	7.5	9.2	ns	7.9	8.5	ns
10th	712	10.7	10.0	ns	10.3	10.5	ns
Private							
8th	1179	4.6	2.9	ns	3.3	4.2	ns
9th	790	8.3	8.4	ns	9.2	7.6	ns
10th	269	18.5	16.3	ns	18.5	16.1	ns
Smoking, lifetime							
Public							
8th	1260	28.4	34.1	*	32.3	29.4	ns
9th	650	19.4	33.2	***	27.0	21.9	ns
10th	450	32.9	39.6	ns	36.8	34.8	ns
Private							
8th	691	16.6	12.1	ns	13.1	15.9	ns
9th	451	36.5	32.9	ns	33.3	36.4	ns
10th	164	47.4	44.2	ns	40.0	52.7	ns

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

passive social pressures can be highly effective at preventing the onset of substance use in public school settings.

The analyses of verified reports of drug use presented in this study also underscore the point that the phenomena under investigation in drug abuse prevention research are complex and context dependent (Donaldson, 1995). The pattern of results demonstrates rather clearly that the social influences-based prevention programs examined in this study operated rather differently in the public versus private Catholic school settings. In the public school context, the absolute levels of prevalence estimates and beliefs about the acceptability of alcohol and cigarette use were much higher than in the private Catholic schools (Donaldson *et al.*, 1994). In addition, the public schools studied were much larger and probably consisted of many more adolescents who exhibited problems behaviors such as alcohol use and smoking. Thus, participants attending public school were much more likely to be affected

by passive social pressure (inaccurate prevalence estimates and acceptability beliefs) than those from the private Catholic schools. These contextual factors suggests why normative education appeared to be effective in the public school settings but not in the private Catholic schools.

Findings from several large-scale, randomized prevention trials (see Donaldson *et al.*, 1996) and a number of meta-analyses (e.g., Hansen, 1992; Tobler, 1986; Tobler and Stratton, 1997) indicate that comprehensive social influences-based drug prevention programs are effective. Studies examining mediating mechanisms of prevention effects suggest that changing social norms (normative education) is an essential ingredient for successful prevention programming (Donaldson *et al.*, 1994; MacKinnon *et al.*, 1991; Sussman *et al.*, 1995). While much of this prior research is based on research designs that rule out threats to internal, external, and statistical conclusion validity (cf. Hansen, 1992; Murray *et al.*, 1996), most (if not all) use self-reported alcohol and drug use as primary outcome variables. It seems plausible that some adolescents who participate in drug prevention program (taught not to use alcohol and drugs) are likely to report little or no substance use to researchers, even if they are using substantial amounts. That is, it seems very likely that demand characteristics and related social pressures (e.g., fear of reprisal, the need to look good) could cause some adolescents to underreport alcohol and substance use in a way that makes prevention programs look more effective than they actually are. A primary contribution of this study is that it provides some of the first empirical evidence that contradicts common speculation about the problem of self-report bias in drug abuse prevention research. That is, the results of this study suggest that self-report bias or systematic under-reporting does not appear to account for, or threaten the validity of, prior studies demonstrating the effectiveness of normative education in preventing drug abuse in public school settings (Donaldson *et al.*, 1994, 1995).

Strengths and Limitations

We realize that the approach used to examine self-report bias in this study is very conservative and trades off increases in precision for decreases in generalizability. First, although we had reciprocal best friend, nonreciprocal best friend, second-best friend, and third-best friend reports, we used only reciprocal best friend reports because preliminary analyses showed that they were by far the most accurate. Second, adolescents who said that they did not use alcohol or cigarettes when their reciprocal best friends said they did were dropped from further analyses (as were participants who indicated use but their reciprocal best friends reported no use by the participant) because we

could not determine which report (self or best friend) was accurate. This resulted in a subsample of adolescents whose self-reports were verified by their reciprocal best friends. While this approach greatly reduces the probability that self-report bias has distorted conclusions about program effectiveness for this subsample, it is possible that the subsample we have analyzed is somewhat unique and not representative of the full sample. Therefore, we reanalyzed the entire sample ($N = 11,995$) using the exact same variables used in this study. As has been shown in previous work (Donaldson *et al.*, 1995), the pattern of results for the full sample was virtually the same as the pattern reported in this study. Nevertheless, the results should be interpreted in light of limitations of analyzing nonrandom subsamples.

It is important to point out that we considered several other approaches for analyzing the influence of self-report bias on prevention outcomes. First, we explored using confirmatory factor analyses of multitrait-multimethod matrices to analyze multiple-item factor scores of alcohol and cigarette use (see Graham and Collins, 1991; Graham *et al.*, 1993). Like others, we encountered nonnormal distributions (i.e., highly skewed distributions), identification problems, and interpretation problems with this analytic strategy (cf. Brannick and Spector, 1990; Marsh, 1989; Spector and Brannick, 1995). Similarly, we attempted to use proxy measures of sources of self-report bias (e.g., social desirability and fear of reprisal) as control variables in our analyses. This approach had virtually no effect on our findings (see Moorman and Podsakoff, 1992). For the purpose of this study, we assert that the main problem with these more standard approaches is conceptual. Normative education is designed to prevent the onset of substance use. Our more conservative and straightforward approach estimates the percentage of adolescents, as a function of the intervention, who have used alcohol and cigarettes by a particular grade level (the focus of the study and intervention). The other approaches seem better suited for addressing the relationships between continuous variables.

Another approach is to examine the self- and reciprocal best reports separately in an attempt to cross-validate findings. For the most part, we found that the normative education program effects appeared even stronger when using reciprocal best friend reports of alcohol and cigarette use. Others have attempted to use biochemical validation to verify self-reports (e.g., Biglan *et al.*, 1985; Heatherton *et al.*, 1989; Pechacek *et al.*, 1984). While this approach seems ideal at first glance, it can appear extremely invasive to participants and has proven to be very difficult to implement in large-scale, school-based prevention trials.

School-based drug prevention programs have been criticized for producing only short-term effects (cf. Murray *et al.*, 1996). One notable strength of this study is that normative education appeared to demonstrate program

effects across the eighth, ninth, and tenth grades. This counters the notion that prevention program effects dissipate rather quickly. Finally, this study is limited in that the effects were only examined at the individual level of analysis. Again, the tradeoff of precision, analyzing only participants with verified reports, is that there is not enough statistical power to conduct reasonable multilevel analyses. Fortunately, prior studies have shown that school level analyses mirror individual level analyses in the Adolescent Alcohol Prevention Trail (e.g., Donaldson *et al.*, 1994). Nevertheless, due to this limitation, the findings of this study must be interpreted with caution.

Implications and Conclusion

This study demonstrates the value of applying principles of behavioral science toward addressing societal concerns. The findings from this line of research demonstrate rather clearly the conditions under which social influence prevention programs are likely to be most effective. First, normative education produced both statistically and practically significant effects [e.g., a 9.2% difference in alcohol use onset in the eighth, 8.2% in the ninth, and 6.9% in the tenth grades; see Lipsey (1990) for a discussion of practical significance] when it was delivered in a context plagued by misperceptions of peer substance use prevalence and acceptability (i.e., the public schools studied in this research). For example, if we consider a hypothetical public school district with 10,000 students, our findings suggest that approximately 920 fewer students would begin using alcohol in the eighth grade if they were given normative education instead of only the more popular programs of resistance training (“just say no”) and/or information about the consequences of use. Consistent with our theoretical understanding of normative education, the program appeared to be less effective in private Catholic school settings, where misperceptions of prevalence and acceptability are less likely. Further, previous research has indicated that resistance skills training can actually be harmful in public school settings unless normative education is included in the prevention curriculum (Donaldson *et al.*, 1995).

There is considerable evidence that lying is a ubiquitous feature of modern social interaction (Saxe, 1991). The probability of prevarication is dramatically enhanced when people are asked to provide information about sensitive topics in context in which their true behavior is socially undesirable and/or they fear reprisal. Unfortunately, a large number of intervention studies and applied behavioral research in general is based on self-reports of human behavior. The failure to properly examine and account for self-report bias can lead researchers astray (Schwartz, 1999). Another important implication of this study is that social influences based prevention programming,

under the conditions outlined above, appears effective after potential self-report bias has been addressed.

Interventions based on sound behavioral science, not just ideology, have great potential for ameliorating some of our most destructive behavioral health problems. Social influence theory applied in the context of adolescent substance abuse prevention illustrates that potential. It is our hope that the findings of this research as well as the growing drug prevention literature will assist behavioral medicine practitioners in their efforts to prevent adolescent problem behavior, as well as help narrow the gap between prevention science and practice.

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