

United States Department of Education
Office of Safe and Drug-Free Schools

**Final Report of a
Demonstration Project:
Enhancing and Assessing Student Drug Testing**

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EXECUTIVE SUMMARY

The Institute for Behavior and Health, Inc. (IBH) was awarded a grant from the U.S. Department of Education's Office of Safe and Drug-Free Schools in fall 2003 for a demonstration project regarding random student drug testing (RSDT). In order to explore ways of maximizing the preventive value of RSDT, IBH chose to study two distinctly different enhancements to already operating RSDT programs. This included increasing the number of random drug tests administered during the school year and adding a proven drug abuse educational program for student athletes, or both.

IBH subcontracted with the Division of Health Promotion and Sports Medicine of the Oregon Health & Science University (OHSU). The education programs developed by OHSU were ATLAS (Athletes Training & Learning to Avoid Steroids) for boys and ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) for girls. These programs were studied through grants from the National Institute on Drug Abuse (NIDA), and results have been published in peer reviewed journals.

Eight high schools that were already operating RSDT programs were recruited to participate in the study. They were randomly assigned to one of four research conditions:

- A: increasing testing rates for athletes by approximately 50 percent,
- B: implementing ATLAS/ATHENA education for their student athletes,
- C: a combination of both testing and education, or
- D: continuing their current RSDT programs with no major changes.

Due to the loss of one school district from the study and another school's inability to secure the coaches' cooperation, we arrived at a slightly amended design with two schools in condition A, one school in condition B, two schools in condition C, and three schools in condition D.

Because of delays caused by the lengthy process encountered in obtaining Institutional Review Board approval of the procedures and consent forms, the interventions could not be implemented until the second semester of the 2004-05 school year. The grant period was extended beyond the initial 3-year period to allow for sufficient time to study the effects of the interventions.

The primary measure of the intended outcomes in this demonstration project (reduced drug use by high school students participating in the enhanced RSDT programs) was by self-report questionnaire, the Student Survey on Drugs and Alcohol (SSDA). The survey instrument was modeled after one developed by Linn Goldberg, M.D. and his colleagues at OHSU for their SATURN (Student-Athlete Testing Using Random Notification), a NIDA sponsored project. The SSDA is an anonymous survey that was administered to all consenting students in the participating high schools. Questions covered their use of various substances, perceptions of drug use and availability, and attitudes toward drug use and drug testing. The survey was administered near the beginning and toward the end of each school year, from fall 2004 through spring 2007.

Two other sources of information supplemented the data provided by the SSDA. One was information provided each year by the participating schools about their RSDT programs. This

included total student enrollment, number of students subject to RSDT, number of random drug tests performed, number of verified positive random drug tests, and the specific substances identified in the positive drug tests. The other source was a series of interviews conducted by IBH with key school personnel by means of site visits in the first two years of implementation and by means of a structured telephone interview during the final year. Schools also maintained periodic contact with IBH, OHSU, and one another via monthly teleconferences and annual meetings.

A total of 27,604 valid surveys were collected from students during the six administrations of the SSDA. Nearly equal numbers of surveys were collected from Experimental and Control schools over the course of the study. Response rates varied but averaged 55 percent for the students at the Experimental schools and 64 percent at the Control schools.

The central hypothesis of the demonstration project—that one or more of the enhancements to existing RSDT programs would further reduce student drug use—was not fully supported by the survey data. Although more drug testing did not alter current use patterns, the ATHENA program did show reductions in substance use among female participants. Therefore the Department of Education’s GPRA measure of a 5 percent overall reduction in the rate of drug use each year was not achieved. There was no significant change in the self-reported use of drugs over the course of the study in either the Experimental Schools or the Control Schools.

There were consistent differences between the drug use rates at Experimental Schools and Control Schools at baseline, with the former showing significantly lower usage than the latter. Overall, these differences did not change over time.

Educational enhancement at the demonstration project was more encouraging. Female athletes who participated in the ATHENA program were less likely to use drugs, alcohol, or supplements than female athletes who were not exposed to ATHENA.

Major differences also were found between students who were subject to testing and those who were not. Those subject to testing reported significantly lower use of drugs and more positive attitudes toward RSDT than students who were not subject to testing. Because two of the schools in our study only tested athletes, it was possible to compare students in extracurriculars who were subject to testing and those who were not. For all categories of substances, those in extracurriculars subject to testing reported significantly lower usage than those who were not. This suggests that the difference in drug use was due to the RSDT rather than the characteristics of students in extracurricular activities, although this cannot be definitely determined due to lack of non-drug testing comparisons at baseline.

Several limitations of the current demonstration project are discussed. These include: variations in the timing and extent of the interventions; unplanned changes in the schools’ RSDT programs such as switching from urine tests to oral fluids; and the lack of a single cohort to follow over time. Because questionnaires were anonymous there was no ability to track the students and determine actual changes in self-reported use.

Recommendations are offered to schools and other researchers, based on the experience of this demonstration project. It is suggested that schools consider carefully the cost-effectiveness of increased frequency of testing. Schools should not compromise the potential deterrent value of RSDT by conducting less accurate tests in an attempt to reduce the costs or time required for the testing. Further research is clearly needed to determine whether there is an optimum frequency of testing. As the state of the art advances, different types of tests or combinations will need to be considered. Finally, a targeted educational program may enhance the results from a drug-testing program.

PURPOSE OF STUDY

In August 2003 the Institute for Behavior and Health, Inc. (IBH) partnered with the Oregon Health & Science University's Division of Health Promotion and Sports Medicine (OHSU) to respond to a 3-year competitive grant opportunity issued by the Office of Safe and Drug-Free Schools of the U.S. Department of Education. The demonstration grants could be used to develop new student drug testing programs or enhance existing ones.

Due to the short timeframe for the proposals and project implementation, as well as the legal challenges that may occur when developing new student drug testing programs, IBH and OHSU chose to seek out schools that already had random student drug testing (RSDT) programs in place and examine the effectiveness of two forms of program enhancements, individually and in combination.

While the question of the effectiveness of RSDT in preventing student drug use is an important research question, there is another closely related question that is often overlooked in this new element of drug abuse prevention: What is the most effective (and cost-effective) way to conduct RSDT? Without identifying the most effective way to conduct RSDT it is difficult to study the effectiveness of this potential tool for drug prevention among adolescents. At this time there is not yet a scientific base on which to judge many important questions about the most effective way to deliver RSDT.

Our demonstration project was designed to test the impact of two types of enhancements of school-based student drug testing programs in reducing the use of drugs by high school students. These enhancements included increasing the likelihood that a substance-using student will be tested and implementing gender-specific, highly regarded education programs. The project was designed to include eight high schools with current random drug testing programs involving the schools' athletes. Although some participating schools also test other categories of students, such as those participating in extra-curricular activities, the interventions in the current study only applied to the athletes.

The schools were recruited by IBH prior to the proposal submission. All of the schools had written policies in place and had received a legal review. Following notification of the grant award, the schools were randomly assigned to the four following conditions:

- A. Increase the number of random tests of athletes conducted during the school year by 50 percent (2 schools);
- B. Implement two separate educational programs for the athletes: ATLAS for the boys and ATHENA for the girls (2 schools);
- C. A combination of the above two enhancements (2 schools);
- D. A control group of 2 schools that would continue with their current student drug testing programs with no major changes.

In accordance with the performance measures established by the Department of Education for the grant program, this demonstration project set out to determine whether one or both of the RSDT enhancements would reduce the rate of drug use among the target population by 5 percent

each year of the 3-year project. We hypothesized that both the increased likelihood of being tested and the behavioral influences of the educational programs acquired from a proven substance abuse prevention education curriculum would reduce the rate of drug use among athletes in the study by at least 5 percent annually. We hypothesized that the control schools would see no significant reduction in drug use during the grant period, while the schools with both enhancements would experience the greatest reduction.

METHODS

This section of the report describes the specific interventions that were part of the demonstration project, as well as the measures used to determine their effectiveness. Some adjustments to both the timeframe and design became necessary.

Due to the lengthy process encountered in obtaining Institutional Review Board approval of the procedures and consent forms, the baseline survey could not be administered until the fall of 2004, and the intervention enhancements could not begin until the spring of 2005. As a result, an additional year was requested and authorized for the demonstration project.

One of the initial eight school districts (Pell City, Alabama) dropped out of the project by the fall of 2004, leaving just seven school districts. However, one of the remaining school districts (Jessamine, Kentucky) has two high schools and both participated in the project. A realignment of two other districts became necessary due to changing circumstances. Twin Falls was not able to secure the coaches' full cooperation to implement ATLAS and ATHENA, but the school wanted to continue with the demonstration project in some capacity. Consequently Twin Falls became an additional control site. Tallassee High School was willing to implement ATLAS and ATHENA in their sports programs and they also obtained a separate non-federal grant to increase the number of random student drug tests. Following these adjustments to the initial design, we arrived at the following assignments to the research conditions:

- A. Increased Testing: Jessamine County District, Nicholasville, KY (2 high schools)
- B. ATLAS and ATHENA: Manchester High School, North Manchester, IN
- C. Both enhancements: Brownsburg High School, Brownsburg, IN
Tallassee High School, Tallassee, AL
- D. Control schools: Huron School District, New Boston, MI
Mooreville High School, Mooreville, IN
Twin Falls School District, Twin Falls, ID

Interventions/Study Conditions

At the time that the schools were recruited to the study, they were administering mandatory, random drug tests at varying frequencies: testing from 10 to 50 percent of the athletes during the year. IBH used the grant funds to provide financial support for two of the schools in conditions A and C to increase the number of tests by approximately 50 percent in order to test 60 - 100 percent of the consenting athletes during each school year. The third school, Tallassee, used a

separate grant to raise their testing rates to approximately 100 percent. The testing protocols were expected to otherwise remain the same.

The educational programs that were implemented by three of the schools (conditions B and C) are ATLAS (Athletes Training & Learning to Avoid Steroids) for boys and ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) for girls. These programs were developed by OHSU, through grants from the National Institute on Drug Abuse, to promote healthy nutrition and exercise behaviors as alternatives to substance abuse, while reducing risk factors for performance enhancing and other substances of abuse (alcohol and illicit drugs). Each sport team participated in the program, with instruction led by student athlete peers and facilitated by coaches. Each of the program's 45-minute sessions (10 for ATLAS, 8 for ATHENA) consists of interactive activities including: educational games, role-playing exercises, creation of mock public service campaigns, and friendly competition between squads (small groups of 5-6 students). With funding from the demonstration project grant, OHSU provided initial training to the coaches and peer (squad) leaders and supplied them with requisite instructional materials: coach manuals, squad leader guides, workbooks and athlete guides.

The three control schools (condition D) were expected to continue operating their current student drug testing programs and agreed to make no substantive changes for a minimum of two years during the project. During the third year, however, some modifications were permitted to allow those schools to implement changes that would improve their programs using lessons learned from IBH, OHSU, and the other schools in the study.

Evaluation Measures

There were three major sources of data used to evaluate the process and results of the demonstration project. These included: an annual reporting form from each of the participating schools, an anonymous student survey, and several opportunities to obtain updates and feedback from representatives of the schools.

RSDT Rates and Results

During the three years of the study implementation IBH collected information from all participating schools about their random student drug testing programs. A form was developed to capture the following information for each school year: total student enrollment, number of students subject to RSDT, number of random drug tests performed, number of verified positive random drug tests, and the specific substances identified in the positive drug tests. The form also asked for the number and results of any drug tests that were performed for cause.

Student Survey on Drugs and Alcohol

The primary measure of the intended outcomes in this project (reduced rate of drug use by high school students participating in the proposed interventions) is a self-report questionnaire titled Student Survey on Drugs and Alcohol (SSDA). The survey instrument was modeled after one developed by Linn Goldberg, M.D. and his colleagues at OHSU for their SATURN (Student Athlete Testing Using Random Notification) a National Institute on Drug Abuse funded project. The SSDA is an anonymous survey that was administered to all consenting students in the

participating high schools. Survey questions asked about their use of various substances, their perceptions of drug use and availability in the school community, and student attitudes toward drug use and drug testing. The final version of the SSDA (which varies slightly from the version used initially) can be found in Appendix A.

The questionnaire was administered twice each school year during the study: from fall 2004 through spring 2007. Consent forms were sent to the homes of all students at the beginning of the study and then to ninth graders and other incoming students in the fall of each subsequent year. Participation in the survey was voluntary and anonymous. To keep other students from knowing who was participating in the drug use questionnaire and who was not, two survey instruments were included in the packets handed out: the actual SSDA and a similar-looking survey with questions about general knowledge rather than drugs and alcohol.

Site Visits and Other Contact with Participating Schools

During the initial months of the project interventions (spring 2005) two researchers from IBH conducted site visits to each of the schools with an intervention. In spring of the second year (2005-06), visits were made to all of the control sites. In the final year (spring 2007) telephone interviews were conducted with key school personnel from all of the schools. The site visits and interviews allowed IBH to receive updates on any changes occurring within the schools and their RSDT programs. Discussions of implementation issues were useful in avoiding any confusion regarding procedures and solving problems that were identified. The final interviews provided an opportunity to share the school-specific survey results and determine how well they meshed with other evidence of drug use in the schools (other surveys, discipline problems, anecdotal evidence). School representatives offered feedback regarding the demonstration project and shared their future plans regarding their RSDT programs.

Several teleconferences were conducted each school year—approximately once a month—for IBH, OHSU and the participating schools. Generally lasting from 30-60 minutes, the teleconferences were used for updates regarding the survey administration, interventions and RSDT programs. New developments and issues in the field were shared and peer relationships were established among representatives from the participating schools.

Annual meetings brought the school representatives together for multiple purposes. The first meeting (April 2004) was focused on training them in the policies and procedures involved in the project, including: consent forms, survey administration, and how the ATLAS/ATHENA programs work. In 2005 and 2006 preliminary results from the initial surveys were shared and discussed. Time was also set aside for the school representatives to share their experiences with RSDT and the program enhancements. The focus of the last meeting (June 2007) was on the interpretation of the findings and the impact of the project.

RESULTS

Random Student Drug Testing Rates and Results

Table 1 summarizes each school's RSDT rates and results from each of the three years of the study. As would be expected, the testing rates for the schools in the enhanced testing condition increased. The timing of the increases varied, however, as did the extent of the increase. Brownsburg was delayed in implementing their enhanced testing, so 2004-05 was a baseline measure. Jessamine, on the other hand, began its enhanced testing during the second semester of 2004-05 but did not administer as many drug tests as planned during the second year due to weather-related cancellations of some testing dates. Tallassee, with the benefit of an additional grant to increase testing for all their students, arrived at a testing rate of above 100 percent.

The percentage of random student drug tests that were positive for one or more substances decreased for the two schools with both enhanced testing and ATLAS/ATHENA (Brownsburg and Tallassee). The school with enhanced testing only (Jessamine) was already at 0 positive tests and varied very little from that level during the study. Manchester, with ATLAS/ATHENA had a very low rate of positive tests during all three years. Although the reduced numbers of positive tests at Brownsburg and Tallassee might be attributable to the interventions, the results may be confounded by other changes in the schools' testing program.

Table 1 records some changes that occurred in the participating schools' RSDT programs were not among the demonstration project's planned interventions. The most striking change was in the type of drug test. Brownsburg used urine tests during the first two years of the study and switched to a combination of tests during the third year, with about two-thirds of tests being urinalysis and one-third oral fluid analysis. Tallassee began with urine only in the first year, alternated urine and oral fluid tests during the second year, and switched to an oral screen with urine tests only for those with preliminary positive results. Due to the lower sensitivity of oral fluid tests, there may be more false negatives than with urine tests. Underscoring this pattern, but in reverse, was the experience of one of the control schools. Huron changed from oral fluids to urine tests during the three years of the study and its percentage of positive tests increased from 0 to 2.9. Mooresville, another control school, used a combination of analyses but with urine tests predominant and oral fluids only used occasionally.

**Table 1
Random Student Drug Testing Rates and Results**

School/Year	Type of Test	Percent in Testing Pool	Testing Rate**	Percent Positive (Without Tobacco)	Percent Positive (Includes Tobacco)
EXPERIMENTAL					
Brownsburg					
04-05	Urine	98	13	7.8	-
05-06	Urine	92	57	3.6	-
06-07	Combo	92	78	1.5	-
Jessamine					
04-05	Urine	39	47	0	-
05-06	Urine	39	46	0.9	-
06-07	Urine	38	67	0	-
Manchester					
04-05	Oral	77	29	1.7	-
05-06	Oral	77	24	0	-
06-07	Oral	92	28	0.8	-
Tallassee*					
04-05	Urine	79	85	2.2	4.7
05-06	Combo	89	105	2.8	7.1
06-07	Oral	88	126	0.0	0.3
CONTROL					
Huron					
04-05	Oral	50	20	0.0	-
05-06	Oral	47	32	0.0	-
06-07	Urine	60	20	2.9	-
Mooreville*					
04-05	Urine	69	31	6.8	11.4
05-06	Combo	81	33	9.0	17.4
06-07	Combo	73	45	7.2	15.9
Twin Falls					
04-05	Urine	43	29	5.3	-
05-06	Urine	49	22	3.0	-
06-07	Urine	54	23	4.6	-

*Tests students for tobacco use.

**Rate is computed by dividing the number of drug tests administered by the number of students in the testing pool.

Student Survey on Drugs and Alcohol

Survey Completion

A total of 27,604 valid surveys¹ were collected from students during the six administrations of the SSDA. Table 2 shows the number of surveys collected by school for each survey period. Nearly equal numbers of surveys were collected from Experimental and Control schools over the course of the study. Excluding the Fall 2005 survey period when only two of the schools distributed surveys to all grade levels, on average 55 percent of students in the Experimental schools and 64 percent of students in Control schools completed valid surveys during each survey period.

Table 2
Number of Valid Surveys Collected by School and Survey Period

	Avg. Enrollment	Fall 2004	Spring 2005	Fall 2005*	Spring 2006	Fall 2006	Spring 2007	Total
Experimental								
Brownsburg	1998	1449	1288	-	1130	1364	915	6146
Jessamine	1885	103	211	-	1194	1104	1018	3630
Manchester	517	468	401	406	344	394	303	2316
Tallassee	538	388	86	-	443	408	455	1780
Subtotal	4938	2408	1986	406	3111	3270	2691	13872
Control								
Huron	801	0	556	639	572	677	610	3054
Mooreville	1304	821	864	-	912	1074	873	4544
Twin Falls	1962	1108	1267	-	1401	918	1440	6134
Subtotal	4067	1929	2687	639	2885	2669	2923	13732
TOTALS	9005	4337	4673	1045	5996	5939	5614	27604

*Five of the schools surveyed only ninth grade students in this period; data from students in these schools were not included in the evaluation study.

¹ A survey was considered invalid and was excluded from the study if response patterns indicated that the student did not answer the survey honestly (e.g., reported participation in every sport or use of every drug 40+ times in the last 30 days), if answers to related questions were highly inconsistent, or if an excessive number of questions were not answered. Of the 28,612 surveys returned to the researchers, 1,008 were judged to be invalid (3.5%).

Characteristics of Experimental and Control Schools

Table 3 summarizes key characteristics of survey respondents for each of the schools in the study. Although there were some variations among the individual schools, there were few overall differences between students in the Experimental and Control conditions.

In both the Experimental and Control conditions just under half of the respondents were males (47%) and the average age was 15.9 years. The majority of students in both conditions, about 58 percent, were underclass students and the respondents were predominantly white (86 percent in each condition). The only difference between students in the two conditions was that more students in the Experimental schools reported participating in athletics (57%) and extracurricular activities (67%) than did students in the Control schools (52% and 63% respectively). Despite these differences, the percentage of respondents who were in the RSDT pool due to participation in these activities was about the same for the two groups (73-74%).

Table 3 indicates that one school in each of the Experimental and Control conditions tested only athletes while the rest tested both athletes and participants in extracurricular activities. Using students' reported participation in these activities, the percentage of students in the testing pool was computed for each school. For schools testing athletes only, it was equivalent to the percentage of athletes in the survey. For schools testing those in extracurriculars, the percentage was calculated by adding the number of students who reported participating in at least one sport (the athletes) to the number of non-athletes who reported engaging in one or more extracurricular activities and then dividing the sum by the total number of respondents. Among the Experimental schools, this percentage ranged from 49 to 92 percent; the range was 62 to 77 percent for Control schools. As expected, schools that tested only athletes had the lowest percentage of students in the testing pool.

Table 3
Characteristics of Experimental and Control Schools

CONDITION:	EXPERIMENTAL SCHOOLS				CONTROL SCHOOLS				ALL SCHOOLS	
Intervention:	Enhanced RSDT	A/A Only	Enhanced RSDT+ A/A		All Exper. Schools (n=13872)	Maintain Current RSDT Program			All Control Schools (n=13732)	Total (n=27604)
Schools:	Jessamine (n=3630)	Manchester (n=2316)	Brownsburg (n=6146)	Tallassee (n=1780)		Huron (n=3054)	Mooreville (n=4544)	Twin Falls (n=6134)		
Percent Male	48%	47%	47%	48%	47%	52%	46%	46%	47%	47%
Grade In School										
9th	34%	28%	32%	33%	32%	30%	30%	31%	30%	31%
10th	29%	26%	27%	23%	27%	28%	28%	26%	27%	27%
11th	21%	26%	24%	23%	23%	24%	22%	24%	24%	24%
12th	15%	20%	17%	21%	18%	18%	20%	19%	19%	18%
Average Age	15.9	16.1	16.0	15.6	15.9	15.7	16.2	15.9	15.9	15.9
Race/Ethnicity										
White	88%	93%	87%	70%	86%	89%	93%	80%	87%	86%
Black/African Am.	6%	1%	6%	27%	8%	3%	2%	2%	2%	5%
Hispanic/Latino	3%	2%	2%	2%	2%	4%	1%	12%	7%	5%
Asian	1%	2%	2%	<1%	2%	1%	1%	3%	2%	2%
American Indian	2%	1%	2%	<1%	1%	3%	2%	3%	1%	2%
Pacific Islander	<1%	<1%	1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Participates In:										
Athletics	49%	65%	54%	71%	57%	62%	54%	45%	52%	54%
Extracurriculars	64%	72%	62%	83%	67%	58%	66%	64%	63%	65%
Tests										
Athletes	Y	Y	Y	Y		Y	Y	Y		
Extracurriculars	N	Y	Y	Y		N	Y	Y		
Percent in Testing Pool	49%	84%	78%	92%	73%	62%	77%	77%	74%	73%

Central Hypotheses/GPRA Measures

The central hypothesis of the evaluation was that the introduction during the first year of the study of one or both of the primary interventions—enhanced rates of testing for those in the testing pool (Enhanced RSDT) and/or implementation of the ATLAS/ATHENA program (A/A)—would result in reduced use of illicit drugs by students in subsequent years. The overall objectives of the study were to determine first if any reductions occurred and second if they achieved the standard for success established by the Department of Education’s GPRA measures: 5 percent reduction per year in reported use for the last 30 days and for the past 12 months.

The evaluation was also designed to study the effects of the interventions on the use of alcohol and other potentially dangerous substances such as steroids and diet pills, even though students were not tested for these substances. Two competing hypotheses were examined. One was that if the interventions were effective in reducing the use of illicit drugs, there might be a spillover or generalization effect that would result in reduced use of these substances. The alternative hypothesis was that reductions in the use of tested drugs such as marijuana might be offset by increases in the use of non-tested substances, particularly alcohol.

The main hypotheses were tested at several levels going from the general to the specific. The initial analysis was to see if the interventions were able to result in school-wide reductions in drug use at any school that implemented one or both of the interventions. For this analysis the data for all Experimental schools were combined to see if there were year-to-year reductions in drug use, as compared to the Control schools. The next level of analysis was by experimental condition to see if either the Enhanced RSDT or A/A intervention alone resulted in school-wide reductions, and if combining the educational and increased drug testing interventions produced a greater effect. The third level of analysis was to examine the effects of the interventions on athletes only, since they were the direct targets of the interventions (ATLAS and ATHENA are substance abuse prevention programs targeted to student-athletes) and therefore should have been the most likely to change their drug use patterns. This analysis would determine if the interventions were effective for athletes, even if there were no overall school-wide changes in drug usage. The final level of analysis was to examine the direct effects of the A/A intervention by comparing drug use by athletes who participated in ATLAS (for males) or ATHENA (for females) to that of athletes at the same schools who indicated that they had not participated.

Drug Use Indices

To test the hypotheses, six separate indices of drug use were developed—three for measuring drug use in the last 30 days and three measuring usage in the past 12 months. The 30-Day Illicit Drugs Index combined students’ reported use of seven illegal substances into one scale. The substances, which included ones tested for by the schools, were cocaine, amphetamines, narcotics, inhalants, PCP, club drugs, and pseudophedrine. Each drug use response was converted to counts of times using the drug. Counts were then summed for all seven drugs and the total was categorized to form the index: nonuse (0), light (1), moderate (2), and heavy use (3). A separate index, the 30-Day “Supplements Index,” was developed in a similar way to measure use of four drugs associated with athletic performance enhancement: androstenedione, anabolic steroids, creatine, and diet pills.

Because marijuana was the most commonly used illegal drug across all schools, generally used at rates that equaled or exceeded the use of all other illicit drugs combined, its usage was examined independently in this study. However, to better gauge the use of all illicit drugs by students, a third index was created that measured the use of any illicit drugs, including marijuana, in the last 30 days. The 30-Day Illicit Drugs and Marijuana Index was constructed in the same way as the two previous indices.

Three similar indices were developed to measure drug usage in the past twelve months. In addition, students' use of alcohol and marijuana were also categorized into four levels of use. The categories for 30-day and 12-month usage for all indices of drug and alcohol use are as follows:

30-Day: 0 = None 1 = Light (1-2 times) 2 = Moderate (3-9 times) 3 = Heavy (10+ times)
12-Month: 0 = None 1 = Light (1-5 times) 2 = Moderate (6-19 times) 3 = Heavy (20+ times)

Drug Use at Experimental and Control Schools

To test the hypothesis that the interventions produced school-wide year-to-year reductions in drug use, data from the spring administrations of the SSSA were analyzed. Fall data were not used in the analyses because students, particularly freshmen, may not have had sufficient exposure to the interventions for them to have an effect at the time the fall data were collected. Analysis of variance was used to compare the mean scores on each index from spring to spring. The ANOVAs were run separately for the Experimental and Control schools. It was hypothesized that by spring 2007 there would be a significant reduction in the use of illicit drugs in the Experimental schools. Drug use in the Control schools was predicted to remain relatively constant across time.

Table 4 presents the results of the analyses of the 30-day drug and alcohol use data for Experimental and Control Schools. For the Experimental schools, the average levels of drug and alcohol use remained unchanged from year to year, contrary to the main hypothesis. There were, however, significant differences from spring to spring in usage of all substances by students in the Control schools. Post hoc pairwise comparisons of the mean scores for the Control schools revealed that in all instances this was caused by a spike in the reported use of drugs and alcohol in spring 2006, the middle year of the study. Mean scores for the first and last years of the study were not significantly different for the Control schools for any substance. This supports the hypothesis that, similar to the Experimental schools, there was no upward or downward trend in drug or alcohol use by students in the Control schools.

Table 4
Drug and Alcohol Use in Last 30 Days for Experimental and Control Schools

	Spring 2005	Spring 2006	Spring 2007	Mean	F	df	p
Alcohol							
Control	.74	.82	.76	.77	3.96	2, 8229	<.05
Experimental	.61	.60	.60	.60	.10	2, 7551	ns
Marijuana							
Control	.37	.44	.39	.40	4.56	2, 8357	<.05
Experimental	.25	.29	.30	.28	2.80	2, 7621	ns
Illicit Drugs							
Control	.30	.36	.28	.31	7.65	2, 8357	<.001
Experimental	.26	.27	.25	.26	.26	2, 7434	ns
Illicit Drugs and MJ							
Control	.52	.60	.52	.55	5.62	2, 8135	<.01
Experimental	.41	.43	.43	.43	.38	2, 7407	ns
Supplements							
Control	.15	.21	.17	.18	6.84	2, 8258	<.001
Experimental	.16	.17	.18	.17	.68	2, 7504	ns

30-Day Scale: 0 = None 1 = Light (1-2 times) 2 = Moderate (3-9 times) 3 = Heavy (10+ times)

A notable finding from the results shown in Table 4 is that, with the exception of supplements, students in the Control schools reported significantly greater usage of drugs and alcohol than those in the Experimental schools. Using t-tests to compare the average means for all years combined, it was found that Control students had significantly higher scores ($p < .001$) on the index for illicit drugs, the index for illicit drugs and marijuana combined, and for use of alcohol and marijuana measured separately. As the table indicates, these differences were constant from year to year beginning in the first year of data collection. Students in the two groups did not differ significantly in the use of supplements.

To help put these findings in context and aid in their interpretation, Table 5 shows the percentage of Experimental and Control group students in each usage category by substance for all spring data combined. In the Experimental schools, alcohol was the most commonly used substance with 32 percent of students reporting that they had drunk alcohol in the last 30 days. Marijuana had been used by 14 percent of these students, and 13 percent had used at least one of the seven drugs in the Illicit Drug Index. Altogether, 20 percent of the Experimental school students had used either marijuana or another illicit drug in the last 30 days. Many fewer students, 8 percent, reported using supplements.

Table 5
Percentage of Experimental and Control Students in Each Usage Category
For Drug and Alcohol Use Reported in the Last 30 Days
(Spring Data Combined Across All Years)

	Control (n=8360)	Experimental (n=7624)	Total (n=15984)
Alcohol			
None	60%	68%	64%
Light	13%	12%	13%
Moderate	15%	13%	14%
Heavy	11%	7%	9%
Marijuana			
None	82%	86%	84%
Light	5%	5%	5%
Moderate	5%	4%	4%
Heavy	8%	5%	7%
Illicit Drugs			
None	85%	87%	86%
Light	5%	4%	4%
Moderate	5%	4%	4%
Heavy	6%	5%	5%
Illicit Drugs and MJ			
None	76%	80%	78%
Light	6%	6%	6%
Moderate	6%	5%	6%
Heavy	12%	9%	10%
Supplements			
None	92%	92%	92%
Light	2%	2%	2%
Moderate	2%	2%	2%
Heavy	4%	3%	4%

For students in Control schools, the reported rates for any use of alcohol (40%), marijuana (18%), other illicit drugs (15%), and marijuana and illicit drugs combined (24%) were significantly higher than for students in Experimental schools. The percentage reporting any use of supplements (8%) was the same.

Data on students' reported use of drugs and alcohol in the past 12 months were analyzed in the same way as the 30-day usage data. The results, as shown in Table 6, were similar to the previous findings:

- Each spring, students in the Experimental schools reported the same rates of drug and alcohol use during the past year;

- In each survey period, students in Control schools reported higher past 12-month usage of alcohol and drugs, except for supplements, than did those in the Experimental schools; and
- There were some statistically different rates of use of drugs and alcohol for Control school students from spring to spring, due primarily to a spike in self-reported usage in spring 2006.

Table 6
Drug and Alcohol Use in Past 12 Months for Experimental and Control Schools

	Spring 2005	Spring 2006	Spring 2007	Mean	F	df	p
Alcohol							
Control	1.16	1.18	1.10	1.15	3.67	2, 8254	<.05
Experimental	.98	.95	.94	.96	.79	2, 7597	ns
Marijuana							
Control	.55	.61	.57	.57	2.73	2, 8344	ns
Experimental	.39	.41	.43	.41	1.43	2, 7617	ns
Illicit Drugs							
Control	.45	.51	.45	.47	4.66	2, 8357	<.01
Experimental	.37	.37	.36	.37	.23	2, 7454	ns
Illicit Drugs and MJ							
Control	.74	.80	.73	.76	3.38	2, 8161	<.05
Experimental	.58	.58	.58	.58	.01	2, 7424	ns
Supplements							
Control	.23	.28	.24	.25	4.79	2, 8274	<.01
Experimental	.25	.24	.24	.24	.03	2, 7519	ns

Past Year Scale: 0 = None 1 = Light (1-5 times) 2 = Moderate (6-19 times) 3 = Heavy (20+ times)

Table 7 shows for the 12-month data the percentage of Experimental and Control group students in each usage category by substance. The overall patterns of use are the same as for the 30-day data; however, a much greater percentage of students reported using each type of substance at least once.

Table 7
Percentage of Experimental and Control Students in Each Usage Category
For Drug and Alcohol Use Reported in the Past 12 Months
(Spring Data Combined Across All Years)

	Control (n=8347)	Experimental (n=7620)	Total (n=15967)
Alcohol			
None	39%	46%	43%
Light	24%	25%	24%
Moderate	19%	16%	18%
Heavy	18%	13%	15%
Marijuana			
None	71%	79%	75%
Light	11%	9%	10%
Moderate	6%	4%	5%
Heavy	11%	8%	10%
Illicit Drugs			
None	74%	80%	77%
Light	12%	9%	11%
Moderate	6%	5%	5%
Heavy	8%	6%	7%
Illicit Drugs and MJ			
None	63%	71%	67%
Light	13%	11%	13%
Moderate	8%	7%	7%
Heavy	16%	11%	13%
Supplements			
None	87%	88%	87%
Light	6%	5%	6%
Moderate	3%	3%	3%
Heavy	4%	4%	4%

In summary, the results of the analyses of the 30-day and 12-month data on reported drug and alcohol use indicate the interventions did not affect usage of any substance among all students at the four Experimental schools combined. Usage rates were similar throughout the three years of the study. Further, the analyses found that despite the overall demographic similarities between the Experimental and Control group students, those in the Control schools consistently used drugs and alcohol at higher rates, even in the first year of the study which constituted the baseline period. Therefore, it is unlikely that the usage differences between the two groups of students were due to the interventions, but rather to pre-existing differences in rates of consumption at the Experimental and Control schools.

Drug Use at Schools in Various Experimental Conditions

For schools in each of the three intervention conditions (Enhanced RSDT Only, A/A Only, and Enhanced + A/A), separate ANOVAs were run as described above comparing drug and alcohol use from spring to spring. The purpose was to determine if at least one of the interventions had resulted in school-wide reductions in 30-day or 12-month usage of any substance. The results were negative for all analyses: the level of reported drug and alcohol use for the entire student body remained constant from year to year regardless of the intervention.

The same analyses were then run just for the athletes in the Experimental schools. The results revealed that none of the interventions resulted in measurable year-to-year reductions of drug and alcohol use by athletes in any of the Experimental schools.

Since there were no changes in drug or alcohol use across years by intervention, data from all three spring surveys were combined within each experimental condition and used to compare usage among schools with different interventions. Table 8 summarizes the results of the tests of significance (F-tests) that were performed on the 30-day drug and alcohol use data for all students in each of the three intervention conditions.

Table 8
Drug and Alcohol Use in the Last 30 Days
For Four Experimental Conditions

Substances	N	Grand Mean	F	df	p
Alcohol	7554	.60	8.15	2, 7551	<.001
Marijuana	7624	.28	11.07	2, 7621	<.001
Illicit Drugs	7437	.26	1.30	2, 7434	ns
Illicit Drugs and MJ	7410	.43	8.41	2, 7407	<.001
Supplements	7507	.17	4.27	2, 7504	<.05

Since the analyses indicated there were significant differences between groups for four of the substances examined, post hoc analyses were performed using Tukey's Honestly Significant Differences (HSD) test to determine which schools differed from each other on their mean scores for measures of drug and alcohol use. The Tukey HSD ranks group mean scores from lowest to highest and performs pairwise comparisons to determine if the means for adjacent groups are significantly different from each other at the $\alpha = .05$ level. Groups that are not significantly

different are considered to belong in the same subset. Table 9 presents the results of the pairwise comparisons for drug and alcohol use in the last 30 days by experimental condition.

Table 9
Post Hoc Comparisons of Mean Scores for Drug and Alcohol Use
In the Last 30 Days for Three Experimental Conditions

Substance/Condition	N	Subset for alpha = .05		
		1	2	3
Alcohol				
Enhanced + A/A	4190	.57		
Enhanced RSDT Only	2351	.60		
A/A Only	1013		.71	
Harmonic Mean Sample Size	1817			
Marijuana				
A/A Only	1026	.25		
Enhanced + A/A	4132	.26		
Enhanced RSDT Only	2385		.35	
Harmonic Mean Sample Size	1839			
Illicit Drugs				
Enhanced + A/A	4097	.25		
A/A Only	1017	.27		
Enhanced RSDT Only	2323	.28		
Harmonic Mean Sample Size	1810			
Illicit Drugs and MJ				
Enhanced + A/A	4081	.39		
A/A Only	1011	.40		
Enhanced RSDT Only	2318		.49	
Harmonic Mean Sample Size	1801			
Supplements				
Enhanced + A/A	4148	.15		
A/A Only	1021	.19		
Enhanced RSDT Only	2338	.19		
Harmonic Mean Sample Size	1820			

Tukey HSD tests for subsets. Means for groups in homogeneous subsets are displayed. Harmonic mean of group size is used since group sizes are unequal.

The subsets in Table 9 indicate that for some substances there were significant differences between students in different experimental conditions. In the case of alcohol use, students at the A/A-Only school had a mean score that was significantly higher than the scores for students in

the other two Experimental conditions. On the other hand, students at the Enhanced-Only school had significantly higher mean scores for marijuana use and on the Illicit Drugs and Marijuana Index. The post hoc comparisons found no real difference between groups on the use of illicit drugs or supplements.

Similar analyses were performed on the 12-month drug and alcohol data and the results are summarized in Tables 10 and 11. These results were generally consistent with the results from the 30-day analysis. The major difference was that students in two of the groups, Enhanced RSDT Only and A/A Only, were more likely to have used supplements in the past year than students in the Enhanced + A/A schools.

Table 10
Drug and Alcohol Use in the Past 12 Months
For Three Experimental Conditions

Substances	N	Grand Mean	F	df	p
Alcohol	7600	.96	20.88	2, 7597	<.001
Marijuana	7620	.41	10.84	2, 7617	<.001
Illicit Drugs	7457	.37	3.54	2, 7456	<.05
Illicit Drugs and MJ	7427	.58	9.34	2, 7424	<.001
Supplements	7522	.24	7.55	2, 7519	<.001

The same analyses were run for athletes in the three experimental conditions to examine differences in 30-day and 12-month drug and alcohol use. The pattern of significant results was nearly identical to that found for the general student body: There were no differences among athletes across conditions in the use of illicit drugs; athletes in the A/A Only school used alcohol more than athletes at other schools; athletes at the Enhanced RSDT Only school were more likely to use marijuana than the others, and consequently had higher scores on the Index of Illicit Drugs and Marijuana Use for past 30-day and 12-month use. In regard to the use of “supplements,” the only significant difference was that athletes in the Enhanced RSDT Only school had a higher level of use of a combination of anabolic steroids, androstenedione (androgen precursor), diet pills, and creatine than those in the Enhanced + A/A condition.

Table 11
Post Hoc Comparisons of Mean Scores for Drug and Alcohol Use
In the Past 12 Months for Three Experimental Conditions

Substance/Condition	N	Subset for alpha = .05		
		1	2	3
Alcohol				
Enhanced + A/A	4217	.91		
Enhanced RSDT Only	2366	.96		
A/A Only	1017		1.14	
Harmonic Mean Sample Size	1826			
Marijuana				
A/A Only	1023	.37		
Enhanced + A/A	4215	.38		
Enhanced RSDT Only	2382		.48	
Harmonic Mean Sample Size	1835			
Illicit Drugs				
Enhanced + A/A	4112	.35		
A/A Only	1015	.38		
Enhanced RSDT Only	2330	.40		
Harmonic Mean Sample Size	1810			
Illicit Drugs and MJ				
Enhanced + A/A	4094	.54		
A/A Only	1010	.55		
Enhanced RSDT Only	2323		.66	
Harmonic Mean Sample Size	1802			
Supplements				
Enhanced + A/A	4154	.21		
Enhanced RSDT Only	2343		.27	
A/A Only	1025		.29	
Harmonic Mean Sample Size	1826			

Tukey HSD tests for subsets. Means for groups in homogeneous subsets are displayed. Harmonic mean of group size is used since group sizes are unequal.

In summary, the results of the school-wide and athlete-only comparisons among students in the three experimental conditions do not support the hypothesis that one intervention was more powerful than the others in reducing drug and alcohol use. There was no significant reduction across time in the use of any substance for students in any of the conditions. The findings that students and student-athletes in the A/A Only school drank more alcohol and those in the Enhanced RSDT Only school used more marijuana than others probably reflects patterns of

usage that existed at the schools prior to the study and continued throughout the follow-up periods. These differences should not be attributed to the effects of the interventions.

The Effects of the ATLAS and ATHENA Programs on Drug and Alcohol Use

The final analyses performed to determine if the interventions had an effect on students' use of drugs and alcohol involved comparing the 30-day and 12-month usage by athletes who had participated in ATLAS or ATHENA to that of students in the same schools who indicated on the SSDA that they had not attended these programs.² Data from all survey periods were used in the analyses. The analyses were performed separately for the two programs, since one was designed for boys and the other for girls.

Table 12, which summarizes the results for male athletes, shows that participation in ATLAS had no impact on their use of drugs or alcohol, either in the last 30 days or in the past 12 months, when compared to their peers. Even those who reported completing all of the ATLAS educational sessions showed no difference in their reported usage when compared to non-participants.

² The latter group may include some athletes who chose not to participate and some whose teams did not fully implement ATLAS or ATHENA that season. There may also be some students who did not recognize the program's name at the time of the survey or who listed a sport in which they did not continue.

Table 12
Drug and Alcohol Use by Male Athletes
In Schools That Implemented ATLAS

	N	Mean	t	df	p
USE IN LAST 30 DAYS					
Alcohol					
Did Not Attend	758	.61	-.80	1441	ns
Attended ATLAS	685	.65			
Marijuana					
Did Not Attend	772	.26	1.36	1460	ns
Attended ATLAS	690	.21			
Illicit Drugs					
Did Not Attend	758	.28	.40	1439	ns
Attended ATLAS	683	.26			
Illicit Drugs and MJ					
Did Not Attend	747	.42	1.29	1427	ns
Attended ATLAS	682	.35			
Supplements					
Did Not Attend	774	.25	-.72	1458	ns
Attended ATLAS	686	.28			
USE IN PAST 12 MONTHS					
Alcohol					
Did Not Attend	765	.92	-1.32	1448	ns
Attended ATLAS	685	.99			
Marijuana					
Did Not Attend	773	.38	1.38	1458	ns
Attended ATLAS	687	.32			
Illicit Drugs					
Did Not Attend	761	.35	.25	1420	ns
Attended ATLAS	683	.36			
Illicit Drugs and MJ					
Did Not Attend	752	.56	.73	1430	ns
Attended ATLAS	680	.53			
Supplements					
Did Not Attend	777	.32	-1.86	1461	ns
Attended ATLAS	686	.41			

30 Day Scale: 0 = None 1 = Light (1-2 times) 2 = Moderate (3-9 times) 3 = Heavy (10+ times)

Past Year Scale: 0 = None 1 = Light (1-5 times) 2 = Moderate (6-19 times) 3 = Heavy (20+ times)

In contrast, female athletes who participated in ATHENA had significantly lower mean scores than their peers on all measures of drug and alcohol use, both in the last 30 days and in the past twelve months (see Table 13). The effects of ATHENA participation were most apparent in the reduced use of marijuana and illicit drugs. As shown in Table 14, ATHENA participants reported

using these substances about half as often as athletes who had not participated in the program, both in the last 30 days and during the past year. The results indicate that the ATHENA program helped those who were directly exposed to this intervention avoid the use of drugs and alcohol.

Table 13
Drug and Alcohol Use by Female Athletes
In Schools That Implemented ATHENA

	N	Mean	t	df	p
USE IN LAST 30 DAYS					
Alcohol					
Did Not Attend	646	.52	2.65	1376	<.01
Attended ATHENA	732	.40			
Marijuana					
Did Not Attend	651	.16	2.70	1383	<.01
Attended ATHENA	734	.09			
Illicit Drugs					
Did Not Attend	639	.21	3.35	1370	<.001
Attended ATHENA	733	.11			
Illicit Drugs and MJ					
Did Not Attend	637	.30	4.15	1365	<.001
Attended ATHENA	730	.15			
Supplements					
Did Not Attend	647	.11	2.02	1381	<.05
Attended ATHENA	736	.06			
USE IN PAST 12 MONTHS					
Alcohol					
Did Not Attend	648	.92	2.97	1382	<.01
Attended ATHENA	736	.76			
Marijuana					
Did Not Attend	651	.27	3.18	1384	<.001
Attended ATHENA	735	.17			
Illicit Drugs					
Did Not Attend	638	.31	3.99	1369	<.001
Attended ATHENA	733	.17			
Illicit Drugs and MJ					
Did Not Attend	636	.45	4.62	1365	<.001
Attended ATHENA	731	.26			
Supplements					
Did Not Attend	648	.15	2.04	1382	<.05
Attended ATHENA	736	.10			

30 Day Scale: 0 = None 1 = Light (1-2 times) 2 = Moderate (3-9 times) 3 = Heavy (10+ times)
Past Year Scale: 0 = None 1 = Light (1-5 times) 2 = Moderate (6-19 times) 3 = Heavy (20+ times)

Table 14
Drug and Alcohol Use by Female Athletes
In Schools That Implemented ATHENA

Any Use of Substance	Attended ATHENA		Difference
	No (n=651)	Yes (n=736)	
USED IN LAST 30 DAYS			
Alcohol	29.7%	23.2%	-6.5%
Marijuana	9.1%	5.6%	-3.5%
Illicit Drugs	11.7%	5.7%	-6.0%
Illicit Drugs and MJ	15.9%	8.6%	-7.3%
Supplements	5.3%	3.1%	-2.2%
USED IN PAST 12 MONTHS			
Alcohol	57.4%	48.2%	-9.2%
Marijuana	18.3%	10.5%	-7.8%
Illicit Drugs	20.2%	10.8%	-9.4%
Illicit Drugs and MJ	27.4%	16.0%	-11.4%
Supplements	9.3%	5.8%	- 3.5%

Other Findings

From the initial administration of the SSDA and throughout subsequent self-reports it was noted that students who were subject to drug testing due to their participation in athletics or extracurricular activities were less likely than those who were not subject to drug testing to report that they used drugs and alcohol. This was true for students in both the Experimental (with enhanced interventions) and the Control schools (who were subject to drug testing at a lower level). Even among the students in the testing pools, some differences in use were observed between athletes and those who were subject to testing only because of their participation in extracurricular activities. It was also noted that students in the testing pool at each school tended to have more positive attitudes toward RSDT than students who were not subject to testing.

As a result of these preliminary findings, two exploratory studies were conducted using data from all administrations of the SSDA combined. The first study compared the rates of drug and alcohol use for five mutually exclusive groups of students. Group membership was derived from students' reported participation in athletics and/or extracurricular activities and whether they were in the testing pools at their particular schools due to their participation in these activities. The five groups were as follows:

Group	Activities	Testing Status
Athletics Only/Tested	Athletics only	Tested at all schools
Extras Only/Not Tested	Extracurriculars only	School tests only athletes
Extras Only/Tested	Extracurriculars only	School tests if in extracurricular activities
Both Activities/Tested	Athletics and Extracurriculars	Tested due to athletics at all schools
No Activities/Not Tested	In neither activity	Not subject to RSDT at any school

The second exploratory study examined students' attitudes and beliefs about drug and alcohol testing to see if there were differences among the groups and if these differences were related to their reported usage.

Drug and Alcohol Use by Activities/Testing Categories

One-way ANOVAs were performed on the various indices of drug and alcohol use to determine if any of the five groups differed in their reported rates of usage during the past 30 days or 12 months. Table 15, which summarizes the results of the analyses for drug and alcohol use in the last 30 days, shows that there were significant differences between the groups on each of the measures.

Table 15
Tests of Significance for Differences in Drug and Alcohol Use in Last 30 Days
For Five Student Activity/Drug Testing Categories

Substance	N	Grand Mean	F	df	p
Alcohol	25923	.63	108.74	4, 25918	<.001
Marijuana	26280	.31	221.12	4, 26275	<.001
Illicit Drugs	25717	.28	65.84	4, 26275	<.001
Illicit Drugs and MJ	25582	.45	187.44	4, 25577	<.001
Supplements	25918	.16	26.76	4, 25913	<.001

Post hoc analyses were performed using Tukey HSD tests to compare group means and determine the magnitude of the differences. The results of these analyses appear in Table 16. For each substance, the Activity/Testing groups are rank ordered by mean score from lowest to highest; groups with means that are significantly different from one another are placed in different subsets. For example, the self-report for alcohol use shows that students in the Extras Only/Tested group and the Both Activities/Tested group had mean scores that were equivalent, but significantly lower than those for the other three groups. The Extras Only/Not Tested group, in turn, had a mean score that was significantly different from those groups above and below them in the ranking. The Athletics Only/Tested and the No Activities/Not Tested groups had the highest mean scores and were in the same subset, which indicates that they were the most likely to have used alcohol recently and at approximately the same level of use.

For the three scales measuring the use of marijuana and other illicit drugs, a similar pattern of results emerged from the comparisons. Students who did not participate in athletics or other extracurricular activities, and therefore were not subject to testing, consistently had mean scores that were significantly higher than the scores for any other groups. Conversely, students who participated in both types of activities and were subject to testing always had mean scores that were significantly lower than for all but perhaps one other group. The mean scores for students in the other three groups fell in between these two extremes, but always in the same order:

Table 16
Post Hoc Comparisons of Drug and Alcohol Use in the Last 30 Days
By Student Activity/Drug Testing Categories

Activity/Testing Group	N	Subset for alpha = .05			
		1	2	3	4
Alcohol					
Extras Only/Tested	5106	.52			
Both Activities/Tested	9490	.53			
Extras Only/Not Tested	1475		.60		
Athletics Only/Tested	4892			.76	
No Activities/Not Tested	4960			.82	
Harmonic Mean Sample Size	3610				
Marijuana					
Both Activities/Tested	9592	.17			
Extras Only/Tested	5183		.25		
Athletics Only/Tested	4975			.33	
Extras Only/Not Tested	1502			.36	
No Activities/Not Tested	5028				.58
Harmonic Mean Sample Size	3669				
Illicit Drugs					
Both Activities/Tested	9406	.21			
Extras Only/Tested	5080	.22			
Athletics Only/Tested	4842		.30		
Extras Only/Not Tested	1472		.32		
No Activities/Not Tested	4917			.42	
Harmonic Mean Sample Size	3591				
Illicit Drugs and MJ					
Both Activities/Tested	9354	.30			
Extras Only/Tested	5061		.37		
Athletics Only/Tested	4813			.49	
Extras Only/Not Tested	1467			.51	
No Activities/Not Tested	4887				.75
Harmonic Mean Sample Size	3575				
Supplements					
Extras Only/Tested	5126	.10			
Extras Only/Not Tested	1476		.15		
No Activities/Not Tested	4969		.15		
Both Activities/Tested	9461		.16		
Athletics Only/Tested	4886			.22	
Harmonic Mean Sample Size	3612				

Tukey HSD tests for subsets. Means for groups in homogeneous subsets are displayed.

Students who participated only in extracurriculars and were tested had significantly lower scores than those who only pursued athletics (tested) or those only in extracurriculars but not tested. The later two groups were always in the same subset.

A different grouping emerged for the index measuring supplement use. On this measure, students who only participated in athletics had the highest mean score, indicating the most use of drugs such as anabolic steroids and diet pills. Their mean score was significantly higher than that of any other group. Students who only participated in extracurricular activities and were also tested had a mean score significantly lower than for the other groups. The other three groups were similar in their usage of supplements.

The analysis of reported drug and alcohol use data for the past 12 months produced nearly identical results as for the 30-day data. These are summarized in Tables 17 and 18. To provide an idea of the magnitude of the differences in drug and alcohol use between groups, the percentage of students who used a particular substance at least once in the past year is shown below for the highest and lowest usage groups:

	Highest		Lowest	
Alcohol:	No Activities/Not Tested:	63.7%	Extras Only/Tested:	50.3%
Marijuana:	No Activities/Not Tested:	36.7%	Both Activities/Tested:	16.3%
Illicit Drugs:	No Activities/Not Tested:	31.0%	Both Activities/Tested:	17.7%
Illicit Drugs & MJ:	No Activities/Not Tested:	44.5%	Both Activities/Tested:	24.6%
Supplements:	Athletes Only/Tested:	16.6%	Extras Only/Tested:	8.8%

Table 17
Tests of Significance for Differences in Drug and Alcohol Use in Past 12 Months
For Five Student Activity/Drug Testing Categories

Substance	N	Grand Mean	F	df	p
Alcohol	26017	1.01	137.67	4, 26012	<.001
Marijuana	26263	.46	228.26	4, 26258	<.001
Illicit Drugs	25790	.41	75.44	4, 26285	<.001
Illicit Drugs and MJ	25651	.64	230.12	4, 25646	<.001
Supplements	25964	.23	39.14	4, 25959	<.001

Table 18
Post Hoc Comparisons of Drug and Alcohol Use in Past 12 Months
By Student Activity/Drug Testing Categories

Activity/Testing Group	N	Subset for alpha = .05			
		1	2	3	4
Alcohol					
Extras Only/Tested	5125	.87			
Both Activities/Tested	9519	.89			
Extras Only/Not Tested	1483		.99		
Athletics Only/Tested	4910			1.17	
No Activities/Not Tested	4980				1.24
Harmonic Mean Sample Size	3626				
Marijuana					
Both Activities/Tested	9585	.28			
Extras Only/Tested	5184		.41		
Extras Only/Not Tested	1503			.52	
Athletics Only/Tested	4970			.53	
No Activities/Not Tested	5021				.80
Harmonic Mean Sample Size	3669				
Illicit Drugs					
Both Activities/Tested	9429	.31			
Extras Only/Tested	5095	.36			
Athletics Only/Tested	4865		.44		
Extras Only/Not Tested	1475		.47		
No Activities/Not Tested	4926			.60	
Harmonic Mean Sample Size	3600				
Illicit Drugs and MJ					
Both Activities/Tested	9374	.45			
Extras Only/Tested	5073		.57		
Extras Only/Not Tested	1470			.71	
Athletics Only/Tested	4837			.71	
No Activities/Not Tested	4897				.99
Harmonic Mean Sample Size	3584				
Supplements					
Extras Only/Tested	5123	.16			
Extras Only/Not Tested	1479		.22		
No Activities/Not Tested	4978		.22		
Both Activities/Tested	9478		.23		
Athletics Only/Tested	4900			.33	
Harmonic Mean Sample Size	3619				

Tukey HSD tests for subsets. Means for groups in homogeneous subsets are displayed.

Attitudes Toward Drug and Alcohol Testing by Activities/Testing Categories

Attitude and Belief Scales. A number of items on the SSDA examined students’ attitudes and beliefs about drug and alcohol testing as well as the extent to which their friends used drugs. A factor analysis was performed using the entire data set to determine which items measured the same constructs so that scales could be developed using related items. The analysis identified four distinct factors as shown in Table 19.

Table 19
Factor Analysis of Student Attitude and Belief Items

Factors	Factor Loading	Cronbach’s Alpha
1. Attitude Toward Testing (5 items)		.88
Q42 – Drug testing is a bad idea	-.901	
Q39 – I think that drug testing high school athletes is a good idea	.828	
Q43 – Drug testing violates my rights	-.815	
Q40 - I think that drug testing all students is a good idea	.796	
Q46 – I support my school’s drug testing policy	.688	
2. Perceived Effectiveness of Drug and Alcohol Testing (2 items)		.88
Q37 – Alcohol testing reduces illegal alcohol use	.943	
Q36 – Drug testing reduces illegal drug use	.926	
3. Friends’ Use of Drugs (2 items)		.79
Q48 – I have close friends who use illegal drugs	-.833	
Q50 – My friends pretty much don’t do drugs at all	.710	
4. Likelihood of Being Tested (1 item)		
Q47 – I am likely to be drug tested during the upcoming school year	.953	

Extraction Method: Principal Component Analysis
Rotation Method: Promax with Kaiser Normalization

The individual items used seven-point Likert agreement scales. Construct scale scores were developed for the first three factors by summing the individual item scores and dividing by the number of items in the particular factor.³ The three construct scales measure Positive Attitude Toward Drug Testing, Belief in Drug and Alcohol Testing (DAT) Effectiveness, and Friends’ Non-Use of Illicit Drugs. Each scale demonstrated an acceptable level of reliability (Cronbach’s alpha > .70).

³The scores for items that loaded negatively on a particular factor were reversed when calculating the scale score.

Analysis of Attitudes and Beliefs. One-way ANOVAs were used to test whether any of the five groups differed in their attitudes and beliefs about drug and alcohol testing as measured by the scales described above. Table 20 presents the results of these analyses, which indicated that there were significant differences among the groups on each of the four measures.

Table 20
Tests of Significance for Differences in Student Attitudes and Perceptions
By Student Activity/Drug Testing Categories

Scales	N	Grand Mean	F	df	p
Positive Attitude Toward Testing	26167	4.72	340.11	4, 26162	<.001
DAT Effectiveness	26084	3.10	45.47	4, 26079	<.001
Friends Don't Use Drugs	26018	4.03	186.73	4, 26013	<.001
Likelihood of Being Tested	17175	1.98	654.28	4, 17170	<.001

The post hoc comparisons for each of the scales are summarized in Table 21, which shows the mean scores for each group. Groups in different subsets have significantly different mean scores from one another. The results for the Positive Attitude Toward Testing Scale nearly duplicate the results for the group comparisons for drug and alcohol usage. Students who participated in athletics and extracurricular activities and were tested had the most positive attitudes toward testing and were also the students least likely to report using illicit drugs and alcohol. Students who did not participate in these activities and were not tested had the most negative attitudes toward drug testing; they also had the highest rates of drug and alcohol use. The other three groups fell in between these two extremes, both in their attitudes and behaviors: the more positive their attitudes, the lower their levels of drug and alcohol use.

The same relationship was found for the scale that measures whether their friends use drugs. The groups of students that were most involved in extracurricular activities and also tested were the most likely to say that their friends don't use drugs. Students not involved in any extracurricular activities and not tested were most likely to indicate that both they and their friends used drugs and alcohol.

In regard to their beliefs about the effectiveness of drug and alcohol testing, students who were involved in both types of extracurriculars and were tested had the strongest belief that testing reduces drug and alcohol use, while the non-tested, non-involved students were the least likely to believe so. Finally, students in the testing pool, particularly those involved in athletics, were most likely to believe they would be drug tested during the school year. However, the highest mean score for any group was 2.19 on a 7-point scale, indicating that most students thought it was unlikely that they would be tested.

Table 21
Post Hoc Comparisons of Student Attitudes and Beliefs
by Student Activity/Drug Testing Categories

Activity/Testing Group	N	Subset for alpha = .05			
		1	2	3	4
Attitude Toward Testing					
No Activities/Not Tested	4990	4.06			
Athletics Only/Tested	4950		4.55		
Extras Only/Not Tested	1493		4.58		
Extras Only/Tested	5164			4.83	
Both Activities/Tested	9570				5.12
Harmonic Mean Sample Size	3648				
DAT Effectiveness					
No Activities/Not Tested	4968	2.84			
Extras Only/Tested	5145		3.04		
Extras Only/Not Tested	1488		3.08	3.08	
Athletics Only/Tested	4942			3.17	
Both Activities/Tested	9541				3.24
Harmonic Mean Sample Size	3637				
Friends Don't Use Drugs					
No Activities/Not Tested	4952	3.46			
Athletics Only/Tested	4912		3.79		
Extras Only/Not Tested	1473		3.90		
Extras Only/Tested	5144			4.27	
Both Activities/Tested	9537			4.33	
Harmonic Mean Sample Size	3614				
Likelihood of Being Tested					
Extras Only/Not Tested	1343	1.45			
No Activities/Not Tested	2999		1.66		
Extras Only/Tested	3294			1.92	
Both Activities/Tested	6433				2.17
Athletics Only/Tested	3106				2.19
Harmonic Mean Sample Size	2690				

Tukey HSD tests for subsets. Means for groups in homogeneous subsets are displayed.
Harmonic mean of group size is used since group sizes are unequal.

Feedback from Participating Schools

Based on the interviews conducted during the site visits and by telephone, the representatives of all seven participating school districts indicated multiple benefits derived from their participation in the demonstration project.

The three schools that had implemented ATLAS and ATHENA reported that it was an excellent program. However, they did not have funding available to continue the program after the grant ended. It was also mentioned that some of the coaches found it challenging to find time for all of the sessions and that in the final year of the project some teams chose not to participate since most of their athletes had already received the training at least once.

The enhanced testing may not continue at the same levels as during the demonstration project, but the schools with that intervention indicated an interest in scheduling more frequent test dates even if there are fewer students tested on each date. One of the schools is planning to switch from in-season only testing to the entire school year for their athletes and another is hoping to do so. Both of these measures are seen as increasing the preventative effect of RSdT.

The control schools, as well as the schools with enhancements, reported benefiting from the contact they had with IBH, OHSU and the other schools. The annual meetings were highly valued by all for the opportunities for peer networking and learning from other schools' experiences with RSdT. The teleconferences were also viewed as helpful, although the assessment varied depending on the specific agenda and how often school representatives had conflicting appointments. Interest was expressed in continuing periodic teleconferences in conjunction with future research studies.

Three of the school districts participated in similar surveys conducted in their states, so the SSdA was not as valuable for them as it was for the others. However, the remaining four districts stressed the importance of the survey data for them and indicated an interest in continuing the surveys (possibly just once a year) if possible. They offered suggestions for additional survey questions and expressed a willingness to participate in future research studies with IBH if the opportunity arises.

CONCLUSIONS

Central Hypothesis

The central hypothesis of this demonstration project—that one or more of the enhancements to existing RSDT programs would further reduce student drug use—was not supported by the self-report data analysis. There are several possible explanations for this negative finding. One is that the schools, which all had RSDT programs in place before this demonstration project began, may have already accrued sufficient benefit from RSDT in reducing the drug use of students in the testing pool, making it difficult to obtain further reductions. Also, the higher use of substances among the Control schools as compared to the Experimental schools may have placed the potential change among the Experimental schools at a disadvantage. This may be due to a floor effect, since the Experimental schools had significantly lower substance use prevalence prior to the enhancement interventions. It may be that a lower use of substances was already achieved and could not be reduced over time, even with these enhancements. However, despite this and the differences in students who completed surveys over time, the study found that those in the Experimental schools remained with significantly lower self-reported substance use than the Control schools (with no program enhancements).

In addition, the implementation of the enhancements was not uniform, with differences across schools in both the timing and the extent of the interventions. Increases in drug testing rates varied among the schools in the enhanced testing condition. This was affected by their base rates, additional sources of funding, delays in obtaining signed consent forms, and weather-related cancellation of testing dates. At one school the number of drug tests per testing date was increased but not the frequency of testing dates. ATLAS and ATHENA were implemented in the second semester of 2004-05 at two of the schools but not until the fall semester of 2005-06 at the third school. It was difficult to ensure consistent use of ATLAS and ATHENA by all the coaches, particularly after the first year or two of implementation. As a result, not all student athletes were exposed to the ATLAS/ATHENA curriculum. Because these particular educational interventions rely on group dynamics and social influence, the lack of participation by some student-athletes may have diluted this influential factor, and reduced the impact of this behavioral approach.

Potential benefits from the enhancements may have been compromised/offset by other changes in the RSDT programs. One of the schools with both enhancements changed from urine tests to oral fluids as they increased the number of tests. The other school in that condition changed from urine only to a combination that involved approximately two-thirds of the tests using urine and one-third using oral fluids. Because of oral fluid tests' lower sensitivity to marijuana, there may have been more false negatives, resulting in a reduction in the deterrent effect of RSDT.

A major limitation in the demonstration project's ability to achieve the U.S. Department of Education's GPRA measure of a 5 percent reduction in the incidence of drug use each year was the lack of a single cohort to follow over time. Because the surveys were anonymous and not linked, it was not possible to determine whether individual students decreased their use of drugs over the duration of the study. Since school turnover is ongoing, the student population changes

as students matriculate, graduate, transfer, or drop out of school. There is additional turnover among the target population of student athletes as they try out different sports, sometimes leaving and later rejoining teams at various times throughout high school. Consequently, our study had to rely on voluntary comparison groups rather than a cohort. While we found significant differences between the Experimental and Control schools in their students' drug use, these differences were consistent throughout the project and cannot be attributed to the interventions.

Additional Findings

Although drug use did not appear to decline during the study, there were some encouraging findings from this demonstration project. For one, there was no evidence that alcohol use increased. Thus we did not find that students switched from drugs to alcohol when the number of random drug tests increased. The most positive finding was that female athletes who participated in the ATHENA program were less likely to use drugs, alcohol or supplements than female athletes who were not exposed to ATHENA.

Highly significant differences in drug use were found between students who are subject to testing and those who are not. For example, 18 percent of students subject to testing reported using an illicit drug (including marijuana) at least once in the last 30 days, compared to 31 percent of students not in the testing pool. Similar results were found for illicit drug use during the past year: 29 percent versus 43 percent.

The lowest rates of illicit drug use (including marijuana) were found among students who participated in both athletics and extracurricular activities and were subject to testing. Only 16 percent of this group reported using drugs at least once in the last 30 days; their rate for the past year was 25 percent. The highest rates of illicit drug use were among students who did not participate in either athletics or extracurricular activities and were not subject to drug testing. Their reported rates of use were nearly double those of the lowest-use group: 32 percent had used an illicit drug at least once in the past 30 days and 45 percent during the past year.

Because two of the schools in our study only test athletes and not students who are in extracurriculars, it was possible to compare students in extracurriculars who are subject to testing with those who are not subject to testing. For all categories of substances, those in extracurriculars who are subject to testing reported significantly lower usage than those who are not. For example, the reported use of any illicit drug (including marijuana) in the last 30 days was 18 percent for the first group and 24 percent for those not subject to testing. Their drug use rates for the past year were 30 percent and 36 percent respectively. The overall pattern of findings suggests that while students who participate in extracurricular activities are already less likely than their nonparticipating peers to use drugs, a RSDT program for students in extracurriculars helps reduce drug use even further.

Another notable finding is that students who are subject to testing have much more positive attitudes toward RSDT than do the students who are not subject to testing. The group with the most positive attitude consists of students who participate in both athletics and extracurriculars and are subject to drug testing in either case. They also are significantly more likely than others

to believe that testing is an effective deterrent to drug and alcohol use. These are the same students who report the lowest rates of drug use both for themselves and their friends. Students who did not participate in athletics or extracurricular activities and were not subject to testing comprised the group that had the lowest opinion of RSDT and its effectiveness and reported the highest rates of use for themselves and friends. They were significantly different from all other student subgroups in this study on these variables.

In addition to the value of the research component of the demonstration project, the participating schools benefited from their involvement in several ways. The study provided the Experimental schools an opportunity to try out some program enhancements with grant support. All schools, both Experimental and Control, learned from the other schools' experience with RSDT policies and procedures and were able to stay current in the field with the input of IBH and OHSU. Those schools that do not routinely participate in other student surveys appreciated the school-specific SSDA data being collected and made available to them. It was also helpful for them to know how their schools compared to the others in both the survey findings and the RSDT rates and results.

RECOMMENDATIONS

Several lessons were learned from this demonstration project that may be helpful to other schools with RSDT programs and to future research projects.

First, it appears that increasing the number of random drug tests does not decrease drug use among those already subject to drug testing. It is not clear from the current study what the optimum or most cost-effective testing rate is. It is possible that the frequency of test dates may be more important than the number of students tested on a given day. Schools with RSDT may not need to incur the costs in both dollars and time of increasing the number of tests in order to maximize the deterrent effect of their program.

Given the current state of the art in the drug-testing field, schools are advised to use the most accurate tests available. At present, that appears to be urine testing or hair testing rather than analysis of oral fluids. The benefits of being able to test students more quickly appear to be offset by the loss of test sensitivity to marijuana. Since marijuana was the most frequently used drug (only alcohol was higher), it is recommended that oral fluids not be relied on exclusively due to the higher probability of false negatives, which could undermine a testing program.

For future research studies in the field of RSDT we would recommend that researchers try to exert as much control as possible over the implementation of the intervention but recognize that schools are not well-controlled laboratories. Some unplanned changes are likely and should at least be documented. We would strongly recommend that funding sources allow for passive consent rather than active consent to maximize the participation in low-risk studies with anonymous survey data. Also, it may be advisable to consider using a confidential questionnaire that can be tracked over time, rather than an anonymous survey, to better understand the true consequences of an intervention over time. Finally, researchers should be careful not to rely on

comparing survey findings from fall to spring. The spring use figures are inevitably higher due to the students' aging and increased exposure to drugs and alcohol.

FUTURE PLANS

IBH plans to disseminate the findings of this demonstration project by developing a series of articles on the specific topics covered in this report. Given the large number of completed surveys and the richness of the data, IBH also plans to continue exploring additional research questions that are beyond the scope of the initial demonstration project. These include: examination of drug use patterns in schools that test athletes only in season vs. all year; assessing the benefits of testing students for tobacco use; examining the effects of student attitudes about drug testing on reported drug use; and identifying patterns of teen driving while under the influence of drugs or alcohol.

The participating schools have expressed an interest in continuing their association with IBH and OHSU. IBH plans to host periodic teleconferences to continue the relationship and explore other research topics that have been identified. Some of the specific topics identified thus far include: exploring the outcomes for students who test positive on random drug tests; identifying the typical cost of operating a RSDT program; and examining the relationship between a student's drug use and grade point average.

APPENDIX A

STUDENT SURVEY ON DRUGS AND ALCOHOL (SSDA)