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Associations between Abstinence in Adolescence and Economic and Educational Outcomes Seven Years Later among High Risk Youth *

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Abstract

Aim—In this study, we investigated the relationship between abstinence and long-term educational and economic outcomes among a sample of high-risk youth.

Methods—Multivariable regression models were used to estimate associations between abstinence and outcomes among a sample of 13–17 year-olds referred to group homes in Los Angeles in 1999–2000 and followed for 87 months afterwards. Abstinence was measured during the first year of the study. We considered differential effects based on the duration of abstinence (12 versus 6 months) and type of abstinence (all substances vs. use of alcohol and/or marijuana) on three 87-month outcomes: having received a high school diploma or equivalent by age 20, institutionalization in the past 90 days, and total legitimate income for the past 90 days.

Results—Abstinence from all substances for 12 months was associated with positive long-term educational and economic outcomes relative to using any drug during the same time interval. Abstaining from all substances for 12 months was also associated with an increased likelihood of being a legitimate wage earner and decreased likelihood of being institutionalized relative to using only alcohol and/or marijuana during that time interval. No effect on long-term outcomes was seen among youth who abstained for only 6 months relative to those who used drugs during this interval, or for youth who used only alcohol and/or marijuana over 12 months versus those who used other drugs during this interval.

Conclusions—The results presented here justify continued and expanded efforts to promote long periods of abstinence from all drugs for high-risk youth.

Keywords

Abstinence; Substance abuse; Treatment; Income; Education; Propensity scores

* A table showing results from the propensity score weighted regression models is available with the online version of this article at doi:xxx/j.drugalcdep.xxx ...

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1. Introduction

Individuals who misuse alcohol and other drugs during adolescence are at increased risk for adverse educational and economic outcomes in young adulthood, including high-school drop-out (Bray et al., 2000; Ellickson et al., 1999; Krohn et al., 1997; Lynskey and Hall, 2000; Tanner et al., 1999), low levels of occupational attainment (MacDonald and Pudney, 2000; Schuster et al., 2001), reduced wages (Kaestner, 1991, 1993; Register and Williams, 1991; Ringel et al., 2006), and work in jobs with poor benefits or limited opportunities (e.g., jobs that do not offer access to health insurance) (Ringel et al., 2007). When considered alongside the adverse physical and psychological consequences of adolescent substance misuse (Ellickson et al., 2004; Kandel et al., 1986; Newcomb and Bentler, 1988), this makes preventing adolescent substance use and misuse a recognized public health priority (Healthy People 2010 (Group) and U.S. Dept. of Health and Human Services, 2000). As a result, there are a number of initiatives in the United States focused on preventing substance use among youth, some with documented success (Botvin et al., 1995; Ellickson et al., 2003; Flay et al., 2001; Skara and Sussman, 2003; Spoth et al., 2008). This focus on prevention, however, must be complemented with high-quality treatment programs for adolescents who do misuse substances to minimize the adverse consequences associated with such misuse.

Since substance misuse in adolescence is associated with adverse educational and economic outcomes in young adulthood, one of the long-term goals of substance abuse treatment for adolescents could be to improve outcomes in these domains, and there is some evidence that treatment produces just such benefits for academic outcomes (Engberg and Morral, 2006; Liddle et al., 2009). However, most substance abuse treatment providers that serve adolescents focus on short-term goals, and primary among these is having their clients achieve sustained abstinence beginning from the time they enter the program and continuing for extended periods from when they complete or discontinue the treatment or are discharged from or leave a treatment facility (Winters, 1999). What is still unclear, however, is whether young clients who demonstrate short-term successes such as sustained abstinence are really less likely than their counterparts who do not exhibit such short-term gains to go on to experience the adverse long-term educational and economic outcomes that are usually associated with adolescent substance misuse.

In pursuing this line of inquiry, it is prudent to consider the type of abstinence that would be required to produce positive long-term outcomes. Definitions of sustained abstinence that have been used to measure the short-term success of substance abuse treatment programs vary, primarily with respect to the duration of time that such abstinence must be “sustained” and the types of drugs from which youth are required to abstain from to be defined as “abstinent.” With respect to timing, we have found no research investigating the minimum length of sustained abstinence necessary for beneficial outcomes (Chung and Maisto, 2006). Evaluations of adolescent substance abuse treatment normally present the proportion of clients who are abstinent at differing points following treatment (e.g., beginning at discharge and for anywhere up to 24 months post-enrollment, typically at 3-month intervals) (Godley et al., 2007; Henggeler et al., 1999; Liddle et al., 2008; Williams and Chang, 2000); this is likely a function of resources available to conduct follow-up interviews and not based on any meaningful empirical validation. With respect to the types of drugs, most researchers have required youth to be abstinent from all psychoactive substances (e.g., Brown et al., 1996; Brown et al., 1989; Cady et al., 1996; Lewis et al., 1990; Richter et al., 1991), while others have only required abstinence from certain classes of drugs (e.g., alcohol/other drugs: Feigelman et al., 1988; Hser et al., 2001; Knapp et al., 1991) or from distinct substance types (Brown et al., 2001; Friedman et al., 1989). Clarifying this point may be especially pertinent for clients with a history of using drugs that are particularly damaging (e.g., cocaine, methamphetamine, heroin), because it may be possible for them to have achieved

the behavioral changes promoted by drug treatment programs by abstaining from using these more damaging drugs, regardless of whether or not they abstain from drugs more commonly used by all adolescents, such as alcohol and even marijuana (Chung and Maisto, 2006; Johnston and National Institute on Drug Abuse, 2008).

The present study critically examines relationships between short-term successes following intake to substance abuse treatment (defined here as sustained abstinence) with long-term educational and economic outcomes. We examine whether these effects differ when sustained abstinence is measured as lasting for different periods of time (i.e., 6 months versus 12 months) and for different categories of drug use (i.e., abstinence from all substances versus use of only alcohol and/or marijuana).

2. Methods

2.1 Sample

The study sample is composed of adolescent offenders in Los Angeles who were adjudicated as delinquent and sent to one of seven residential group homes from February 1999 to May 2000. Extensive details can be found in Morral et al. 2004. Briefly, adolescents were interviewed face-to-face at intake and 3, 6, 12, 72, and 87 months post-intake. Of the 574 deemed eligible, 125 were excluded because they were sent to the group home before they could be interviewed, they did not sufficiently understand English, or a parent/legal guardian asked that his or her adolescent not be included in the study. As such, the sampling plan was not designed to be representative of all youths with community placement dispositions but is generally representative of the majority of such youths who are sent to the largest group homes in the county (Ramchand et al., 2009).

This study uses data from the baseline, 3, 6, 12, and 87-month follow-ups. There was high retention at each of these waves (90%, 91%, 91%, and 85%, respectively). Our outcomes were measured at the 87-month follow-up, and therefore the total analytic sample consisted of 383 youth, the number interviewed at that assessment. Of the 66 non-responders at 87 months, 12 were dead, 12 refused to participate, 40 were inaccessible, and 2 were unable or too ill. More details on the study appear elsewhere (Ramchand et al., 2009).

2.2 Measures

At each assessment, participants were interviewed using the Global Appraisal of Individual Needs (GAIN). The GAIN is a structured clinical interview that collects information on eight main topic domains (background, substance use, physical health, risk behaviors, mental health, and environment, legal, as well as vocational factors) (Dennis, 1999a).

2.2.1 Sustained Abstinence—At the 3, 6, and 12-month assessments, all respondents were asked about the last time they used each of 13 types of drugs: alcohol, marijuana or other forms of THC, crack or free base cocaine, other forms of cocaine, inhalants, heroin, pain killers, PCP or angel dust, “Acid” or other hallucinogens, anti-anxiety drugs or tranquilizers, stimulants, sedatives, and other. From these measures, we constructed three different definitions of sustained abstinence. *6 months of sustained abstinence from all drugs* was defined as reporting no substance use in the past 3 months at both the 3- and 6-month assessments. *12 months of sustained abstinence from all drugs* was defined as meeting the criteria for 6 months of sustained abstinence in addition to reporting at the 12-month assessment either never having used or having used any substance more than one year ago. *12 months of only alcohol and/or marijuana use* was defined similarly as 12 months of sustained abstinence from all drugs though in this instance the use of alcohol and marijuana or other forms of THC was permitted.

Youth missing either 3- or 6-month assessments were excluded from analyses of the effects of 6 months of abstinence, though they were included in our analyses on the effects of 12-month abstinence (i.e., the additional constraint of having achieved abstinence at 6 months was waived) as long as they had 12-month assessment data stating that they had not used drugs in the past year. Due to missing data on one or more of the 13 questions on recency of drug use, 12-month abstinence could only be calculated for 355 youth (93% of the 87-month sample), and 6 months of abstinence could only be calculated for 319 youth (83% of the 87-month sample). In general, the excluded youth at baseline were slightly older, had fewer withdrawal symptoms and health problems, had less stable social support systems, had fewer recent employment episodes, and had more often been in institutionalized settings. They were also slightly more likely to need treatment specifically for marijuana use (results available upon request).

2.2.2 Outcomes—We examined three outcomes in our analyses: (1) educational attainment by the age of 20, (2) total legitimate income in the past 90 days, and (3) institutionalization in the past 90 days. All outcomes were measured at the 87-month follow-up.

Educational attainment was measured using an indicator of whether or not the study participant reported having received his/her GED or high school diploma by the age of 20. *Total legitimate income* was measured using respondents' responses to the question: "During the past 90 days, about how much money did you receive from wages or salary from a legitimate job or business?" *Institutionalization* was defined as having spent one or more of the past 90 days in any of several types of controlled environments in which drug use and liberty were substantially constrained for the whole day (e.g., jail, inpatient treatment, group homes, or probation camps). Two participants were excluded from the analysis of total legitimate income in the 90 days prior to the 87-month follow-up, one due to missing outcome data, and one due to having an outlying value of income over \$100,000; all cases were included in analyses of the other two outcomes.

2.2.3 Control variables—For each outcome, we fit a Generalized Boosted Model (GBM) that included 80 baseline variables related to adolescent substance abuse patient placement criteria (Mee-Lee and American Society of Addiction Medicine., 2001) that have been used in previous investigations examining the effectiveness of adolescent drug treatment (McCaffrey et al., 2004; Morral et al., 2004). GBM is a flexible, non-parametric estimation technique that can account for a large number of covariates and that adaptively captures the functional form of the relationship between the covariates and an outcome with less bias than traditional approaches (McCaffrey et al., 2004). From this analysis, we selected for our final multivariable models only those baseline variables that explained at least 1% of the variation in at least one of the outcomes. Missingness on the 80 pre-treatment variables was low (mean = 2.3% and max = 20%) and thus a regression model hot-deck imputation procedure was employed to fill in missing values (Little and Rubin, 1987). Specifically, for a given variable with missing values, we modeled the expected value of the variable as a function of demographic characteristics, drug use history, psychological status, treatment history, legal history, responses to the same item at earlier survey waves (when available), and other variables from the GAIN (53 or more items in all) and used the observed data to fit the model. Records were stratified into ten sets by the percentiles of the predicted scores from this fitted model. For each observation with a missing value, a "donor" value was drawn at random from the records with observed data in the same predicted score stratum as the case with the missing value.

Nine baseline variables met the above criteria to be included in the final multivariable models. The *Substance Frequency Scale* is a 7-item scale that sums days of use during the

past 90 days for alcohol, marijuana, and other illicit drugs. Interitem reliability is good ($\alpha = 0.81$; (Dennis, 1999a)). The *Emotional Problem Scale* is a 7-item scale assessing psychological distress recency, frequency, and severity during the 90 days preceding assessment ($\alpha = 0.80$; (Chestnut Health Systems., 2004)). The *Crime Violence Scale* is a count of 29 past-year symptoms of criminal and violent behavior ($\alpha=0.90$; (Dennis, 2005)). The *General Social Support Scale* ($\alpha =0.60$; (Dennis, 1999b)) is a count of the self-reported number of social support sources identified by the adolescent and can include professionals, family, friends, school mates, or work colleagues. The *Training Problem Scale* is a count of problems related to school or training, including bad grades, skipping, leaving early, missing multiple days, and getting into trouble ($\alpha = 0.79$; (Modisette, 2009)). The *General Satisfaction Index* is a scale assessing self-reported satisfaction with housing, relationships, activities, and help ($\alpha=0.74$; (Modisette, 2009)). The *Recovery Environment Risk Index* is the sum or recency (divided by range) of Alcohol Anonymous attendance (reversed), homelessness, living with drug and alcohol use in the home, violent arguments, and physical, emotional, or sexual abuse ($\alpha = 0.75$; (Scott et al., 2005)). The models also included indicators for which substance the study participant liked to use most and how many times they had received treatment prior to the baseline.

2.3 Analysis

The goal of our analysis was to assess five specific hypotheses:

1. 12 months of abstinence yields favorable outcomes relative to using any drug during the same 12-month interval;
2. 12 month of abstinence yields favorable outcomes relative to abstaining for 6 months only;
3. 6 months of abstinence yields favorable outcomes relative to using any drug during the same 6-month interval;
4. Abstaining from all drugs for 12 months yields favorable outcomes relative to using only alcohol and/or marijuana during the same 12-month interval;
5. Using only alcohol and/or marijuana for 12 months yields favorable outcomes relative to using other drugs during the same 12-month interval.

For each hypothesis, we estimated multivariable regression models for each of the three outcomes by regressing the outcome on an indicator of whether the respondent was in the abstinent (vs. the comparison) group and the nine control variables listed above. The two binary outcomes (i.e., educational attainment and institutionalization) were modeled using logistic regression. Due to a preponderance of zero-values for total legitimate income, we fit a two-part model to this outcome (Duan et al., 1983): the first part regresses the probability that the outcome was a non-zero value on the indicator of whether the respondent was in the abstinent group and our nine control variables (e.g. fits a logistic regression model), and the second part regresses non-zero values of the outcome on the same ten independent variables (e.g. fits a linear regression model on those outcomes greater than zero). Both parts of the model were then used to compute the predicted mean and standard error for each group (e.g. abstinent vs. comparison) and to test whether the difference in the means was different from zero (Duan et al., 1983).

2.4 Sensitivity Analyses

Previous studies indicate that sustained abstinence following treatment is influenced by pre-treatment characteristics. These include pre-treatment level of substance use (Alford et al., 1991; Jenson et al., 1993; Kennedy and Minami, 1993; Shoemaker and Sherry, 1991), symptoms associated with emotional well-being and criminality (Alford et al., 1991; Brown

et al., 1996; Brown et al., 2000; Myers et al., 1995), academic/scholastic attendance/performance (Rush, 1979; Shoemaker and Sherry, 1991), employment (Rush, 1979), sociodemographics (Alford et al., 1991; Cady et al., 1996; Friedman and Glickman, 1986; Friedman et al., 1986; Shoemaker and Sherry, 1991), and social/familial substance use (Richter et al., 1991; Shoemaker and Sherry, 1991). It is likely that many of these characteristics will also influence clients' long-term educational and economic outcomes. To address this issue, we used propensity score weighting to assess the robustness of our findings from the multivariable regression models described above to selection effects. We created propensity score weights using GBM and the 80 pre-treatment characteristics described above to balance the abstinent and comparison group in each hypothesis on all 80 pre-treatment characteristics (McCaffrey et al., 2004; Morral et al., 2004). After creating the weights, we fit weighted regression models to each outcome, which only controlled for the indicator of whether the respondent was in the abstinent group, and examined the difference in the point estimates for the regression coefficients of these indicators in these models as compared to our multivariable models reported here.

We also examined the potential for enforced abstinence to moderate the effect of abstinence. By definition, all youth who are in our sample spent some time in a residential facility in which abstinence was enforced. It could be that enforced abstinence produces effects that are different from voluntary abstinence. Since the duration in which youth stayed in these programs varied, we re-estimated our analyses to discern whether the days youth spent in treatment modified the effect of abstinence on our outcomes. However, because the number of days youth spent in treatment was only available between intake and 6 months, we could only examine whether days in treatment modified the effect of 6 months of abstinence. Thus, we only performed this analysis for hypothesis 3, where we assessed whether the effect of abstaining for 6 months varied as a function of days in treatment. We did this by fitting regression models to our outcomes that included the indicator for whether or not the client abstained for 6 months, days in treatment, our nine control variables, and an interaction between days in treatment and our indicator of whether or not the client abstained for 6 months.

3. Results

3.1 Client Characteristics

The baseline descriptive characteristics of the 449 youth enrolled and the subsample of 383 with 87-month follow-up data are presented in Table 1. As shown, the two groups were similar across all measures. Among the 355 clients for whom 12-month abstinence could be calculated, 85 (24%) were abstinent from all drugs, 108 (30%) used only alcohol and/or marijuana during the 12-month interval, and the remaining 162 (46%) reported using other drugs (Table 2). Among the 319 clients for whom 6-month abstinence could be calculated, 81 (25%) abstained for 12 months, 71 (22%) youth were abstinent for 6 months but not for 12 months, and 167 (52%) used drugs within the first 6 months post-enrollment.

3.2 Duration of sustained abstinence (Hypotheses 1, 2, and 3)

In unadjusted analyses, 12-month abstainers have significantly higher rates of educational attainment (65% vs. 51%), higher mean income (\$3,131 vs. \$1,783), and lower rates of institutionalization (19% vs. 33%) than drug users at the 87-month follow-up (Table 2). Multivariable models show that these differences remain statistically significant after adjusting for our key baseline control variables (Table 3). Specifically, results indicate that youth who abstained from all substances for 12 months have 1.77 times higher odds of obtaining their high school diploma or GED by the age of 20 (95% CI = 1.01, 3.08), 0.34 times the odds of being institutionalized (95% CI = 0.19, 0.72), and 1.98 times the odds of

having any legitimate earning (95% CI = 1.14, 3.45) at the 87-month follow-up when compared to drug users.

For hypothesis 2, 12-month abstainers have significantly higher unadjusted mean income (\$3,208 vs. \$1,350) and marginally higher unadjusted rates of educational attainment (67% vs. 55%) and lower unadjusted rates of institutionalization (20% vs. 31%) than 6-month abstainers at the 87-month follow-up. After adjustment, these differences, for the most part, go away (Table 3).

For hypothesis 3, 6-month abstainers and drug users during the first 6 months have very similar unadjusted rates of educational attainment and institutionalization as well as very similar unadjusted mean income. In fact, the estimated odds ratios from the multivariable models (Table 3) which compare 6-month abstainers to those who used during that same time are all very close to 1; the OR for educational attainment is 1.10 (95% CI = 0.60, 2.03), the OR for institutionalization is 0.99 (95% CI = 0.50, 1.93), and the OR for non-zero income is 1.20 (95% CI = 0.66, 2.20).

3.3 Type of drug use (Hypotheses 4 and 5)

For hypothesis 4, youth who abstain from all substances have significantly higher unadjusted mean income (\$3,039 vs. \$1,477) and lower rates of institutionalization (19% vs. 32%) than youth who just use alcohol and/or marijuana. These results were maintained in our multivariate regression model: Youth who abstained from all substances have 0.37 times the odds of being institutionalized (95% CI = 0.17, 0.80) and 2.41 times the odds of earning non-zero income (95% CI = 1.27, 4.57) at the 87-month follow-up when compared to youth who used only alcohol and/or marijuana during the 12-month post-study enrollment.

For hypothesis 5, we failed to find evidence to support our hypothesis that youth who used only alcohol and/or marijuana would fare better than youth who used these and/or additional psychoactive substances during the 12 months post-enrollment. Youth using only alcohol and/or marijuana had similar unadjusted rates of educational attainment and institutionalization as well as very similar unadjusted mean income (Table 2). After adjustment, there remained no statistically significant differences between these two groups (Table 3).

Sensitivity Analysis

In our first set of sensitivity analyses, we fit propensity score weighted regression models to our outcomes. Our results from this analysis did not differ greatly from the unweighted, multivariable results shown in Table 3. Point estimates were very similar, suggesting that our results are not sensitive to our use of linear covariate adjustment or the covariates we chose to include in the model.

In our second set of analyses, we found no statistically significant interactions between our indicator of 6 months of abstinence and the number of days youth spent in treatment for any outcome. Thus, we have no evidence that enforced abstinence produces effects that are different from voluntary abstinence within the 6-month time frame (results available upon request).

¹Table A shows results from the propensity score weighted regression models available with the online version of this article at doi:xxx/j.drugalcdep.xxx ...

4. Discussion

Our objective was to investigate whether abstinence among adolescents in substance abuse treatment programs was associated with better long-term educational and economic outcomes, and whether differences in duration of abstinence and in the drugs from which youth abstained moderated these associations. With respect to duration, abstinence exerts a benefit on long-term outcomes in this sample if it persists for more than 6 months. Youth who abstained from all drugs for 12 months had better outcomes relative to those who did not, while there was no evidence that those who abstained from all drugs for 6 months fared any better than those who did not during this same time frame. While we found no significant differences in long-term outcomes between those who abstained for 12 versus 6 months, we believe this analysis had limited power to detect meaningful differences (e.g., we had 80% power to detect differences only as large as 22 percentage points, but the observed differences between 12- and 6-month abstainers ranged from 11 to 14%).

With respect to type of drug use, the beneficial effects of abstinence on long-term outcomes only existed among those who were abstinent from all drugs, including alcohol and marijuana. Youth who abstained from all drugs for 12 months had higher mean wages and lower mean rates of institutionalization than youth who abstained from all drugs except alcohol or marijuana. Moreover, there was no evidence that youth who used alcohol and/or marijuana but abstained from all other substances fared better than those who used other psychoactive substances.

Our sensitivity analyses were able to test whether the observed associations above were due to differences (i.e., selection effects) between the various groups of abstainers and drug users, and whether enforced abstinence yielded effects different from abstinence that was “voluntary.” Our analyses suggested that the observed benefits of abstinence were not sensitive to observed differences between groups, and there was no evidence that the effects of abstinence were moderated by an individual being in an environment in which liberties were constrained relative to abstinence that was “voluntary.” However, we note that our test of this latter hypothesis was limited to 6-month outcomes in which we found no main effects of abstinence.

Researchers, providers, and policymakers commonly use abstinence as a marker of success, which is why we undertook the current analysis. This does not imply, however, that our findings are specific to this threshold. Similar findings may appear if we were to set our threshold at “light” drug use or if we looked at reductions in use. Whether or not the effect is attributable specifically to it, abstaining from all substances for 12 months is a strong signal of positive long-term educational and economic outcomes for high-risk youth.

It is unfortunate that while our findings suggest apparent benefits of 12 months of sustained abstinence, youth in substance abuse treatment programs rarely achieve this outcome. Fewer than half of adolescents in outpatient treatment report being abstinent during the course of treatment (Lewis et al., 1990). A recent review highlights that on average only 38% of youth are abstinent for 6 months after treatment ends, only 32% are so at 12 months, and that abstinence rates generally decrease over time (Williams and Chang, 2000). Also, rates of early dropout among youth in residential treatment settings are high (Jainchill, 1997; Orlando et al., 2003): only 24% (85) of the current sample maintained 12 months of abstinence from all substances.

Substance abuse treatment programs should adopt strategies to promote long periods of abstinence from all drugs. This includes not only delivering effective treatments but also reducing early dropout and using effective continuing care strategies. An earlier analysis of the current sample indicated that retention was largely driven by respondents’ perceptions

that they were getting the help they needed, though participants reported an under-provision of job training and alcohol counseling (Orlando et al., 2003). Incorporating services that meet the perceived needs of clients should promote program retention, a byproduct of which is likely to be enforced abstinence. Although it is recognized as the standard of care (Joint Commission on Accreditation of Healthcare Organizations, 2006; Mee-Lee and American Society of Addiction Medicine., 2001) and deemed as theoretically critical for achieving sustained abstinence (Godley et al., 2007), most young people do not link to continuing care programs after they leave treatment (Donovan, 1998; Godley et al., 2002). Linking to continuing care could be facilitated using novel strategies including in-home visits (Godley et al., 2002; Godley et al., 2007; Godley et al., 2001) and telephone-based check-ups (Kaminer and Napolitano, 2004).

These results should be considered alongside certain limitations. The analysis used respondents' self-reports of substance use which may be biased or inaccurate. However, our strict definition of sustained abstinence and the pattern of bias previously detected in the sample (Harris et al., 2008) suggests that only a few youth should be misclassified. Also, we only looked at sustained abstinence at 6 and 12 months, and it is possible that the benefits of 12 months of sustained abstinence may have been observed any time between 6 and 12 months; future research can examine variations in this time frame. It would also be useful to examine intermediate educational and economic outcomes, though such data are not available in this sample. Finally, the sample is not representative of all youth, and the relationship between abstinence and future economic and educational well-being may be different for youth who have not had contact with the juvenile justice system and are known to differ from former juvenile offenders (Loeber et al., 2003).

Although the results presented here do not encompass all the adverse outcomes for which adolescents with substance use problems are at risk, these findings do indicate that promoting long-term abstinence in substance abuse treatment programs is beneficial and should remain a key component providers use to measure their performance (Kleber et al., 2006). Future research should substantiate the results suggested here and also examine potential benefits of sustained abstinence in other important domains including physical and emotional health (Ellickson et al., 2004).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Baseline characteristics of entire sample and those followed at 87-months

	Baseline		87-months	
	N	%	N	%
Total	449	100	383	100.0
Demographics				
Female	57	12.7	54	14.1
Latino/Hispanic	248	55.2	205	53.5
Black/African American	66	14.7	59	15.4
White	72	16.0	63	16.4
Other	63	14.0	56	14.6
Age				
13	30	6.7	26	6.7
14	65	14.5	55	14.4
15	98	21.8	86	22.5
16	157	35.0	134	35.0
17	99	22.0	82	21.4
Prior probation/parole/jail/detention	326	72.6	278	72.5
Homeless/run away	83	18.9	76	19.8
In School	371	82.6	317	82.8
Working	114	25.4	100	26.1
Mental Health Disorders (past year)				
Depressive Symptoms	130	29.0	115	30.0
Conduct disorder symptoms *	293	65.3	253	66.1
ADHD Symptoms	208	46.3	180	47.0
Substance use disorders and substance use (past year)				
Substance dependence symptoms	221	49.2	190	49.6
Substance abuse symptoms	108	24.1	93	24.3
Tobacco use	314	69.9	270	70.5
Alcohol until drunk	344	76.6	303	79.1
Illegal drug use	385	85.7	331	86.4
Hard drug use	256	57.0	224	58.5
Parenthood				
Given birth to/fathered a child	31	6.9	27	7.1

* Reporting 3 or more of 15 symptoms of DSM-IV conduct disorder.

Table 2

Unadjusted summary statistics for 87-months outcomes

Hypothesis 1.	Duration of Abstinence			Total Legitimate Income	
	GED/HS Diploma by 20 (Mean %)	Institutional- ized (Mean %)		(Mean % non-zero)	(Mean)
12-Month Abstainers (N = 85*)	65%	19%		65%	\$3131
Drug Users (N = 270)	51%	33%		49%	\$1783
Mean Difference (95% CI)	14% (2%, 26%)	-14% (-24%, -4%)		16% (4%, 27%)	\$1348 (-\$47, \$2743)
Hypothesis 2.					
12-Month Abstainers (N = 81*)	67%	20%		65%	\$3208
6-Month Abstainers (N = 71)	55%	31%		51%	\$1350
Mean Difference (95% CI)	12% (-4%, 27%)	-11% (-25%, 3%)		14% (0%, 30%)	\$1857 (\$361, \$3353)
Hypothesis 3.					
6-Month Abstainers (N = 71)	55%	31%		50%	\$1411
Drug Users in first 6- months (N = 167)	54%	29%		48%	\$1890
Mean Difference (95% CI)	1% (-13%, 15%)	2% (-11%, 14%)		2% (-11%, 16%)	-\$479 (-\$1492, \$532)
Drugs of Abstinence					
Hypothesis 4.					
Abstainers from all substances (N = 85)	65%	19%		65%	\$3039
Alcohol &/or Marijuana Users (N = 108)	53%	32%		45%	\$1477
Mean Difference (95% CI)	12% (-2%, 26%)	-13% (-26%, -1%)		20% (5%, 33%)	\$1562 (\$162, \$2963)

	Duration of Abstinence			Total Legitimate Income (Mean % non-zero)
	GED/HS Diploma by 20 (Mean %)	Institutional- ized (Mean %)		
Hypothesis 1.				
Hypothesis 5.				
Alcohol &/or Marijuana Users (N = 108)	52%	32%	45%	\$1545
Other Drug Users [†] (N = 162)	49%	33%	52%	\$1994
Mean Difference (95% CI)	3% (-9%, 15%)	-1% (-12%, 10%)	-7% (-18%, 6%)	-\$449 (-\$1430.532)

* Note these samples are different because we required study participants to have 3- and 6-month follow-up data to be included in the analysis of hypotheses 2 and 3; 4 of our 12-month abstainers from hypothesis 1 did not have such follow-up data.

[†] Other drug users refers to youth reported using crack or free base cocaine, other forms of cocaine, inhalants, heroin, pain killers, PCP or angel dust, "Acid" or other hallucinogens, Anti-anxiety drugs or tranquilizers, stimulants, sedatives or other drugs besides just marijuana and/or alcohol.

Table 3

Multivariable regression results on 87-months outcomes

	GED/HS Diploma by 20*	Institution- alized*	Total Legitimate Income**
	OR (95% CI)	OR (95% CI)	OR (95% CI) β (95% CI)
Hypothesis 1.			
12-Month Abstainers vs. Drug Users (Ref)	1.77 (1.01, 3.08)	0.34 (0.19, 0.72)	1.98 (1.14, 3.43) 0.27 (-0.25, 0.80)
Hypothesis 2.			
12- vs. 6-Month Abstainers (Ref)	1.86 (0.86, 4.02)	0.44 (0.19, 1.05)	1.62 (0.79, 3.31) 0.56 (-0.22, 1.35)
Hypothesis 3.			
6-Month Abstainers vs. Drug Users (Ref)	1.10 (0.60, 2.03)	0.99 (0.50, 1.93)	1.20 (0.66, 2.20) -0.23 (-0.86, 0.40)
Hypothesis 4.			
Abstainers vs. Alcohol and/or Marijuana Users (Ref)	1.78 (0.93, 3.43)	0.37 (0.17, 0.80)	2.41 (1.27, 4.57) 0.35 (-0.31, 1.01)
Hypothesis 5.			
Alcohol and/or Marijuana vs. Other Drug Users [†] (Ref)	1.24 (0.74, 2.08)	0.74 (0.42, 1.29)	0.86 (0.50, 1.49) -0.11 (-0.67, 0.46)

Bolded results indicate those that reached conventional levels of statistical significance (i.e., 95% Confidence Intervals do not contain the null value).

* Estimated with logistic regression model

** Estimated with two-part regression model

[†] Other drug users refers to youth reported using crack or free base cocaine, other forms of cocaine, inhalants, heroin, pain killers, PCP or angel dust, "Acid" or other hallucinogens, Anti-anxiety drugs or tranquilizers, stimulants, sedatives or other drugs besides just marijuana and/or alcohol.