

Workplace Drug Testing and Worker Drug Use

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Objective. To examine the nature and extent of the association between workplace drug testing and worker drug use.

Data Sources. Repeated cross-sections from the 2000 to 2001 National Household Surveys on Drug Abuse (NHSDA) and the 2002 National Survey on Drug Use and Health (NSDUH).

Study Design. Multivariate logistic regression models of the likelihood of marijuana use are estimated as a function of several different workplace drug policies, including drug testing. Specific questions about penalty severity and the likelihood of detection are used to further evaluate the nature of the association.

Principal Findings. Individuals whose employers perform drug tests are significantly less likely to report past month marijuana use, even after controlling for a wide array of worker and job characteristics. However, large negative associations are also found for variables indicating whether a firm has drug education, an employee assistance program, or a simple written policy about substance use. Accounting for these other workplace characteristics reduces—but does not eliminate—the testing differential. Frequent testing and severe penalties reduce the likelihood that workers use marijuana.

Conclusions. Previous studies have interpreted the large negative correlation between workplace drug testing and employee substance use as representing a causal deterrent effect of drug testing. Our results using more comprehensive data suggest that these estimates have been slightly overstated due to omitted variables bias. The overall pattern of results remains largely consistent with the hypothesis that workplace drug testing deters worker drug use.

Key Words. Drug testing, marijuana use, deterrence

A large literature suggests that employee substance use in the workplace may impose high costs to firms in the form of lower productivity, increased absenteeism, and more workplace accidents (see National Research Council 1994 for a review). Partially as a response to these costs, employers have responded by implementing a variety of policies and programs designed to reduce employee substance use. In addition to education programs and

written standards such as “Zero Tolerance” policies, employers have in the past two decades increasingly turned to drug testing programs. Currently, about 46 percent of all workers report that their employer performs drug testing, although other sources indicate that as many as 90 percent of *Fortune 200* firms use some type of drug testing (Flynn 1999). The rationale behind workplace drug testing is straightforward: by raising the expected costs of workplace substance use, the programs aim to deter consumption of dangerous substances by current and prospective employees.

Indeed, anecdotal evidence suggests that both supporters and opponents of workplace drug testing—which increased substantially throughout the late 1980s and remained steady throughout the 1990s—believe that testing deters employee drug use. Despite this, there are only three studies that have used nationally representative data to provide evidence on whether large-scale employer drug testing deters employee drug use (Hoffmann and Larison 1999; SAMHSA 1999; French, Roebuck, and Alexandre 2004). Each of these finds that drug use is lower among individuals whose firms test for drugs. Some have interpreted the negative testing/use correlation as representing a causal deterrent effect of testing on worker drug use.

Admittedly, a strong negative relationship between testing and use is consistent with such an interpretation. However, the same observed negative correlation is also consistent with a handful of equally plausible alternative explanations that have not been adequately ruled out by previous research. For example, the presence of a workplace drug testing program may simply proxy for other omitted firm characteristics. Previous research has not adequately addressed concerns about these and other omitted variables biases, and as such the claim that a negative testing/use relationship reflects a causal deterrent effect warrants further investigation.

This research question has become increasingly important, as in recent years firms have begun to question the merits of drug testing. This opposition has arisen, in part, because drug testing is a huge industry in the United States, costing employers six billion dollars per year (Constantinou 2001). Of course, if drug testing reduces workplace substance use (either through a deterrent effect among current workers or through firm screening), then the programs may well be worth their expense. One important evaluation question, then, is: Do workplace drug testing programs really reduce substance use? In this paper,

we revisit this question by using more comprehensive data than has been used previously to more fully evaluate alternative explanations for the negative relationship between testing and use.

PREVIOUS LITERATURE

Although there are large and growing independent literatures on the institutional details regarding workplace substance testing programs and on the effects of workplace drug testing programs on outcomes such as absenteeism, productivity, and workplace accidents, we do not review them here.¹ Instead, this section focuses on the handful of studies that have specifically asked whether workplace drug testing has a deterrent effect on employee drug use. Before reviewing these studies, however, it is worth noting that a panel of experts commissioned by the National Research Council and the Institute of Medicine wrote in a 1994 book that “[d]espite beliefs to the contrary, the preventive effects of drug-testing programs have never been adequately demonstrated” (p. 11).

Since 1994 NAS/IOM book, there have been at least five large-scale studies of the effects of workplace drug testing on employee substance use; three of these have used data from various years of the National Household Survey on Drug Abuse. First, a 1999 study by the Substance Abuse and Mental Health Services Administration (SAMHSA) related the presence of drug testing programs to self-reported marijuana use and heavy drinking rates using the 1994 and 1997 waves of the NHSDA. That study found a significant negative relationship between workplace testing and drug use in the 1997 data. A similar study published in 1999 used only on the 1994 NHSDA and similarly found a significant negative relationship between workplace drug testing and self-reported illicit drug use (Hoffmann and Larison 1999). Finally, French, Roebuck, and Alexandre (2004) used data from the 1997 and 1998 NHSDA and found a significant negative association between testing and drug use.

All of the studies to some extent interpret the observed negative association as representing a “deterrent” effect of workplace drug testing. Despite this claim, there are several reasons to be skeptical that the associations uncovered by these studies do in fact reflect deterrence effects. First, none of the studies has had information on the penalties individuals face for failing a drug test. We show below that about a quarter of workers in worksites that test employees for drugs report either that there is “no official penalty” for first offense or that “nothing happens.” Understanding the sensitivity of individual

behavior to differential sanctions is crucial for testing economic theories of deterrence. Second, the existing studies provide little or no information on other drug programs or policies in the respondents' workplaces. If drug testing is simply proxying for a relatively high value of health placed by firms, or if firms that impose drug testing are more likely to provide other relevant programs such as drug education (which itself might have independent effects on use), then the drug testing estimates may be upward biased. For these reasons, one might be skeptical that the negative testing/use correlations do in fact represent true deterrence effects of testing.

A common characteristic of the above studies is that they use observational data to examine the nature of the cross-sectional association between workplace drug testing and worker drug use (we use a similar approach below). In contrast, we are aware of only one large-scale study to use a pre-post treatment-control research design to study the effects of workplace drug testing. Specifically, Mehay and Pacula (1999) consider the effects of an aggressive "Zero Tolerance" drug testing policy that was implemented in the United States military in 1981. Using data from multiple surveys before and after implementation of the policy, the authors compare differences in drug use rates for military personnel versus civilians over the period 1979-1995. They find much lower rates of drug use reported by military personnel in 1995 compared with civilians, and this difference remains even after controlling for the associated military/civilian difference that existed in the preprogram period. Using a policy change in this manner allows a more direct assessment of causality in the relationship between drug testing and drug use than in observational studies such as those considered here.

DATA AND EMPIRICAL APPROACH

Our main analysis data come from the public-use files of the National Household Surveys on Drug Abuse (NHSDA) over the period 2000-2002.² These data were first collected in 1971 and in recent years have been administered annually to produce prevalence estimates of substance use in the United States. Youths under age 25 and racial minorities are oversampled. As early as the 1994 wave of the NHSDA, the questionnaire has included a section on substance use policies and programs at the individual's workplace. These include whether the individual's employer: (1) had a written policy regarding substance use; (2) provided substance use education; (3) provided an employee assistance program (EAP) for workers with drug or alcohol problems;

and (4) tested its employees for drugs and alcohol.³ We follow most previous research by considering only drug (not alcohol) testing. We do so for several reasons: there is very little independent variation in alcohol testing (almost all employers that test for alcohol also test for drugs); jobs that test for alcohol tend to be qualitatively distinct and/or mandated by the federal government (such as transportation workers); and alcohol is not an illegal substance for individuals over age 21. We further restrict attention to marijuana because previous evidence suggests that it is the main concern of employers and the drug with the highest test positive rates.⁴ Also, use rates of other illicit substances are so low as to provide insufficient statistical power.

The 2000–2002 NHSDA surveys also asked follow-up questions regarding the nature of drug testing for those indicating their employers performed testing. These included whether the employer tested as part of the hiring process, randomly, or both. Respondents are also asked about the penalty for first drug test offense in their workplace. The substantive responses included: being fired, referred to treatment/counseling, nothing, or something else. We use these penalty severity responses below to provide descriptive evidence on the nature of the underlying relationship between testing and use.

In addition to questions about drug testing, the core NHSDA survey asks respondents about recent marijuana use. Notably, these questions are asked in the first part of the survey, well before questions on drug testing programs are administered. We use information from these responses to create an outcome variable called Marijuana Use that equals one if the respondent used marijuana at least 1 day of the previous 30 and zero otherwise.⁵

We restrict attention to individuals age 18 and older who report they are currently working (the drug testing questions were not asked of those without jobs). We further restrict attention to those reporting that they work for a private for-profit firm, as some government workers face mandated drug testing. To account for the uneven distribution of marijuana use in the population, we estimate the marijuana participation model using standard logit regression. The general form of the model is given by

$$\begin{aligned}
 Y = & \alpha + \beta_1 X \\
 & + \beta_2 (\text{Workplace Has Substance Use Policy/Program}) \\
 & + \beta_3 (\text{Don't Know if Workplace Has the} \\
 & \quad \text{Substance Use Policy/Program}) + \varepsilon
 \end{aligned}
 \tag{1}$$

where Y is the marijuana use indicator. X is a vector of demographic and job information, including a male dummy, three education dummies, two race

dummies, two age category dummies, a military service dummy, five firm size dummies, 16 industry dummies, 15 occupation dummies, and 2 year dummies. Geographic identifiers are not available in the public use files of the NHSDA. As in previous research, we are therefore unable to append relevant state policies and prices to the individual observations or to account for state level clustering. All regressions are weighted using the NHSDA sampling weight.

MAIN RESULTS

Table 1 presents means of key variables (weighted to be nationally representative). The first column of Table 1 presents means for the full sample, while the second and third columns present means separately by whether the

Table 1: Descriptive Statistics 2000–2002 National Household Surveys on Drug Abuse

<i>Variable</i>	<i>Full Sample (%)</i>	<i>Employer Performs Workplace Drug Testing (%)</i>	<i>Employer Does Not Perform Workplace Drug Testing (%)</i>
Demographic characteristics			
Male	58	63	54
Female	42	37	46
18–25	18	16	20
26–34	22	23	21
35+	60	61	59
Less than HS degree	14	13	15
College degree	24	21	26
Black	10	14	7
Hispanic	12	11	13
Employer characteristics			
Employer performs workplace drug testing	46	100	0
Employer provides substance use education	37	56	21
Employer has an official written policy regarding substance use	72	94	53
Employer has an employee assistance program (EAP)	46	68	28
Individual marijuana use			
Used marijuana past 30 days	6	5	8
<i>N</i>	57,397	24,914	32,483

Sample is adults age 18+ who work for a private for-profit firm in the 2000–2002 National Household Surveys on Drug Abuse, public-use files. Weighted percents.

respondent reports that her employer performs workplace drug testing. The top panel presents demographic characteristics and shows that males are more likely to work in jobs where the employer performs drug testing, while younger workers are less likely to work in these types of jobs. Highly educated workers are also less likely to work in a job subject to drug testing, while black respondents are over-represented in the group subject to drug testing.

The bottom panel of Table 1 presents characteristics of the employer. With respect to the main workplace policy variable of interest, 46 percent of the full sample reports that their employer performs workplace drug testing. Interestingly, Table 1 also shows that the other types of workplace policies are more likely to be observed by employees whose worksites have drug testing programs, a pattern that is consistent with the possibility that unobserved characteristics about employers are partially responsible for the negative association between workplace drug testing and worker drug use found previously.

The key relationship of interest is also apparent in the data shown in Table 1: about 6 percent of the working sample reports having used marijuana in the past 30 days, and this rate is higher among respondents whose employers do not test for drugs. Some of the raw gap in use, however, may be related to the differences in demographic characteristics associated with workplace drug testing that were also apparent in Table 1. We control directly for these observed characteristics in Table 2, which reports adjusted odds ratios and associated standard errors on the relevant drug testing indicator in models that successively add more control variables (each entry in Table 2 is from a different regression). The testing estimates in column 1 are from sparse models that only control for year effects and the dummy variable indicating the respondent does not know if the employer performs substance use testing. Column 2 adds the individual demographic characteristics (age, education, etc.), while column 3 includes firm size and occupation dummies and column 4 adds industry dummies. These job characteristics may be important, as some courts and governments have regulated the types of jobs in which testing can take place (e.g., safety-sensitive positions).

The relationships in the raw data observed in Table 1 are largely unchanged after inclusion of detailed covariates in Table 2. For example, the raw model for past month marijuana use shows a significant gap in column 1: workers whose employers test for drugs are just 0.57 times as likely to report using marijuana in the past month compared with workers whose employers do not test for drugs. Adding demographic and employer characteristics changes this only slightly: in the fully saturated model the adjusted odds ratio is just 0.634 and remains significant at the one percent level in every specification.

Table 2: Workplace Testing IS Negatively Related to Marijuana Participation

	(1)	(2)	(3)	(4)
Model controls for →	Year effects, dummy for “don’t know” about testing	(1)+demographics	(2)+firm size, occupation	(3)+industry
<i>Used marijuana past month (mean = 6%)</i>				
Employer tests for drugs	0.572** (0.029)	0.569** (0.030)	0.629** (0.037)	0.634** (0.039)
N	57,397	57,397	57,397	57,397

Sample is adults age 18+ who work for a private for-profit firm in the 2000–2002 National Surveys on Drug Use and Health, public-use files. Each entry represents a different model. Models are estimated using logit, and adjusted odds ratios are presented for the drug testing indicator with standard errors presented below in parentheses. Controls include: the drug testing indicator, a dummy variable indicating the respondent does not know if there is a workplace testing program, a male dummy, dummies for less than high school education, some college, and BA or more, dummy variables for non-Hispanic black and Hispanic, dummies for age groups 25–34 and 35+, a military service dummy, 2 year indicators, five firm size indicators, 15 occupation indicators, and 16 industry indicators.

*Significant at 5%;
 **Significant at 1%.

Of course, there may be other unmeasured characteristics about firms that perform drug testing that might also be negatively correlated with substance use. Specifically, Table 1 showed that individuals whose employers test for drugs are much more likely to report that their employer provides substance use education (56 percent of individuals whose employers test for drugs versus 21 percent of other workers), has an official substance use policy (94 versus 53 percent), or has an EAP (68 versus 28 percent). While not surprising, these patterns do suggest the likely presence of omitted variables about firms. That is, some firms might just be “anti-drug,” which could result in drug testing programs, other substance use policies, and workers that are relatively substance free. Importantly, all of these could be true even in the absence of a deterrent effect of testing.

Table 3 makes this point explicitly by showing the association between each of the substance use policies listed above in similarly specified models for marijuana participation (i.e., Equation 1 above, replacing the drug testing indicator with the drug education indicator, and so forth). These models include all the control variables listed in column 4 of Table 2. In each of the first four columns the adjusted odds ratio for the relevant workplace policy

Table 3: Evidence on Omitted Variables Bias Adjusted Odds Ratios for Various Policy/Program Indicators—Each Column Represents a Different Model 2000–2002 NHSDA

	<i>Used Marijuana Past Month</i>				
	(1)	(2)	(3)	(4)	(5)
Employer performs employee drug testing	0.634** (0.039)				0.697** (0.050)
Employer provides drug education		0.710** (0.037)			0.791** (0.048)
Employer has official written policy regarding substance use			0.700** (0.039)		0.863* (0.053)
Employer has employee assistance program (EAP)				0.799** (0.044)	1.01 (0.064)
<i>N</i>	57,397	57,397	57,397	57,397	57,397

See notes to Table 2 for control variables. All models also include the relevant “don’t know” dummy variables for each workplace policy.

indicator is less than one and highly significant, indicating that workers whose employers have these policies are less likely to report marijuana use. However, in the rightmost column of Table 3 when we separately control for each type of workplace policy, we find that the magnitude of the differentials between each of the policies—including workplace drug testing—and worker marijuana use is smaller (i.e., the adjusted odds ratios are closer to one) than when they are each entered separately. Moreover, the statistical significance of the estimates is reduced or eliminated. These patterns suggest that previous drug testing estimates have been biased upward from failure to account for other workplace programs. Despite this, an important testing/use association remains: the estimate in column 5 of Table 3 indicates that respondents whose employers test for drugs are only about 0.7 times as likely to have used marijuana in the past 30 days as respondents whose employers do not test for drugs.⁶

Another possibility for the observed testing/use relationship is that worker-based sorting and omitted individual characteristics may drive the relationship. It could be, for example, that people with unobserved preferences for health are systematically more likely to sort into jobs where workplace drug testing is required. And, individuals who use drugs may sort out of

jobs that require such testing.⁷ These individuals might have differentially poor health or health habits, or they may have a higher preference for risk, for example. We can assess the empirical importance of these factors in two ways. First, in results unreported but available upon request, we re-estimated Equation (1) above including an additional control for self-rated health (excellent, very good, good, fair, or poor). We also estimated models that included dummy variables indicating that the respondent always wears a seatbelt when riding in a car or never/rarely wears a seatbelt. Neither of these controls—either in isolation or together—substantively altered the adjusted odds ratio for the drug testing indicator.⁸ This suggests that bias from unobserved worker sorting is not likely driving the observed association between drug testing and marijuana use.

Does the association between workplace drug testing and worker drug use plausibly reflect deterrent effects of drug testing? To address this question, we turn to two additional sets of variables that capture variation in expected costs of employee drug use. First, we use responses about whether the employer testing is performed at the hiring stage, at random, or both at hiring and at random. These variables arguably measure the aggressiveness of workplace testing and the likelihood of detection.⁹ Second, we use previously unexplored data on the penalty for first drug test offense as reported by the individual. If the reductions in use reflect deterrence effects, then the estimated reductions in substance use should be increasing in penalty severity.

These estimates are presented in Table 4: the results regarding whether the employer tests prehire only, at random only, or both prehire and at random are presented in column 1, while column 2 presents the results for the expected penalty severity variables. We find that individuals reporting that their employer tests both at hire and at random are only 0.44 times as likely as individuals whose employers do not perform drug testing to report past month marijuana use. More importantly, we estimate that the likelihood of marijuana participation among individuals whose employers test both at hiring and randomly is significantly lower than participation among individuals whose employers test only at random or only at hiring. These patterns are consistent with deterrent effects of testing associated with an increased likelihood of detection.

The second column of Table 4 presents the penalty severity results. If drug testing reduces substance use primarily through a deterrent effect, we would expect the estimated relationships between each of the various penalties and marijuana participation to be increasing in the severity of the penalty. That is, the dummy variable indicating violators are fired upon first

Table 4: Worker Drug Use Is Decreasing in the Likelihood of Detection and Penalty Severity, Adjusted Odds Ratios for Various Employer Policies—Each Column Is a Different Model, 2000–2002 NHSDA

	<i>Used Marijuana Past Month</i>	
	(1)	(2)
Likelihood of detection		
Employer tests prehire but not randomly (17% of sample)	0.715** (0.054)	
Employer uses random drug tests but not prehire (3% of sample)	0.721** (0.087)	
Employer uses both prehire and random testing (23% of sample)	0.444** (0.036)	
Penalty severity		
Fired upon first offense (18% of sample)		0.559** (0.043)
Referred to treatment/counseling (11% of sample)		0.707** (0.066)
No official policy (8% of sample)		0.797* (0.084)
Something else happens (2% of sample)		0.881 (0.154)
<i>N</i>	57,397	57,397

See notes to Table 2. The model in column 1 also includes a dummy variable indicating the respondent did not know if the employer tested as part of the hiring process and a dummy variable indicating the respondent did not know if the employer tested randomly. The model in column 2 also includes a dummy indicating the person does not know the penalty for first offense.

offense should have the smallest adjusted odds ratio, followed by treatment/counseling referral. This is precisely the pattern that emerges. Specifically, we find that individuals reporting that the penalty for first offense is getting fired (i.e., individuals subject to a “Zero Tolerance” policy) are just 0.56 times as likely to report past month marijuana use compared with individuals whose employers do not test. Moreover, the coefficient on the most severe penalty—being fired—is statistically different from the second most costly penalty (treatment/counseling). That substance use is strongly decreasing in penalty severity is again consistent with a deterrent effect of drug testing.

DISCUSSION AND CONCLUSION

The results presented above provide further evidence consistent with the idea that workplace drug testing may deter worker drug use. In particular, we have extended previous research by controlling for other potentially confounding workplace policies, as well as providing new evidence on the relationship between marijuana use, the likelihood of detection, and penalty severity. A

number of concerns, however, remain. Two of particular importance deal with reporting: first, do individuals report accurate information about the presence of workplace testing? And second, do individuals report accurate information about their drug use?

To answer the first question, we examined self-reported drug testing data from the 1994 NHSDA to independent worksite survey data collected by the National Institute on Drug Abuse in 1993. The results of the latter survey of large employers (50+ full time workers) were published in 1996, and we used those published estimates to compare testing rates by industry and geographic region to the associated rates reported by individuals in the NHSDA with firm sizes of 25+ individuals (Hartwell et al. 1996).¹⁰ We found that the patterns from the independent worksite survey corresponded very closely to the self-reported data from the NHSDA. For example, about 62 percent of employees in the NIDA survey were covered by an employer drug testing program, while the associated rate in the NHSDA was 59.5 percent. Moreover, these rates by industry revealed qualitatively identical and quantitatively similar patterns in the industries in which testing is most highly concentrated: communications, utilities, and transportation have the highest testing rates (about 85 percent in each sample), followed closely by mining and construction and manufacturing. The geographic testing patterns also generally conformed across the two sources, with the highest testing rates reported in the South and the lowest in the Northeast. These patterns suggest that individual self-reports of workplace testing are consistent with independent measures of actual testing practices.¹¹

The other serious reporting concern is that individuals underreport drug use in survey data; this problem is well-known and has been addressed at length elsewhere (see, for example, Mensch and Kandel 1988). Of course, if the propensity to underreport substance use is uncorrelated with the presence of testing, then this concern is quite minor in the context of evaluating the deterrence hypothesis. More worrisome, however, is the possibility that underreporting in the NHSDA survey is correlated with workplace testing. For example, individuals who face large work sanctions (such as job loss) if they get caught using drugs may simply be less likely to tell anyone that they use drugs. To provide some evidence on this issue we estimated models relating drug use to the likelihood of detection (as proxied by whether the firm tests at hire, at random, or both) that excluded individuals with the strongest incentives to underreport use: those who report that failing a drug test at their worksite results in termination of employment. Even in this subsample, we found that individuals whose employers test for drug use were significantly less likely to report past month marijuana use. Moreover, the evidence for the deterrence

hypothesis remained: the estimate for the variable indicating the employer tests both at hire and at random indicated significantly lower likelihood of marijuana participation compared with the other two dummy variables indicating either hiring testing or random testing only. That these tests of the deterrence hypothesis survive exclusion of individuals who should be most susceptible to testing-based underreporting is consistent with a deterrent effect of drug testing.

These alternative hypotheses highlight the fact that this study is subject to some important limitations, all of which are shared by previous studies using these data. One problem is that the NHSDA does not provide information on the location of drug use or the degree of impairment associated with such use. Much of the controversy regarding drug testing surrounds the fact that testing positive for, say, marijuana use need not imply that the individual is impaired At Work. As impairment is the more relevant concern for employers, one could argue that examining the effect of testing on marijuana use is somewhat misguided.¹²

Also, the NHSDA are cross-sectional in nature; as such, we have no ability to determine the precise ordering of substance use, employment flows, and drug testing. Cross-sectional data also limit the strength of our conclusions with respect to the underlying structural relationships between drug testing and drug use: absent a compelling strategy for addressing nonrandom adoption of workplace drug testing (e.g., instrumental variables), we have instead tried to mitigate obvious sources of omitted variables bias by including detailed worker and employer characteristics. To the extent that the negative relationship in the cross-section between testing and use survives these controls, this increases support for the hypothesis that the differentials are true testing effects. Our approach cannot prove, however, that drug testing causes a reduction in use.

Finally, this paper has not evaluated the overall cost/benefit analysis associated with workplace drug testing. That is, are any benefits with respect to increased productivity, decreased accidents, etc., that may be attributable to workplace drug testing worth the associated costs? Given that these costs have risen substantially in recent years—now representing a nontrivial expense for employers—the answer to this question is not obvious. Such a calculation would also require an estimate of the additional job search costs imposed on various types of workers with different preferences regarding drug use and workplace drug testing policy. Given that the current paper cannot pinpoint causality directly, these questions—while important—are beyond our scope.

Despite these limitations, this paper has advanced the previous literature by providing a more comprehensive analysis of workplace drug testing and worker substance use. Overall, the results are most consistent with a deterrent effect of workplace drug testing on worker drug use that cannot be easily explained away by omitted variables about firms or workers, or by selection and sorting stories. We estimate that respondents subject to workplace drug testing are about 0.6–0.7 times as likely to have used marijuana in the past 30 days compared with similarly situated individuals whose employers do not test for drugs. Future work might use these estimates in combination with evidence on the association between drug testing and productivity to provide new insight on underlying structural relationships between substance use and workplace outcomes.

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NOTES

1. See, for example, National Research Council/IOM 1994 book, *Under the Influence*, for a review.
2. We also replicated previous findings using data from 1994 to 1999, and these results are available upon request. We focus on 2000–2002 because these are the only years to provide data on penalty severity, and sample sizes in these years were increased such that at least 900 households per state were sampled. In 2002 the NHSDA changed its name to the National Survey on Drug Use and Health (NSDUH). Throughout the paper, we refer simply to the NHSDA. There were some substantive changes that accompanied the name change in 2002, including the provision of a monetary incentive to respondents. The main results are not sensitive to excluding the 2002 data; they are included here for completeness.
3. The NHSDA does ask respondents whether the employer's written substance use policy covers alcohol, drugs, or both. However, nearly all respondents report that the policy covers both drugs and alcohol. We do not delete the handful of individuals (<10 in each survey year) who report the policy covers alcohol but not drugs. EAPs are generally directed at workers with alcohol problems.

4. Data from Quest Dynamics published at *Workforce* shows that in recent years about 60 percent of all positive drug tests in the U.S. workforce are for marijuana; the next closest substance is cocaine at < 15 percent. There is also evidence that under-reporting of marijuana use is less severe than for other drugs (see Mesch and Kandel 1988). A notable limitation of focusing on marijuana is that it is not obvious that marijuana causes workplace impairment—the key concern of employers—more than other substances.
5. Results for alternative measures of use—such as marijuana intensity—were similar. We exclude individuals with missing or incomplete information on any of the marijuana outcome variables. We do not, however, delete observations where the respondent reports not knowing information about workplace substance use policies. We also create a dummy variable indicating the respondent reported not knowing about the specific policy in question. Throughout, when we control for a particular program or policy, we also control for the associated “don’t know” dummy variable.
6. It is also worth noting that the magnitude of the changes in the adjusted odds ratio in Table 3 suggests larger sensitivity to accounting for other workplace characteristics both for having a workplace policy and offering drug education compared to the associated sensitivity of the drug testing coefficient. Also, in results not reported (but available upon request) we found that the statistical significance of the associations between marijuana use and having a written policy or having received drug education is not robust to considering an alternative time period (1994–1998), despite that the significant negative association between workplace drug testing and past month marijuana participation remains.
7. Pinpointing this type of direct job sorting by drug users requires a prospective research design that is beyond the scope of this paper.
8. Results were also insensitive to inclusion of various controls for current smoking behavior, such as a dummy variable indicating the individual is a daily smoker, or the number of cigarettes consumed in the previous month. To the extent that cigarettes proxy for unobservable characteristics related to time preference, this further supports the main findings.
9. This information has been used previously by researchers, but in a relatively limited way; no previous research, for example, has formally tested whether the substance use differential is larger for firms that perform both types of testing than for firms that do one but not the other.
10. For the 1994 NHSDA estimates we excluded all individuals who report they did not know about the employer’s testing programs. The firm size cutoffs in the 1994 NHSDA were 25–99 and 100+; to preserve sample size, we chose the 25+ threshold.
11. Probably the most persistent type of misreporting regarding employer testing is individuals reporting that they do not know about employer testing. Some researchers have argued that these “don’t know” responses should be coded as “no testing” if perceptions about testing are relevant for drug use decisions. Throughout, we have separately controlled for whether the individual does not know about drug testing.

12. Another possible concern is that because the substances commonly tested for under the "NIDA 5" (cannabinoids, cocaine, amphetamines, opiates, and phencyclidine) are known to workers, drug testing could have the unintended consequence of inducing marijuana users to substitute toward other illicit drugs with unknown relative effects on impairment and productivity (e.g., barbiturates).

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