NBER WORKING PAPER SERIES

THE EFFECTIVENESS OF WORKPLACE DRUG PREVENTION POLICIES: DOES 'ZERO TOLERANCE' WORK?

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Working Paper 7383
http://www.nber.org/papers/w7383

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 1999

The authors thank Antonio Martinez, Dean Ward, and Rich Diddams for research assistance. Opinions and conclusions expressed are solely those of the authors and do not reflect the positions of any of the organizations with which the authors are affiliated.

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NBER Working Paper No. 7383
October 1999
JEL No. I18, J28

ABSTRACT

Workplace drug testing programs are becoming increasingly more common although there is little research demonstrating that they have any effect on drug use by employees. This paper analyzes the deterrence effect of a particularly aggressive workplace drug-testing policy implemented by the military in 1981. The military's policy incorporates random drug testing of current employees and zero tolerance. Using data from various years of the Department of Defense's Worldwide Survey of Health Related Behaviors and the NHSDA, we find illicit drug prevalence rates among military personnel are significantly lower than civilian rates in years after the implementation of the program but not before, suggesting a sizeable deterrence effect. These basic findings are replicated with data from the NLSY. The NLSY are also used to explore sensitivity of the deterrence effect to the probability of detection and severity of punishment, which varied across military branches during the first few years of the program's implementation.

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I. INTRODUCTION

In recent years both private firms and government agencies have adopted various programs to combat illegal substance abuse in the workplace. The percentage of medium- to large-sized firms that use some form of drug testing nearly doubled in only four years, from 31.9 percent in 1988 to over 62 percent in 1992-93 (Hartwell, et al., 1996). The use of drug testing by public sector organizations also has grown in recent years (Felman and Petrini, 1988). Unlike most private firms that require only job applicants to submit to drug tests, many public sector organizations, particularly those involved in public transit and public safety, require regular random drug testing of current employees. A few organizations go even further than that by adopting a policy of "zero tolerance," which requires dismissal of workers who test positive for drugs on urinalysis tests. The goal of such aggressive policies is to impose high enough sanctions to deter drug use among current and potential users.

Despite the growth in the use of drug testing, little research exists on the effects of these programs in the workplace. Assuming rational behavior, drug testing policies should affect decisions to use illicit substances by increasing the cost of such behavior. This cost is positively related to the probability of detection, the probability of punishment given detection, and the severity of the penalty imposed. Each of these components is to some extent determined by the structure of the drug testing program. In some industries or firms, for example, drug (or alcohol) tests are administered only when an accident occurs.[1] Clearly, the primary goal of such a policy is to detect those who may have been impaired by illegal substances and punish them accordingly. The deterrence effects of such ex-post policies will tend to be weaker than when drug testing is administered randomly to an entire work force. Even random drug testing strategies, however, may not be very effective at detecting users. Borack (1997) shows that, for selected monthly testing rates, the expected time until detection of a non-gaming user ranges from one year to as high as 10 years. Of course, experienced users can try to "beat" the system by using illicit drugs at certain low-risk times (like immediately following a drug test), and it has been shown that these gaming users will generally avoid detection for longer periods (Borack, 1995). Thus, although detection is a valuable component of anti-drug programs, especially a drug testing program, it is not the primary output. Rather, the main output of such programs is the deterrence of potential users. Little research has been done, however, on the effectiveness of drug testing as a deterrent to either current or potential users.

In this paper we explore the deterrence effect of a particularly aggressive drug-testing program that has existed in the military since 1981. The military offers a unique natural experiment to study the deterrence effect because it imposes mandatory random drug testing on its current employees, which raises the probability of detection, and it assesses a very high penalty -- job loss -- on those detected. This combination of random drug testing and zero tolerance is relatively rare in the private sector or in other government agencies and is likely to yield the maximum deterrence effect for alternative feasible drug prevention programs. However, the cost of this program can be high due to the costs (recruiting and training costs) of replacing discharged personnel. Assessing the true magnitude of the deterrence effect is therefore critical for enabling a more complete assessment of the cost-effectiveness of zero-tolerance policies.

Using data from the National Household Survey of Drug Abuse (NHSDA) and the Department of Defense's Worldwide Survey of Health Related Behaviors (DODWWS), we examine the deterrence effect of the military's rigid drug program by comparing differences in illicit drug use between the military population and the civilian population. Although the civilian

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[1] For example,in many states a breath test for blood alcohol is administered to drivers involved in a vehicle accident (see Rhee and Zhang, 1993).

population is not a clean comparison group because some individuals may be subject to a similarly aggressive prevention program, the vast majority of the population experiences far less rigid programs, or none at all. Data from these two cross sectional studies in 1995 reveal that significant differences in drug use exist between these two populations, with those in the military being significantly less likely to report use of an illicit drug in the past year or in the past month. It is not clear if this difference can be entirely attributed to a deterrence effect of the drug testing program, however, given that people who decide to join the military know the program is already in place and may self-select into or away from this occupation. Further, drug use may be correlated with unobservable factors that influence an individual's willingness to serve in the military, such as patriotism and a strong belief in our nation's laws. We, therefore, also examine data from these two surveys prior to the implementation of the military's rigid program to assess whether there were significant differences in drug use patterns before the program existed. Finally, to more directly assess the issue of selectivity bias, we examine self-reported drug use in the National Longitudinal Survey of Youth (NLSY) both before and after the adoption of the military's program. The use of these longitudinal data enables us to restrict our difference-in-differences approach to those individuals who are either "continuously in the military" or "continuously in the civilian population."

The rest of this paper is organized as follows. Section II discusses the implementation of the military's program beginning in 1981 and how the program currently operates today. Section III presents data from the NHSDA and DODWWS surveys to examine both post- and pre-program differences in drug use between the civilian and military sectors. Section IV addresses the same issues using longitudinal data from the NLSY. Section V provides some insight into the separate effects of random drug testing versus zero tolerance policies, and Section VI concludes the paper.

II. THE MILITARY'S DRUG PREVENTION PROGRAM

The Department of Defense (DoD) first began implementing a urinalysis drug testing program in 1971 with the original intent of identifying illicit drug users, rehabilitating them, and returning them to full duty status (Bray et al, 1992). It was not initially envisioned as a tool for disciplinary or punitive actions. When in 1974 the DoD tried to change its approach and use the results of drug tests for disciplinary and administrative action, these efforts were invalidated by a Military Court of Appeals ruling. In 1980, that ruling was reversed and the DoD issued a new directive updating its original drug testing policy. The new directive required each of the military services to enact and operate urinalysis drug testing programs and clearly stated that drug testing results could be used, with certain restrictions, in punitive or separation proceedings. Immediately following this new directive, the U.S. Air Force adopted a policy of frequent and random drug testing. Further, Air Force commanders were empowered to order spot testing anytime they felt there was a reasonable suspicion of drug or alcohol abuse. All of the service branches adopted a general policy of "zero tolerance," but these policies were not applied uniformly to all personnel. For example, the Army allowed soldiers with less than three years of service a reprieve from separation proceedings if it was their first offense.[2] Similarly, the Navy and Marine Corps allowed for the possibility of rehabilitation of junior personnel if their problems were deemed treatable.[3] Further, drug testing rates varied across the services. Army commanders were given the freedom to set their own drug testing rates for members of their command (Department of the Army, 1988), while commanders in the U.S. Navy and Marines were required to test 10 to 20 percent of their commands on a monthly basis (Lieb, 1986). By 1995, however,

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[2] This was subsequently changed in 1995 so that all Army personnel currently are processed for administrative separation and disciplinary action.

[3] The Navy formally changed its policy to apply strict zero tolerance to all pay grades in 1990.

all of the services had changed their drug testing strategies to be consistent with each other and zero-tolerance had become uniformly applied to all personnel.

Despite some initial differences in program implementation, the introduction of the military's drug program in 1981 was followed by a steady downward trend in illicit drug use among active duty personnel. Drug prevalence rates fell from 27.6 percent in 1980 to only 3.4 percent in 1992. (Bray et al, 1995). The biggest drop occurred between 1980 and 1985 (from 27.6 to 8.9 percent), which spans the period when the Department of Defense (DOD) introduced and refined its program. Some analysts have assumed these drops in drug use in the armed forces were attributable directly to the military's programs. However, data from the National Household Survey of Drug Abuse (NHSDA) shows that past month drug use among civilians also fell during this period. Thus, it is difficult to determine whether the drug use reductions were a true program effect or simply due to changes in drug use patterns among the general youth population from which the military recruits.

III. ANALYSIS OF NHSDA AND DODWWS DATA

The 1995 National Household Survey on Drug Abuse (NHSDA) is part of a series of nationwide surveys designed to measure the prevalence of drug use among U.S. households. The 1995 NHSDA is the 15th in a series of studies that began in 1971. The survey was based on a stratified, multi-stage area probability sample that provides a nationally representative sample of the non-institutionalized civilian population 12 years old and older (SAMHSA, 1996). For the 1995 survey, 115 districts were selected for the first stage of sampling and approximately 22,000 persons were screened for interviewing. Only 17,747 interviews were completed yielding a response rate of 80.6 percent.[4] In addition to collecting important socioeconomic and demographic information, each year the NHSDA asks a series of questions pertaining to lifetime, annual and thirty-day non-medical use of 11 or more illicit substances including marijuana, cocaine, crack, inhalants hallucinogens, PCP, heroin, stimulants, sedatives, tranquilizers and analgesics. The drug use questions have been developed and tested over time so as to maximize response rates and minimize reporting biases. To further reduce reporting bias, the NHSDA uses self-administered questionnaires for this portion of the household interview.

Although the NHSDA contains some military personnel, this sample is small and not representative of all uniformed personnel since the sampling frame excludes individuals living on military installations. To examine drug use among military personnel, we therefore use the 1995 Department of Defense Worldwide Survey of Health Related Behaviors Among Military Personnel (DODWWS). The DODWWS was the sixth in a series of surveys of active-duty military personnel that started in 1980. The overall purpose of the series of surveys is to determine the nature, causes and consequences of substance use and health behavior among active-duty military personnel and to evaluate the impact of current and future program policies targeting substance use and health decisions in this population. Included in the survey were 395 questions pertaining to illicit drug, alcohol and tobacco use within the military. In 1995, the overall response rate for the eligible population was 69.6 percent. The final 1995 DODWWS data set consists of 16,193 observations (4,440 Air Force, 4,265 Navy, 3,960 Marine Corps and 3,638 Army).[5]

Both of these surveys are based on self-reported data. Hoyt and Chaloupka (1993) show that the method of administering these type of surveys can affect the magnitude of reported drug use. However, both surveys were self-administered rather than interviewer-administered precisely

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[4]For more on the sampling design and survey administration of the NHSDA, see USDHHS (1996).
[5] For a discussion of sampling design and survey administration methods see Bray, Kroutil, and Marsden (1995).

to minimize underreporting of drug use (Turner, Lessler, and Devore, 1992). Bray et al. (1995) discuss specifically the validity of the self-reported DOD survey.

Two indexes of respondents' illicit drug use are constructed from both of these surveys, one reflecting any illicit drug use in the past 12 months and one reflecting any use in the past month. These variables measure drug participation rather than the quantity of drugs consumed. These two analysis variables were selected in part based on the availability of questions that were asked in both the NHSDA and DODWWS surveys and that were structured the same in both surveys. The indexes are based on the prevalence of the nonmedical use of one or more of 11 categories of illegal substances.

Standard demographic characteristics that are available in both surveys and measured the same in both include gender, marital status, any children, education, age, and race and ethnicity. Although there are other characteristics that have been shown to be significant correlates with illicit drug use, such as religious participation, urbanity, and current living arrangements, these measures are either unavailable in both surveys or not collected in a consistent fashion.

No geographic identifiers were available for respondents in the DODWWS, therefore it is not possible to include geographic-specific drug price information in the models. Although omission of price variables in demand equations represents a specification error, the omission is unlikely to bias the coefficient of the focus variable, military status, unless military installations are consistently placed in areas where drug prices are systematically different. Even if geographic location information were available, however, constructing a geographic-specific price measure for military personnel would be problematic due to the high geographic mobility of military personnel, who often deploy to areas (states or countries) far from their "home" unit. Furthermore, because our dependent variable is non-drug specific, it is likely that any measure of an illicit drug price used would only introduce more measurement error since prices exist only for particular substances. No composite price for illicit drugs currently exists.[6]

Table 1 provides definitions of the analysis variables and the weighted means. The civilian data from the NHSDA is restricted to 17- to 49-year olds to align civilians with the age groups represented in the military population. The restricted civilian sample from the NHSDA, contains 12,012 individuals, and the military sample has 16,067 observations. Table 1 shows that both current (previous 30 day) drug participation as well as past-year drug participation are significantly lower among the military population than the civilian population. However, there are also a number of demographic differences that may be driving these utilization differences, such as differences in marital status, age, and level of education, suggesting that multivariate analysis is needed. To investigate this further, we pool the two samples and estimate the prevalence of any illicit drug use in the past month and the past year.

Coefficient estimates from logistic specifications of the probability of using any illicit drug in the past year and in the past month for the pooled sample of 17- to 49- year olds are recorded in Table 2. These estimates show that even after other correlates of illicit drug use are accounted for, the military sample is still significantly less likely to report using any illicit substance in the past year or the past month. The number in brackets shows the marginal effect of being in the military (evaluated as a change from 0=civilian to 1=military) on the prevalence of any illicit drug use. Individuals in the military are approximately 20% less likely to report use in the past year and 14% less likely to report use in the past 30 days than their civilian counterparts, holding other factors constant at their mean values. Although some of this difference may represent the deterrence effect of the military's drug testing program, it is not clear that all of it can be

[6]In addition, personal income is not available in the DODWWS. Military pay grade is available, which could be converted to annual income, but pay grade would reflect seniority in the organization more than a true income

attributable to the program. For example, it may be that the military population is less willing to self-report illicit drug use than the civilian population because of the enormous penalty imposed. Alternatively, it may be the case that military participation is correlated with unobservable factors that also influence an individual's willingness to use illicit drugs.

To determine the sensitivity of the estimated program effect to an individual's willingness to report drug use, we modify the sample in several ways. First, we omit all officers and college graduates from the military sample. The reason for this restriction is the very low self-reported drug prevalence rates among officers compared to regular enlistees (Bray et al., 1995). Military officers are more indoctrinated into the military culture and have more to lose if they are caught using illicit substances. The lower reported use rates among officers, therefore, may in fact represent true differences in illicit drug use or they may simply reflect an increased unwillingness to report illicit drug use. If it is the latter, then restricting the sample to just enlistees should shrink the difference in reported drug use found between the civilian and military population. To align the civilian comparison group more closely with military enlistees, the civilian sample is restricted to non-college graduate workers in blue-collar occupations (civilians in professional, technical, and administrative occupations are deleted). The restricted pooled sample consists of 22,374 observations.

Table 3 presents results from logistic specifications of the same model as in Table 2 for the restricted sample. To conserve space only the coefficients of the military dummy variables are presented. The results are similar to those obtained for the unrestricted sample in Table 3 that includes officers and white-collar civilian workers. Column 1 estimates the drug use models for the 17 to 49 age group to see the effect of the sample restrictions. A comparison of the coefficients of the military dummies in column 1 to the coefficients in Table 2 reveals very little

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effect.

change in their size or significance in either of the drug participation models. Columns 2 and 3 of Table 3 provide estimates of drug use for samples further restricted to 17-34 year olds and 17-25 year olds, respectively. Even though the restriction to ages 17 to 34 eliminates about 6,000 observations, there is very little difference in the coefficient of the military dummy in column 2. The sample falls by another 7,000 in column 3 for the youngest sample but, once again, the program effect remains robust. That the various age restrictions do not alter the estimated program effect appears to be due to a fixed relationship between drug participation in the two sectors over various sub-groups. We interpret these findings as evidence that the willingness to underreport is not a major component of the observed differences in illicit drug use between the civilian and military populations.

The question remains, however, as to whether the large deterrence effect estimated in Table 2 is biased upward due to selection bias. Drug use among military personnel may be lower even in the absence of the drug prevention program due to application of the military's entrance standards and to self selection among applicants. One way of examining whether this is indeed the case is to assess the difference in military and civilian drug participation in a period before the military's drug program took effect. If adjusted prevalence rates for military personnel are also lower when no punitive programs were in place (pre-1981), one may infer that the estimated differences in drug use in 1995 are explained by unobserved differences between the two populations rather than by a true program effect. If, on the other hand, military personnel use drugs at similar, or higher, rates than civilians in the pre-program (pre-1981) year, one may infer that the prevention program (in 1995) is causally linked to the lower drug use behavior among military personnel.

To conduct this difference-in-differences analysis we merge data from the 1980 DODWWS and 1979 NHSDA surveys. We were forced to use different survey years for each survey because prior to 1981 there was no single year when both surveys were fielded. We choose these two survey years because they immediately preceded the implementation of the military's program and they were two survey years in which the national trend in drug use remained unchanged (we were at a peak in illicit drug use that started to decline after 1981). The specification of the drug use models for the pre-drug program period is similar to those for the post-drug prevention program period. However, due to differences in questions asked in the older DoD surveys (see Burt, et al., 1980), the continuous age variable was replaced by dummies for age categories, and the presence of children living in the household had to be omitted from the analysis. Otherwise, model specification is the same as in the 1995 file.

Table 4 provides weighted means for the 1979 NHSDA and 1980 DODWWS data sets. The data from the 1979 NHSDA are restricted to individuals between the ages of 17 to 49 so as to align civilians with the age groups of military members. It appears that current drug participation still is significantly lower in the military population than in the civilian population, but the magnitude of the difference is only 1.7 points, substantially smaller than in 1995. Furthermore, past year participation is significantly higher for military personnel, by 8 points, suggesting that some of the differences that were observed in 1995 may indeed reflect a program effect. However, there are again significant differences in other population characteristics that may be correlated with these observed differences in utilization rates, so multivariate analysis is necessary if we want to make any definitive statements. We, therefore, use the same approach as before and pool the sample so that we can estimate prevalence rates controlling for other determinants of demand.

Table 5 presents coefficient estimates from logistic specifications of the prevalence of past year and past month use for the pooled 1979/1980 NHSDA/DODWWS data file. To conserve space we again report only the coefficients of the military dummies, and only for the restricted samples. Thus, these results can be compared to those in Table 3. Here we find that the coefficient estimate on the military dummy variable in the past year model is positive but statistically insignificant. Further, although the coefficient estimate in the past month model is negative and statistically significant, it indicates a much smaller difference in magnitude than that observed in the 1995 sample. Holding other variables in the model constant at their means, we find that military personnel are only 3% less likely to report using illicit drugs in the previous thirty days than the civilian population. This suggests that the military's drug testing program has been extremely successful at deterring drug participation, explaining as much as 80% of the difference we see in 1995.

These findings are not stable across younger cohorts, however. Columns 2 and 3 show what happens to the estimated coefficients when we restrict the sample to ages 17-34 and 17-25, respectively. As in column 1, column 2 reveals no significant difference in past-year drug use between the two populations and that past month use is lower in the armed forces. However, the partial effect of the military coefficient in the past month model has risen to 8.3 percentage points for 17- to 34-year olds. The most notable difference arises in column 3 for the youngest age group, 17-25 -- past year drug use is 4.3 points higher for those in the military in 1979/1980 and the difference is statistically significant. Current use continues to be lower for enlistees among 17- to 25-year olds and the partial effect of military status is now similar to what it is in the 1995 data.

Overall, the patterns are inconclusive regarding underlying differences in the two populations. At least in the full sample, it appears that the differences in past year and past month participation are significantly smaller in the pre-program sample than they are in the post-program samples. However, as we restrict the sample to the younger cohorts and compare civilian blue-collar workers with military enlistees we find conflicting results based on the dependent variable being measured. Although past year use in the pre-program period is higher among enlistees, supporting a strong program effect, current (30-day) drug participation is significantly lower among enlistees. The difference in differences estimate based on the 30-day prevalence measures falls to about 4 percentage points (10.12 – 14.97 = - 4.85), suggesting that only about one-third of the difference in prevalence can be attributed to the military's stringent drug testing program. One interpretation of the shrinking difference-in-differences estimates is that self selection is greater among the youngest age groups.

IV. DETERRENCE EFFECTS IN THE NLSY

Part of the inconsistency in findings reported in the previous analysis may have to do with inherent limitations of cross-sectional data. When considering the impact of a policy change on the behavior of those in the military, cross-sectional data cannot account for entry and exit from the sample of interest over time. Further, given the long time lag between periods being evaluated, there may have been changes in the recruiting strategy employed by the military that would make the military population more or less like the civilian population over time in ways we have not measured. We therefore thought it would be useful to see if we could replicate our findings of a deterrence effect using longitudinal data from the National Longitudinal Survey of Youth (NLSY).

There are several advantages of using the NLSY for evaluating the deterrence effect of the military's drug testing program. First, because the NLSY tracks the same individuals over time, it is possible to separate people who choose to leave the military after the military's drug testing program went into place with those people who choose to stay. We can therefore evaluate how drug use patterns change for those entering and exiting the military, thus making it possible to isolate the deterrence effect to some extent from the selection effect. Second, we can track how individuals who choose to stay in the military change their drug use over time given the implementation of the military's drug testing program and compare this with changes in the civilian population during the same time period. Finally, the NLSY contains a richer set of demographic and background characteristics that enable us to obtain a better specification of the individual's demand function. Variables omitted from the earlier analysis that can now be accounted for include parental education, a measure of cognitive ability (AFQT scores), and mother's work status while the respondent was growing up.

The NLSY's advantages are countered by a major disadvantage -- drug use is not collected in every survey year. Although an extensive array of drug use questions were asked in 1984, 1988, and 1992, only the 1980 survey contains information on illicit drug use prior to implementation of the military's program. Further, the 1980 survey only asked use of marijuana in the previous year. It contains no information on the use of other illicit substances. Since we cannot construct a measure of any illicit drug participation for both a pre-program and post-program year, annual marijuana use is analyzed instead. Given that marijuana is by far the most widely used illicit drug, this change in the dependent variable should not have a dramatic effect on our ability to identify a deterrence effect.

The two years chosen for analysis, 1980 and 1984, straddle the change in the military's drug policy, which occurred in 1981. Descriptive statistics for the civilian and military samples in the 1984 NLSY are presented in the Appendix. In both populations, the vast majority of people who report using any illicit drug in the previous year also report using marijuana in the previous year, suggesting that limiting our analysis to past-year marijuana use should not jeopardize our ability to find a deterrence effect. The appendix also shows that in 1984 statistically significant differences exist between the military and civilian populations in all of our measures of illicit drug use. For example, military personnel are only half as likely to report using marijuana in the previous year as the civilian population. The question is whether this difference in utilization rates existed before the military's strict drug testing program.

An important first step in answering this question is determining whether the sample changed before and after the program was introduced and whether those changes are correlated with marijuana use. Approximately 54.3% of those who were in the military in 1980 were still serving in the military in 1984, so approximately 46% of 1980 military personnel separated from the military during the four years. Among the 1980 civilian sample, 93.7% remained civilians during this four year period, while the remaining 6.3% decided to join the military during the intervening period.

Table 6 provides a break down of marijuana prevalence rates by transition status. The overall use rate for military members in 1984 was 17.9 percent. This compared to a prevalence rate of 32.5 percent for civilians, a difference of 14.6 points. However, the military group included individuals who entered the military between 1980 and 1984 and the civilian group included veterans who left the military during this period. If we compare prevalence rates in 1984 between those who were continuously in the military during the period versus those who were continuously civilians the difference becomes somewhat larger, 18.7 points (32 percent versus 13.3 percent). Marjuana use in 1980 had a different pattern, with the military sample reporting higher annual prevalence of marijuana use than those in the civilian sector (56.5% and 45.8%, respectively). However, if we limit the samples to those who remained in the military to those who remained civilian, this difference in prevalence rates drops substantially, with the military population reporting use rates of 48.5% and the civilian population reporting use rates of 45.9%. The group that left the military after 1980 had the highest annual prevalence, as one might expect.

There are other suggestive differences for the various transition groups. Use rates dropped between 1980 and 1984 for all groups. However, the drop was the greatest for continuous military personnel, from 48.5 percent to only 13.3 percent (a drop of 35.2 points), followed by those who entered the military during the period (a drop of 27.1 points). By comparison, continuous civilians reduced marijuana use by only 7.1 percentage points. As was already mentioned, those who initially were on active duty in 1980 but who later separated had the highest use rates of any group (61.9%). Their usage dropped in 1984 but not by as much as those who remained on active duty. This suggests that some drug users in the military may have been induced to leave by the new drug policies. Similarly, civilians who enlisted during the period had a much larger drop in marijuana use, as compared to continuous civilians.

Logistic specifications of annual prevalence of marijuana use for 1980 (column1) and 1984 (column 2) are presented in Table 7. In 1980, the year before the military's drug policy was introduced, there is no significant difference in self-reported annual marijuana prevalence between the civilian and military sectors. However, by 1984 it appears clear that the military's drug prevention program had reduced drug participation; marijuana use among military personnel in 1984 was 20% below that of civilians. This is consistent with the program effect estimated above using the 1995 NHSDA-DODWWS data [see Table 2]. These results suggest that the adjusted military-civilian marijuana participation differential has remained relatively steady over the decade since the inception of the military's strict anti-drug policies.

As previously discussed, the composition of the military sample changes between 1980 and 1984. Estimates of the program effect calculated from the regressions presented in Table 7 may be biased by individual decisions to enter or leave the military over time. One way to overcome this limitation is to remove from the sample those who transition between the military and civilian sectors. We therefore re-ran our analysis on a restricted sample of individuals who remained in either the military or the civilian population between 1980 and 1984. We find that the coefficient estimate on the military dummy variable in 1980 remains fairly stable and insignificant.

The estimated coefficient on the military dummy variable in 1984 becomes –1.085 and remains significant at the 0.01 level. The marginal effect of –23.7% is slightly larger than the estimate of 20.2% presented in Table 7, suggesting that the programmatic effect of the military's drug testing program is even larger than previously estimated. It should be stressed, however, that marijuana use is measured for the past year. These basic results were also observed in the NHSDA/DoD data for past year illicit drug use, but not for current drug use.

V. THE EFFECT OF DIFFERENCES IN DETECTION AND PUNISHMENT PROBABILITIES

As note above in Section II, by 1995 all of the military branches had adopted similar drug prevention policies that incorporated both random drug testing and dismissal of all members testing positive for illicit drugs. This policy is much more stringent than programs found in most private firms and government agencies. However, in 1984 the military's policies were still evolving and somewhat less stringent than they are today (see Leib, 1996; Martinez, 1999). In addition, the policies created differences in the probabilities of detection and punishment across service branches within the military.

In this section we rely on natural differences that arose in the implementation of anti-drug policies in the military. Although all branches implemented some form of drug testing after 1981, not all immediately adopted zero tolerance. In particular, all branches allowed junior enlisted personnel (in pay grades 1 through 3) who tested positive to continue their careers (a "two-strikes" policy) under certain conditions. Considerable discretion was given to local commanders, and only senior enlisted and officers were subject to automatic termination. Another difference was that testing rates in the Army were lower than in the other branches. Due to the widespread "two-strikes" policy for junior personnel, which reduced the probability of punishment for this group, we would expect any deterrence effect of overall military policies to be smaller in 1984 than in 1995. Also, we would expect deterrence effects to be the lowest in the Army, which had a lower probability of detection owing to a lower testing rate. Since the military sample in the NLSY consists of junior enlisted, we use the NLSY to test for these hypothesized differences. We estimate three drug participation models, one for current illicit drug participation, one for any past year participation, and one for past year marijuana participation. The model contains dummies for each military branch rather than a single military dummy. The results are displayed in Table 8.[7]

The results in Table 8 reveal striking differences in the estimated overall deterrent effect attributed to military polices in 1984 and 1995, and deterrence among the four service branches. The size of the overall military coefficient in 1984 is -.886 for past year drug use, which is 20-40 percent lower than the range reported for 1995 past year participation in Tables 2 and 3. Similarly, 1984 past month drug participation is considerably lower than the estimates in Tables 2 and 3. Furthermore, the magnitude of the negative coefficient for the Army in 1984 is between one-third and one-half the size of the coefficients of the other branches in 1984.

The military drug prevention program in effect in 1984 was closer qualitatively to those currently being used by civilian employers.[8] Thus, these results suggest the potential size of the deterrence effect for policies that are closer to those currently in use by civilian employers. If we assume that the results for the Army provide a lower bound estimate of this effect, due to the lower detection risk and lighter punishment, then a deterrence effect of about 10 percent could be expected from the programs in civilian firms.

VI. SUMMARY AND CONCLUSIONS.

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[7] We are not able to use the 1995 NHDA/DODWWS data file for this test because by 1995 service policy differences had blurred.

[8] For example, local government transportation workers can be subject to pre-employmnent, random, and post-accident alcohol and drug testing. Those who test positive may be referred to treatment and rehabilitation. Although termination of employment is one outcome, it is used rarely. The most severe penalty appears to be transfer of an employee to jobs that are not ‘safety-sensitive.’

Using the U.S. military's policy of random drug testing and zero tolerance, we find that a strict employer anti-drug program is a highly effective means of deterring illicit drug use both among current users as well as potential users. However, the size of the deterrence effect varies considerably depending on which age group, which drug use measure, and which data set is used. In the NHSDA/DoD surveys past year drug participation in the military is as much as 16% lower than in the civilian sector for the program year (1995); furthermore, it appears that selection bias does not account for much of this effect. Analysis of NLSY data on past year marijuana use reinforce these results. However, civilian-military differences in past month use among younger age groups appear to be more heavily affected by selection bias, which may account for as much as 70 percent of the estimated deterrence effect. Based on these considerations, the deterrence effect for the military program would range between 4% and 16%.

It is interesting to note that even the strictest workplace anti-drug program cannot eliminate illicit drug use among employees. Although drug participation rates in the military are low, they are not zero. This raises the question as to whether or not such strict anti-drug programs are worth their cost. The primary cost of zero tolerance is the cost of replacing terminated workers. The program the military used in 1984 involved a two-strikes policy, and in the case of the Army, lower random testing rates, yet still produced a sizeable deterrence effect. These results suggest that policies that would be feasible today in the private sector can be expected to reduce drug use in a cost-effective manner.

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Table 1. Weighted Means from 1995 DoD and NHSDA Surveys

Variables	Variable Definitions	Military Means	Civilian Means
Past-Month Drug Participation	= 1 if respondent reports using any illicit drug in the past month	.030 (.171)	.081 (.273)
Past-Year Drug Participation	=1 if respondent reports using any illicit drugs in	.065 (.247)	.147 (.354)
Married	= 1 if respondent is married	.601 (.489)	.558 (.496)
Children	= 1 if respondent has children	.430 (.495)	.445 (.497)
High School Diploma	= 1 if respondent has high school diploma	.341 (.474)	.331 (.470)
Some College	= 1 if respondent attended college, but did not attain diploma	.440 (.496)	.247 (.431)
College Graduate	= 1 if respondent has college degree,	.190 (.392)	.256 (.436)
Age	= Respondent's age in years	28.44 (7.22)	33.24 (9.10)
Black	= 1 if respondent is Black	.172 (.377)	.119 (.324)
Hispanic	= 1 if respondent is Hispanic	.085 (.279)	.107 (.309)
Other Minority	= 1 if respondent is other racial/ethnic minority	.065 (.279)	.044 (.206)
Female	= 1 if respondent is female	.124 (.330)	.509 (.499)

Notes: Restricted to ages 17-49. All data are weighted
Military sample = 16,067; civilian sample = 12,012

Table 2. Logit Estimates of Any Illicit Drug Participation, 1995
(Ages 17-49)

Variable	Past Year Participation	Past Month Participation
Military	-1.466	-1.591
	(.052)[a]	(.070)
	[20.70][b]	[14.10]
Female	-.398	-.507
	(.052)	(.059)
Children	-.284	-.255
	(.046)	(.064)
Married	-.591	-.661
	(.054)	(.073)
Black	-.242	-.147
	(.055)	(.069)
Hispanic	-.609	-.567
	(.062)	(.079)
Other race	-.232	-.136
	(.112)	(.146)
Age	-.052	-.037
	(.003)	(.004)
High school diploma	-.087	-.181
	(.059)	(.073)
Some college	-.210	-.290
	(.064)	(.080)
College graduate	-.589	-.862
	(.081)	(.108)
Constant	.775	-.172
Log likelihood	1254.4	765.6
N	28,075	28,020

Notes: Merged 1995 NHSDA/DODWWS data.
[a] Standard errors are in parentheses.
[b] Partial effects in brackets.

Table 3. Logit Estimates of Military Coefficient in Drug Participation Models, Restricted Samples

	Ages 17-49	Ages 17-34	Ages 17-25
Past Year participation	-1.386	-1.301	-1.175
	(.056)[a]	(.128)	(.073)
	[19.35][b]	[18.89]	[17.25]
Past Month participation	-1.537	-1.450	-1.329
	(.076)	(.080)	(.096)
	[13.33]	[13.47]	[14.97]
N	22,374	16,142	9,112

Notes: Based on merged 1995 NHSDA/DODWWS data. For full model specification see Table 3.
[a] Standard errors are reported in parenthesis.
[b] Partial effects in brackets.

Table 4. Weighted Means from 1979 NHSDA and 1980 DoD Surveys

Variables	Variable Definitions	Military Means	Civilian Means
Past -Month Drug Participation	= 1 if respondent reports using any illicit drug in the past month	.177 (.382)	.194 (.395)
Past-Year Drug Participation	=1 if respondent reports using any illicit drugs in	.357 (.479)	.276 (.447)
Married	= 1 if respondent is married	.522 (.499)	.611 (.487)
High School Diploma	= 1 if respondent has high school diploma	.404 (.490)	.342 (.474)
Some College	= 1 if respondent attended college, but did not complete degree	.303 (.459)	.245 (.430)
College Graduate	= 1 if respondent has college degree	.156 (.363)	.189 (.391)
Age 17 - 20	= 1 if respondent is 17 -20	.212 (.408)	.147 (.354)
Age 21 - 25	= 1 if respondent is 21 - 25	.356 (.478)	.184 (.387)
Age 26 - 34	= 1 if respondent is 26 - 34	.276 (.447)	.286 (.452)
Age 35 - 49	= 1 if respondent is 35 - 49	.155 (.362)	.381 (.485)
Black	= 1 if respondent is Black	.185 (.388)	.113 (.317)
Hispanic	= 1 if respondent is Hispanic	.045 (.208)	.066 (.248)
Other Minority	= 1 if respondent is other racial/ethnic minority	.021 (.145)	.021 (.145)
Female	= 1 if respondent is female	.086 (.281)	.514 (.499)

Notes: Restricted to ages 17 - 49. All data are weighted.
Military sample = 15,268; civilian sample = 4,624

Table 5. Logit Estimates of Military Coefficient in Drug Participation Models, 1979/1980 Data, Restricted Samples

	Ages 17-49	Ages 17-34	Ages 17-25
Past Year Participation	.0116	.0662	.1911
	(.049)[a]	(.050)	(.055)
	[0.11][b]	[1.53]	[4.38]
Past Month Participation	-.5716	-.5273	-.4197
	(.053)	(.054)	(.059)
	[-2.79]	[-8.38]	[-10.12]
N	19,149	15,809	10,777

Notes: Based on merged 1979 NHSDA/1980 DODWWS file. For full model specification see Table 3.
[a]Standard errors are reported in parenthesis.
[b]Partial effects in brackets.

Table 6. Marijuana Use Rates By Transition Status, NLSY Data
(standard errors in parentheses)

Status	(1) Marijuana Use 1980	(2) Marijuana Use 1984	Difference= (1)-(2)
Stayed Military	.485 (.500)	.132 (.340)	-.353
Stayed Civilian	.458 (.498)	.320 (.466)	-.138
Entered Military	.504 (.500)	.234 (.424)	-.270
Left Military	.618 (.486)	.406 (.491)	-.212
Mil. 1984	--	.179 (.383)	--
Civ. 1984	--	.325 (.468)	--

Table 7. Estimates of Past Year Marijuana Participation, 1980 and 1984

Variable	Marijuana Participation, 1980	Marijuana Participation, 1984
Military	.105 (.084)[a] [2.57][b]	-.919 (.118) [20.22]
Black	-.392 (.057)	.043 (.063)
Other minority	-.074 (.102)	.046 (.111)
Female	-.220 (.043)	-.578 (.047)
Children	.125 (.081)	.065 (.062)
Married	-.445 (.082)	-.762 (.065)
Separated	-.269 (.187)	.024 (.104)
High school diploma	-.096 (.070)	-.363 (.067)
Some college	-.255 (.074)	-.482 (.060)
Mother worked	.206 (.044)	.164 (.047)
AFQT Score (%)	-.001 (.001)	.006 (.001)
Father's Education	.038 (.006)	.050 (.007)
Age	.649 (.116)	.544 (.217)
Age squared	-.013 (.003)	-.011 (.004)
Intercept	-.7623	-7.166
Log likelihood	338.4	625.9
N	9,161	9,355

[a] Standard errors in parenthesis
[b] Marginal effects in brackets

Table 8. Coefficients of Service Branch Dummies, 1984 NLSY Data

Branch dummy	Past Year Drug Participation	Current Drug Participation	Past Year Marijuana Participation
Army	-.486	-.681	-.520
	(.168) [a]	(.189)	(.155)
	[11.1] [b]	[13.2]	[12.9]
Navy	-1.452	-1.792	-1.341
	(.310)	(.394)	(.268)
	[25.5]	[26.5]	[28.0]
Marine Corps	-.874	-1.625	-.908
	(.419)	(.602)	(.380)
	[16.0]	[21.6]	[21.8]
Air Force	-1.333	-1.515	-1.520
	(.308)	(.370)	(.297)
	[25.2]	[23.4]	[31.8]
All Military	-.886	-1.124	-.919 [c]
	(.012)	(.151)	(.118)
	[16.9]	[17.3]	[20.2]

Notes: For full model specification see Table 7 (column 2)

[a] Standard error in parentheses

[b] Partial effect in brackets

[c] From Table 7, column 2

Appendix Table. Descriptive Statistics for 1984 NLSY

Variable	Civilian Sample	Military Sample	Total
Current drug use[a]	.216	.085	.211
	(.411)	(.280)	(.408)
Past-year drug use[b]	.261	.118	.255
	(.439)	(.323)	(.436)
Past-year marijuana[c]	.319	.138	.312
	(.466)	(.345)	(.463)
White	.690	.681	.691
	(.462)	(.466)	(.461)
Black	.252	.272	.251
	(.434)	(.445)	(.433)
Other minority	.057	.045	.057
	(.232)	(.209)	(.232)
Female	.526	.365	.517
	(.499)	(.482)	(.499)
Married	.272	.652	.287
	(.445)	(.476)	(.452)
Children	.281	.511	.290
	(.449)	(.500)	(.454)
High school diploma	.749	.981	.759
	(.433)	(.133)	(.427)
Some college	.354	.226	.349
	(.478)	(.419)	(.476)
Age	22.6	24.8	22.7
	(2.26)	(1.20)	(2.27)
Mother worked	.574	.584	.573
	(.494)	(.493)	(.494)
Father's education	11.10	11.42	11.12
	(3.74)	(3.07)	(3.71)
AFQT	39.68	52.18	40.09
	(29.05)	(23.30)	(28.93)
N	10,606	440	11,593

[a] t-test of difference in means = 9.301(p=.0001)
[b] t-test of difference in means = 8.895(p=.0001)
[c] t-test of difference in means = 8.056(p=.0000)

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