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NATIONAL EVALUATION DATA SERVICES

## EARLY INITIATION OF MARIJUANA USE IN JOB CORPS AND NHSDA

March 2002



**CSAT**  
Center for Substance  
Abuse Treatment  
SAMHSA

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NATIONAL EVALUATION DATA SERVICES

## **EARLY INITIATION OF MARIJUANA USE IN JOB CORPS AND NHSDA**

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## FOREWORD

The Center for Substance Abuse Treatment (CSAT), Office of Evaluation, Scientific Analysis, and Synthesis (OESAS), established the original National Evaluation Data Services (NEDS) contract (No. 270-97-7016) in 1997 to support the CSAT mission by increasing knowledge of the effectiveness of substance abuse treatment and promoting access to treatment evaluation and analysis data and findings. NEDS furnished that support by supplying data management, scientific analysis, and technical support services.

In 2000, through a new contract (Contract No. 270-00-7078), OESAS both continued and expanded the scope of NEDS in three major areas: treatment data infrastructure, secondary analysis of treatment data including Government Performance and Results Act support, and Web-based treatment data tools for states. NEDS is designed to give the Center the capability to strategically target, and access existing data from CSAT and the other data sources, to generate new treatment information over time through analyses of the available data, and to provide access to this new treatment information to diverse audiences through multiple product lines and avenues. All of these activities are aided throughout by the active participation of a preeminent panel of experts representing diverse constituencies from the field of substance abuse treatment.

This analytic report examines the association of early initiation of marijuana use with later substance abuse and criminal behaviors among adolescent populations at risk (e.g., Job Corps students), compared to a national sample of youths who responded to the National Household Survey on Drug Abuse (NHSDA). This analysis expands on earlier Job Corps evaluations by Caliber Associates and Battelle Centers for Public Health Research and Evaluation (1996) and by NEDS (Orwin and Ellis, 2001), which evaluated the intensive services of the DTEP component in Job Corps in comparison to the Job Corps standard services. In contrast, the present analysis compared the changes over time in substance abuse and criminal behavior for Job Corps participants who initiated marijuana use before age 15 (Early Initiators) compared to those students age 15 and older (Late Initiators). Similar analyses were then completed for youth in the NHSDA to examine similar behaviors for a more normative sample. The study concludes with recommendations for the treatment and prevention of substance abuse and criminal behavior of adolescents and young adults.

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## **EXECUTIVE SUMMARY**

Substance use and abuse among adolescents has been a persistent problem during the past three decades and is a particularly serious problem for economically disadvantaged youth. The casual use of tobacco, alcohol, and/or marijuana by youth in their early teens may be a precursor to more regular use of these and other substances, including drugs such as cocaine and heroin in later years. To enhance the knowledge and understanding of adolescent substance abuse, the Center for Substance Abuse Treatment (CSAT) National Evaluation Data Services (NEDS) conducted an analysis of data collected from an adolescent residential job training program for disadvantaged youth. The focus of this analysis was on the period from 1993 to 1995, when this program had an alcohol and other drug abuse service component called the Drug Treatment Enrichment Project (DTEP). While DTEP was administered in four experimental sites, the Job Corps Alcohol and Other Drugs of Abuse (AODA) program was administered in another four matching sites. In a prior evaluation, Caliber Associates, Battelle Human Affairs Research Center and Research Triangle, Inc., in 1996, completed an evaluation of the students in DTEP who received periodic substance abuse screening and a comprehensive array of substance abuse and non-substance abuse services, compared to students in AODA sites, who received initial screening and minimal substance abuse services. The Job Corps data for the present analysis were drawn from the students at these eight DTEP and AODA sites. For comparison, data were analyzed for youth who responded to a national survey, to determine the relative substance use patterns of a nationally representative sample of youth. This report presents the results of the analysis.

### **1. INTRODUCTION**

Given the propensity of adolescent youth to use substances, it is important to improve our understanding so as to help adolescents eliminate their substance abuse. To contribute to our understanding, the present analysis used data collected for the CSAT-sponsored evaluation of the Job Corps Drug Treatment Enrichment Project (DTEP) together with adolescent and young adult data contained in the National Household Survey on Drug Abuse (NHSDA).

The literature on adolescent substance abuse suggests that youth who become involved with alcohol and drugs very early in life may have underlying social and mental health problems that render them more vulnerable to substance abuse, and more resistant to treatment. In general, these studies suggest that there may be a critical age range for the initiation of substance use during early adolescence that is associated with subsequent behavioral problems during later adolescence and adulthood. The suggested range for this critical period is from ages 12 to 16, and it is likely to occur somewhat sooner for alcohol, i.e., ages 12-13, and somewhat later for

marijuana, i.e., age 15-16. Given that the primary substance of abuse for the Job Corps youth was marijuana, the present analysis examined the substance use and criminal behaviors among adolescents in Job Corps who initiated marijuana use prior to age 15 (Early Initiators) and those initiating marijuana use at age 15 and older (Late Initiators). Its purpose was to test the notion that early substance users are more likely to further engage in substance use and criminal behaviors compared to late initiators. To examine the consistency of these findings among youth who are more and less economically disadvantaged, the relationships between early initiation of marijuana use and further substance abuse, criminal behaviors, and arrests were analyzed in two economically disparate samples of youth. The first was an economically disadvantaged sample of Job Corps youth drawn from an earlier CSAT evaluation. The second was a more normative sample drawn from the 1993 and 1995 National Household Survey of Drug Abuse (NHSDA). Comparisons of the Job Corps data with data for a sample of early and late users in the NHSDA survey allowed the assessment of the behavior associated with early use to determine if this behavior is normative, or specific to economically disadvantaged youth, such as those who participate in Job Corps. These youth may be more vulnerable to substance use and criminal behaviors, compared to a more normative sample of youth, such as those found in the NHSDA.

To address the primary analytic question, i.e., are early substance users more likely to further engage in substance use and criminal behaviors compared to Late Initiators, five detailed analytic questions were asked:

- What are the characteristics of the Job Corps and NHSDA youth who initiated marijuana use before age 15 and those youth who initiated marijuana use at age 15 years and older?
- Is early initial marijuana use associated with the substance use of Job Corps students prior to admission and during follow-up?
- Is early initial marijuana use associated with the substance use of NHSDA youth?
- Is early initial marijuana use associated with the Job Corps students' criminal behaviors and arrests before and after Job Corps?
- Is early initial marijuana use associated with the criminal behaviors and arrests of NHSDA youth?

The present analysis was not intended to evaluate Job Corps per se and because it was based on a subsample of respondents from the Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute (1996) DTEP evaluation, the present findings

may not be comparable to those of the earlier evaluation. For each student analysis at Job Corps admission, a similar analysis was conducted of marijuana-using youths from the 1993 NHSDA. Similarly, for each student analysis at Job Corps follow-up, a similar analysis was conducted of marijuana-using youths in the 1995 NHSDA. As the Job Corps analysis examined the same students at program entry and follow-up, whereas different samples of respondents were examined in the 1993 and 1995 NHSDA, our ability to compare the Job Corps and NHSDA youth with respect to changes over time in drug use and criminal behavior was limited. Finally, given the post hoc nature of the analysis (e.g., that risk groupings were based on post hoc categorizations of the data), the findings can only be interpreted as correlational rather than causal.

## **2. METHODS**

Of more than 6,000 Job Corps students assessed by the DTEP evaluation, about 1,500 were found to have a substance abuse problem and were selected to participate in the original DTEP evaluation. Of the selected youth, 1,156 provided admission and follow-up data, including 1,031 participants who reported using marijuana prior to entering Job Corps; these students were selected for analysis. The Job Corps data were separated into two groups: students who used marijuana before age 15 (Early Initiators) and students who used marijuana at 15 and older (Later Initiators). These groups were analyzed for demographic characteristics, substance use, and criminal behaviors, prior to admission and at follow-up.

Most of the Job Corps students were admitted to Job Corps in 1993, and the age range was 16 to 24. Consequently, an analysis was completed for all male and female respondents to the 1993 NHSDA between the ages of 16 to 24 who reported prior marijuana use. Similarly, male and female respondents to the 1995 NHSDA who were in the same age range as the Job Corps participants were assessed, namely, respondents age 17 to 26, corresponding to the follow-up year for most Job Corps students.

## **3. RESULTS**

The results of the analyses are summarized according to the analytic questions.

***What are the characteristics of the Job Corps and NHSDA students who initiated marijuana use before age 15 and those students who initiated marijuana use at age 15 years and older?***

The early initiation of marijuana use among Job Corps students (Early Initiators compared to Late Initiators) was associated with a number of risk factors, including problems in school and at home, and early onset of criminal behavior and alcohol use. Early Initiators were more likely to report having run away from home, having been expelled from school, having substance abusing friends and relatives, receiving substance abuse treatment, and attending a 12-step program. Males were more likely to have initiated marijuana use prior to age 15, and Whites were more likely to initiate early marijuana use compared to either African-Americans or Hispanics.

As in Job Corps, the early initiation of marijuana use was associated with a number of risk factors for the NHSDA respondents. Compared to Late Initiators, Early Initiators were less likely to complete high school, more likely to drink prior to age 15, and more likely to have been treated for substance use during the past 12 months.

Differences in the sample characteristics of the Job Corps youth at admission and the 1993 NHSDA youth were as follows. Compared to 1993 NHSDA, the Job Corps youth on the average were two years younger, more likely to be male, more likely to be African-Americans and less likely to be White. Job Corps students were also less likely to have completed high school, less likely to be employed, and less likely to be married compared to the 1993 NHSDA youth.

***Is early initial use of marijuana associated with the substance use behaviors of Job Corps students before and after Job Corps?***

The Early Initiators had higher rates of substance use compared with Late Initiators at Job Corps admission, but with the exception of binge drinking, these initial differences between the Early Initiators and Late Initiators disappeared during follow-up. In further analyses, similar results were found when the DTEP versus AODA site factor and various student factors were controlled, including age, gender, race, high school completion and employment. When these factors were controlled at admission, the Early Initiators compared to Late Initiators had a greater likelihood or odds of reporting:

- Past 30-day near-daily marijuana use (3:1 odds)
- Past 12-month cocaine use (2:1)
- Past 12-month crack use (9:1)
- Past 30-day alcohol use (2:1)
- Past 30-day and past 12-month binge drinking (2:1)
- Past 2-week smoking averaging six or more cigarettes per day (2:1).

In predicting substance use behavior during follow-up, the same admission variables were controlled in addition to the behavior of interest at baseline and the number of days of follow-up. Only the likelihood of binge drinking during follow-up remained significantly higher for the Early Initiators group compared to the Late Initiators group (2:1 odds).

Differences in age of marijuana initiation were associated with changes over time in near-daily marijuana use. The Early Initiators reported significant reductions in near-daily marijuana use between Job Corps admission and follow-up, whereas the Late Initiators reported about the same level of near-daily marijuana use in each period. In contrast, both groups reported reductions in past 30-day marijuana use and significant declines over time in past 12-month cocaine use and past 30-day binge drinking.

***Is the early initial marijuana use associated with the substance use behaviors of NHSDA youth?***

Consistently higher rates of drug and tobacco use, but no differences in alcohol use, were reported by the Early Initiators compared to the Late Initiators in both the 1993 and 1995 NHSDA. With other variables controlled, Early Initiators were more likely to report:

- # Near-daily marijuana use (4:1 odds each year)
- # Any past 30-day marijuana use (2:1 odds each year)
- # Past 12-month cocaine use (2:1 odds in '93 and 3:1 odds in '95)
- # Past 12-month crack use (3:1 odds each year)
- # Smoked 6 cigarettes per day/past 2 weeks (1.5:1 odds in '93 and 2:1 odds in '95)

No differences were found in the rates of substance use in the 1993 and 1995 NHSDA surveys.

***Is the early initial marijuana use associated with the Job Corps students' criminal behaviors and arrests before and after Job Corps?***

Higher rates of criminal behavior among the Job Corps youth were associated with earlier initial marijuana use before admission and during follow-up, including DUI, destroying property, and assaults. With age, gender, high school completion, and work status controlled, the association of these variables with age of initial use was no longer evident. In multivariate analysis, however, the odds of reporting an arrest prior to admission was 45 percent higher for the Early Initiators. Similar results were found during follow-up.

The reported instances of assaulting someone rose significantly between admission and follow-up for both Job Corps groups. Only the Late Initiators showed an increase in the percentage of DUI and destroying property between admission and follow-up, whereas the Early Initiators reported no significant changes in these behaviors over time. Both groups reported significant increases in arrests, however. In summary, assault and arrest rates increased from Job Corps admissions to follow-up for both Early and Late Initiators. After controlling for other variables including baseline rates of assaults and arrests, respectively, clients in the Early Initiation group had a higher odds of being arrested compared to the Later Initiation group, but the two groups had similar odds of assaulting someone.

***Is the early initial marijuana use associated with the criminal behavior and arrests for NHSDA youths?***

The analytic results of respondents to the 1993 and 1995 NHSDA surveys were consistent with the Job Corps findings with respect to assaults. Using multivariate analyses to control for other respondent characteristics, Early Initiators on both the 1993 and 1995 NHSDA had a higher (2:1) odds of assaulting someone compared to Late Initiators. Also, with other variables controlled, Early Initiators on the 1995 NHSDA had 50 percent higher odds of DUI behavior. The Early Initiators on the 1993 NHSDA survey reported higher arrest rates and on the 1995 NHSDA survey reported higher rates of destroying property, however, these findings vanished once other variables were controlled. In summary, the data clearly suggest that an earlier age of initial marijuana use is associated with higher levels of assault behavior for marijuana-using NHSDA youth. The data also suggest that early initiation of marijuana use is associated with higher levels of DUI behavior in this normative sample of marijuana users.

#### **4. IMPLICATIONS FOR RESEARCH, POLICY, AND PRACTICE**

Findings from the early use of marijuana analysis serve two primary purposes. First, the findings extend the growing body of literature that demonstrates associations between high risk factors for substance use, early initiation of marijuana use, and later substance abuse and criminal behaviors. The current findings also extend the importance of these factors to a more normative and presumably less vulnerable population of youth. Second, the findings support the identification of implications for further research, policy, and practice, as described below.

#### **4.1 Implications for Research**

**Compare a single cut point for age of initial use with an age continuum.** In the present analysis, age of initial marijuana use was assessed as a dichotomous variable, whereby the students who initiated use before the cut point age of 15 were compared to those who initiated use after the cut point, i.e. at age 15 and older. Another possibility is that an earlier onset of use becomes increasingly associated with later substance abuse problems along a continuum, whereby the problems become worse with a younger age of onset and better with an older age of onset. To investigate this possibility, Job Corps students during admission and follow-up would be compared along an age of initial use continuum, say from ages 12 through 18 and higher. Such an analysis would indicate whether the problems that were associated with early initiation of marijuana use based on a single age cut point, i.e., younger than age 15 and age 15 and older would increase with younger ages of initiation below this cut point and decrease with older ages of initiation above it.

**Determine time line between initial marijuana use and regular use.** The mean age of clients admitted to Job Corps was about 18.5 years, yet at Job Corps admission the odds of using marijuana on a near-daily basis was 3 times higher for the group that initiated marijuana use prior to age 15, compared to the group that initiated such use at age 15 and older. Given that the Late Initiators had less time to develop into regular users prior to Job Corps admission, it is possible that in the absence of Job Corps, they too would eventually have engaged in regular marijuana use to the same extent as the Early Initiators. To examine this possibility, further research is needed to determine the time line between initial and regular use for both the Early Initiators and Late Initiators.

**Expand use of NHSDA for substance abuse treatment evaluation.** The NHSDA survey provides a convenient sample to assess secular trends and a benchmark for normative behavior. Frequently, treatment evaluations rely on before and after treatment comparisons to make inferences concerning program success. With an adolescent sample such as Job Corps, such changes in behavior may be attributed to maturation and secular trends in the population, as alternatives to the program itself. Given the relatively small sample size of respondents in the NHSDA surveys who were comparable to the Job Corps students, the Job Corps youth could not be adequately matched to the NHSDA youth on important socioeconomic risk factors. As the Substance Abuse and Mental Health Services Administration's Office of Applied Studies has expanded the 1999 NHSDA from 18,000 to 70,000 respondents to include State data, more extensive normative data will soon be available to which treatment samples may be compared.

## **4.2 Implications for Policy**

As demonstrated by the literature review and the results of this analysis of adolescent substance use, there are indisputable relationships among age of first drug use, criminal behaviors, and later substance abuse. Policy makers would be well served if they recognized and understood the relationships among early substance use and later aberrant behaviors, as well as the relationships between high-risk youth and substance abuse. Adolescent treatment and prevention services are critically needed, and, if shown to be effective, are deserving of at least the same, if not more attention (and funding) as is provided by national policy decision makers for adult services. CSAT evaluators, together with the substance abuse treatment field, must ensure that the critical information about adolescent substance abuse reaches those in positions of policy development.

## **4.3 Implications for Practice**

**Expand mental health services for adolescents.** In addition to the early onset of alcohol and drug use, Job Corps participants frequently reported other behavioral problems, including early onset of criminal behavior and problems at home and in school. These problems were especially acute among the early marijuana initiators. Consistent with the literature, such behaviors frequently coincide with a conduct disorder diagnosis and can be precursors of adult mental health problems. Based on these findings, it is recommended that adolescents in treatment or prevention programs be provided with mental health assessment and services and that the effectiveness of such services be carefully evaluated.

**Provide more comprehensive services to the early initiating youth in Job Corps.** Given that the Early Initiators in this analysis were shown to be more at risk for substance abuse and criminal behavior, it is recommended that they be offered the benefits of a comprehensive array of services. Although the data did not examine the services components that were provided to Early Initiators and Late Initiators and their effectiveness, a prior analysis by Orwin and Ellis (2001) did assess such data. In general, DTEP students who received a comprehensive array of substance abuse and non-substance abuse services and those who received both individual and group counseling reduced their substance use during follow-up to a greater degree compared to students who only received substance use services and/or individual counseling alone. A comprehensive array of substance abuse and non-substance abuse services should be targeted in particular to the more at risk youth, especially those who report early initiation of substance use. Further analysis is also needed to assess the cost effectiveness of these services for the youth in each group.

## **I. INTRODUCTION**

## I. INTRODUCTION

Substance use and abuse among adolescents has been a persistent problem during the past three decades and is a particularly serious problem for economically disadvantaged youth. Experimentation with substances such as alcohol and marijuana frequently occurs during the teen years, but the use of these so called “soft” substances in the early teens may be a precursor to the use of “hard” drugs, such as cocaine and/or crack, in the late teens and early twenties (Kandel and Yamaguchi, 1992). To enhance the knowledge and understanding of adolescent substance abuse, the Center for Substance Abuse Treatment (CSAT) National Evaluation Data Services (NEDS) conducted an analysis of an existing adolescent treatment database, together with data from a national survey, to determine the relative use patterns and associated behaviors of economically disadvantaged youth as compared with national averages.

This report presents the results of the analysis of data collected for the CSAT-sponsored evaluation of the Job Corps Drug Treatment Enrichment Project (DTEP) and an analysis of adolescent data contained in the National Household Survey on Drug Abuse (NHSDA). The analysis compared the substance abuse and criminal behaviors of Job Corps participants who initiated substance abuse early (before age 15) to participants who initiated substance abuse later (at age 15 and older). The analysis also compared the experiences of the Job Corps students to a “normative” sample from the NHSDA. The remainder of the introduction provides background information on CSAT, the Job Corps program, and the DTEP demonstration and evaluation. The relevant adolescent substance abuse treatment literature is then briefly summarized to draw from the literature supporting documentation for the approach used in this analysis and the interpretation of the analytic results. This chapter concludes with a description of the organization of the report.

### 1. BACKGROUND

In 1992, CSAT initiated an enriched drug treatment project in cooperation with the U.S. Department of Labor (DOL) Office of Job Corps. The design of the original DTEP program grew from the expertise of adolescent job training program specialists (including the then Assistant Secretary of Labor and the then Director of the Office of Job Corps) together with the expertise of numerous substance abuse treatment researchers, policy analysts, and clinicians, nationally and from within CSAT. The present report was based on a secondary analysis of data from the original DTEP evaluation that was conducted by Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute (1996). The purpose of this section is to provide information on the background of the DTEP demonstration and evaluation.

## **1.1 Office of Job Corps**

The legislation authorizing the Job Corps indicates “the purpose of Job Corps is to assist young individuals who need and can benefit from an unusually intensive program operated in a group setting to become more responsible, employable and productive citizens” (Betsey et al., 1985). Job Corps was designed to serve economically disadvantaged youth ages 16 to 24 through a comprehensive, competency-based service philosophy and delivery system, and, by extension, compensate for socioeconomic risk factors for substance abuse, unemployment, and criminal behavior. The emphasis on residential treatment reflected the program’s concern with young people’s “disruptive home life or other disorienting conditions” that must be overcome to achieve self-sufficiency. At the time of the DTEP demonstration, the Job Corps program included assessment, basic education, vocational skills training, and work experience. This holistic approach was complemented by health education, medical services, individual and group counseling, and structured residential and recreation programs. As of 1996, the Job Corps program was serving about 60,000 youth annually in 107 Job Centers, ranging from 149 to over 2,000 students each (Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute, 1996). Approximately 60 percent of Job Corps students were male, one-half were African American, and the average entry age was 18 years. The majority came from urban areas and 28 percent from families who received public assistance. About three-fourths were high school dropouts, 80 percent read at or below an 8th grade level, and 75 percent had never been employed full-time. As a group, Job Corps students were an economically disadvantaged population at high risk for substance abuse. More recent data for Program Year 1999 (U.S. Department of Labor, 2000), indicates that 71,000 new enrollees were admitted into 118 Job Corps Centers nationwide. The average length of stay for these new enrollees was 7.2 months.

A benefit-cost analysis of Job Corps was completed in the National Job Corps Study based on a random sample of all eligible applicants to Job Corps in late 1994 and 1995 (Burghardt et al., 2001). The sampled youths were assigned randomly to either a program group or a control group. Program group members could enroll in Job Corps. Control group members could not enroll in Job Corps, but they could enroll in all other programs in their communities. The analysis was based on 6,828 program group members and 4,485 control group members. Almost three-fourths of the control group members participated in an alternative education program following random assignment. Nevertheless, Job Corps substantially increased participant education and training, as 93 percent of the program group engaged in some education or training. Based on the analysis, it was concluded that Job Corps is cost-effective, with net benefits from the program exceeding the costs by \$2.02 dollars per dollar of program expenditures.

## **1.2 CSAT and the Office of Job Corps DTEP Demonstration**

CSAT recognized the potential of the Job Corps program to serve as a controlled environment in which adolescent substance abuse intervention services could be examined. Although the 1991 Job Corps Program bore some resemblance to adolescent therapeutic communities (TCs) that were thought to be beneficial to adolescent substance abusers, the primary focus of Job Corps was on job training skills, not substance abuse treatment (Orwin and Ellis, 2001; Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute, 1996). Therefore, the DTEP program designers hypothesized that by introducing substance abuse interventions within Job Corps, the program could expand its utility, and assist high risk youth with both their employment readiness and their abstinence from substance abuse. The DTEP evaluation compared four Job Corps centers that implemented DTEP in 1993-1994, and four centers that provided the standard Job Corps Alcohol and Other Drugs of Abuse (AODA) program. The following paragraphs provide a summary of the Alcohol and Other Drugs of Abuse (AODA) program, and the demonstration initiative, the Drug Treatment Enrichment Program (DTEP).

### **The Job Corps' AODA Program**

At the time of the DTEP evaluation, the Job Corps AODA policies prohibited the possession and use of alcohol or illicit drugs either on or off the Center, and required that all Centers implement an AODA program (Orwin and Ellis, 2001; Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute, 1996). The AODA program consisted of biochemical testing, an intake assessment, a written intervention plan (including a behavior agreement), and AODA education. A full-time, certified AODA specialist conducted the intake assessment for those students who tested positive for substance use at Job Corps Center entry and initiated the AODA intervention for those students identified as needing services.

### **The Drug Treatment Enrichment Project (DTEP)**

As an enhancement to the AODA program, the DTEP added four personnel who were specialists in substance abuse counseling, activities/program coordination, education, and social and medical assessments (Orwin and Ellis, 2001; Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute, 1996). This enhanced initiative included development of individual intervention plans, weekly case management meetings for substance abuse interventions, individual and group counseling, remedial/enhanced education plans,

individual and group learning sessions, educational tutorial programs, life skills seminars, peer leadership programs, relapse intervention, and aftercare treatment.

## **DTEP Evaluation Results**

The findings from the original evaluation of DTEP are described in Caliber/Battelle's Final Report, *CSAT Demonstration: Evaluation of Job Corps Drug Treatment Enrichment Project* (September 1996). The findings revealed a significantly greater reduction in marijuana and crack cocaine use among Job Corps students who participated in the DTEP as compared to AODA program participants. DTEP significantly lowered the proportion of students with mental health problems. In a follow-up to the original analysis, the components of the DTEP intervention that were most effective in reducing substance use were assessed by Orwin and Ellis (2001). It was found in that analysis that no single type of service alone resulted in improved student outcomes, but rather a comprehensive set of substance abuse and non-substance abuse services tended to produce the best results. The original DTEP analysis was limited to differences in outcomes between the DTEP group and the AODA group and did not fully evaluate participant characteristics associated with the early (pre-15 years) and later (15 years and older) initiation of marijuana use. Therefore, the present analysis expands the utility of the adolescent data collected for DTEP and the lessons learned from this CSAT demonstration program.

## **2. ADOLESCENT SUBSTANCE ABUSE TREATMENT LITERATURE**

Numerous studies have established that substance use in adolescence is related to other deviant activities, such as early sexual activity, delinquency, truancy, and dropping out of school (Kandel, 1995). Substance use and abuse are associated with the three leading causes of mortality among adolescents: accidents (in particular automobile accidents), suicides, and homicides (Windle and Windle, 1999). Moreover, several studies and health surveillance systems point to increased drug use among adolescents since the late 1980s and early 1990s, as well as a decline in the age of first use (Johnston, O'Malley, and Bachman, 1999; Brasseux et al., 1998). Thus, research examining the prevention of substance use and the treatment of substance abusing youth is an important first step in addressing these social problems.

### **2.1 Stage Theory of Addiction**

Numerous authors have suggested that the pathway to frequent use of or addiction to illicit substances follows a predictable pattern of progression through varying "stages" of substance use (Kandel and Chen, 2000; Kandel and Davies, 1992; Kelley, Denny and Young, 1999). The Stage Theory of Addiction suggests that addiction to illicit substances is preceded by

the use of various substances that are perceived to be less harmful than illicit drugs such as cocaine and heroin (Golub and Johnson, 1994). Studies of experimental use of tobacco, alcohol, marijuana, or some combination thereof, support the idea that involvement with illicit substances are typically preceded by more “acceptable” forms of drug use (Fergusson and Horwood, 2000). Although marijuana is illegal in the United States, it is sometimes grouped with licit substances such as alcohol and tobacco as a “gateway” drug leading to more hard core drug use (Gorelick et al., 1997; Green and Ritter, 1997). The specific drug or drugs of choice for different demographic populations vary (Guerra et al., 2000), but studies support the theory that many adolescents who experiment with “safer” drugs such as tobacco and marijuana may then move to drugs such as cocaine and heroin (Ellickson, Hays, and Bell, 1992; Ellickson et al., 1998).

Kandel and Yamaguchi (1999) found evidence supporting this “stage theory” of addiction. Marijuana is perhaps the most commonly perceived “gateway” drug, particularly for adolescents (Blaze-Temple and Lo, 1992). The model of addiction for males was observed to move from cigarettes, alcohol and/or marijuana into illicit drugs. Females were observed to use alcohol or cigarettes before marijuana, but the combination of alcohol and marijuana preceded other illicit drugs. These models held up for more than 80 percent of the populations studied.

## **2.2 Early Initiation of Drug Use**

There is a growing literature on the prevalence and consequences of early initiation of drug use. Most studies focused on the association of early initiation into substance use with other factors, such as delinquency, heavier substance use involvement, and school drop-out. A few studies actively addressed the temporal order of social or emotional problems and early onset of substance use. Most of the literature suggested that conduct problems such as delinquency or violence, and/or family instability/abuse, and mental illness *precede* early substance use initiation rather than early substance use causing the conduct and/or family and mental health problems (Bensely et al., 1999; Anda et al., 1999; Brook, Kessler and Cohen, 1999; Ellickson et al., 1998; Winters, 1998).

These findings suggest that early initial substance use may be a marker for underlying emotional and conduct problems, rather than conduct, or other problems appearing as symptoms of or as a result of substance abuse (Gil, Vega and Biafora, 1998; Clark, Kirisci and Moss, 1998; Fergusson and Woodward, 2000; Fergusson, Lynskey and Horwood, 1993; Friedman et al., 1996; Wilens et al., 1999). Fergusson, Lynskey and Horwood (1993), for example, found that conduct problems for youth of ages 6, 8, 10 and 12 were associated with the early onset of marijuana use by the age of 15. It is also clear, however, that early initiation is associated with a variety of problems later in adolescence and adulthood (Bray et al., 2000; Capaldi, Crosby and Stoolmiller,

1996; Fergusson and Horwood, 1998). The majority of the literature suggests that childhood social and emotional problems lead to substance use in early adolescence, which then reinforces or mediates a variety of social and emotional problems concurrently and subsequently in later adolescence and into adulthood (Green and Ritter, 2000; Stenbacka, Allebeck and Romelsjo, 1993).

Early initiation of substance use, particularly of marijuana, has been found to be associated with a variety of social, emotional, and economic problems for adolescents, both concurrently and later in adolescence and adulthood (Brook, Kessler and Cohen, 1999; DuRant et al., 1999; Fergusson and Horwood, 1997; Gruber et al., 1996; Kandel, 1995; Hays and Ellickson, 1996; Lando et al., 1999). One of the strongest associations with early marijuana use is delinquency or violent behavior, particularly for males (Winters, 1998; Adlaf et al., 1994; DuRant et al., 1999; Farrell, Danish and Howard, 1992; Fergusson and Horwood, 1997; Fergusson and Woodward, 2000; Gruber et al., 1996; Hays and Ellickson, 1996; Kandel, 1995; Lipsey and Derzon, 1998; Watts and Wright, 1990; Winters, 1998).

Poor educational and vocational outcomes are also strongly associated with early marijuana use, particularly among those adolescents who proceed to become more frequently involved with marijuana (Bray et al., 1999; DuRant et al., 1999; Ellickson et al., 1998; Fergusson and Horwood, 1998; Friedman et al., 1996; Grant and Dawson, 1998; Gruber et al., 1996; Kandel, 1995; Sanford et al., 1994). Researchers have found consistent associations between early marijuana use and mental illness, specifically depression and conduct disorder (Abraham and Fava, 1999; Carlson and Bromet, 2000; Clark et al., 1997; Clark, Kirisci and Tarter, 1998; Collins, Ellickson and Bell, 1998; Durant et al., 1999; Farrell, Danish and Howard, 1992; Fergusson and Horwood, 1997; Grilo et al., 1996; Lipsey and Derzon, 1998; Young et al., 1995). Finally, initial marijuana use is likely to progress more rapidly to regular use for youth with conduct disorder (Crowley et al., 1998).

A number of studies have suggested a critical age or period of onset during early adolescence, i.e., the age period that is most likely to be associated with substance use and other behaviors in later adolescence and adulthood (Yu and Williford, 1992; Grant and Dawson, 1998; Gruber et al., 1996; Kandel and Davies, 1992; Kosterman et al., 2000; Young, Mikulich et al., 1995). Several of these studies have also identified variations in the age of onset for particular substances. Yu and Williford (1992), for example, suggested that the impact of early onset for alcohol use is strongest when such use is initiated in a "posited critical age period between 13 and 16." Grant and Dawson (1998) reported that youth who drank before age 15 were four times more likely to develop alcohol dependence than youth who began drinking at age 21 and that the risk of alcohol abuse decreased by 8 percent with each year of increasing age of drinking onset.

Gruber et al., (1996) reported that the early onset of alcohol use by age 12 is associated with subsequent abuse of alcohol and related problem behaviors in later adolescence. In a longitudinal youth study, Kosterman et al. (2000) reported that while most participants had initiated alcohol use by age 13, marijuana initiation was higher after the age of 13 years. Kandel and Davies (1992) found that youth who initiated use before age 16 had much higher and earlier rates of near-daily marijuana use. Young et al. (1995) reported that 78 percent of boys with conduct disorder had begun regular substance use by age 13.

These studies suggest a critical period for the initiation of substance use during early adolescence that is associated with subsequent behavioral problems during later adolescence and adulthood. The suggested age range for such a critical period based on these studies is 12 to 16 years and is likely to occur somewhat sooner for alcohol, i.e., ages 12-13, and somewhat later for marijuana, i.e., ages 15-16. Yet, at least one study suggests the problems associated with the early initiation of marijuana use varies along an age continuum (Gfroerer and Epstein, 1999). Using the National Household Survey on Drug Abuse (NHSDA) to predict the need for substance abuse treatment in different years, Gfroerer and Epstein (1999) reported a decline in the likelihood of such a need with each one year increase in the age of initial marijuana use from 12 to 17 years.

Meanwhile, the substance abuse trends among youth from age 12 to 25 were assessed from 1990 to the present in three national surveys: NHSDA, Monitoring the Future (MTF), and the Youth Risk Behavior Survey (YRBS) (Fowler and Stringfellow, 2001; Harrison, 2001). While NHSDA is a national survey of U.S. households, MTF is a longitudinal school-based, self-administered survey of 8<sup>th</sup>, 10<sup>th</sup> and 12<sup>th</sup> graders, and the YRBS is a self-administered school-based survey of 9<sup>th</sup> through 12<sup>th</sup> grades completed annually. While methodological differences have resulted in different estimates, as reported by Gfroerer (2001); Harrison (2001); and Fowler and Stringfellow (2001), the three surveys tend to show a remarkable consistency of results overall. Given that the Job Corps students in the present analysis were mostly out of school, the NHSDA is the most applicable of the three surveys for comparison with Job Corps, as it includes both in-school and out-of-school youth. In the next section, we present an overview of this important national survey.

### **3. THE NATIONAL HOUSEHOLD SURVEY ON DRUG ABUSE (NHSDA)**

#### **3.1 Overview of NHSDA**

The National Household Survey on Drug Abuse is an annual survey designed to measure the prevalence and correlates of drug use in the United States and to monitor drug use trends over time. The NHSDA began in 1971 under the auspices of the National Commission on Marihuana

and Drug Abuse. Responsibility for conducting the NHSDA shifted to the National Institute on Drug Abuse (NIDA) from 1974 to 1991. In October 1992, the Office of Applied Studies (OAS) within the Substance Abuse and Mental Health Services Administration (SAMHSA) took the lead in conducting the NHSDA.

### **3.2 Sampling Methodology**

The NHSDA sample consists of civilian noninstitutionalized individuals aged 12 and older living in the United States. Persons excluded from the survey include homeless people who do not use shelters, active military personnel, and residents of institutional group quarters such as jails and hospitals. In 1991, Alaska and Hawaii were included for the first time as were civilians living on military bases, in college dormitories, rooming houses and homeless shelters. Beginning in April 1997, residents of Arizona and California were over-sampled to provide survey estimates for these State populations to measure the impact of Propositions related to illicit drugs that were passed by voters in 1996. The sample was selected using a deeply stratified, multistage area probability sample design and over-sampled Hispanics, African Americans, younger respondents and current smokers. The survey is conducted in person by an interviewer in the respondent's home and takes about an hour to complete. Self-administered answer sheets are used for the most sensitive aspects of the interview to increase the reliability of self-reported data. Individuals are interviewed once and not followed up for subsequent interviews. Sampling weights were applied to adjust for the varying probability of selection. Response rates for household screening and for interviewing in 1998 were 93 percent and 77 percent, respectively.

### **3.3 Changes in the NHSDA**

In 1994, two separate versions of the NHSDA questionnaire were administered as part of a split-sample experiment. The 1994-A survey was similar to the previous NHSDA surveys, while the 1994-B version was changed to create a core of demographic and drug use items, to make wording consistent across answer sheets, and to increase comprehension of the survey. The number of questions asked was reduced and reordered, and some sections were asked using a self-administered rather than an interviewer-administered answer sheet. Subsequent NHSDA questionnaires are modeled after the 1994-B version. (Substance Abuse and Mental Health Services Administration, 1996b). Beginning in 1999, data are being collected using computer-assisted interviewing, including audio computer-assisted self interviewing in lieu of the paper answer sheets used in 1998 and earlier. Additionally, to enable generalizations to be made at the State level of analysis, the sample size in the 1999 NHSDA has been increased to approximately 70,000 respondents.

#### **4. USE OF THE LITERATURE IN THE PRESENT ANALYSIS**

The research on the stage theory of addiction together with the research findings on factors associated with early initiation of “gateway drugs” provided the underlying assumptions that guided the present analysis. Specifically, the reported empirical studies of adolescent marijuana use and the supposition that early initiation of marijuana use may be associated with later substance abuse and criminal behaviors formed the foundation of the present analytic focus on age of initial marijuana use.

A primary analytic premise was to determine the initial differences in substance use and criminal behavior between early and late initiators of marijuana use among Job Corps students. Key to this analytic premise was whether or not the behaviors associated with early use at Job Corps admission would persist during Job Corps follow-up. If the initial differences in substance use and criminal behavior/arrests between the early and late initiators prior to Job Corps admission were no longer evident during follow-up, one possible explanation is that these behaviors were eliminated by the Job Corps intervention. Other explanations also are possible including maturation, and a secular trend in the population. On the other hand, if the behavioral differences between the early and late initiators persisted during follow-up, the findings would suggest that stronger interventions than Job Corps may be needed to eliminate these behaviors.

Studies suggest that the initiation of marijuana use during early adolescence can have a significant impact on subsequent behavior during later adolescence and adulthood (e.g., Yu and Williford, 1992; Grant and Dawson, 1998; Gfroerer and Epstein, 1999). The present analysis uses data for participants in the DTEP evaluation to examine the characteristics of adolescents who initiated marijuana use prior to age 15 and the characteristics of adolescents who initiated marijuana at age 15 and older. The characteristics examined include socio-demographics, substance use patterns, and criminal behaviors and arrests before and after Job Corps program participation. More specifically, the analysis attempts to establish relationships between early use of marijuana and later aberrant substance use and criminal behavior by examining the Job Corps students, who by Job Corps entrance criteria are at high risk for substance abuse, in comparison with more normative data (NHSDA) of similar age groups and marijuana use patterns.

The approach used in this analysis enabled the following additional relationships to be explored. Comparisons of the Job Corps data with data for a sample of early and late users in the NHSDA survey allowed the assessment of the behavior associated with early use to determine if this behavior is normative, or specific to economically disadvantaged youth, such as those who

participate in Job Corps. These youth may be more vulnerable to substance use and criminal behaviors, compared to a more normative sample of youth, such as those found in the NHSDA.

## **5. ANALYSIS QUESTIONS AND ANALYTIC DESIGN ISSUES**

The primary analytic question was whether the early use of marijuana by adolescents is associated with current and future substance use and/or criminal behaviors for economically disadvantaged youth only, or for both economically disadvantaged and non-economically disadvantaged youth? To address this primary analytic question, five detailed analytic questions were asked:

- What are the characteristics of the Job Corps and NHSDA students who initiated marijuana use before age 15 and those students who initiated marijuana use at age 15 years and older?
- Is early initial marijuana use associated with the substance use behavior of Job Corps students prior to admission and during follow-up?
- Is early initial marijuana use associated with the substance use behavior of NHSDA youth?
- Is early initial marijuana use associated with the Job Corps students' criminal behaviors and arrests prior to admission and during follow-up?
- Is early initial marijuana use associated with the criminal behavior of NHSDA youth?

The present Job Corps analysis was based on a secondary analysis of data that were collected from the original DTEP evaluation by Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute (1996). Since the purpose of this analysis was not to evaluate the Job Corps program per se, the students who had not yet initiated marijuana use prior to Job Corps were not included in the analysis. Because the present analysis was based on a subsample of youth in the original DTEP analysis, the results of the two analyses may not be comparable. As the Job Corps program was implemented differently across the sites in the original DTEP analysis, [i.e., half the sites were designated by CSAT as enhanced or experimental sites (DTEP) and half as standard or control sites (AODA)], the analyses controlled for these site differences.

For each set of Job Corps student analyses, a similar analysis was conducted of marijuana using youth from the 1993 and 1995 NHSDA. Whereas the Job Corps analysis examined the same students at program entry and follow-up, the 1993 and 1995 NHSDA employed different

samples of respondents in each year. For this reason, the trends or changes over time in the two surveys may not be compared. Building on the Gfroerer and Epstein (1999) study, which found that an earlier age of initial marijuana use for NHSDA respondents was associated with a greater need for substance abuse treatment, the present analysis examined the association between age of initial marijuana use and the subsequent use of a variety of substances including tobacco, alcohol, marijuana and other illicit drugs, and involvement in criminal activities. Finally, given the post hoc nature of the analysis, i.e., risk groupings were based on post hoc categorizations of the data, the findings can only be interpreted as correlational rather than causal.

## **6. ORGANIZATION OF THE REPORT**

Chapter I provides an introduction to the current analysis, including an description of the DOL Office of Job Corps Program, a summary of the relevant literature, and the research questions and design issues. Chapter II addresses analytic methods, including sampling procedures, variables and statistical procedures. Chapter III presents the analytic results, including analyses of unweighted Job Corps data and comparisons of Job Corps and NHSDA data employing weighted observations. Chapter IV summarizes the findings and presents the implications of the findings for research, policy, and practice. Appendix A provides the variables from the 1993 NHSDA and 1995 NHSDA used in the analyses provided in this report.

## **II. METHODS**

## II. METHODS

The purpose of this chapter is to describe the methodology used to conduct the analysis of adolescent substance use and associated behaviors. The chapter is divided into three sections. The first section presents a description of the sampling procedures used to construct the analytic and comparison cohorts. The second section provides a description of the selection of variables used in the analysis and their definitions. The chapter concludes with a description of the statistical methods employed in the analysis of each survey.

The analyses were based on comparisons of the reported characteristics, substance use behaviors, and criminal behaviors of Job Corps and NHSDA interviewees who reported early and late initiation of marijuana use. Bivariate and multivariate techniques (i.e., with other variables controlled) were employed in these analyses. Similar analyses employing bivariate and multivariate techniques were completed with both the 1993 and 1995 NHSDA surveys so as to be temporally comparable to the Job Corps samples.

### 1. SAMPLING

The following paragraphs summarize the samples used for the Job Corps student and the NHSDA respondent analysis.

#### 1.1 Job Corps Student Analysis

Of more than 6,000 Job Corps students assessed by the DTEP evaluation, about 1,500 were found have a substance abuse problem, and were selected to participate in the original DTEP evaluation. Of this group, 1,156 were assessed at intake and follow-up during the latter evaluation (Caliber Associates et al., 1996). The Job Corps sample in the present analysis comprised 1,031 Job Corps students selected from these 1,156. The remaining 115 students who reported no marijuana use prior to entering the program and the 10 who provided no information about their previous marijuana use were dropped from the present analysis. The 1,031 selected students, including 273 females and 758 males, averaged age 18 years at Job Corps entry and all reported using marijuana prior to entering Job Corps. Approximately 40 percent (447) of these Job Corps students reported that they initiated marijuana use before age 15 and approximately 60 percent (584) reported initiating marijuana use at age 15 and older. After comparing the characteristics of the latter two groups, the Job Corps Early and Late Initiators were further compared with respect to their substance use and criminal behaviors/arrests prior to admission and during follow up.

## **1.2 NHSDA Analysis**

To facilitate comparisons between the Job Corps and NHSDA samples, youth from the 1993 and 1995 NHSDA were selected for analysis. These survey years, respectively, correspond to the periods of admission and follow-up for most of the Job Corps students. While we also considered weighting the Job Corps samples to further improve the comparability of the Job Corps and NHSDA data, we had to abandon this effort. Due to limitations in the number of marijuana-using NHSDA respondents who were non-White and had not completed high school, we were unable to match the NHSDA and Job Corps samples on these important factors.

From each NHSDA survey, we first selected respondents who reported prior marijuana use. From the 1993 NHSDA survey, we further selected respondents between the ages of 16 to 24, which corresponded to the ages of the Job Corps admission sample. Similarly, from the 1995 NHSDA survey, we further selected respondents between the ages 17 to 26, corresponding to the ages of the Job Corps follow-up sample. The final samples assessed here were as follows. From the 1993 NHSDA survey, we assessed 826 Early Initiators and 2,006 Late Initiators, who reported first using marijuana before age 15 and at age 15 and older, respectively. Similarly, from the 1995 NHSDA, we assessed 521 Early Initiators and 1,658 Late Initiators.

## **2. VARIABLES**

The variables and their definitions for the Job Corps and the NHSDA samples are described below.

### **2.1 Job Corps Variables**

Variables in the following categories were selected for the Job Corps sample: personal characteristics/treatment, substance use, and criminal behaviors and arrests.

**Personal Characteristics/Treatment:** The personal characteristics/treatment variables assessed among the Job Corps sample were gender, race/ethnicity, type of residence, current marital status and employment status. The treatment variables were “ever treated for alcohol/drugs,” and “ever attended a 12-step program.”

**Alcohol, Drug and Tobacco Use:** Variables used from the Job Corps admission assessment were the use of tobacco, alcohol and marijuana prior to age 15. Variables used from the admission and follow-up assessments were past 30-day and 12-month use of marijuana, cocaine, crack and heroin. Variables collected in both periods among the Job Corps sample

were use of marijuana in 20 of past 30 days (near-daily use), past 30-day alcohol use, and binge drinking in the past 30 days/12 months. Binge drinking was defined in Job Corps as having two to seven or more drinks per hour, depending on the person's gender and weight. About 80 percent of students in Job Corps who reported binge drinking would have had to have four or more drinks per hour to be classified as binge drinkers. Finally, students were asked in both periods about the average number of cigarettes smoked per day in the past two weeks. Based on the distribution of this variable, a new variable was created that assessed in each period whether or not the client averaged six or more cigarettes per day.

**Criminal Behavior/Arrests:** The criminal behaviors assessed in these analyses included driving while under the influence (DUI), destroying property, and assaulting/beating someone up. Finally, the number of arrests in the prior 12 months was assessed both at admission and follow-up.

## **2.2 Adjusting for Varying Job Corps Student Follow-up Periods**

The follow-up period for the Job Corps sample was relatively long (mean=16 months, S.D.=4), and 97 percent of the participants had follow-up periods that exceeded 12 months. Additionally, the duration of follow-up was similar for the Early Initiators and Late Initiators, suggesting that comparisons between these groups were not associated with the length of the follow-up period. Despite the relatively long duration of follow-up for most participants, we were concerned about the potential for bias that could result from differences in the periods of assessment prior to admission and during follow-up. For example, some respondents were assessed for the same type of behavior within less than 12 months following Job Corps exit, while all respondents were assessed for exactly 12 months prior to Job Corps admission. Such a difference could potentially bias the results in favor of the program. Alternatively, bias in the opposite direction was possible when respondents were assessed over a longer period during follow-up compared to admission.

These examples of potential bias were applicable to the assessment of changes in criminal behaviors between admission and follow-up, as these behaviors were assessed over the entire follow-up period, compared to a 12 month period prior to admission. To offset the potential bias inherent in the criminal behavior data, each respondent's follow-up period was adjusted to a standard of 365 days or 12 months. Prior to adjusting these variables, respondents who reported a given behavior (e.g., DUI) were assigned a score of 1, while respondents who did not report the behavior were assigned a score of 0. To adjust these data, prior values of 1 were multiplied by 365 and divided by the number of days in the follow-up period. For example, students with a 12-month follow-up (365 days) who reported the given behavior would receive a score of 1.0.

Alternatively, with a 6-month (180-day) follow-up, the adjusted score would be 0.5, and for a 2-year follow-up (730 days), the adjusted score would be 2.0. Additionally, the criminal behavior data were also adjusted in multivariate analysis (i.e. Hierarchical Linear Modeling (HLM)), which was used to assess the significance of age of initial use in predicting follow-up criminal behavior, while controlling for the length of the follow-up period in days, along with the Job Corps site and other student factors. To rule out potential bias in these analyses, we also controlled for the length of the Job Corps follow-up period along with the remaining variables.

The latter adjustments were not employed for comparing the criminal behavior for each age of initiation group prior to admission and during follow-up, as these groups had similar durations of follow-up. Nor were these types of adjustments employed for the past 30-day data, as all but two respondents had follow-up periods that exceeded 30 days. Furthermore, as the duration of follow-up in the Job Corps sample as a whole was relatively long (i.e., exceeding 12 months for 9%), the validity of these 30-day data appeared to be evident.

### **2.3 National Household Survey on Drug Abuse (NHSDA)**

The NHSDA variables assessed were similar to the variables included in the Job Corps sample and included personal characteristics, substance use, and criminal behaviors. The specific variables and the variable names from the NHSDA are shown in Appendix A.

## **3. STATISTICAL PROCEDURES**

The bivariate and multivariate analytic methods that were employed are described below. Also described are the application of these methods to the Job Corps and NHSDA analysis. Finally, the procedures used for ruling out design effects in the NHSDA survey are described.

### **3.1 Bivariate Analysis**

The analytic methods employed for examining bivariate relationships for both Job Corps and NHSDA analysis was Chi-square, a measure of the randomness of a distribution. For example, the Chi-square was used to assess the significance of differences between the Early Initiators and Late Initiators in their rates of substance use during admission and follow-up. Additionally, for comparing substance use and arrests during the 12-month pre-admission among Job Corps students with substance use and arrests during the past 12 months at follow-up, Cochran's Q, a measure of change over time, was employed. For comparing criminal behavior in the 12 months pre-admission among Job Corps students with criminal behavior during the entire follow-up period, the latter data were first adjusted for the length of the follow-up period.

Subsequently, the Sign test was employed to test the significance of the differences in criminal behavior between the latter periods. SPSS version 10.0 was used for the latter analyses (SPSS, Inc., 2000)

### **3.2 Multivariate Analysis**

The principle multivariate analytic technique employed for Job Corps respondents was hierarchical linear modeling (HLM) (Bryk and Raudenbush, 1992). The software used for this purpose was HLM by SSI Scientific Software International, Inc. (Bryk et al., 2000). HLM was employed in the Job Corps analysis to assess the independent effects of Job Corps site and student factors, in predicting substance use and criminal behaviors prior to admission and during follow-up. Using HLM, the contributions of age of initiation to student substance use and criminal behaviors/arrests was assessed, while controlling for other factors. The site factor controlled in these analyses was enrollment in a DTEP or AODA site. The student factors controlled were age, gender, high school education, school attendance, employment, and race. In addition, in predicting behavior during follow-up, the length of the follow-up period and the practice of the behavior of interest prior to admission were also controlled.

Similar analyses were completed for the 1993 NHSDA and 1995 NHSDA data employing logistic regression. The software employed for these analyses was SUDAAN, 7.5 (Shah, Barnwell and Bieler, 1997). Employing the 1993 NHSDA, the association between age of initiation and various substance use and criminal behaviors/arrests were assessed while controlling for age, gender, high school education, school enrollment, and receipt of substance abuse treatment during the past 12 months. Similarly, employing the 1995 NHSDA, the same variables were controlled with the exception of prior treatment, which was unavailable for analysis.

### **3.3 Adjusting for Design Effects in NHSDA**

The Taylor Series variance estimation method in SUDAAN (Shah, Barnwell and Bieler, 1997) was used to adjust for sampling bias. For the 1995 survey, the NEST statement identified the four variables that required adjustment due to the nesting of sampling units within the primary sampling unit (PSU), area segment (ENCSEG), dwelling unit (ENCASE) and respondents within dwelling units (RESPID). For the 1993 survey, only bias due to nesting at the PSU level could be removed, as one or more area segments overlapped with the PSUs. Accordingly, only the PSU variable was identified in the NEST statement for the 1993 survey analyses.

### **III. RESULTS**

### **III. RESULTS**

This chapter presents the results of an analysis of adolescent drug use patterns and associated behaviors. The present analysis uses data for participants in the Job Corps Drug Treatment Enrichment Program (DTEP) evaluation to examine the characteristics of adolescents who initiated marijuana use prior to age 15 and the characteristics of adolescents who initiated marijuana at age 15 and older. The characteristics examined include socio-demographics, substance use patterns, and criminal behaviors and arrests before and after Job Corps program participation. More specifically, the analysis attempts to establish relationships between early use of marijuana and later aberrant substance use and criminal behavior by examining the Job Corps students, who by Job Corps entrance criteria are at high risk for substance abuse, in comparison with more normative data from the National Household Survey on Drug Abuse (NHSDA) of similar age groups and marijuana use patterns.

The approach used in this analysis enabled the following relationships to be explored. Comparisons of the Job Corps data with data for a sample of early and late users in the NHSDA survey allowed the assessment of the behavior associated with early use to determine if this behavior is normative, or specific to economically disadvantaged youth, such as those who participate in Job Corps. These youth may be more vulnerable to substance use and criminal behaviors. Alternatively, perhaps a more normative sample of youth, such as those found in the NHSDA, would be less predisposed to engage in such behaviors.

#### **1. ANALYSIS QUESTIONS AND ANALYTIC DESIGN ISSUES**

The overarching analytic question is: Is early use of marijuana by adolescents associated with current and future substance use and/or criminal behaviors? To address this primary analytic question, five detailed analytic questions were asked:

- What are the characteristics of the Job Corps and NHSDA students who initiated marijuana use before age 15 and those students who initiated marijuana use at 15 years and older?
- Is early initial marijuana use associated with the substance use behavior of Job Corps students prior to admission and during follow-up?
- Is early initial marijuana use associated with the substance use behavior of NHSDA youth?
- Is early initial marijuana use associated with the Job Corps students' criminal behaviors and arrests before and after Job Corps?

■ Is early initial marijuana use associated with the criminal behavior of NHSDA youth?

The present Job Corps analysis was based on a secondary analysis of data that were collected from the original DTEP evaluation by Caliber Associates, Battelle Human Affairs Research Center and Research Triangle Institute (1996). Since the purpose of this analysis was not to evaluate the Job Corps program per se, the students who had not yet initiated marijuana use prior to Job Corps were not included in the analysis. Because the present analysis was based on a subsample of youth in the original DTEP analysis, the results of the two analyses may not be comparable. As the Job Corps program was implemented differently across the sites in the original DTEP analysis, [i.e., half the sites were designated by CSAT as enhanced or experimental sites (DTEP) and half as standard or control sites (AODA)], the present analyses controlled for these site differences.

The analysis began with a comparison of two groups of Job Corps students—those students who initiated marijuana use before age 15 (Early Initiators) and those students who initiated marijuana use at age 15 or older (Late Initiators). For each set of Job Corps student analyses, a similar analysis was conducted on a comparable group of respondents from the NHSDA. The comparisons were designed to provide a context for the Job Corps findings and to determine the extent to which the students behaved similarly to or differently from a national sample of adolescents.

## **2. RESPONDENT CHARACTERISTICS**

The adolescent samples are described below in terms of demographic characteristics and other factors that may influence substance use. The first description focuses on the Job Corps students and compares the demographic and other characteristics of the two groups—those who used marijuana before age 15 and those who used marijuana at age 15 and older. Next, similar analyses were completed for the 1993 NHSDA respondents. Finally, the Job Corps and NHSDA samples, overall, were compared.

### **2.1 Job Corps Student Characteristics and Risk Factors by Age of Initial Use**

Exhibit III-1 shows the personal characteristics, treatment history, employment, and welfare status for the Job Corps students, pre-admission. For both Early Initiators and Late Initiators, the average age of Job Corps students pre-admission was 18 years. The proportion of Early Initiators and Late Initiators with a high school diploma or GED was similar (11% and 15%, respectively). In addition, the proportion of students who were employed prior to Job

Corps entry was the same for both groups; approximately one in five (17%) Job Corps students worked prior to entering Job Corps.

| <b>EXHIBIT III-1<br/>ADMISSION CHARACTERISTICS OF JOB CORPS STUDENTS<br/>BY AGE OF INITIAL MARIJUANA USE</b> |                               |                              |                               |
|--|-------------------------------|------------------------------|-------------------------------|
|  | <b>Early Initiators<br/>%</b> | <b>Late Initiators<br/>%</b> | <b>Chi-square<sup>1</sup></b> |
| N=   | 447                           | 584                          |                               |
| Age-Mean <sup>2</sup> (S.D.)   | 18.5 [1.9]                    | 18.7 [2.0]                   | N/A                           |
| Gender Female  | 36                            | 46                           | 7.93**                        |
| <b>Race/Ethnicity</b>  |                               |                              |                               |
| White  | 26                            | 13                           | 25.46****                     |
| African American   | 49                            | 64                           | 22.52****                     |
| Hispanic   | 22                            | 19                           | NS                            |
| Other non-White race   | 4                             | 4                            | NS                            |
| H.S. degree/diploma  | 11                            | 15                           | NS                            |
| Ever run away from home  | 37                            | 26                           | 13.81***                      |
| Ever run away from school  | 38                            | 25                           | 20.39***                      |
| Ever suspended from school   | 81                            | 68                           | 21.6****                      |
| Committed crime prior to age 15  | 49                            | 28                           | 49.4****                      |
| Legally married  | 1                             | 1                            | NS                            |
| <b>Living in:</b>  |                               |                              |                               |
| Jail/detention/hospital  | 1                             | 0                            | NS                            |
| House/apartment  | 90                            | 94                           | 8.35**                        |
| Mobile home/hotel/dormitory  | 6                             | 5                            | NS                            |
| Res. treatment/group home  | 1                             | 1                            | NS                            |
| Shelter/homeless   | 2                             | 0                            | NS                            |
| Employed   | 17                            | 17                           | NS                            |
| Receiving public assistance  | N/A                           | N/A                          | NS                            |
| Treated for alcohol/drugs- past 12 mos.  | 5                             | 1                            | 17.23***                      |
| Ever attended a 12-step program  | 21                            | 7                            | 39.96**                       |
| Had first drink before age 15 <sup>3</sup>   | 70                            | 29                           | 170.3***                      |
| Relatives/friends use drugs  | 89                            | 78                           | 22.12****                     |
| Relatives/friends use alcohol  | 77                            | 65                           | 16.69****                     |

<sup>1</sup> Unless otherwise indicated, the Chi-Square analyses were based on df=1;

<sup>2</sup> A t test between independent groups was used to compare means;

<sup>3</sup> Based on 3-groups, drank before 15, drank after 14 and did not drink (df=2)

\*p<.05, \*\*p<.01, \*\*\*p<.001, NS=Not Significant

Nevertheless, significant differences between the pre-admission characteristics and risk factors of the Early and Late Initiators were found. The Early Initiators, compared to the Late

Initiators, included relatively fewer females (36% versus 46%), a higher percentage of Whites (26% vs. 13%), and fewer African Americans (49% versus 64%). About a fifth of each group (22% and 19%), respectively, was of Hispanic origin.

Also, early initiation of marijuana use among Job Corps entrants was associated with a number of risk factors for substance use, including problems in school and at home, early onset of criminal behavior, and the early onset of alcohol use. Specifically, running away from home, being expelled or suspended from school, committing a crime before age 15 and drinking before the age of 15 were each more often reported by the Early Initiators compared to the Late Initiators. Early initial marijuana use also was associated with the use of drugs and alcohol by friends and relatives, receiving treatment for drugs and alcohol, and attending a 12-step program.

## **2.2 Characteristics of 1993 NHSDA Respondents by Age of Initial Marijuana Use**

As in Job Corps, the early initiation of use of marijuana was associated with higher risk factors for the NHSDA respondents. Early Initiators compared to Later Initiators were less likely to complete high school (62% versus 73%) and more likely to drink alcohol prior to age 15 (79% versus 37%). Also, the Early Initiators compared to Late Initiators were more likely to have been treated for substance use during the past 12 months. These results are summarized in Exhibit III-2.

## **2.3 Job Corps and NHSDA Respondent Demographic and Risk Characteristics**

The second analysis focused on a comparison of the Job Corps students and the NHSDA adolescents. Job Corps students were generally younger, and in the case of the Early Initiators, less likely to be female compared to the 1993 NHSDA respondents. The remaining analyses were completed with and without weighting the Job Corps sample. In the weighted analysis, the Job Corps sample data were weighted to match the NHSDA in the distribution of respondents by age and gender. In the unweighted analysis, none of the variables were weighted. As the results were similar, only the unweighted results are shown here. Exhibits III-1 and III-2, above, show these results, respectively.

| <b>EXHIBIT III-2</b>                        |                                   |                                  |                   |
|---|-----------------------------------|----------------------------------|-------------------|
| <b>1993 NHSDA SAMPLE CHARACTERISTICS BY</b> |                                   |                                  |                   |
| <b>AGE OF INITIAL MARIJUANA USE</b>         |                                   |                                  |                   |
|   | <b>Early<br/>Initiators<br/>%</b> | <b>Late<br/>Initiators<br/>%</b> | <b>Chi-Square</b> |
| N (Weighted) =                              | 826                               | 2006                             | 2832              |
| Mean age <sup>2</sup>                       | 20.7                              | 21                               | N/A               |
| Female                                      | 49                                | 46                               | NS                |
| White                                       | 76                                | 77                               | NS                |
| African American                            | 8                                 | 10                               | NS                |
| Hispanic                                    | 12                                | 10                               | NS                |
| Other non-White race                        | 4                                 | 3                                | NS                |
| HS degree/diploma                           | 62                                | 73                               | -9.82**           |
| Legally married                             | 20                                | 16                               | NS                |
| Residing in house/apartment                 | 100                               | 100                              | N/A               |
| Employed/working                            | 62                                | 65                               | NS                |
| Treated for alcohol/ drugs/past 12 mos.     | 6                                 | 2                                | 4.84*             |
| Had first drink before age 15 <sup>3</sup>  | 79                                | 37                               | 113.95***         |

<sup>1</sup> Unless otherwise indicated, the Chi-Square analyses were based on df=1;

<sup>2</sup> A t test between independent groups was used to compare means;

<sup>3</sup> Based on 3-groups, drank before 15, drank after 14, and did not drink (df=2)

\*p<.05, \*\*p<.01, \*\*\*p<.001, NS=Not Significant

Job Corps respondents were more educationally and economically disadvantaged than respondents to the NHSDA. Job Corps respondents were less likely to have completed high school compared to 1993 NHSDA respondents. Completing high school were 11 and 15 percent of the Job Corps Early Initiators and Late Initiators, respectively, compared to almost two-thirds of the 1993 NHSDA early initial marijuana users and three-fourths of the later initial users.

Employment also was substantially lower for Job Corps respondents compared to the NHSDA, as less than one in five Job Corps respondents were employed, in each group, respectively, versus more than three in five in the 1993 NHSDA. Finally, race/ethnicity differed between Job Corps students and NHSDA respondents. Of the Early Initiators in Job Corps, about a fourth were White compared to 75 percent of the 1993 NHSDA. Of the Late Initiators in

Job Corps, 13 percent were White versus 77 percent of the 1993 NHSDA. Conversely, Job Corps respondents were more likely to be African American, (49% versus 8% percent of the Early Initiators and 64% percent versus 10% in the Late Initiators, respectively). In contrast, the Job Corps and NHSDA respondents were about equally likely to report drug/alcohol treatment in the past 12 months and the Job Corps and NHSDA Early Initiators were each more likely to initiate tobacco use prior to age 15, compared to Late Initiators.

### **3. ADOLESCENT SUBSTANCE USE**

The second area of analytic inquiry focused on the association between age of initial marijuana use and the use of other substances. The first section describes the comparison of the two groups of Job Corps students, namely, Early Initiators and Late Initiators. Similar analyses were then conducted with the NHSDA respondents.

#### **3.1 Substance Use Among Job Corps Students**

The analysis examined use of marijuana and other illicit drugs, alcohol, and tobacco among the Job Corps students.

##### **Early Initiation: A Persistent or Transitory Effect?**

Exhibit III-3 presents a comparison of the alcohol and drug use behaviors by age of initial marijuana use at Job Corps admission and follow-up. The Early Initiators had higher rates of substance use compared with Late Initiators at Job Corps admission, but with the exception of binge drinking, these initial differences between the Early Initiators and Late Initiators disappeared during follow-up. In further analyses, similar results were found when the type of site and various student factors were controlled, including age, gender, race, high school completion and employment. When these factors were controlled at admission, the Early Initiators compared to Late Initiators had a greater likelihood or odds of reporting:

- Near-daily marijuana use (3:1 odds)
- 12-month cocaine use (2:1)
- Past 12-month crack use (9:1)
- Past 30-day alcohol use (2:1)
- Past 30-day and past 12-month binge drinking (2:1)
- Smoking an average of six or more cigarettes per day in the past two weeks (2:1).

Again, while these results suggest that early marijuana use may be a marker for substance abuse, they cannot be used to infer that early marijuana use causes these substance use problems.

| <b>EXHIBIT III-3</b>   |                              |                          |                   |                       |                                |                          |                   |                       |
|--|------------------------------|--------------------------|-------------------|-----------------------|--------------------------------|--------------------------|-------------------|-----------------------|
| <b>CHI-SQUARES AND HLM ODDS RATIOS FOR AGE OF FIRST MARIJUANA USE TO PREDICT JOB CORPS SUBSTANCE USE BEHAVIORS PRIOR TO ADMISSION AND DURING FOLLOW-UP</b> |                              |                          |                   |                       |                                |                          |                   |                       |
|  | <b>Admission<sup>1</sup></b> |                          |                   |                       | <b>Follow-up<sup>1,2</sup></b> |                          |                   |                       |
|  | <b>Early Initiators %</b>    | <b>Late Initiators %</b> | <b>Chi-square</b> | <b>OR<sup>3</sup></b> | <b>Early Initiators %</b>      | <b>Late Initiators %</b> | <b>Chi-square</b> | <b>OR<sup>3</sup></b> |
| N=   | 447                          | 584                      | 1037              | 1037                  | 447                            | 584                      | 1031              | 1031                  |
| Marijuana-Near-daily use/Past 30 days  | 23                           | 9                        | 38.5***           | 3.20***               | 11                             | 10                       | 0.221             | -1.10                 |
| Marijuana-Past 30 days   | 78                           | 78                       | 0.024             | 1.06                  | 35                             | 34                       | 0.181             | 1.14                  |
| Cocaine-Past 12 months   | 12                           | 6                        | 11.98***          | 2.21**                | 3                              | 3                        | 0.026             | -1.08                 |
| Crack-Past 30 days   | 4                            | 1                        | 8.94**            | 8.34**                | 4                              | 2                        | 3.59              | 2.13                  |
| Alcohol-Past 30 days   | 56                           | 44                       | 13.1***           | 1.64***               | 54                             | 52                       | .26               | -1.04                 |
| Binged (2+ Drinks)/hr. <sup>4</sup> -Past 30 days  | 27                           | 14                       | 26.3***           | 2.17***               | 19                             | 10                       | 19.89***          | 1.78**                |
| Smoked 6+ cigarettes per day   | 49                           | 33                       | 28.3***           | 1.70***               | 52                             | 41                       | 1.32***           | 1.22                  |

<sup>1</sup> Variables controlled in HLM models for predicting admission and follow-up behavior were age, gender, high school graduation, race and work status at admission and whether student was enrolled in a DTEP or AODA site.

<sup>2</sup> Other variables controlled in HLM models for predicting follow-up behavior only were the behavior of interest at admission and duration of follow-up.

<sup>3</sup> A significantly positive (negative) OR indicates the odds of a given status/behavior at follow-up is relatively higher (lower) for the Early Initiators vs. Late Initiators. Controlled at admission were the predicted behavior plus age, gender, race/education and work status.

<sup>4</sup> Binge drinkers in Job Corps averaged 4 or more drinks per hour one or more times in the period assessed

\*p < .05, \*\*p < .01, \*\*\* p < .001.

With admission variables and the length of the follow-up period controlled, only the odds of binge drinking during follow-up remained significantly higher for Early Initiators compared to Late Initiators. Thus, students who initiated marijuana use prior to age 15 compared to initiators age 15 and older had twice the odds of binge drinking. In contrast, the remaining differences associated with age of initiation that were found prior to admission disappeared during follow-up.

To further examine the potential influence of early marijuana use on subsequent substance use, additional bivariate analyses were conducted to examine the changes in behavior from admission to follow-up. Using the Cochran's Q test, the results are analyzed separately for

the Early Initiators and Late Initiators. While any past 30-day marijuana use declined for both groups, reductions in near-daily use were found for Early Initiators only (from 23% prior to admission to 11% during follow-up). In contrast, near-daily use remained about the same in each period for Late Initiators. Cocaine use in the past 12 months declined significantly in both groups between these periods (from 12% to 3% and 6% to 3% respectively). In contrast, past 12-month crack and heroin use, which were both infrequently reported, remained about the same in each period. These results are presented in Exhibit III-4.

| <b>EXHIBIT III-4</b>  |                  |             |                |                 |             |                |
|---|------------------|-------------|----------------|-----------------|-------------|----------------|
| <b>PERCENT OF JOB CORPS STUDENTS USING SUBSTANCES PRIOR TO ADMISSION AND DURING FOLLOW-UP BY AGE OF INITIAL MARIJUANA USE</b> |                  |             |                |                 |             |                |
|   | Early Initiators |             |                | Late Initiators |             |                |
|   | Adm. %           | Follow-up % | Q <sup>1</sup> | Adm. %          | Follow-up % | Q <sup>1</sup> |
| N=  | 447              | 447         |                | 584             | 584         |                |
| Marijuana - Near-daily use/past 30 days   | 23               | 11          | 24.00***       | 9               | 10          | 0.56           |
| Marijuana-Any use/past 30 days  | 78               | 35          | 148.00***      | 78              | 34          | 205.40***      |
| Marijuana-Past 12 mos.  | 94               | 60          | 136.00***      | 96              | 57          | 210.60***      |
| Cocaine-Any use/past 12 mos.  | 12               | 3           | 24.90***       | 6               | 3           | 7.80**         |
| Crack-Any use/past 12 mos.  | 4                | 4           | 0.04           | 1               | 2           | 1.33           |
| Alcohol Past 30 days  | 55               | 54          | 0.18           | 43              | 52          | 11.70***       |
| Binged (2= drinks)/hr. <sup>2</sup> -Past 30 days   | 27               | 19          | 8.07**         | 14              | 10          | 5.10*          |
| Binged (2= drinks)/hr. <sup>2</sup> -Past 12 mos.   | 56               | 34          | 10.07**        | 27              | 22          | 4.37*          |
| Smoked 6+ cigarettes/ave. Per day   | 49               | 52          | 0.54           | 33              | 41          | 16.00***       |

<sup>1</sup> Cochran's Q measures the significance of the difference in the reported percentage between periods.

<sup>2</sup> Job Corps students who were classified as binge drinkers averaged 4 more drinks per hour at least once in the period assessed.

\*p<.05, \*\*p<.01, \*\*\*p<.001.

### Other Predictors of Job Corps Substance Use

In this section, the importance of the site of the Job Corps intervention (DTEP versus AODA) and other client factors besides age of initial marijuana use were assessed as predictors of these substance use behaviors during follow-up. To adjust for the non-random assignment (nesting) of clients within sites, HLM was employed. Exhibit III-5 shows the HLM odds ratios in predicting illicit drug, alcohol and tobacco use for the site variable, in addition to each of several student admission characteristics. The student admission characteristics that were

assessed were age, age of initial marijuana use, currently working, being Hispanic (versus White), being African American (versus White), being another non-White race or ethnic group (versus White), being female, and having a high school diploma/GED. For each predicted behavior that was assessed in these analyses, the practice of that behavior prior to admission was also controlled. Finally, the length of the follow-up period also was controlled in these analyses. Significant findings included the following.

**Behavior of interest at baseline.** The analysis showed that the use of illicit drugs, alcohol and/or tobacco prior to admission predicted use during follow-up. Students who engaged in each of the measured behaviors prior to admission, (e.g. near-daily marijuana use, past 30-day marijuana use) were more likely to practice these behaviors during follow-up than students who did not do so prior to admission.

**Race/ethnicity, gender and age.** Compared to Whites, African Americans were more likely to report past 30-day marijuana use, but African Americans compared to Whites were also less likely to report a daily average of six or more cigarettes during the past two weeks. Hispanics in Job Corps compared to Whites were less likely to report a daily average of six or more cigarettes during the past two weeks. Gender significantly predicted past 30-day alcohol use, as males were more likely to report past 30-day alcohol use compared to females. Client age significantly predicted past 12-month crack use. Younger clients were less likely to report crack use compared to older clients. No other relationships to student age were significant.

**Other variables.** Students who worked were less likely to smoke, compared to those who did not work. The DTEP compared to AODA intervention was not a significant predictor of any behavior. The length of follow-up significantly predicted lower past 30-day marijuana use, but otherwise was not significant.

| <b>EXHIBIT III-5</b>   |                             |                              |                             |                           |                            |                                   |                                    |
|--|-----------------------------|------------------------------|-----------------------------|---------------------------|----------------------------|-----------------------------------|------------------------------------|
| <b>HLM ODDS RATIOS FOR OTHER ADMISSION VARIABLES PREDICTING<br/>JOB CORPS SUBSTANCE USE DURING FOLLOW-UP</b> |                             |                              |                             |                           |                            |                                   |                                    |
| <b>Other Admission Variables</b>   | <b>Near-Daily Marijuana</b> | <b>Past 30-Day Marijuana</b> | <b>Past 12-Mos. Cocaine</b> | <b>Past 12-mos. Crack</b> | <b>Past 30-Day Alcohol</b> | <b>Past 30-Day Binge Drinking</b> | <b>Average 6+ Cigarettes Daily</b> |
| Entered DTEP vs. AODA  | -1.26                       | 1.20                         | 1.17                        | 1.96                      | 1.39                       | 1.29                              | -1.35                              |
| Behavior of interest (at admission)  | 2.63***                     | 1.49*                        | 4.03**                      | 7.66**                    | 1.82**                     | 1.98**                            | 5.37***                            |
| Younger age  | 1.08                        | -1.01                        | -1.11                       | -1.25*                    | -1.04                      | -1.08                             | -1.05                              |
| Currently working  | -1.35                       | -1.37                        | -2.21                       | -2.83                     | -1.16                      | 1.35                              | -1.55*                             |
| Hispanic (vs. White)   | -1.24                       | 1.10                         | 1.17                        | -1.31                     | -1.14                      | -1.65                             | -2.15***                           |
| African American (vs. White)   | 1.16                        | 1.60*                        | 1.05                        | 1.15                      | -1.05                      | -1.42                             | -2.20***                           |
| Other (vs. White)  | -1.87                       | -2.43                        | 1.70                        | 1.42                      | -2.30                      | -1.90                             | -1.18                              |
| Male (vs. Female)  | 1.57                        | 1.15                         | -1.22                       | -1.11                     | 2.14***                    | 1.59                              | 1.12                               |
| High school degree/diploma   | 1.04                        | 1.05                         | 1.07                        | 1.09                      | 1.97**                     | 1.20                              | -1.09                              |

<sup>1</sup> Length of follow-up period in days was also controlled in the analysis, but the results for this variable are not shown in the exhibit.

<sup>2</sup> DTEP vs. AODA was a site level variable, the remaining variables were measured at the individual level.

<sup>3</sup> The results show the odds for the reported behavior with each one year decrease in age.

\*p<.05, \*\*p<.01, \*\*\*p<.001

### 3.2 NHSDA Analyses

The following paragraphs summarize the analyses of the NHSDA samples. These analyses include age of initial marijuana use and other predictors of substance use.

## **Age of Initial Marijuana Use**

The association of early marijuana use with substance use behaviors for respondents to the 1993 and 1995 NHSDA surveys, are shown in Exhibit III-6. The substance use behaviors examined in these analyses included near-daily and past 30-day marijuana use, past 12-month cocaine use, past 12-month crack use, past 30-day alcohol use, past 30-day binge drinking, and smoking six or more cigarettes daily in the past 30 days. Using bivariate and logistic regression analysis with other variables controlled, these data were examined separately for Early Initiator and Late Initiator respondents. Similar results were found in the 1993 and 1995 NHSDA surveys, as consistently higher rates of drug use were reported by the Early Initiators compared to the Late Initiators in each survey period. With other variables controlled, Early Initiators compared to Late Initiators were more likely to report:

- Near-daily marijuana use (4:1 odds each year)
- Any past 30-day marijuana use (2:1 odds each year)
- Past 12-month cocaine use (2:1 odds in '93 and 3:1 odds in '95)
- Past 12-month crack use (3:1 odds each year)
- Smoked 6+ cigarettes per day/past 2 weeks (1.5:1 odds in '93 and 2:1 odds in '95).

Comparing the substance use rates reported in the 1993 NHSDA to the rates reported in the 1995 NHSDA, no differences were found for any of the substances assessed.

## **Other Predictors of Substance Use Behavior**

The relationship of other respondent characteristics to substance abuse behavior were assessed for respondents to the 1993 and 1995 NHSDA surveys. Logistic regression analysis was used for this purpose. The predicted behaviors were near-daily use and past 30-day marijuana use, past 12-month cocaine and crack use, past 30-day alcohol use, past 30-day binge drinking, and smoking six or more cigarettes per day during the past 30 days. Assessed in these analyses, in addition to age of initial marijuana use, were age, work status, race, gender, school enrollment, and high school diploma/GED. Exhibit III-7 shows the odds ratios for these personal characteristics (except for age of initial marijuana use), in predicting each substance use behavior for respondents to the 1995 NHSDA.

**EXHIBIT III-6**  
**PERCENTAGE OF 1993 AND 1995 NHSDA SAMPLES REPORTING DRUG/ALCOHOL USE**

|   | 1993       |           |          |                 | 1995       |           |          |                 |
|---|------------|-----------|----------|-----------------|------------|-----------|----------|-----------------|
|   | EARLY<br>% | LATE<br>% | CHI-SQ   | OR <sup>1</sup> | EARLY<br>% | LATE<br>% | CHI-SQ   | OR <sup>2</sup> |
| N=  | 826        | 2006      | 2832     | 2832            | 521        | 1658      | 2179     | 2179            |
| Marijuana- Near-daily use/Past 30 days    | 10         | 3         | 16.27*** | 4.00***         | 14         | 3         | 28.87*** | 4.28***         |
| Marijuana-Any use/Past 30 days            | 34         | 25        | 7.50**   | 1.56**          | 39         | 26        | 20.03*** | 1.78***         |
| Cocaine - Any use/Past 12 months          | 15         | 8         | 8.90**   | 1.75*           | 17         | 7         | 18.48*** | 2.56***         |
| Crack - Any use/Past 12 months            | 5          | 1         | 5.35*    | 2.78*           | 5          | 2         | 6.60*    | 2.94***         |
| Alcohol - Any use/Past 30 days            | 73         | 77        | 1.94     | -1.11           | 78         | 81        | 1.34     | -1.24           |
| Binge drink past 30 days <sup>3</sup>     | 42         | 43        | 0.11     | 1.04            | 49         | 43        | 2.93     | 1.14            |
| Smoked 6+ cigarettes per day <sup>4</sup> | 40         | 28        | 11.58*** | 1.47*           | 48         | 30        | 38.67*** | 1.78***         |

<sup>1</sup> Logistic Regression Odds Ratios (ORs) were obtained for Early versus Late initiation, in predicting alcohol/drug use for 1993 NHSDA respondents, with past 12 month substance abuse treatment, age, gender, race/ethnicity, high school education, school enrollment and work status controlled for.

<sup>2</sup> Logistic Regression Odds Ratios (ORs) were obtained for Early versus Late initiation in predicting alcohol/drug use for 1995 NHSDA respondents, with age, gender, race/ethnicity, high school education, school enrollment and work status controlled for.

<sup>3</sup> Defined in NHSDA as 5 or more drinks per hour .

<sup>4</sup> Data were based on smoking behavior over the last 30 days.

\*p<.05, \*\*p<.01, \*\*\*p<.001.

| EXHIBIT III-7  |                         |                              |                               |                             |                            |                                      |                                   |
|--|-------------------------|------------------------------|-------------------------------|-----------------------------|----------------------------|--------------------------------------|-----------------------------------|
| LOGISTIC REGRESSION ODDS RATIOS FOR VARIABLES PREDICTING |                         |                              |                               |                             |                            |                                      |                                   |
| SUBSTANCE USE FOR 1995 NHSDA RESPONDENTS SUBSTANCE USE   |                         |                              |                               |                             |                            |                                      |                                   |
| Variables  | Near-Daily<br>Marijuana | Past 30-<br>Day<br>Marijuana | Past 12-<br>Months<br>Cocaine | Past 12-<br>Months<br>Crack | Past 30-<br>Day<br>Alcohol | Past 30-<br>Day<br>Binge<br>Drinking | Average 6+<br>Cigarettes<br>Daily |
| Younger age  | 1.14**                  | 1.16***                      | 1.08*                         | 1.10                        | -1.03                      | 1.03                                 | 1.05                              |
| Currently working  | -1.66                   | -1.02                        | -1.10                         | -1.64                       | 1.26                       | 1.18                                 | -1.28                             |
| Hispanic (vs. White)                                     | -1.41                   | -1.08                        | -1.04                         | 1.38                        | -1.02                      | -1.06                                | -4.16***                          |
| African American<br>(vs. White)                          | 1.45                    | 1.68***                      | -3.22***                      | -1.65                       | -1.72**                    | -2.63***                             | -5.00***                          |
| Other (vs. White)  | -4.76                   | -1.39                        | 1.35                          | 1.63                        | -1.25                      | -1.11                                | -2.04*                            |
| Male (vs. Female)  | 1.79*                   | 1.69***                      | 1.14                          | -1.22                       | 2.34***                    | 3.55***                              | 1.01                              |
| Enrolled in school                                       | -1.64                   | 1.08                         | -1.61*                        | -1.96                       | 1.61**                     | 1.12                                 | -3.12***                          |
| High school<br>degree/diploma                            | 1.10                    | -1.09                        | 1.01                          | -1.30                       | 1.66**                     | 1.29                                 | -2.94***                          |
| Marijuana use<br>before 15                               | 4.28***                 | 1.78***                      | 2.56***                       | 2.94**                      | -1.24                      | 1.14                                 | 1.78***                           |

\*p<.05, \*\*p<.01, \*\*\*p<.001

**Younger vs. older respondents.** Controlling for other factors, younger respondents compared to older respondents were more likely to report near-daily marijuana use in the past 30 days, any past 30-day marijuana use, and past 12-month cocaine use. The remaining differences associated with age were not significant. Similar results were found in the 1993 NHSDA analysis, where younger aged respondents compared to older had higher odds of using marijuana in the past 30-days but did not differ significantly in their likelihood of using any of the remaining substances..

**Race/Ethnicity.** With regard to racial/ethnic differences, the results for respondents to the 1993 NHSDA and 1995 NHSDA were for the most part similar. Mixed results in each survey were found for African Americans compared with Whites. African Americans in both years compared with Whites were more likely to report past 30-day marijuana use. African Americans compared with Whites, however, in each year were less likely to report any past 12-month cocaine use, any past 30-day drinking, and any past 30-day binge drinking. African Americans compared with Whites in both 1993 and 1995 were also less likely to report smoking more than

an average of six cigarettes per day in the past 30 days. Hispanics compared with Whites in each year and Other non-White students in 1995 only, compared with Whites, were less likely to report smoking an average of six or more cigarettes per day during the past two weeks.

**Male versus female respondents.** Males compared to females, both in 1993 and 1995, were more likely to report near-daily marijuana use in the past 30 days, any past 30-day marijuana use, any past 30-day cocaine use, any past 30-day alcohol use, and any past 30-day binge drinking.

**High school education/School enrollment.** NHSDA respondents in both NHSDA survey years who were enrolled in school were less likely to report either past 12-month cocaine use, or smoking six or more cigarettes per day in the past 30 days, compared to those not enrolled. NHSDA respondents in both survey years who earned a high school diploma/GED were less likely to smoke six or more cigarettes per day in the past 30 days, and more likely to report past 30-day alcohol use, compared to NHSDA respondents who did not earn a high school diploma/GED.

## **Summary**

In summary, early marijuana use appears to be associated with later substance use in both the economically disadvantaged Job Corps and the more normative NHSDA samples. A direct comparison of the two Job Corps student groups, prior to admission and during follow-up, suggests that the differences in substance abuse use rates are initially significant for drug use, alcohol use and tobacco. Once other factors are considered, these differences tend to disappear over time, with the exception of heavy alcohol use, since binge drinking remains more prevalent among the Job Corps Early Initiators compared to Later Initiators. The NHSDA findings in both survey years are remarkably consistent. They provide evidence for a powerful association between early initial marijuana use and later substance use across a range of substances including tobacco, marijuana and cocaine/crack, but not alcohol.

## **4. CRIMINAL BEHAVIOR/ARRESTS**

The analysis of adolescent criminal behaviors and arrests is reported below. The first section focuses on criminal behaviors and arrests among the Job Corps samples. The second section provides the NHSDA sample results.

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#### **4.1 Criminal Behavior and Arrests Among Job Corps Students**

The following paragraphs describe criminal behavior and arrests, separately, prior to admission and during follow-up, by age of marijuana initiation and other variables. First, analyses were completed of the association of age of initial marijuana use and subsequent criminal behaviors/arrests. Next, data on the significance of other variables as predictors of these behaviors are presented. In addition to bivariate statistical analysis, these comparisons were completed employing HLM to control for site and student variation. The site variable included in these HLM analyses was the assignment of students to DTEP versus AODA sites. The student variables controlled in these analyses were age, race, gender, high school completion, current work status, and early initial use of marijuana. Additionally, for predicting criminal behavior/arrests during follow-up, the duration of the follow-up period in days also was controlled.

##### **Age of Initial Marijuana Use and Criminal Behavior/Arrests**

The bivariate associations between age of marijuana use and subsequent criminal behaviors and arrests are described below and summarized in Exhibit III-8. Shown in Exhibit III-8 are the percentages of students who reported criminal behavior and arrests among the Early Initiators and Late Initiators. As the Early Initiators and Late Initiators had follow-up periods that were similar in duration, the length of follow-up was not adjusted in this analysis., Exhibit 8 also shows the odds ratios that were obtained through HLM in predicting the respective criminal behaviors and arrests at Job Corps admission and follow-up.

In bivariate analyses, students who initiated marijuana use early had higher rates of criminal behavior, both pre-admission and during follow-up. With respect to arrests, on the other hand, the Early Initiators reported a higher rate of arrests during follow-up compared to Late Initiators, but did not differ from the Late Initiators with respect to rates of arrests prior to admission. When HLM was used to control for both site and client characteristics in predicting these pre-admission and follow-up behaviors, the students who initiated marijuana use prior to age 15 compared to at age 15 and older did not differ significantly with respect to their likelihood of engaging in criminal behavior, but both prior to admission and during follow-up were more likely to be arrested (2:1 odds).

**EXHIBIT III-8**  
**CHI-SQUARES AND HLM ODDS RATIOS BY AGE OF FIRST MARIJUANA USE FOR**  
**CRIMINAL BEHAVIORS/ARRESTS REPORTED BY JOB CORPS RESPONDENTS**  
**PRIOR TO ADMISSION AND DURING FOLLOW-UP**

|                         | Admission <sup>1,3</sup> |                   |            |                 | Follow-up <sup>2,3,4</sup> |                   |            |                 |
|-------------------------|--------------------------|-------------------|------------|-----------------|----------------------------|-------------------|------------|-----------------|
|                         | Early Initiators %       | Late Initiators % | Chi-square | OR <sup>5</sup> | Early Initiators %         | Late Initiators % | Chi-square | OR <sup>5</sup> |
| N=                      | 447                      | 584               | 1031       | 1031            | 447                        | 584               | 1031       | 1031            |
| DUI (alcohol/drugs)     | 12                       | 6                 | 11.97***   | 1.15            | 21                         | 15                | 4.03*      | 1.15            |
| Destroyed property      | 7                        | 3                 | 12.06***   | 1.38            | 13                         | 9                 | 4.32*      | 1.38            |
| Beat someone up         | 9                        | 6                 | 4.24*      | 1.26            | 31                         | 25                | 4.98*      | 1.26            |
| Arrested past 12 months | 14                       | 13                | 0.44       | 1.48**          | 33                         | 25                | 8.46**     | 1.48**          |

<sup>1</sup> Admission data were based on prior 12 months for all variables.

<sup>2</sup> Follow-up data were based on prior 12 months for arrests and entire follow-up period for remaining criminal behaviors.

<sup>3</sup> Variables controlled in HLM models for predicting admission and follow-up behavior were age, gender, high school degree/GED, race and work status at admission and whether student was enrolled in a DTEP or AODA site.

<sup>4</sup> Other variables controlled in HLM models for predicting follow-up behavior only were the behavior of interest at admission and duration of follow-up.

<sup>5</sup> A significantly positive (negative) OR indicates the odds of a given status/behavior at follow-up is relatively higher (lower) for the Early Initiators vs. Late Initiators.

\*p<.05, \*\*p<.01, \*\*\*p<.001.

### Changes in Criminal Behavior/Arrests Over Time by Age of Initial Marijuana Use

Next, we examined changes in criminal behaviors and arrests over time for each group. Exhibit III-9 shows these findings, including the reported percentages of Early and Late Initiators who reported criminal behaviors and arrests prior to admission and during follow-up. Also shown are the follow-up percentages for criminal behaviors, after adjusting the data for the length of the follow-up period. Significant increases in arrest rates were found between Job Corps admission and follow-up for both Early Initiators and Late Initiators. Significant increases in assaults were also found for both groups after adjusting for the length of follow-up. Significant increases between Job Corps admission and follow-up in DUI and destroying property rates were found for both Early Initiators and Late Initiators prior to adjusting for follow-up, but these increases between periods were significant only for the Late Initiators, after adjusting for the length of follow-up.

| <b>EXHIBIT III-9</b><br><b>SIGNIFICANCE OF CHANGES IN CRIMINAL BEHAVIOR/ARRESTS</b><br><b>REPORTED PRIOR TO ADMISSION AND DURING FOLLOW-UP</b><br><b>AFTER ADJUSTING FOR LENGTH OF FOLLOW-UP</b><br><b>BY AGE OF INITIAL MARIJUANA USE</b> |                        |                                     |                                   |                        |                                     |                                   |
|--|------------------------|-------------------------------------|-----------------------------------|------------------------|-------------------------------------|-----------------------------------|
|  | Early Initiators       |                                     |                                   | Late Initiators        |                                     |                                   |
|  | Admission <sup>1</sup> | Unadjusted Follow-up <sup>2,3</sup> | Adjusted Follow-up <sup>4,5</sup> | Admission <sup>1</sup> | Unadjusted Follow-up <sup>2,3</sup> | Adjusted Follow-up <sup>4,5</sup> |
| N=   | 447                    | 447                                 | 447                               | 584                    | 584                                 | 584                               |
| DUI<br>(Alcohol/Drugs)   | 12                     | 21***                               | 16                                | 6                      | 15***                               | 12***                             |
| Destroyed<br>property  | 7                      | 13**                                | 7                                 | 3                      | 9***                                | 6***                              |
| Beat someone up  | 9                      | 31***                               | 25***                             | 6                      | 25***                               | 19**                              |
| Arrested past 12<br>months   | 14                     | 33**                                | NA                                | 13                     | 25**                                | NA                                |

<sup>1</sup> Admission data were based on prior 12 months for all variables.

<sup>2</sup> Follow-up data were based on prior 12 months for arrests and entire follow-up period for remaining criminal behaviors.

<sup>3</sup> Cochran's Q test used to test for the significance of differences between admission and unadjusted follow-up data.

<sup>4</sup> Follow-up data were adjusted for the length of the follow-up period.

<sup>5</sup> Non-parametric Sign test used to test for significance of differences between admission and adjusted follow-up data.

\*p<.05, \*\*p<.01, \*\*\*p<.001.

### Other Predictors of Criminal Behavior/Arrests

In this section, the HLM results for other predictors of criminal behavior and arrests are presented included one site variable, namely, DTEP versus AODA, and several student pre-admission factors, including the practice of the behavior of interest, race, gender, high school completion and employment. Exhibit III-10 shows the HLM odds ratios for these factors in predicting follow-up criminal behavior. The criminal behaviors assessed in these analyses were DUI, destroying property, and assaults. An additional variable that was controlled in these HLM analyses was the number of days of follow-up.

**EXHIBIT III-10**  
**HLM ODDS RATIOS FOR OTHER ADMISSION VARIABLES BY JOB CORPS RESPONDENTS'**  
**CRIMINAL BEHAVIORS DURING FOLLOW-UP<sup>1</sup>**

| Variables                            | DUI     | Property | Assaults | Arrest  |
|--------------------------------------|---------|----------|----------|---------|
| DTEP (vs. Control Site) <sup>2</sup> | -1.03   | -1.18    | 1.04     | -1.07   |
| Behavior of interest pre-admission   | 2.53*** | 3.03**   | 4.10***  | 1.63**  |
| Younger age                          | -1.06   | 1.09     | 1.13**   | 1.06    |
| Currently working                    | 1.03    | -1.72    | -1.06    | -1.45   |
| Hispanic (vs. White)                 | -1.12   | 1.06     | 1.11     | 1.00    |
| African American (vs. White)         | -1.15   | 1.05     | 1.18     | 1.46    |
| Other non-White (vs. White)          | 1.80    | -1.09    | -1.32    | 1.22    |
| Male (vs. Female)                    | 2.50*** | 2.31**   | 1.82**   | 5.49*** |
| High school diploma/GED              | -1.07   | -1.29    | -1.12    | -1.19   |
| Marijuana use before age 15          | 1.15    | 1.38     | 1.26     | 1.48**  |

<sup>1</sup> Length of follow-up period in days was also controlled in the analysis, but the results for this variables is not included in this exhibit.

<sup>2</sup> DTEP vs. AODA was a site level variable, the remaining variables were measured at the individual level.

<sup>3</sup> The results show the odds for the reported behavior with each one year decrease in age.

<sup>4</sup> DUI, destroyed property and assaults were measured over 12 months prior to admission compared to the entire follow-up period.

\*p<.05, \*\*p<.01, \*\*\*p<.001.

**Behavior of interest pre-admission.** The practice of a given criminal behavior or being arrested prior to admission was useful in predicting the practice of the same criminal behavior or being arrested during follow-up. Students who reported each of the respective criminal behaviors or being arrested prior to admission were more likely to report such behaviors or being arrested during follow-up, compared to students who did not report such behaviors or being arrested prior to admission.

**Younger students versus older.** Client age significantly predicted assaulting someone during follow-up, as younger students compared to older students were more likely to report assaulting someone. With each one year increase in student age, the odds of assaulting someone fell by 13 percent, compared to the level of assaults for the youngest students. This decline in the level of violence for older students is suggestive of a maturation effect.

**Male versus female.** The likelihood of reporting criminal behavior and arrests during follow-up was consistently higher for males compared with females. The odds of reporting DUI, property damage and assaultive behavior were about 2:1 times as high, and the odds of reporting an arrest were more than 5:1 times as high for males.

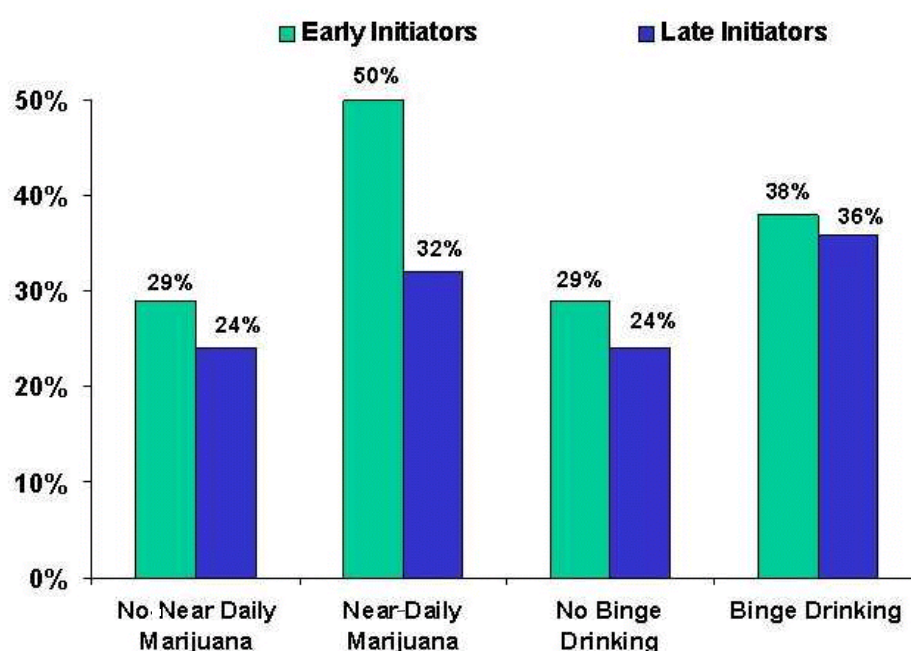
**Other predictors.** With other variables controlled, clients with longer follow-up periods, compared to clients with shorter follow-up periods, were less likely to assault someone and less likely to be arrested. This result was unexpected, as lower rates of assaults were found after adjusting the data for the number of days of follow-up. It is possible that the length of the follow-up period was a proxy for some other variable, which was uncontrolled in the HLM analysis. None of the remaining variables, including DTEP versus AODA site, race/ethnicity and high school education were significant in these analyses.

### **Early Marijuana Use and Substance Use Interactions With Assaults**

From the prior HLM analysis, we learned that the reported level of assaults during follow-up for Early Initiators and Late Initiators did not differ, once the site of enrollment and other student factors were controlled, or in statistical terms, there was no “main effect.” In further analysis, the possibility that assault levels during follow-up could be accounted for by an interaction between age of initial marijuana use and substance use during follow-up was explored. The focus of these analyses was on the interaction of early initiation with near-daily use of marijuana and binge drinking, as practiced in each case during follow-up. These relationships were first examined through bivariate analysis, followed with the use of HLM to control for site and student factors. The site factor controlled was enrollment in a DTEP versus AODA site and the student factors controlled were assault levels at baseline, age, gender, race,

employment, high school completion and length of the follow-up period. Exhibit III-11 shows the results.

**EXHIBIT III-11**  
**ASSAULTS DURING JOB CORPS FOLLOW-UP BY AGE OF INITIAL MARIJUANA**  
**USE AND SUBSTANCE USE DURING FOLLOW-UP**



Using bivariate analysis, a significant interaction was found between age of initiation, near-daily marijuana use during follow-up, and the level of reported assaults during follow-up. Of those who used marijuana near daily during follow-up, the Early Initiators reported a 50 percent assault rate, compared to 32 percent for the Late Initiators. Using HLM to control for site and student factors, the odds of assaulting someone during follow-up for the former group compared to the latter was 2:1 ( $p=.05$ ). Also, the Early Initiators who reported near-daily marijuana use during follow-up, reported a higher assault rate (50%), compared to the assault rate for the Early Initiators who reported no near-daily marijuana use during follow-up (29%). Again using HLM, the odds of assaulting someone during follow-up for the Early Initiation group compared to the Late Initiation were 2:1 ( $p=.006$ ). In similar analyses for binge drinking during follow-up, age of initiation overall was unrelated to the level of reported assaults, either for the binge drinkers or non-binge drinkers. Among the Late Initiators, however, binge drinkers during

follow-up reported higher levels of assaults (36%), compared to non-binge drinkers (24%). Using HLM, the odds of reporting assaults was 2:1 for the binge drinkers, compared to the non-binge drinkers ( $p=.022$ ). In a similar comparison for the Early Initiators, the differences were not significant.

## **4.2 NHSDA Analysis**

In this section, criminal behaviors and arrests are assessed for respondents to the 1993 and 1995 NHSDA survey. The first part of this section compares these behaviors for the Early Initiators and Late Initiators who responded to each survey. For this purpose, bivariate and logistic regression analysis were completed. Subsequently, logistic regression analysis was used to assess the relationship of several other respondent characteristics to these criminal behaviors and arrests, while controlling for the remaining characteristics. The respondent characteristics that were examined for each survey, apart from age of initial marijuana use were age, gender, high school diploma/GED, school enrollment, and current employment. Also, because the data were available from the 1993 NHSDA only, the relationship of enrollment in alcohol/drug treatment during the past 12 months to criminal behavior and arrests was also examined for respondents to the 1993 NHSDA.

### **Association of Early Initiation with Criminal Behavior/Arrests**

Exhibit III-12 shows the rates of past 12-months DUI behavior, destroying property, and assaults and arrests for Early Initiators and Late Initiators, who responded to the 1993 and 1995 NHSDA, respectively. Criminal behaviors/arrests varied by age of initiation in each period. Early Initiators in each survey year compared to the Late Initiators reported significantly higher rates of assaults both in bivariate comparisons and in logistic regression analysis, with other variables controlled (2:1 odds). The remaining differences varied by survey, or did not hold up in analyses with other variables controlled.

### **Other Predictors of Criminal Behaviors/Arrests for NHSDA Respondents**

The odds ratios obtained from logistic regression analyses for other predictors of these criminal behaviors/arrests among respondents to the 1995 NHSDA are presented in Exhibit III-13 (following Exhibit III-12). The factors assessed in these analyses, apart from age of initiation (see previous section), were younger age, currently working, race (African American, Hispanic and Other non-White compared to White), high school education, and school enrollment. Similar analyses were completed for respondents to the 1993 NHSDA.

| <b>EXHIBIT III-12</b>  |                    |                   |                |                       |                    |                   |                |                       |
|--|--------------------|-------------------|----------------|-----------------------|--------------------|-------------------|----------------|-----------------------|
| <b>PERCENTAGE OF 1993 AND 1995 NHSDA SAMPLES REPORTING CRIMINAL BEHAVIORS/ARRESTS BY EARLY VERSUS LATE INITIATION OF MARIJUANA USE</b> |                    |                   |                |                       |                    |                   |                |                       |
|  | <b>1993</b>        |                   |                |                       | <b>1995</b>        |                   |                |                       |
|  | <b>EARLY<br/>%</b> | <b>LATE<br/>%</b> | <b>CHI-SQ.</b> | <b>OR<sup>1</sup></b> | <b>EARLY<br/>%</b> | <b>LATE<br/>%</b> | <b>CHI-SQ.</b> | <b>OR<sup>2</sup></b> |
| N =  | 826                | 2006              | 2832           | 2832                  | 521                | 1658              | 2179           | 2179                  |
| DUI (Alcohol/Drugs)  | 34                 | 31                | 0.62           | 1.2                   | 39                 | 29                | 8.63**         | 1.49**                |
| Destroyed property   | 12                 | 8                 | 3.33           | 1.52                  | 8                  | 5                 | 4.20*          | 1.99                  |
| Assaulted someone  | 11                 | 5                 | 7.30**         | 1.89*                 | 7                  | 3                 | 8.64**         | 1.89**                |
| Arrested in past 12 months   | 12                 | 7                 | 4.84*          | 1.47                  | 7                  | 6                 | 0.69           | -1.05                 |

<sup>1</sup> Logistic Regression Odds Ratios (ORs) were obtained for Early versus Late initiation, in predicting criminal behavior/arrests for 1993 NHSDA respondents, with past 12 month substance abuse treatment, age, gender, race/ethnicity, high school education, school enrollment and work status controlled for.

<sup>2</sup> Logistic Regression Odds Ratios (ORs) were obtained for Early versus Late initiation in predicting criminal behavior/arrests for 1995 NHSDA respondents, with age, gender, race/ethnicity, high school education, school enrollment and work status controlled for (5%). Destroying property was similarly reported by the 1993 and 1995 NHSDA respondents (12% and 8%).

\*p<.05, \*\*p<.01

| <b>EXHIBIT III-13</b>   |            |                        |                 |                |
|---|------------|------------------------|-----------------|----------------|
| <b>LOGISTIC REGRESSION ODDS RATIOS FOR VARIABLES PREDICTING CRIMINAL BEHAVIOR /ARRESTS FOR 1995 NHSDA RESPONDENTS</b> |            |                        |                 |                |
| <b>CRIMINAL BEHAVIOR/ARRESTS</b>  |            |                        |                 |                |
| <b>Variables</b>  | <b>DUI</b> | <b>Property Damage</b> | <b>Assaults</b> | <b>Arrests</b> |
| Younger age   | 1.06**     | 1.25**                 | 1.30***         | 1.12**         |
| Currently working   | 1.46*      | -1.12                  | 1.11            | -1.22          |
| Hispanic (vs. White)  | -1.75***   | -1.26                  | 1.46            | -1.20          |
| African American (vs. White)  | -2.94***   | -1.96                  | 1.54            | 1.44           |
| Other (vs. White)   | -2.78**    | -2.17                  | -1.89           | -1.23          |
| Male (vs. Female)   | 1.74***    | 1.77*                  | 4.12***         | 2.50***        |
| Enrolled in school  | 1.25       | 1.17                   | -1.28           | -2.50***       |
| High school degree/diploma  | 1.64**     | -1.88                  | -1.04           | -1.85*         |
| Marijuana use before age 15   | 1.49**     | 1.99                   | 1.89**          | -1.05          |

\*p,.05, \*\*p<.01, \*\*\*p<.001

**Younger age.** With other variables controlled, younger respondents to the 1995 NHSDA compared to older were more likely to report DUI, property crimes, and assaults and arrests. Significant results among the respondents to the 1993 survey were found only for property crimes and arrests, as the younger respondents compared to older were again more likely to report these behaviors.

**Race/Ethnicity.** Compared to Whites, African American, Hispanic and Other non-White respondents were each less likely to report DUI. These results were consistent across the two NHSDA surveys. Race/ethnicity was not useful in predicting any of the remaining criminal behaviors/arrests in either NHSDA survey.

**Education.** Analyzing data from the 1995 NHSDA, being enrolled in school and completing high school were each significantly associated with a reduced likelihood of being arrested. Similar results were found for completing high school in the 1993 analysis, as students who completed high school were less likely to be arrested, compared with the non-completers. Being enrolled in school, however, was not a significant predictor of arrests for the 1993 NHSDA respondents.

**Currently working.** With other variables controlled, being employed was associated with a higher likelihood of DUI behavior in both the 1993 and 1995 NHSDA. Work status,

however, failed to predict any of the remaining criminal behaviors/arrests in either national survey.

## **Summary**

For Job Corps students, early initial marijuana use was associated with higher rates of criminal behavior before admission and during follow-up, including DUI, the destruction of property, and assaulting someone. These relationships, however, were significant only in bivariate analyses but disappeared once the Job Corps site, i.e., DTEP versus AODA, and various student factors were controlled. Using HLM to control for these factors, early initial marijuana use was associated with a higher likelihood of arrests at baseline and during follow-up. Early Initiators in each period compared to Late Initiators had a 2:1 odds of being arrested.

While comparisons of DTEP versus AODA sites were not significant in predicting follow-up criminal behavior/arrests, two student factors were significant in these analyses: the baseline level of the behavior of interest and gender. Students who reported a given behavior at baseline were more likely to practice that behavior during follow-up, compared to students who did not report the behavior at baseline. Also, male students were more likely to report criminal behaviors/arrests than female students. Late Initiators reported increases in DUI and the destruction of property between periods, while both groups reported increased assaults and arrests between periods. Controlling for baseline assault levels, site differences, and student demographic factors, the age of initial marijuana use interacted with the near-daily use of that substance during follow-up to predict assault behavior during follow-up. For the students who reported near-daily marijuana use during follow-up, earlier initial use was associated with a higher odds (2:1) of assaulting someone during follow-up compared to later initial use ( $p=.05$ ). For the students who did not use marijuana on a near-daily basis during follow-up, the association of age of initial use with assaults during follow-up was not significant. In similar analyses, binge drinking was associated with higher assault levels, regardless of the age of initiation.

The results of our analysis of respondents to the 1993 and 1995 NHSDA were consistent with respect to assaults, as higher assault levels were reported by Early Initiators compared to Late Initiators in each survey year. With other variables controlled, Early Initiators compared to Late Initiators had a 2:1 odds of assaulting someone. In further analysis, several additional factors were identified to be associated with criminal behavior/arrests in each survey year. The younger marijuana users compared to older marijuana users and marijuana users who worked full or part time, compared to those who did not work at all, were each more likely to report DUI behavior. African Americans, Hispanics and Other non-Whites compared to Whites, on the other hand, were each less likely to report DUI behavior. Finally, high school completers were less likely to report being arrested, compared to high school non-completers.

## **IV. SUMMARY AND IMPLICATIONS**

## IV. SUMMARY AND IMPLICATIONS

Our review of the literature suggested that the early initiation of drug use during adolescence is associated with further substance abuse and criminal behaviors. To examine the consistency of these findings across different samples and conditions, the relationships between early initiation of marijuana use and further substance abuse, criminal behaviors, and arrests were analyzed in two disparate samples of youth. The first sample was drawn from an earlier CSAT evaluation and the second drawn from the 1993 and 1995 National Household Survey of Drug Abuse (NHSDA). The purpose of this analysis was to assess the association between the early initial marijuana use and other substance use and criminal behaviors for the youth in each sample. A key question was whether an association between early initiation of marijuana use and further substance use and criminal behaviors, would be found only for the more economically disadvantaged Job Corps youth, or would such an association also be found for the more normative sample of NHSDA youth.

As we were not interested in evaluating the Job Corps program per se, the students who had not yet initiated marijuana use prior to Job Corps were not included in this analysis. As the Job Corps program was implemented differently across the sites, [i.e., half the sites were designated by CSAT as enhanced or experimental sites (DTEP) and half as standard or control sites (AODA)], these differences were controlled for in the Job Corps sample analysis. Based on a subsample of respondents from the original DTEP evaluation instead of the full sample, the present analysis and the original Job Corps evaluation may not be comparable. For each set of Job Corps student analyses, a similar analysis was conducted of marijuana using youth from the 1993 and 1995 NHSDA. Whereas the Job Corps analysis examined the same students at program entry and follow-up, the 1993 and 1995 NHSDA employed different samples of respondents in each of the latter periods. For this reason, the trends or changes over time in the two surveys may not be compared. In this chapter, a summary of the analyses is presented and the implications for future research, policy, and practice are described.

### 1. SUMMARY

The analysis summaries are organized by the original analysis questions.

*What are the characteristics of the Job Corps and NHSDA students who initiated marijuana use before age 15 and those students who initiated marijuana use at age 15 years and older?*

The early initiation of marijuana use among Job Corps students, (Early Initiators compared to Late Initiators) was associated with a number of risk factors, including problems in school and at home, and early onset of criminal behavior and alcohol use. Early Initiators were

more likely to report having run away from home, having been expelled from school, having substance abusing friends and relatives, receiving substance abuse treatment, and attending a 12-step program. Males were more likely to have initiated marijuana use prior to age 15, and Whites were more likely to initiate early marijuana use compared to either African-Americans or Hispanics.

As in Job Corps, the early initiation of marijuana use was associated with a number of risk factors for the NHSDA respondents. Compared to Late Initiators, Early Initiators were less likely to complete high school, more likely to drink prior to age 15 and more likely to have been treated for substance use during the past 12 months.

Differences in the sample characteristics of the Job Corps youth at admission and the 1993 NHSDA youth were as follows. Compared to 1993 NHSDA, the Job Corps youth on the average were 2 years younger, more likely to be male, more likely to be African-American and less likely to be white. Job Corps students were also less likely to have completed high school, less likely to be employed, and less likely to be married compared to the 1993 NHSDA youth.

***Is early initial use of marijuana associated with the substance use behaviors of Job Corps students before and after Job Corps?***

The Early Initiators had higher rates of substance use compared with Late Initiators at Job Corps admission, but with the exception of binge drinking, these initial differences between the Early Initiators and Late Initiators disappeared during follow-up. In further analyses, similar results were found when the DTEP versus AODA site factor and various student factors were controlled, including age, gender, race, high school completion and employment. When these factors were controlled at admission, the Early Initiators compared to Late Initiators had a greater likelihood or odds of reporting:

- Past 30-day near-daily marijuana use (3:1 odds)
- Past 12-month cocaine use (2:1)
- Past 12-month crack use (9:1)
- Past 30-day alcohol use (2:1)
- Past 30-day and past 12-month binge drinking (2:1)
- Past 2-week smoking averaging six or more cigarettes per day (2:1).

In predicting substance use behavior during follow-up, the same admission variables were controlled in addition to the behavior of interest at baseline and the number of days of follow-up. Only the likelihood of binge drinking during follow-up remained significantly higher for the Early Initiators group compared to the Late Initiators group (2:1 odds).

Differences in age of marijuana initiation were associated with changes over time in near-daily marijuana use. The Early Initiators reported significant reductions in near-daily marijuana use between Job Corps admission and follow-up, whereas the Late Initiators reported about the same level of near-daily marijuana use in each period. In contrast, both groups reported reductions in past 30-day marijuana use and significant declines over time in past 12-month cocaine use and past 30-day binge drinking.

***Is the early initial marijuana use associated with the substance use behavior of NHSDA youth?***

Consistently higher rates of drug and tobacco use but no differences in alcohol use were reported by the Early Initiators compared to the Late Initiators in both the 1993 and 1995 NHSDA. With other variables controlled, Early Initiators were more likely to report:

- # Near-daily marijuana use (4:1 odds each year)
- # Any past 30-day marijuana use (2:1 odds each year)
- # Past 12-month cocaine use (2:1 odds in '93 and 3:1 odds in '95)
- # Past 12-month crack use (3:1 odds each year)
- # Smoked 6 cigarettes per day/past 2 weeks (1.5:1 odds in '93 and 2:1 odds in '95).

No differences were found in the rates of substance use in the 1993 and 1995 NHSDA surveys.

***Is the early initial marijuana use associated with the Job Corps students' criminal behaviors and arrests before and after Job Corps?***

Higher rates of criminal behavior among the Job Corps youth were associated with earlier initial marijuana use before admission and during follow-up, including DUI, destroying property, and assaults. With age, gender, high school completion, and work status controlled, the association of these variables with age of initial use was no longer evident. In multivariate analysis, however, the odds of reporting an arrest prior to admission was 45 percent higher for the Early Initiators. Similar results were found during follow-up.

The reported instances of assaulting someone rose significantly between admission and follow-up for both Job Corps groups. Only the Late Initiators reported an increase in the percentage of DUI and destroying property between admission and follow-up, whereas the Early Initiators reported no significant changes in these behaviors over time. Both groups reported significant increases in arrests, however. In summary, assault and arrest rates increased from Job Corps admissions to follow-up for both early and late initiators. After controlling for other variables including baseline rates of assaults and arrests, respectively, clients in the Early

Initiation group had a higher odds of being arrested compared to the Later Initiation group but the two groups had similar odds of assaulting someone.

***Is the early initial marijuana use associated with the criminal behavior and arrests for NHSDA youths?***

The analytic results of respondents to the 1993 and 1995 NHSDA surveys were consistent with the Job Corps findings with respect to assaults. Using multivariate analyses to control for other respondent characteristics, Early Initiators on both the 1993 and 1995 NHSDA had a higher (2:1) odds of assaulting someone compared to Late Initiators. Also, with other variables controlled, Early Initiators on the 1995 NHSDA had a 50 percent higher odds of DUI behavior. The Early Initiators on the 1993 NHSDA survey reported higher arrest rates and on the 1995 NHSDA survey reported higher rates of destroying property, however, these findings vanished once other variables were controlled. In summary, the data clearly suggest that an earlier age of initial marijuana use is associated with higher levels of assault behavior for marijuana using NHSDA youth. The data also suggest that early initiation of marijuana use is associated with higher levels of DUI behavior in this normative sample of marijuana users.

**2. IMPLICATIONS FOR RESEARCH, POLICY, AND PRACTICE**

Findings from the early use of marijuana analysis serve two primary purposes. First, the findings extend the growing body of literature that demonstrates associations between high risk factors for substance use, early initiation of marijuana use and later substance abuse and criminal behaviors. The current findings also extend the importance of these factors to a more normative and presumably less vulnerable population of youth. Second, the findings support the identification of implications for further research, policy, and practice, as described below.

**2.1 Implications for Research**

**Compare a single cut point for age of initial use with an age continuum.** In the present analysis, age of initial marijuana use was assessed as a dichotomous variable, whereby the students who initiated use before the cut point age of 15 were compared to those who initiated use after the cut point, i.e. at age 15 and older. Another possibility is that an earlier onset of use becomes increasingly associated with later substance abuse problems along a continuum, whereby the problems become worse with a younger age of onset and better with an older age of onset. To investigate this possibility, Job Corps students during admission and follow-up would be compared along an age of initial use continuum, say from ages 12 through 18 and higher. Such an analysis would indicate whether the problems that were associated with early initiation of

marijuana use based on a single age cut point, i.e., less than age 15 and age 15 and older would increase with younger ages of initiation below this cut point and decrease with older ages of initiation above it.

**Determine time line between initial marijuana use and regular use.** The mean age of clients admitted to Job Corps was about 18.5 years, yet at Job Corps admission the odds of using marijuana on a near-daily basis was 3 times higher for the group that initiated marijuana use prior to age 15, compared to the group that initiated such use at age 15 and older. Given that the Late Initiators had less time to develop into regular users prior to Job Corps admission, it is possible that in the absence of Job Corps, they, too, would eventually have engaged in regular marijuana use to the same extent as the Early Initiators. To examine this possibility, further research is needed to determine the time line between initial and regular use for both the Early Initiators and Late Initiators.

**Expand use of NHSDA for substance abuse treatment evaluation.** The NHSDA survey provides a convenient sample to assess secular trends and a benchmark for normative behavior. Frequently, treatment evaluations rely on before and after treatment comparisons to make inferences concerning program success. With an adolescent sample such as Job Corps, such changes in behavior may be attributed to maturation and secular trends in the population, as alternatives to the program itself. Given the relatively small sample size of respondents who were comparable to the Job Corps students in the NHSDA surveys, the Job Corps youth could not be adequately matched to the NHSDA youth on important socioeconomic risk factors. As SAMHSA's Office of Applied Studies has expanded the 1999 NHSDA from 18,000 to 70,000 respondents to include State data, more extensive normative data will soon be available to which treatment samples may be compared.

## 2.2 Implications for Policy

As demonstrated by the literature review and the results of this analysis of adolescent substance use, there are indisputable relationships among age of first drug use, criminal behaviors, and later substance abuse. Policy makers would be well served if they recognize and understand the relationships between early substance use and later aberrant behaviors as well as the relationships between high-risk youth and substance abuse. Adolescent treatment and prevention services are critically needed, and, if shown to be effective, are deserving of at least the same, if not more attention (and funding) as is provided by national policy decision makers for adult services. CSAT evaluators, together with the substance abuse treatment field, must

ensure that the critical information about adolescent substance abuse reaches those in positions of policy development.

### 2.3 Implications for Practice

**Expand mental health services for adolescents.** In addition to the early onset of alcohol and drug use, Job Corps participants frequently reported other behavioral problems, including early onset of criminal behavior and problems at home and in school. These problems were especially acute among the early marijuana initiators. Consistent with the literature, such behaviors frequently coincide with a conduct disorder diagnosis and can be precursors of adult mental health problems. Based on these findings, it is recommended that adolescents in treatment or prevention programs be provided with mental health assessment and services and that the effectiveness of such services be carefully evaluated.

**Provide more comprehensive services to the early initiating youth in Job Corps.** Given that the Early Initiators in our analysis were shown to be more at risk for substance abuse and criminal behavior, we recommend that they be offered the benefits of a comprehensive array of services. Although our data did not examine the services components that were provided to Early Initiators and Late Initiators and their effectiveness, a prior analysis by Orwin and Ellis (2001) did assess such data. In general, DTEP students who received a comprehensive array of substance abuse and non-substance abuse services and those who received both individual and group counseling reduced their substance use during follow-up to a greater degree compared to students who only received substance use services and/or individual counseling alone. Therefore, we suggest that a comprehensive array of substance abuse and non-substance abuse services be targeted in particular to the more at-risk youth, especially those who report early initiation of substance use. Further analysis is also needed to assess the cost effectiveness of these services for the youth in each group.

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**APPENDIX A**  
**1993 AND 1995 NHSDA VARIABLES USED IN ANALYSIS**

| <b>1993 AND 1995 NHSDA VARIABLES USED IN STUDY</b>               |             |             |
|--|-------------|-------------|
| <b>Personal Characteristics</b>                                  | <b>1993</b> | <b>1995</b> |
| Gender   | IRSEX       | IRSEX       |
| Age  | IRAGE       | IRAGE       |
| Marital status   | IRMARIT     | IRMARIT     |
| High school graduate   | IRHSGRAD    | IRHSGRAD    |
| Currently working  | IRWORKST    | IRWORKST    |
| Race   | RACE        | RACE        |
| Ever received drug treatment                                     | TRMNTHLP    | NA          |
| Ever attended a self help group                                  | TRMNTSHG    | NA          |
| Currently receiving welfare                                      | IRWEL1      | IRPUB1      |
| <b>Alcohol, Drug and Tobacco Use</b>                             | <b>1993</b> | <b>1995</b> |
| Age initiated alcohol use  | ALCTRY      | ALCTRY      |
| Number of cigarettes smoked per day in past 30                   | AVCIG       | AVCIG       |
| Age first used marijuana   | MJAGE       | MJAGE2      |
| Near-daily marijuana use/marijuana use in 20 of past 30 days     | MJDAY30A    | MJDAY30A    |
| Past 30-day cocaine use  | COCMON      | COCMON      |
| Past 12-month cocaine use  | COCYR       | COCYR       |
| Past 30-day crack use  | CRKYR       | CRKYR       |
| Past 12-month alcohol use  | ALSMON      | ALSMON      |
| Had 5 or more drinks per hour in the past 30 days                | DR5DAY      | DR5DAY      |
| <b>Criminal Behavior/Arrests</b>                                 | <b>1993</b> | <b>1995</b> |
| Purposely damaged property (not yours)                           | DAMAGE      | DAMAGE      |
| Arrested and booked in the past 12 months                        | NOBOOKYR    | NOBOOKYR    |
| Driving under the influence of drugs or alcohol                  | DRNKDRV     | DRNKDRV     |
| Getting into a physical fight                                    | PHYFIGHT    | PHYFIGHT    |
| Hurting someone badly enough so they needed bandages or a doctor | HURTBAD     | HURTBAD     |

**The perspective offered in this document is solely that of the author(s) and does not reflect the policies or views of the Federal government, or any of its Departments or Agencies.**