The effect of treatment completion and length of stay on employment and crime in outpatient drug-free treatment

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Zarkin, G. A., Dunlap, L. J., Bray, J. W., & Wechsberg, W. M. (2002). The effect of treatment completion and length of stay on employment and crime in outpatient drug-free treatment. *Journal of Substance Abuse Treatment, 23*(4), 261–271.

Abstract:

Length of stay in treatment has been found to be a significant predictor of positive post-treatment outcomes, such as decreases in unemployment and crime. However, length of stay may be an incomplete predictor of successful treatment. Surprisingly, few studies have examined whether completing treatment in addition to length of stay is an important factor in explaining positive treatment outcomes. The objective of our study is to examine the effect that treatment completion and length of stay have on post-treatment employment and crime for patients in outpatient drug-free treatment, the largest treatment modality in the United States. We use conditional logit and multiple regression models with program-level indicator variables (fixed effects) to estimate the effect of treatment completion and length of stay on employment and crime controlling for drug use severity, previous treatment history, and other patient demographics. Data are from the National Treatment Improvement Evaluation Study and include 986 adults enrolled in outpatient drug-free programs across the United States. We find that treatment completion and length of stay are significantly related to post-treatment employment. Holding length of stay constant, the occurrence of employment at follow-up among patients who complete their planned treatment is almost 2 times that of patients who do not complete treatment. However, treatment completion did not have a statistically significant effect on the probability of post-treatment crime. Although our results are mixed, these findings suggest that greater attention should be placed on evaluating the importance of both length of stay and treatment completion in treatment outcome studies.

Keywords: Substance abuse | Treatment completion | Length of stay | Employment | Crime

Article:

1. Introduction

Many studies in the past few decades have shown the effectiveness of substance abuse treatment as measured by post-treatment outcomes such as drug use, criminality, and employment. A common finding in the substance abuse treatment literature is that patients who stay in treatment longer have better outcomes Condelli & Hubbard, 1994, De Leon, 1985, Etheridge et al., 1999, Hubbard et al., 1989, Hubbard et al., 1997, Simpson & Sells, 1982 and Simpson et al., 1999. Based on such studies, researchers, policy makers, and treatment providers have often focused on ways to increase patients' lengths of stay and consequently improve treatment outcomes.

Recent randomized studies raise questions about length of stay as an important predictor of successful treatment outcomes. Although some randomized studies have found that patients who stay in treatment longer have better outcomes Gottheil et al., 1998, Guydish et al., 1999 and McCusker et al., 1996, other studies have found no significant effect of length of stay on outcomes Kamara & Van Der Hyde, 1998, Longabaugh et al., 1995, McCusker et al., 1995 and Nemes et al., 1999. McCusker and colleagues (1995) found minimal differences in outcomes for patients at two therapeutic communities in which patients were randomized among varying lengths of stay between 3 and 12 months. Kamara and Van Der Hyde (1998) found no major differences in post-treatment drug use or employment for patients randomized between a 3-month and 6-month outpatient treatment program. However, they did find that for those employed post-treatment, patients receiving longer treatment had fewer work-related problems.

Nemes and colleagues (1999) found no statistically significant effect of treatment intensity on post-discharge drug use for patients in a therapeutic community in which they were randomized between a standard program with 10 months inpatient and 2 months outpatient and an enhanced program with 6 months inpatient and 6 months outpatient. They did find, however, that women in the standard program were less likely to have a post-discharge arrest and more likely to be employed. Using the same sample in a related study, Messina, Wish, and Nemes (2000) found that clients who completed the 12 month program (standard or enhanced) had better outcomes than those who did not complete the program. They concluded that treatment completion was an important predictor of post-treatment outcomes.

As noted by McLellan, Woody, & Metzger (1996) in a review of studies on substance abuse treatments, these findings suggest that merely increasing duration of treatment may not be adequate to produce desired treatment outcomes. Thus, although many studies suggest that treatment success depends largely on length of stay, it may also be that success is closely related to other aspects of treatment, such as whether a patient completes a planned treatment regimen as prescribed by the program.

The question about the significance of length of stay in conjunction with other treatment factors is important to understand, especially in the era of managed care. In the past decade, the substance abuse treatment field has seen an increased use of managed care practices in the delivery and financing of substance abuse treatment. The primary mechanism often employed to control treatment costs is to limit specific services provided and to reduce treatment duration. To better understand the impact of these managed care practices, we need to understand the factors, in addition to length of stay, that help achieve desired outcomes. It may be possible, for example, to maintain effective treatment with reduced lengths of stay if, in fact, other important treatment

factors are implemented. Or it may be that, regardless of other treatment factors, a minimum length of stay is necessary to achieve desired outcomes.

In the past few years, research has begun to examine the effect of specific treatment factors such as services and treatment completion on outcomes, and the findings have been mixed. Some studies have examined whether treatment completion, without controlling for length of stay, is an important factor in predicting treatment outcomes (Harrison & Asche, 2001 and Luchansky et al., 2000a). Harrison and Asche, in a study of clients admitted to outpatient and inpatient programs in Minnesota found that treatment completion was a statistically significant predictor of 6-month post-treatment abstinence for adult outpatient clients, but not for adult inpatient clients. Adult outpatient clients who completed treatment were found to be over two times more likely to be abstinent 6 months after their treatment episode. Luchansky and colleagues examined the effect of treatment completion and completion of a post-treatment vocational services regimen on employment outcomes for indigent clients in Washington State. They found a statistically significant effect of treatment completion.

Other studies have examined whether treatment completion, in addition to length of stay, is an important factor in predicting positive treatment outcomes. Some of these studies have found that those who complete treatment have better outcomes than those who do not (Luchansky et al., 2000b, Messina et al., 2000, Pettinati et al., 1996, Stark, 1992 and Toumbourou et al., 1998). For clients in Washington state, Luchansky and colleagues examined factors affecting readmission to substance abuse treatment in the year following a treatment episode. They found that treatment completion was negatively and statistically significantly associated to readmissions, but length of stay (measured as a dichotomous variable equal to 1 if the episode was less than 90 days) was not significant. The reduction in risk of readmission attributable to treatment completion ranged from 20 to 30 percent for the client groups analyzed.

However, other studies examining treatment completion while controlling for length of stay have found no difference in treatment outcomes between treatment completers and noncompleters (McMahon, Kouzekanani, & Malow, 1999). In a small study of male cocaine users in treatment in two therapeutic communities in Dade County, Florida, McMahon and colleagues found that, after controlling for treatment duration, treatment completion had no effect on substance use, coping skills, or social support characteristics at 3 and 6 months after treatment.

The findings from these studies have some limitations. Most studies comparing treatment completers with noncompleters include individuals in therapeutic communities or residential treatment only (McMahon et al., 1999). Thus, little is known about the effects of length of stay and treatment completion for individuals in outpatient drug-free treatment, the largest modality in the United States. Furthermore, many studies include patients from only one or two programs or from a small geographic area, making it difficult to draw any conclusions beyond the sample.

Our study extends the current research by examining the effect of both length of stay and treatment completion on post-treatment employment and crime for a large sample of outpatient drug-free patients enrolled in programs across the United States. We focus on employment and crime outcomes because research has shown that they are associated with the largest social costs of drug abuse (Hubbard et al., 1989 and National Research Council Institute of Medicine, 1990).

Thus, the results of this study provide useful information to policy makers, funding agents, and providers as they plan the delivery of services for individuals with substance abuse problems and seek policies to reduce the social cost of drug abuse.

2. Materials and methods

The data in this study are from the National Treatment Improvement Evaluation Study (NTIES) that was conducted by the National Opinion Research Center in collaboration with RTI. The National Treatment Improvement Evaluation Study is one of the most extensive national substance abuse treatment evaluation studies to date, providing data on treatment services and outcomes on the largest drug treatment follow-up sample in the substance abuse treatment evaluation field (The Center for Substance Abuse Treatment [CSAT], 1999a). The Center for Substance Abuse Treatment (CSAT) funded NTIES to determine how CSAT demonstration grants initiated between 1989 and 1992 were being used and to estimate the improvement in treatment services generated by such funding.

The NTIES sample was a purposive sample designed to meet the specific needs of CSAT and is therefore not representative of patients or programs nationally. Rather, it is representative of the program areas in CSAT's demonstration grant program in 1990–1991. The three demonstration grant areas focused on: (1) improving treatment in large cities (Target Cities program); (2) improving access and treatment for disadvantaged populations (Critical Populations program); and (3) providing services for probationers, parolees, and inmates (Criminal Justice program). The NTIES sample consisted of patients in treatment programs that received direct funding from any of these three demonstration grant areas Gerstein et al., 1997). Funding from these grant areas typically supports underserved populations such as minorities, pregnant women, at-risk women, public housing residents, welfare recipients, those in the criminal justice system, and adolescents. When compared to populations nationally, the NTIES sample has more publicly supported treatment programs, a higher proportion of patients in correctional facilities, more inner-city populations, and a higher proportion of Hispanic and African-American patients. As a result, NTIES findings are most representative of low income groups receiving treatment in public sector programs (CSAT, 1999b).

Patient data was collected by NTIES between 1992 and 1995 on 6,593 patients enrolled for treatment at 78 participating treatment programs representing six treatment modalities: methadone maintenance, methadone detoxification, outpatient drug-free, short-term residential, long-term residential, and correctional (see Gerstein et al., 1997, for more details on the study design). Of these, 4,526 completed three interviews: intake, discharge, and a 1-year follow-up. The intake questionnaire collected general demographic information and data on treatment history and behavior in the 12 months prior to the current treatment episode. The discharge interview collected data on the patient's treatment experience, drug and alcohol use during treatment, and other behaviors and living conditions during treatment. The follow-up questionnaire collected information similar to the intake questionnaire but for the post-treatment period. NTIES team members also conducted record abstractions on patients and collected information on treatment-related items such as primary diagnoses, services received, reasons for discharge, and lengths of stay.

For this study, we included only outpatient drug-free patients who completed all three interviews: intake, discharge, and follow-up (N = 1,333). We excluded patients who were less than 18 years of age because adolescent substance abusers may have different treatment objectives, experiences, and outcomes than adult substance abusers, suggesting that these 2 groups should not be pooled together. We excluded patients who left treatment within 1 week of admission to eliminate individuals who do not truly engage in treatment. We also excluded patients who were in school or training at the time of follow-up, and we limited our sample to patients who were not in treatment at the time of the follow-up interview. We felt that both groups of individuals may be less likely to seek employment. After applying our exclusion criteria, our sample included 1,136 patients. Finally, 150 patients were excluded from the employment analysis and 169 patients were excluded from the crime analysis due to missing data on analysis variables. Therefore, our final samples include 986 outpatient drug-free patients in 28 programs for the employment analysis and 967 outpatient drug-free patients in 23 programs for the crime analysis.

2.1 Variables

Our outcome measures were post-treatment employment status and criminal activity. Crimes include selling drugs, trading sex for money, robbery, shoplifting, burglary, and assaults. We excluded more violent crimes such as rape and murder because the incidence of these crimes was very low in our data. We first considered dichotomous measures of current employment status and whether a crime was committed over the follow-up period. The employment status variable was equal to one if the patient was currently employed either part-time or full-time at the time of the follow-up interview (approximately 12 months after leaving treatment) and zero otherwise. The crime status variable was equal to one if the patient committed a crime in the follow-up period and zero otherwise. Next, for those who worked or committed a crime, we considered continuous measures of hours worked per week at the time of the follow-up interview and the number of crimes committed over the follow-up period.

The main explanatory variables of interest are length of stay and treatment completion status. Length of stay is defined as weeks in treatment and was determined from information provided on discharge forms from the program and verified by the patient in the treatment discharge and follow-up interviews. We defined treatment completion as a dichotomous variable equal to one if the patient completed treatment as defined by the program at the time of the discharge interview and zero otherwise. Completion status was identified from information collected on patients' record abstraction forms. If a program reported that the reason for a patient's discharge was “completed planned treatment,” then the patient is classified as a treatment completer. If a program reported that the patient was discharged for any reason or the patient had not completed treatment by the time the record abstraction form was completed, then the patient is classified as a noncompleter. Reasons for leaving treatment other than completion included referral to another program, discharge prior to completion by program administration, discharge prior to completion by patient choice, death, or incarceration.

To control for patients' drug use severity at intake, we used self-reported pre-treatment drug use variables. These variables included days of alcohol use in the 30 days prior to treatment for alcohol; days of heavy alcohol use (defined as having 5 or more drinks on the same occasion on

at least 5 different days in the past 30 days); and days of cocaine, heroin, marijuana, and crack use.

To control for patients' prior treatment history, we included two dichotomous measures of whether the patient had received mental health inpatient or outpatient services in the past 12 months prior to treatment and a measure of the number of past drug abuse treatment episodes (one prior episode, two or more prior episodes, and number of episodes unknown with no prior treatment episodes as the reference category). In addition, we included a variable to indicate if the patient had been required or strongly encouraged to attend treatment by someone in the criminal justice system. Finally, we included several demographic variables in our models—age, gender, race/ethnicity, marital status, number of dependents, homelessness, and years of schooling—to control for differences in patient characteristics and severity that may affect treatment outcomes.

The NTIES design was such that patients had treatment departures at different calendar times and had varying lengths of follow-up periods. Because of business cycle conditions, the date at which a patient leaves a program may affect crime and employment opportunities. Therefore, we created a group of dichotomous variables to control for differences in patients' dates of treatment departure. We created three variables indicating whether the patient received the follow-up questionnaire in the first half of 1994, the second half of 1994, or the first half of 1995. In addition, because patients with longer follow-up periods may have more time in which to be employed or commit a crime, we created a continuous variable for the number of days from administration of the treatment discharge questionnaire to administration of the follow-up questionnaire.

2.2 Methods

The objective of our analysis is to determine the effect of two in-treatment variables—length of stay and treatment completion—on post-treatment employment and criminal behavior, holding constant pre-treatment employment and criminal behavior and other pre-treatment patient variables. We include pre-treatment outcomes because behavior tends to be correlated over time and they serve as additional measures for the severity of patients' diagnosis upon treatment entry.

n our sample, 52% of patients were not employed at follow-up, and 82% of patients did not commit any crimes in the post-treatment period; therefore, we have a large number of zeros for these outcome variables. To model this pattern of zeros, we use a two-part model (Culyer & Newhouse, 2000) that divides the analysis into two steps—whether to be employed (commit a crime) and then, conditional on being employed (committing a crime) how much to work (how many crimes to commit). First, using the full sample, we examine separately how length of stay in treatment and treatment completion affect the propensity to be employed at the time of the follow-up survey or to commit a crime during the follow-up period. Because our dependent variables for these models are dichotomous, standard ordinary least squares regression is inappropriate. Thus, we used logistic regression of the form:

$$\Pr\{Y_{post} = 1\} = f[B0 + (B1 \times Y_{pre}) + (B2 \times LOS) + (B3 \times TxComp) + (B4 \times X)] \quad (1)$$

where Y is the discrete employment or crime outcome at the individual patient level, equal to one if the individual is employed or committed a crime as appropriate; Ypre is a discrete pre-treatment measure of our outcome variable; LOS (length of stay) is a continuous variable equal to the number of weeks in treatment; TxComp (treatment completion) is a dichotomous variable equal to one if the individual completed treatment; X is a vector that represents various pre-treatment individual characteristics, the patient's treatment departure date, and the length of the follow-up period (see Table 1); and f(·) is the logit function.

Table 1
Variable means

Variables	Means (Standard deviation)		
	Full sample (N = 986)	Treatment completers (n = 216)	Treatment noncompleters (n = 770)
Employment Status			
Employed in pre-treatment period	0.31 (0.46)	0.36 (0.48)	0.30 (0.46)
Employed in post-treatment period[a]	0.48 (0.50)	0.63 (0.48)	0.44 (0.50)
Hours worked per week in pre-treatment period (conditional on being employed in the follow-up period)	19.09 (22.31)	21.09 (22.65)	18.30 (22.16)
Hours worked per week in post-treatment period (conditional on being employed in the follow-up period)	40.84 (13.23)	41.90 (11.34)	40.43 (13.90)
Crime			
Committed a crime in pre-treatment period	0.88 (0.32)	0.82 (0.39)	0.90 (0.30)
Committed a crime in post-treatment period	0.18 (0.38)	0.16 (0.37)	0.19 (0.39)
Number of crimes committed in past 12 months prior to treatment (conditional on committing a crime in the follow-up period)	187.43 (177.76)	184.18 (166.05)	188.22 (181.12)
Number of crimes committed in post-treatment period (conditional on committing a crime in the follow-up period)	34.71 (46.54)	26.26 (37.74)	36.82 (48.39)
Treatment Variables			
Completed treatment	0.22 (0.41)	1.00 (0.00)	0.00 (0.00)
Length of stay (weeks)[a]	18.23 (14.62)	21.26 (12.26)	17.38 (15.12)
Time out of treatment (weeks) at time of follow-up interview	42.05 (12.59)	41.70 (12.26)	42.15 (12.69)
Treatment was required by criminal justice system	0.41 (0.49)	0.45 (0.50)	0.39 (0.49)
No prior drug abuse treatment episodes	0.38 (0.48)	0.40 (0.49)	0.37 (0.48)
One prior drug abuse treatment episode	0.24 (0.43)	0.24 (0.43)	0.24 (0.43)
Two or more prior drug abuse treatment episodes	0.34 (0.47)	0.35 (0.48)	0.34 (0.47)
Number of prior drug abuse treatment episodes unknown	0.05 (0.21)	0.02 (0.14)	0.05 (0.22)
Drug Use Prior to Treatment			
Days of alcohol use in past 30 days prior to treatment[b]	5.08 (8.49)	6.28 (9.50)	4.75 (8.15)
Days of heavy alcohol use in past 30 days prior to treatment	1.89 (4.88)	1.97 (4.88)	1.86 (4.89)
Days of cocaine use in past 30 days prior to treatment	0.58 (3.07)	0.53 (3.16)	0.59 (3.05)
Days of heroin use in past 30 days prior to treatment[b]	0.48 (3.08)	0.04 (0.55)	0.60 (3.46)
Days of marijuana use in past 30 days prior to treatment	1.24 (4.62)	1.07 (4.54)	1.28 (4.64)
Days of crack use in past 30 days prior to treatment	1.48 (4.65)	1.64 (4.77)	1.44 (4.62)
Mental Health Treatment History prior to Treatment			
Received inpatient mental health treatment in past 12 months	0.07 (0.26)	0.08 (0.27)	0.07 (0.26)
Received outpatient mental health treatment in past 12 months	0.12 (0.33)	0.14 (0.35)	0.12 (0.32)
Demographics			
Age	33.82 (8.72)	34.59 (9.47)	33.60 (8.49)
Male[b]	0.71 (0.45)	0.76 (0.43)	0.69 (0.46)
Nonwhite[b]	0.76 (0.42)	0.70 (0.46)	0.78 (0.41)
Married	0.22 (0.42)	0.24 (0.43)	0.22 (0.41)
Number of dependents	1.10 (1.61)	0.98 (1.40)	1.13 (1.67)
Homeless in past 30 days prior to treatment	0.07 (0.26)	0.06 (0.24)	0.08 (0.26)
Years of schooling[a]	11.46 (2.04)	11.95 (2.08)	11.32 (2.01)

[a] Difference in means between treatment completers and noncompleters is statistically significant at $p < .01$.
[b] Difference in means between treatment completers and noncompleters is statistically significant at $p < .05$.

This model is different from many previous specifications examining the relationship between outcomes and drug abuse treatment because we focus on the effect of treatment completion while controlling for length of stay. Much of the previous research in this area has focused on length of stay alone. We hypothesize that, controlling for length of stay, patients who complete treatment are more likely to be employed after treatment than patients who do not complete treatment. Furthermore, these individuals are less likely to commit a crime than patients who do not complete treatment.

In the second part of our analysis, we examine the effect of length of stay and treatment completion on hours worked per week (given that the individual worked) and the number of crimes committed during the follow-up period (given that the individual committed a crime). Our empirical specification is identical to the logistic models except that the dependent variable is now continuous, allowing us to use ordinary least squares regression. The regression equation is of the form:

$$\mathbf{Y}_{post} = \mathbf{B0} + (\mathbf{B1} \times \mathbf{Y}_{pre}) + (\mathbf{B2} \times \mathbf{LOS}) + (\mathbf{B3} \times \mathbf{TxComp}) + (\mathbf{B4} \times \mathbf{X}) + \mathbf{e} \qquad (2)$$

where Y is hours worked per week or the number of crimes committed. The explanatory variables are the same as those defined for Equation (1) and e is an error term. Equation (2) is estimated only for those individuals who were employed or committed a crime during the post-treatment period. Due to the skewness of the crime and hours data, we estimated two specifications of each model—with and without the logarithm of the number of crimes (and hours). The results differed little between the two specifications and we present the unlogged results for ease of interpretation. Logged results are available from the corresponding author upon request.

A potential problem for Equations (1) and (2) is selection bias. The potential for selection bias arises because individuals were not randomly assigned to varying lengths of stay or to treatment completion/noncompletion. The observed length of stay and treatment completion may be based in part on program-level and patient-level variables unobserved by the researcher that may also be correlated with employment or criminal behavior. For example, patients who are in more intense treatment programs may be more likely to complete treatment, more likely to be employed post-treatment, and less likely to commit crimes post-treatment. We are unable to control specifically for these unobservables so they are included in the error term. Thus, the error term may be correlated with length of stay and treatment completion, resulting in biased coefficients.

One method that has been proposed to address selection bias in evaluation studies is a fixed effects model Heckman & Hotz, 1989 and Heckman & Robb, 1985. Program-level indicator variables (fixed effects) control for unobserved differences across programs that are fixed within treatment programs and do not vary over time. These differences may include differences in programmatic focus, program intensity, treatment philosophy, demographic composition of the patients and staff, and staff training. Almost certainly, these differences exist across programs. By including program-level fixed effects, the estimation methodology uses variation in length of stay and treatment completion across patients within each treatment program to identify the length of stay and treatment completion effects. By using within program variation in these

variables, we control for potential bias caused by differences in unobservables across programs. Therefore, to address the potential program-level selection bias in our specifications, we estimate our empirical equations with program-level fixed effects. For the continuous outcomes in Equation (2), we use a fixed effects ordinary least squares model, which is equivalent to including program indicator variables in the model. Because the logit is a nonlinear model (Equation 1), the method that is equivalent to the fixed effect is the conditional logit (StataCorp, 1999).

3. Results

Table 1 shows the means of the dependent and explanatory variables by treatment completion status for the larger sample used in the employment analysis (N = 986). Approximately 31% of the sample was employed prior to treatment compared to 48% who were employed at the time of the follow-up interview. Although the probability of being employed increased for both treatment completers and noncompleters, the magnitude of the increase was much greater for treatment completers, and the difference in means between the two groups post-treatment was statistically significant ($p < .01$). Of those employed at follow-up (n = 477), the average hours worked per week was about 41 compared to only 19 hours prior to treatment. We found similar improvement in hours worked per week for both treatment completers and noncompleters. Mean differences between the two groups post-treatment were not statistically significant.

Approximately 18% of the sample reported committing at least one crime during the follow-up period compared to 88% who reported committing a crime in the 12 months prior to treatment. The propensity to commit a crime greatly decreased for both treatment completers and noncompleters, and the difference in means between the two groups post-treatment was not statistically significant. Of those committing a crime in the follow-up period (n = 170), the average frequency of crimes was about 35 occurrences compared to over 187 occurrences during the 12 months prior to treatment. Again, we found that the number of crimes decreased for both treatment completers and noncompleters after treatment, and the difference in means post-treatment was not statistically significant.

Only 22% of the sample completed their planned treatment protocol as reported by the program (n = 216). This rate of completion is similar to findings from other studies. For example, Simpson (1981) found that only 20% of 455 outpatient drug-free patients in the Drug Abuse Reporting Program (DARP) study completed treatment. The average length of stay for patients in the sample was approximately 18 weeks. Only 3% of the sample remained in treatment for more than 1 year. Almost three quarters of the sample either completed treatment or left treatment after 24 weeks. Perhaps surprisingly, a simple correlation analysis between treatment completion and length of stay revealed that they were not highly correlated (Spearman's rank correlation coefficient equal to .18). Additional support for the low correlation of treatment completion and length of stay is provided in our sensitivity analysis in which we found that excluding treatment completion from the model did not change the size or statistical significance of the parameter estimate for length of stay.

Approximately 40% of the sample was required or encouraged to attend treatment by the criminal justice system. This percentage is comparable to both the Treatment Outcomes

Prospective Study (TOPS) and the Drug Abuse Treatment Outcome Study (DATOS) that found that 31% and 42% of their outpatient drug-free patients had received a criminal justice referral, respectively Craddock et al., 1997 and Hubbard et al., 1989.

The mean number of days of alcohol use in the past 30 days prior to treatment was about 5 days. The average number of days of use for each of the other drugs was less than 2 days in the past 30 days prior to treatment. Thus, the primary drug of use immediately prior to outpatient treatment was alcohol.

Only 7% of the sample received inpatient mental health services during the 12 months prior to treatment, and 12% received outpatient mental health services. These two categories were not mutually exclusive, with 4% of the sample receiving both inpatient and outpatient mental health services in the 12 months prior to treatment. The average age of patients in the sample was approximately 34 years. Seventy-six percent of the sample was nonwhite and 71% was male.

3.1 Multivariate results

3.1.1. Employment

The first two columns of Table 2 present the parameter estimates from the employment analysis. For the conditional logit analysis, each parameter estimate measures the change in the log odds ratio for a change of one unit in the explanatory variable (Hosmer & Lemeshow, 1989). The log odds ratio is defined as the ratio of the log odds for 2 groups—one group in which the event occurs ($x = 1$) and one group in which the event does not occur ($x = 0$). For dichotomous variables, a more intuitive interpretation is to present the odds ratio, which is simply derived by exponentiating the parameter coefficient. We present this transformation below for key dichotomous explanatory variables for which it is most useful. For the continuous regression analysis (OLS) of hours worked per week, the parameter estimate measures the change in the outcome (hours worked per week) given a unit change in a given explanatory variable.

Similar to findings in previous studies, our results indicate that patients who stayed in treatment longer were more likely to be employed in the post-treatment period ($p < .01$). We also found that completing treatment had a positive and statistically significant effect on the probability of being employed at the time of post-treatment follow-up. The odds ratio of 1.65 ($e^{0.498}$), suggests that the occurrence of employment among treatment completers was approximately 1.65 times that of noncompleters.

To judge the relative magnitude of the coefficient estimate for length of stay, we estimated the average across patients of the percentage change in the probability of being employed at follow-up relative to the percentage change in length of stay. Our estimate was 0.35, suggesting that a 10% increase in length of stay increases the average probability of employment by only 3.5%, a less than proportionate increase.

Days of heroin use ($p < .05$) and days of crack use ($p < .10$) in the 30 days prior to intake were negatively related to post-treatment employment. Thus, more severe patients at treatment entry were less likely to be employed after treatment. Other significant predictors of post-treatment

employment were age, age squared (which captures non-linear age effects), highest grade completed, being male, being nonwhite, and being employed in the 12 months prior to treatment.

Table 2
Multivariate analyses of employment and crime in follow-up period

Variables	Probability of employment at follow-up: Conditional logit[a] (standard error)	Linear models for hours worked per week: Site-level fixed effects (standard error)	Probability of crime during follow-up Period: Conditional logit[a] (standard error)	Linear models for number of crimes during follow-up period: Site-level fixed effects (standard error)
N	986	477[b]	967	151[c]
Length of stay (weeks)	0.020*** (0.007)	0.066 (0.059)	−0.016* (0.010)	−0.622 (0.424)
Completed treatment	0.498** (0.203)	0.555 (1.556)	−0.313 (0.263)	−14.277 (11.099)
Employed at treatment entry	1.261*** (0.183)	— (—)	−0.660*** (0.241)	−0.108 (10.535)
Hours worked per week in past 12 months prior to treatment	— (—)	0.049 (0.031)	— (—)	— (—)
Committed a crime in past 12 months prior to treatment	— (—)	— (—)	1.289*** (0.450)	— (—)
Number of Crimes committed in past 12 months prior to treatment	— (—)	— (—)	— (—)	0.038 (0.024)
Days of alcohol use in past 30 days prior to treatment	−0.014 (0.012)	0.016 (0.106)	0.013 (0.013)	−0.136 (0.493)
Days of heavy alcohol use in past 30 days prior to treatment	0.004 (0.020)	−0.461*** (0.166)	−0.021 (0.023)	−1.069 (0.998)
Days of cocaine use in past 30 days prior to treatment	0.008 (0.030)	−0.193 (0.301)	0.004 (0.028)	−1.383 (1.098)
Days of heroin use in past 30 days prior to treatment	−0.078** (0.040)	−0.282 (0.548)	0.016 (0.026)	2.996*** (1.083)
Days of marijuana use in past 30 days prior to treatment	−0.015 (0.017)	−0.081 (0.146)	0.036** (0.019)	1.117 (0.842)
Days of crack use in past 30 days prior to treatment	−0.036* (0.019)	0.099 (0.200)	0.051*** (0.019)	2.535*** (0.800)
Received inpatient treatment for mental illness in past 12 months prior to treatment	−0.258 (0.302)	0.967 (2.530)	0.354 (0.331)	−2.038 (13.517)
Received outpatient treatment for mental illness in past 12 months prior to treatment	−0.071 (0.249)	−5.108** (1.963)	0.387 (0.294)	−5.110 (14.229)
Male	0.525*** (0.195)	7.048*** (1.730)	0.077 (0.241)	4.780 (10.759)
Age	0.117** (0.059)	0.952* (0.567)	−0.096 (0.072)	0.849 (3.940)
Age squared	−0.002** (0.001)	−0.013 (0.008)	0.001 (0.001)	−0.006 (0.055)
Married	0.072 (0.187)	−0.449 (1.521)	0.480** (0.232)	−11.651 (11.247)
Number of dependents	−0.062 (0.051)	−0.500 (0.429)	−0.022 (0.061)	−1.899 (2.571)
Nonwhite	−0.493** (0.207)	−0.510 (1.601)	0.299 (0.267)	−13.639 (11.830)
Highest grade completed	0.113*** (0.040)	−0.008 (0.317)	−0.083* (0.051)	1.965 (2.345)
Treatment was required/encouraged by criminal justice system	0.047 (0.183)	−0.110 (1.481)	0.422** (0.219)	−14.297 (10.594)
Homeless during past 30 days prior to treatment	0.182 (0.286)	7.502*** (2.499)	−0.042 (0.349)	−5.069 (13.936)
Unknown number of prior treatment episodes	−1.151*** (0.429)	−0.572 (4.041)	−0.722 (0.673)	44.367 (35.823)
One prior treatment episode	0.075 (0.195)	−3.729** (1.575)	0.263 (0.249)	3.753 (11.619)
Two or more prior treatment episodes	0.011 (0.181)	−4.289*** (1.528)	0.542** (0.229)	−5.583 (9.835)
Administered NPAQ 2nd half 1994	−0.311 (0.282)	0.811 (2.445)	0.093 (0.361)	3.980 (15.503)
Administered NPAQ 1st half 1995	−0.143 (0.177)	−1.484 (1.425)	0.201 (0.222)	0.158 (9.839)
Time out of treatment at follow-up	0.017** (0.008)	0.121* (0.063)	0.009 (0.010)	−0.373 (0.483)
Constant	— (—)	15.920 (11.273)	— (—)	29.141 (78.824)

[a] The slope coefficients presented are interpreted as the change in the log odds ratio for a unit change in the explanatory variable. For dichotomous variables, a more intuitive interpretation is the odds ratio which is simply the exponential of the parameter coefficient. This interpretation is presented and discussed in the text for key parameters.

[b] Analysis included only those individuals who were employed in the follow-up period.

[c] Analysis included only those individuals who committed at least one crime in the follow-up period.

* Statistically significant at $p < .10$.

** Statistically significant at $p < .05$.

*** Statistically significant at $p < .01$.

Table 2 also shows the results of regressing hours worked per week on length of stay and treatment completion. This regression was limited to individuals who reported being employed at the follow-up interview. Neither length of stay nor treatment completion had a statistically significant effect on hours worked per week at follow-up. Hours worked per week at treatment entry had a positive but not statistically significant effect on the total hours worked per week at follow-up. Days of heavy alcohol use in the 30 days prior to treatment had a small negative effect on hours worked at follow-up ($p < .01$). Receipt of outpatient services for mental illness in the 12 months prior to treatment was associated with a large negative effect on total hours worked per week at follow-up ($p < .01$). Having one or more prior treatment episodes decreased the hours worked per week at follow-up compared to individuals with no prior treatment. Surprisingly, being homeless in the 30 days prior to entering treatment was associated with substantially larger post-treatment hours of work ($p < .01$).

3.1.2. Crime

The third column of Table 2 presents results from the analysis of the effects of length of stay and treatment completion on the probability of committing a crime. Length of stay had a negative and statistically significant effect on the probability of committing a crime during the follow-up period ($p < .10$). Thus, on average, individuals with longer lengths of stay were less likely to commit a crime during the follow-up period. We estimated that the average percentage change in the probability of committing a crime with respect to the percentage change in length of stay was −0.29, suggesting that a 10% increase in length of stay decreases the average probability of committing a crime by only 2.9%.

Treatment completion had a large (in absolute value) negative estimated effect on the probability of committing a crime—the occurrence of post-treatment crime among treatment completers was 0.73 times that of noncompleters ($e^{-0.313}$) —but the coefficient estimate was not significant at conventional levels. In fact, the most significant factor (as measured by both magnitude of the effect and p-value) in predicting whether an individual committed crimes after treatment was whether a person committed crimes prior to treatment. The occurrence of post-treatment crime among individuals committing a crime prior to treatment was almost four times ($e^{1.289}$) of individuals who did not commit a crime prior to treatment ($p < .01$). Individuals employed at treatment entry were less likely to commit a crime in the follow-up period than individuals who were not employed ($p < .01$). The occurrence of post-treatment crime among individuals with two or more prior treatment episodes was twice ($e^{0.542}$) that among individuals with no prior treatment episodes ($p < .05$).

The last column of Table 2 presents the regression results for the number of crimes committed by individuals who reported committing a crime in the follow-up period. Both length of stay and treatment completion had a negative effect on the number of crimes, but their effects were not statistically significant.

3.1.3. Sensitivity analysis

We examined several variations of the employment and crime models to determine the robustness of the results to changes in the model specification. We focused on changes that may

affect the key parameters of interest—treatment completion and length of stay. In one specification, we excluded treatment completion. This model is similar to models examined in previous studies. We found that the length of stay coefficient in the employment conditional logit model increased slightly from 0.020 to 0.024. Similarly, the absolute value of the length of stay coefficient in the crime conditional logit model increased slightly from 0.024 to 0.027. These results suggest that length of stay captures at most only a small part of the excluded effect of treatment completion. Thus, there appears to be an important independent effect of treatment completion on employment and crime. We also estimated models in which the lagged dependent variables were excluded from each of the specifications. We found very similar results for length of stay and treatment completion as reported here. Thus, we conclude that our findings for treatment completion and length of stay are robust to specification changes.

4. Discussion

Length of stay in treatment has often been found to be a significant predictor of post-treatment outcomes Condelli & Hubbard, 1994, De Leon, 1985, Etheridge et al., 1999, Hubbard et al., 1989, Hubbard et al., 1997, Simpson et al., 1999 and Simpson & Sells, 1982, suggesting that one of the most important factors in successful drug abuse treatment is keeping patients in treatment longer. However, findings in recent randomized trials of substance abuse treatment have raised questions as to whether length of stay is a key predictor of treatment success.

A limitation of length of stay as the sole measure of treatment exposure is that it provides only a partial view of the treatment process, and it does not provide information on the progress made by the patient while in treatment. Information on whether a patient completes treatment helps fill this gap because it captures additional information about the treatment process. A patient's completion of a program suggests that the patient received appropriate services to achieve the treatment objectives. However, treatment outcome studies rarely include both treatment completion and length of stay. In this study, we evaluated the effect of both length of stay and treatment completion on post-treatment employment and crime. We found that both length of stay and treatment completion are significantly related to post-treatment employment. Holding constant length of stay and a variety of other variables designed to capture patient severity, the occurrence of post-treatment employment for patients who complete treatment is twice that of patients who do not complete treatment. In contrast, treatment completion has a large (in absolute value) effect on the probability of committing a crime, but the estimated effect is not significant. Although our treatment completion findings are mixed, the results suggest that, at least for employment, treatment completion plays an important role. Future work should examine whether treatment completion affects other key outcomes such as drug use and health care utilization.

Our study has some limitations. First, the results presented here reflect the universe of CSAT-supported outpatient drug-free treatment programs, so they are not generalizable to the universe of all outpatient drug-free treatment programs. The NTIES sample of publicly funded community-based programs receiving CSAT funding for critical and inner-city populations includes a higher proportion of Hispanic and African-American patients than would be observed in a national probability sample. Thus, NTIES results are most reflective of public sector programs that serve lower income individuals. Another limitation is that NTIES used a purposive

sampling strategy. Thus, programs in the universe were not sampled randomly. However, it is important to note that DATOS, TOPS, and other large-scale drug treatment surveys also used purposive samples and were not nationally representative of all treatment programs. Until true random samples of drug treatment programs are collected, researchers doing real-world effectiveness studies must rely on data from NTIES, DATOS, and other purposive samples.

Another limitation is the ambiguity associated with the definition of treatment completion. Treatment success and the related concept of treatment completion are much-debated topics in the substance abuse field. Since addiction is a chronically relapsing disease and recovery is a life challenge, ambiguity exists as to when treatment is complete. Treatment completion may mean the achievement of established treatment goals (e.g., counseling attendance and clean toxicology), or it may mean a set strategy structured by the programs, courts, or managed care. Usually, the counselor and patient establish reasonable goals that arise from an assessment and treatment plan developed at the initial stage of treatment. Progress is then documented regularly in clinical records, and treatment reviews are signed by a supervisor and medical director. However, documentation of actual services received and other in-treatment process measures, such as time in group or individual sessions or treatment completion, have been inconsistent, especially in drug-free outpatient settings where standards of care are mixed. Further, completion dates may reflect more bookkeeping needs than completion of treatment goals. Yet, in some cases, completed treatment as well as attrition may be motivated by patient financial issues, incarceration, or even transition to another type of program.

In this paper, we define treatment completion based on the program's indication that an individual completed treatment. However, it is possible that individual programs are defining treatment completion inconsistently. Recognizing this, we used fixed effects methods to control for differences across treatment programs in how treatment completion may be defined. This estimation method uses variation in treatment completion of patients *within* programs to estimate the models. Thus, our results are not affected by differences across programs in how treatment completion is defined. Importantly, in spite of the potential confounders which would tend to attenuate any estimated relationship, we found substantial independent effects of treatment completion on employment and sizeable point estimates (but insignificant) for crimes.

Despite limitations, our results are noteworthy for two reasons. First, we focus on outpatient drug-free treatment, which is the largest drug treatment modality but is relatively understudied. Our results thus provide insights into an important treatment modality. Second, our analysis is performed on 986 adults in 28 treatment programs. These individuals and programs are part of NTIES, a large study that collected data from the universe of treatment programs that received CSAT funding. Previous studies of treatment completion have only examined a handful of drug treatment programs with a small number of patients.

Although our cross-section results do not prove a causal link, the results suggest that completing treatment significantly improves the probability of employment after treatment, even after controlling for the length of stay in treatment. However, our findings are mixed with no significant effect of completing treatment found for crime outcomes. Still, even with these mixed findings, the results suggest that completing treatment may be an important factor along with length of stay for some treatment outcomes and, that greater attention should be placed on

evaluating the importance of both length of stay and treatment completion in treatment outcome studies.

Acknowledgements

This study was funded through a grant from the National Institute on Drug Abuse (NIDA) (DA12420). The views expressed here do not represent those of NIDA or RTI.

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