Economic Evaluation of a Pre-Release Substance Abuse Treatment Program for Repeat Criminal Offenders

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Abstract

Substance use disorders are common conditions among repeat criminal offenders. Without addressing these underlying substance use behaviors, parolees are significantly more likely to recidivate within one year of release. New Jersey is one of the first states to actively pursue substance abuse treatment options for inmates who are in the final stages of their sentences. Given the fiscal realities of taxpayer-supported programs, such initiatives must clearly demonstrate economic benefits for sustainability and growth. The present paper conducted one of the few comprehensive economic evaluations of pre-release substance abuse treatment to determine whether Community Education Center’s’ programs in New Jersey generated desirable outcomes, significant economic benefits, and positive net benefits. Relative to a matched comparison group of offenders who did not receive treatment, the intervention group returned an average economic benefit of $4,307 to $6,209 over the 1-year post-release period. These economic benefits are underscored by the fact that the treatment program is housed in a separate facility, with a lower average per diem from that of the general inmate population. These results provide quantitative economic evidence that pre-release substance abuse treatment programs have the potential to reduce recidivism and save taxpayer dollars without adding to existing prison resources.

Keywords: Cost; Economic benefits; Substance abuse treatment
1. Introduction

The U.S. spent a total of $204 billion (approximately $690 per capita) in 2005 to incarcerate arrestees and convicted criminals in federal, state, and local prisons/jails (U.S. Courts, 2006; U.S. Department of Justice, 2008). Adjusted for inflation, this figure has increased by 31 percent over the past 5 years and by 81 percent over the past 10 years (U.S. Department of Justice, 2008). Jail and prison overcrowding is at crisis levels in most states, leading to suspended sentences, early paroles, and construction of new facilities. Predictably, many of the new inmates entering these facilities are actually returning offenders who violated the conditions of their parole or were arrested and convicted for new crimes. Criminal justice agencies routinely list chronic recidivism as one of their most daunting challenges (Field, 1998a).

Exact statistics are hard to come by, but approximately 50 percent of parole or probation violators are under the influence of drugs while committing their latest offense and this number grows with the offenders’ convictions (Field, 1998b). Approximately 63 percent of offenders with more than two convictions have used drugs, compared to 81 percent of offenders with five or more convictions (Field, 1998b). Regardless of the exact prevalence, most criminal justice experts would agree that identification and treatment of substance abuse disorders among inmates is a critical component of any successful rehabilitation. Indeed, many would argue that substance abuse treatment for eligible offenders is perhaps the best approach to facilitate a transition back to the community, enhance employability, and reduce recidivism.

To confront these challenges, Corrections agencies in several states have invested considerable resources in a variety of substance abuse interventions, including in-prison treatment (Hiller, Knight, & Simpson, 1999; Pelissier et al., 2001; Wexler, Falkin, & Lipton, 1990), halfway houses (Pelissier et al., 2001), and aftercare programs (Hiller et al., 1999;
Pelissier et al., 2001). However, the effectiveness of these programs is still unproven and very few have been subjected to an economic evaluation. At a time of flat or declining state budgets and increasing competition for resources, it is imperative that these programs demonstrate economic as well as clinical benefits.

To this end, the present study completed a full economic evaluation of a pre-release substance abuse treatment program for repeat male offenders in New Jersey. Community Education Centers (CEC), Inc., under contract with the State of New Jersey, operates several assessment and treatment centers and community corrections programs throughout the state. The analysis programs are located in northern New Jersey and have been functioning in their current form since 1998. The period of analysis for this paper is from 2000 to 2001. Using criminal justice records for a treatment cohort and a randomly selected comparison group, we estimated the economic benefits of treatment over the 1-year period post release. The treatment and control groups were in the same level of minimum security, rendering each group eligible for residential community release. Economic benefits were calculated in five areas: arrest, conviction, incarceration, victim, and productivity. Finally, assumptions were modified and alternative estimation techniques were employed to assess the stability and robustness of our findings.

The remainder of the paper is structured as follows: Section II reviews the literature on offender treatment programs and their economic implications. Section III describes the data and measures. Section IV introduces and explains our estimation methods. Section V presents the results. Section VI concludes with a review of research limitations, a discussion of policy implications, and recommendations for future studies.

2. Background
2.1. Offender treatment programs

Numerous projects have investigated the effectiveness of substance abuse treatment services provided within prisons or jails. Most of these studies support the premise that criminal sanctioning without provision of rehabilitative services may not succeed in reducing recidivism (Ax et al., 2007; Clements et al., 2007; Wormith et al., 2007). Andrews and colleagues (1990) observed that successful offender treatment programs shared three criteria: they deliver services to higher risk cases, target needs of offenders, and tailor treatments to the needs and learning styles of individual patients. Antonowicz and Ross (1994) proposed six essential components of successful rehabilitation programs for criminal offenders: (1) a sound conceptual model; (2) multifaceted programming; (3) the targeting of “criminogenic needs,” (4) the responsivity principle; (5) role playing and modeling; and (6) social cognitive skills training. Studying an addiction treatment program for criminal offenders in New Jersey, Fretz and colleagues (2005) found that subjects in the treatment group had significantly lower probabilities of re-arrest, re-conviction, and re-incarceration at six-, nine-, and twelve-month follow-ups than subjects in the untreated control group.

Offender treatment programs were shown to be particularly effective for substance abusers (Hubbard et al., 1989; Lipton, 1995), as recidivism rates among drug offenders without any in-prison and/or aftercare treatments are very high (Hepburn, 2005). Knight and colleagues (1999) compared re-incarceration records for three groups of drug-offenders over a three-year post-release period: those who received in-prison treatment, those who received both in-prison treatment and aftercare, and those who received no treatment. They found that of these three groups, offenders who received both in-prison treatment and aftercare had the lowest probability of re-incarceration. Pearson and Lipton (1999) performed a meta-analysis of corrections-based
treatments for drug abusers and found that most studies supported the effectiveness of therapeutic community (TC) programs in reducing recidivism.

Butzin and colleagues (2002) studied the continuum of correctional-based therapeutic community treatment programs for drug-involved offenders, focusing specifically on the relative impacts of in-prison, transitional, and aftercare treatment components upon criminal recidivism and relapse to illicit drug use. They found that the outcomes were sensitive to the degree of completion of the continuum. De Leon and colleagues (2000) studied the role of motivation factors in prison treatment and outcomes and found that motivational enhancements in prison-based therapeutic community treatment increased entry into aftercare. Farabee and colleagues (1999) examined the barriers to implementing effective correctional drug treatment programs and identified six common implementation challenges for developing programs. To improve prison-based drug treatment programs, a census was developed which assessed program content and structure, program staff, and inmates for 118 programs in 24 state prisons (Welsh & Zajac, 2004).

2.2. Economic analyses of offender treatment programs

Various offender treatment programs have proven to reduce recidivism, but justifying the economic merits of these programs via cost-effectiveness analysis (CEA) or benefit-cost analysis (BCA) requires additional research. Economic evaluation of correctional interventions shows that the economic benefits often exceed the economic costs, even for violent offenders (Caldwell, Vitacco, & Van Rybroek, 2006; Farrington, Petrosino, & Welsh, 2001; Welsh & Farrington, 2000).

Belenko, Patapis, and French (2005) conducted a comprehensive review of corrections-based economic studies of substance abuse treatment. This systematic study finds that substance
abuse treatment significantly reduces alcohol/drug use and criminal activities, and improves health and social functions for most clients. In addition, economic studies consistently find robust results related to the positive net economic benefits of crime reduction (i.e., avoided incarceration and victimization costs). McCollister et al. (2003a) used data from a Delaware program and found that the incremental cost effectiveness ratio for all treatment clients (compared to the untreated group) was $65 per incarceration day avoided. McCollister, French, Prendergast, Hall, & Sacks (2004) studied data from a California prison treatment and aftercare program. They found that in-prison treatment results in a cost of $45-65 per incarceration day avoided and is more cost effective if combined with aftercare. Daley et al. (2004) examine the costs and benefits of voluntary prison treatment programs operated by the Connecticut Department of Correction with a sample of inmates released from prison between 1996 and 1997. They find a significant reduction in re-arrest for subjects in the treatment group during the one-year period following release compared to subjects in the untreated comparison group. The estimated benefit-cost ratios are between 1.79 and 5.74 for various types of treatment options.

Robertson, Grimes, and Rogers (2001) performed a short-run benefit-cost analysis of two types of community-based interventions for juvenile offenders: intensive supervision/monitoring and intensive outpatient counseling with cognitive behavioral therapy. Both types of intervention proved significantly superior to probation alone for the entire justice system. McCollister et al. (2003b) performed a cost-effectiveness analysis of the Amity in-prison therapeutic community and Vista aftercare programs for criminal offenders in California and found that these treatment programs were more cost effective than no treatment.

Griffith and colleagues (1999) studied the cost effectiveness of in-prison therapeutic community treatment with three-year outcome data and concluded that intensive services were
more cost effective when the entire treatment continuum was completed. They also found that the greatest benefit was experienced by high-risk offenders and accordingly proposed that the treatment needs of individual patients be taken into account when assigning offenders to various treatment options.

In summary, the literature suggests that in-prison treatment can be both effective and cost-effective in reducing recidivism, possibly with the greatest impact for the most serious offenders. Moreover, in-prison treatment coupled with aftercare in the community returns the greatest clinical and economic outcomes. Not all treatments work in every setting and for every type of offender, so treatment approaches should be matched to settings and inmates, based on previously developed research guidelines.

3. Data and Measures

3.1. Data

This study uses longitudinal data from the New Jersey Department of Corrections (NJDOC), which was responsible for assembling the treatment and control groups for our analysis. The treatment group includes 176 subjects that the New Jersey Department of Corrections randomly selected from a list of offenders who completed CEC’s continuum of care treatment and were released in 2000. The control group includes 395 randomly selected subjects who were released in the same year from the same security level prisons, but did not participate in any offender treatment programs. The subjects in the control group were also eligible for the CEC treatment. Even though subjects in both groups were randomly selected from their respective populations, participation in the CEC continuum of care treatment was not random, as the CEC group signed up for work release once they were notified of their eligibility. Based on the severity of their substance abuse needs, the NJDOC placed the CEC group in a residential
substance abuse treatment facility prior to their release into the community. After being released from jail in 2000, the NJDOC gathered recidivism information for each subject during the one-year period following release.

Data from the NJDOC include the date on which the subject was released in 2000, the date on which the subject was re-arrested over the one-year follow-up period (if applicable), the type of crime for which the subject was re-arrested, whether the subject was re-convicted, and whether the subject was re-incarcerated. The NJDOC also provided background characteristics for each subject, including age at release, race, and type of crime applying to the previous commitment (predatory, drug-related, property, and other crimes). Data were not available on the duration of re-incarceration for individual subjects.

3.2. Measures

We examine four treatment outcomes of the CEC continuum of care treatment (relative to the comparison group) during the one-year period following release. One is a continuous treatment outcome and measures the number of days without re-arrest. The other three are dichotomous (i.e., binary) outcomes measuring re-arrest, re-conviction, and re-incarceration for each subject. Days without re-arrest reflect the number of days between the date that a subject was released and the date that the same subject was re-arrested. If the subject was not re-arrested during the entire one-year period following release, this measure is set to 365. The dichotomous measure of re-arrest is set to 1 if the subject was re-arrested during this period and 0 otherwise. After the legal process commences, the measure of re-conviction is set to 1 if the subject was convicted. Victim losses should be applied to a particular crime only if the subject was convicted. The dichotomous measure of re-incarceration records whether the subject was incarcerated after being convicted.
4. Methods

4.1. Bivariate analyses

The most straightforward estimation technique to compare outcome differences across two groups is bivariate analyses. Specifically, we examined the following treatment outcomes during the one-year period post release: days without re-arrest, any re-arrest, any re-conviction, and any re-incarceration. Because “days without re-arrest” is a continuous variable, a t-test is used to determine whether there is a significant difference between the treatment group and the control group. Re-arrest, re-conviction, and re-incarceration are all dichotomous variables, so $\chi^2$ tests are used to examine the different probabilities of these dichotomous outcomes. We also analyze available background characteristics between the two groups to ensure that both groups are comparable. All statistical analyses were executed with Stata version 9.2 (Stata Corporation, 2005).

4.2. Multivariate regression analyses

Because bivariate analyses cannot adjust for background characteristics and other subject differences, we conducted multivariate analyses to control for these factors in the outcome estimation. The covariates include age at release, race, and previous criminal activity. Other factors such as marital status, employment history, substance use history, and ethnicity could significantly influence the outcomes as well, but these measures were not available. Ordinary least squares (OLS) regression was used to estimate days without re-arrest, while logistic regression was used to estimate the dichotomous outcomes of re-arrest, re-conviction, and re-incarceration. Coefficient estimates are directly reported for the OLS regression, and both estimated coefficients and odds ratios are reported in the logistic estimation.

4.3. Hazard analyses
To further study days without re-arrest, we also employed a hazard model (Cox & Oakes, 1984; Greene, 2007; Wooldridge, 2001), which examined whether the treatment changed the survival probability that a treated subject was not re-arrested over the follow-up period. Both parametric and semi-parametric hazard models were used to study the “time to failure.” In the parametric hazard analysis, two different hazard distributions, exponential and Weibull, were used. The semi-parametric proportional Cox hazard model enables us to study the treatment effect without strictly assuming the specific hazard distribution. The hazard model adjusts for the background characteristics discussed above, and hazard ratios are reported in the tables. The hazard model also examines whether the risk of re-arrest in the one-year period following release is constant, monotonically increasing, or monotonically decreasing for the subjects in the treatment and control groups.

4.4. Propensity score matching (PSM)

The preferred design for estimating group differences in outcomes is a randomized controlled trial (RCT). However, an RCT was neither feasible nor ethical in the present study. Because subjects were not randomly assigned to the treatment or control groups, the selection criteria may affect the outcomes. PSM is an alternative technique that is designed to address group heterogeneity and thereby mimic the redeeming features of a RCT. For example, observable characteristics may display significant variation between the treatment and control groups, and these differences may be due to the selection criteria. PSM directly addresses group self selections.

The first step to executing PSM is to examine the propensity score for being included in the treatment group conditional on all the background characteristics available. In the second stage, we match each subject in the treatment group with one or several subjects in the control
group that have a similar propensity score. A new, quasi-experimental control group is created that is systematically homogenous to the treatment group in terms of available covariates (Rosenbaum & Rubin, 1983; Rubin, 1974). Finally, the average treatment effects on the treated (ATT) are reported for each treatment outcome. To ensure that our results are robust with different matching algorithms, we implemented four types of matching criteria in this paper: nearest neighbor matching with three neighbors, radius matching with a default radius of 0.1, stratification matching with three blocks, and kernel matching with a Gaussian distribution.

When performed properly with reliable data, PSM enables researchers to form a balanced control group and produces estimates comparable to experimental designs (Heckman, Ichimura, & Todd, 1997; Michalopoulos, Bloom, & Hill, 2004; Rosenbaum & Rubin, 1983; Smith & Todd, 2001).

4.5. Unit cost estimates for criminal activity

The economic or opportunity costs related to criminal activity include various categories. Monzingo (1977) analyzed the costs associated with arrest, conviction, incarceration, wage loss, and victim loss during the one-year period following release from prison. Whereas the unit costs for arrest, conviction, and victim loss differed by types of criminal activity (predatory, property, drug-related, miscellaneous), the unit costs of incarceration and wage loss were the same for all types of crimes. More recently, Aos, Miller, and Drake (2006) and Kleykamp, Rosenfeld, and Scotti (2008) analyzed the costs of criminal activity and derived unit cost estimates for arrest, conviction, incarceration, wage loss, and victim loss, which were used in the benefit calculations for this paper.

For the present analysis, if a subject was re-arrested during the one-year period following parole, then the average cost of an arrest is included in the calculations. If the subject was also convicted, then we include the unit cost of conviction as well as the victim loss associated with
each type of criminal activity. Similarly, if the subject was incarcerated in a county or state correctional facility after conviction, then we add the cost of incarceration and wage loss associated with not being able to work in the community. Whereas the unit costs for arrest and conviction of a certain crime type have the same values for all individuals who commit those crimes, incarceration costs depend on the length of the sentence. Ideally, the total incarceration cost should be calculated as the product of total days incarcerated and average cost per day. Our data, however, report the specific dates on which subjects were incarcerated, but not the date they were released. Yet for the vast majority of individuals in our sample, this is not a concern, as anyone who is arrested, convicted, and incarcerated during the one-year follow-up is almost certain to remain incarcerated during the remaining time. Thus, if a subject is convicted and ultimately incarcerated, we assume that that subject stays in prison from the date of re-arrest to the end of the one-year period following the subject’s initial release. Likewise, the wage loss is also applied from the date of re-arrest to the end of the one-year period following release. The labor market consequences of incarceration should include both wage loss during the period of incarceration and permanent lifetime wage loss (Sviridoff & Thompson, 1983; Western, Kling, & Weiman, 2001). Because all subjects have been incarcerated multiple times before the index episode, the cost of re-incarceration in this study includes only the wages lost from the first day of re-incarceration to the end of the one-year period following the subject’s initial release.

Rigorously estimating the unit costs associated with arrest, conviction, incarceration, victim loss, and wage loss is a major undertaking that could form a stand-alone paper. As a more efficient alternative, we performed a comprehensive literature review and obtained the most reliable unit cost estimates available from previous studies (Aos et al., 2006; Kleykamp et al., 2008). For predatory crimes, four subtypes were analyzed—murder, sexual assault, robbery, and
assault—because the costs associated with arrest, conviction, and victim loss for these types of crimes were substantially different. To come up with a single number for all predatory crimes, the unit costs for each type of crime were weighted by the percentage occurrence of these four subtypes among the total number of violent crimes committed in New Jersey in 2001 (New Jersey Law Enforcement Agency, 2001). Because the events in our data occurred in 2000-2001, all costs related to criminal activity were converted to 2001 U.S. dollars using the inflation calculator from the Bureau of Labor Statistics (2008).

4.6. Economic benefits

After calculating the total cost of criminal activity over the follow-up period for each subject in our sample, we conducted bivariate analyses, multivariate regression analyses, and PSM techniques to estimate the economic benefits associated with CEC treatment. In simple terms, the difference between the average cost of follow-up criminal activity for the control (higher cost) and treatment (lower cost) groups is the estimated economic benefit of treatment. For reasons noted earlier, we believe PSM is the best and most reliable method for estimating group differences with non-randomized samples. The other approaches were implemented to examine the stability of the PSM estimates and produce a likely range for the economic benefits of treatment.

5. Results

5.1. Bivariate analyses

Table 1 shows the descriptive statistics of criminal activity measures and background characteristics. On average, subjects in the treatment group had approximately 296 days without re-arrest in the one-year period following release, while subjects in the control group had 260 days. This difference is statistically significant at the 1 percent level (t-test). Approximately 36
percent of subjects in the treatment group and 48 percent of subjects in the control group were re-arrested during the one-year period following release. The rates of re-conviction were 25 percent for the treatment group and 37 percent for the control group. Approximately 21 percent of subjects in the treatment group and 30 percent of subjects in the control group were reincarcerated. All 4 of these criminal justice outcomes provide strong preliminary evidence that the CEC treatment reduces recidivism and return to confinement during the one-year period following treatment and parole. Moreover, these results are consistent with the earlier study by Fretz, Heilbrun, and Brown (2004), which examined six-month, nine-month, and twelve-month criminal justice outcomes for the same sample of CEC treatment clients.

[Insert Table 1 here]

Descriptive statistics for the background characteristics show that, on average, subjects in the treatment group are younger than subjects in the control group. The racial breakdown of the two groups is comparable while the percentage of subjects who were incarcerated for a predatory crime is higher in the treatment group than in the control group.

5.2. *Multivariate analyses*

Table 2 provides the results of the multivariate analyses. Looking first at OLS estimation of days without re-arrest, the coefficient estimate for the treatment group is 37.23 (p<0.01). This implies that subjects in the treatment group had an average of 37.23 more days without re-arrest than those in the control group. The magnitude of this multivariate estimate is consistent with the bivariate estimate in Table 1.

Turning now to the dichotomous outcomes, the odds of re-arrest for the treatment group relative to the control group is 0.59 (p<0.01). Similarly, the odds ratios are 0.56 (p<0.01) for re-conviction and 0.62 (p<0.01) for re-incarceration. Considered together, the multivariate
estimation strongly supports our hypothesis that CEC treatment reduces the risk of re-arrest, re-conviction, and re-incarceration during the one-year period following release.

[Insert Table 2 here]

Table 3 provides the results of hazard model estimation with the risk of re-arrest as the outcome. We find that the subjects in the treatment group have a significantly lower risk of re-arrest (p<0.01) when we use either parametric or semi-parametric hazard models. The estimated hazard ratios depict the ratio of re-arrest for subjects in the treatment group relative to subjects in the control group, after adjusting for background characteristics.

[Insert Table 3 here]

Figure 1 shows the Kaplan-Meier survival probability of no re-arrest during the one-year period following release. We find that subjects in the treatment group have a higher survival probability of no re-arrest than those in the control group. Figure 1 also indicates that the risk of re-arrest has a fairly constant trajectory for subjects in both groups with a similar treatment effect throughout the one-year period following release.

[Insert Figure 1 here]

5.3. Propensity score matching (PSM)

Because the subjects in our sample are not randomly assigned to the study conditions, the multivariate estimates may be biased due to self selection or other factors that could influence the outcomes. To address these potential biases, we implemented PSM, using four types of matching methods. Our matching results show a good balance across the control variables, and each is statistically significant at the 1 percent level. The average treatment effects on the treated (ATT) are reported in Table 4. Depending on the matching method, subjects in the treatment group have an estimated 36-39 more days without re-arrest than those in the control groups

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during the one-year period following release. These results are consistent with both the bivariate findings (Table 1) and OLS estimates (Table 2). The ATT estimates in Table 4 also show that subjects in the treatment group have lower risks of re-arrest, re-conviction, and re-incarceration than those in the control group. All PSM results are statistically significant at the 1 percent level.  

[Insert Table 4 here]

5.4. Economic benefits

To convert the outcome differences to economic benefits, we need to apply monetary conversion factors (i.e., unit cost estimates). This approach is explained in detail in several recent papers (French & Drummond, 2005; McCollister & French, 2003; Homer, Drummond, & French, 2008). The monetary conversion factors we used in the present study can be found in Table 5. All unit cost estimates were converted to 2001 U.S. dollars using the inflation calculator from the Bureau of Labor Statistics (2008). The unit costs (per case) for arrest, conviction, and victim loss are national averages (Aos et al., 2006), as estimates for New Jersey are not available in literature. As expected, predatory crimes have the highest unit costs of arrest, conviction, and victim loss. The unit costs for incarceration and wage loss were obtained from Kleykamp et al., (2008), and these estimates apply directly to New Jersey. The cost of incarcerating one inmate for one day was $109 in 2001 and the associated wage loss was about $23 per day. Although the average daily wage loss may seem low, many offenders were not working at the time of their arrest and securing employment after release is often difficult (Kleykamp et al., 2008).

[Insert Table 5 here]

Table 6 presents the average cost of re-arrest, re-conviction, re-incarceration, victim loss, and wage loss over the one-year follow-up for both treatment and control groups. For each
outcome, the treatment group has a lower average cost than the control group, but not all of the differences are statistically significant. Most important, the total cost difference is highly significant (p<0.01), but it is evident that high incarceration costs for the control group heavily influence this result. Quantitatively, the total cost of criminal activity for an average subject in the treatment group ($7,678) is $4,307 lower than the total cost for an average subject in the control group ($11,985).

[Insert Table 6 here]

The same cautions about potential biases associated with the bivariate estimates of criminal justice outcomes also apply to the economic benefit estimates. For this reason, we present the range of total cost estimates that results from bivariate comparison, multivariate adjustment (OLS), and PSM (see Table 7). Compared to the bivariate or unmatched difference in total cost between groups ($4,307), the OLS and PSM estimates are larger, ranging from $4,323 to $6,209. All of these cost differences are statistically significant at the 1 percent level. We discuss the plausibility and policy implications of these estimates in the Discussion section that follows.

[Insert Table 7 here]

5.5. Benefit-cost analysis (BCA)

Ordinarily, the total economic cost of an intervention is compared to the total economic benefit to form a benefit-cost ratio and net benefit estimate (French, 2000; French, Salome, & Carney, 2002; French, Salome, Sindelar, & McLellan, 2002). However, the CEC treatment program presents an interesting exception to this analysis approach. Specifically, the average daily per diem to incarcerate an inmate in a New Jersey correctional facility was approximately $109 in 2001 (Kleykamp et al., 2008). During this same period, the New Jersey Department of
Corrections reimbursed CEC at the flat rate of $75 per day for each inmate who was housed in an adjacent treatment facility. The main reasons for the cost savings are fewer security guards, lower average salaries for all other personnel, and lower overhead costs as a result of the extensive use of inmate work crews, the dormitory style of sleeping quarters, and the decrease in monitoring equipment. Such treatment-related cost savings are highly unusual for a program that also generates significant economic benefits relative to standard incarceration.

6. Discussion and Conclusion

State legislatures and other policy makers must decide how to deal with a growing prison population that is often committing drug/alcohol-related crimes or entering (and re-entering) the criminal justice system with substance use disorders. Offering re-entry residential substance abuse treatment services is one approach to confront these underlying addiction problems before inmates return to the community and probably resume their previous behaviors. Diverting offenders to community-based treatment programs in lieu of incarceration is another creative and cost-effective approach to managing an increasing prison population (Logan, et al., 2004). With limited resources and flat or declining budgets for correctional departments, these treatment programs must demonstrate economic value beyond any positive clinical outcomes that may accrue. Accordingly, the present paper conducted one of the few comprehensive economic evaluations of pre-release substance abuse treatment to determine whether CEC’s programs in New Jersey generated positive outcomes, significant economic benefits, and positive net benefits.

Using a variety of estimation techniques, we determined that, relative to the control group, the treatment group had significantly lower recidivism rates that translated into sizable economic benefits. Among the estimation methods presented, we feel that PSM is the best approach because it comes closest to mimicking randomization. Using the most common and preferable
matching algorithm (nearest neighbors), the estimated total benefit of treatment over the one-year follow-up period is about $6,200. This value is amplified by the fact that the average daily per diem among the treatment group is actually lower than the average daily per diem among the control group.

Although these findings strongly support the economic value of CEC’s pre-release substance abuse treatment programs, several sample and data limitations should be acknowledged, as the effect of these shortcomings in the results is unknown. First, the treatment and control groups were randomly selected among subjects in each condition, but individuals were not randomly assigned. Because inmates self-select to enter a work release program after becoming eligible, this could bias the bivariate and multivariate findings. Again, it should be emphasized that the CEC cohort signed up for work release, not substance abuse treatment. The NJDOC determined that the CEC group needed residential substance abuse treatment before they entered a work release program. In this regard, PSM is a powerful technique that is designed to form balanced treatment and control groups, but it is not a perfect substitute for randomization.

Second, the list of background characteristics available to us was relatively small. It would have been desirable to have more information on measures such as marital status, substance use history, employment history, and living environment. The absence of these measures could affect the precision of the multivariate estimates as well as the PSM.

Third, we were only able to examine criminal activity outcomes, yet existing research shows that employment, education, and health care outcomes are also important sources of economic benefits (McCollister & French, 2003). Since it is likely that untreated substance abusers are visiting emergency rooms and entering hospitals at a greater rate than those who are managing their addiction (Balsa, French, Maclean, & Norton, in press), the economic benefit
estimates are almost certainly understated. Future economic evaluations of pre-release substance abuse treatment should incorporate these other outcomes, if possible.

Fourth, we do not know the exact length of incarceration for those subjects who recidivated over the follow-up period. While we are fairly certain that incarceration extended beyond the short follow-up period for these repeat offenders, exact dates could confirm this assumption.

Fifth, the pre-release substance abuse treatment programs are located in large industrialized cities in northern New Jersey. Most of the subjects reside in urban and inner city locations. Thus, the generalizability of these findings to other settings, particularly those in more distant states with rural populations, is unknown.

Finally, with criminal justice data corresponding to the one-year period post release, this study should be viewed as a short-run examination of the economic benefits of pre-release substance abuse treatment. It is unknown, therefore, whether these economic benefits endure, expand, or contract over the long-term.

Viewed from a different perspective, these limitations can serve as guidelines for extensions and improvements when conducting future economic research on substance abuse treatment, as none of these challenges are insurmountable. In the interim, the present findings offer direct quantitative economic evidence that CEC's pre-release treatment programs in New Jersey are cost-beneficial over a one-year follow-up period. Policy makers in New Jersey and elsewhere should give serious consideration to similar programs as a viable rehabilitative approach for criminal offenders with substance use disorders.
References


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Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Treatment Group</th>
<th>Control Group</th>
<th>p-value¹</th>
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<td><strong>Criminal activity measures</strong></td>
<td>(N = 176)</td>
<td>(N = 395)</td>
<td></td>
</tr>
<tr>
<td>Days without re-arrest²</td>
<td>295.98</td>
<td>259.93</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>(108.78)</td>
<td>(129.11)</td>
<td></td>
</tr>
<tr>
<td>Re-arrest¹ (%)</td>
<td>35.80</td>
<td>47.85</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Predatory</td>
<td>2.27</td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td>12.50</td>
<td>10.89</td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>6.25</td>
<td>6.08</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>14.78</td>
<td>27.08</td>
<td></td>
</tr>
<tr>
<td>Re-conviction² (%)</td>
<td>25.00</td>
<td>36.71</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Predatory</td>
<td>0.00</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td>9.66</td>
<td>7.34</td>
<td></td>
</tr>
<tr>
<td>Property</td>
<td>3.98</td>
<td>3.54</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>11.36</td>
<td>24.82</td>
<td></td>
</tr>
<tr>
<td>Re-incarceration³ (%)</td>
<td>21.02</td>
<td>29.87</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Background characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at release</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Race (%)</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Black</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>Previous commitment (%)</td>
</tr>
<tr>
<td>Predatory</td>
</tr>
<tr>
<td>Drugs</td>
</tr>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

Note: standard deviations are reported in parentheses for continuous variables.

1 Student's t-test for continuous variables and Chi-square test for categorical variables to determine significant differences between treatment and control groups.

2 The number of days between release date and re-arrest date during the one-year period following release.

3 During the one-year period following release.
<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Days without re-arrest(^1)</th>
<th>Re-arrest</th>
<th>Re-conviction</th>
<th>Re-incarceration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS(^2)</td>
<td>Logit(^3)</td>
<td>OLS(^2)</td>
<td>Logit(^3)</td>
</tr>
<tr>
<td>Treatment group</td>
<td>37.23(^{***})</td>
<td>-0.12(^{<em><strong>}) 0.59(^{</strong></em>})</td>
<td>-0.12(^{<em><strong>}) 0.56(^{</strong></em>})</td>
<td>-0.09(^{<strong>}) 0.62(^{</strong>})</td>
</tr>
<tr>
<td>Age at release</td>
<td>1.16(^*)</td>
<td>-0.005(^<em>) 0.98(^</em>)</td>
<td>-0.003 0.99</td>
<td>-0.003 0.99</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (reference)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-25.34(^*)</td>
<td>0.08 1.40</td>
<td>0.05 1.26</td>
<td>0.04 1.23</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4.13</td>
<td>-0.06 0.75</td>
<td>-0.05 0.76</td>
<td>-0.02 0.89</td>
</tr>
<tr>
<td>Previous commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predatory (reference)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td>2.80</td>
<td>0.03 1.13</td>
<td>-0.01 0.97</td>
<td>-0.01 0.94</td>
</tr>
<tr>
<td>Property</td>
<td>-41.92(^{**})</td>
<td>0.17(^{<em><strong>}) 2.07(^{</strong></em>})</td>
<td>0.13(^<em>) 1.78(^</em>)</td>
<td>0.12(^<em>) 1.83(^</em>)</td>
</tr>
<tr>
<td>Other</td>
<td>20.89</td>
<td>-0.15 0.51</td>
<td>-0.16 0.44</td>
<td>-0.04 0.82</td>
</tr>
<tr>
<td>Constant</td>
<td>243.00(^{***})</td>
<td>0.55(^{***}) N/A</td>
<td>0.42(^{***}) N/A</td>
<td>0.34(^{***}) N/A</td>
</tr>
</tbody>
</table>

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

N/A: not applicable

\(^1\) The number of days between release date and re-arrest date during the one-year period following release.

\(^2\) OLS estimation reports coefficients. OLS is linear probability model for dichotomous variables: re-arrest, re-conviction, and re-incarceration.

\(^3\) Logit estimation reports odds ratios.
Table 3. Hazard Model Estimation

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Days without re-arrest&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Parametric Hazard Model</th>
<th>Semi-parametric Hazard Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Exponential&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Weibull&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Treatment group</td>
<td></td>
<td>0.64***</td>
<td>0.64***</td>
</tr>
<tr>
<td>Age at release</td>
<td></td>
<td>0.98*</td>
<td>0.98*</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (reference)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>1.27</td>
<td>1.27</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>Previous commitment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predatory (reference)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td></td>
<td>1.07</td>
<td>1.07</td>
</tr>
<tr>
<td>Property</td>
<td></td>
<td>1.76***</td>
<td>1.76***</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>0.61</td>
<td>0.61</td>
</tr>
</tbody>
</table>

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

<sup>1</sup> The number of days between release date and re-arrest date during the one-year period following release.

<sup>2</sup> Hazard ratios depict the ratio of re-arrest for a subject in the treatment group relative to a subject in the control group, adjusting for other variables.
Table 4: Average Treatment Effect on the Treated (ATT) via Propensity Score Matching (PSM)

<table>
<thead>
<tr>
<th>Matching Methods</th>
<th>Days without Re-arrest</th>
<th>Re-arrest</th>
<th>Re-conviction</th>
<th>Re-incarceration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nearest neighbors¹</td>
<td>38.85***</td>
<td>-0.15***</td>
<td>-0.15***</td>
<td>-0.12**</td>
</tr>
<tr>
<td>Radius²</td>
<td>39.38***</td>
<td>-0.13***</td>
<td>-0.13***</td>
<td>-0.09**</td>
</tr>
<tr>
<td>Stratification³</td>
<td>36.33***</td>
<td>-0.13***</td>
<td>-0.13***</td>
<td>-0.09**</td>
</tr>
<tr>
<td>Kernel-based⁴</td>
<td>37.49***</td>
<td>-0.13***</td>
<td>-0.13***</td>
<td>-0.09**</td>
</tr>
</tbody>
</table>

* Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

¹ Matching with 3 closest neighbors in the control group.

² The size of radius is 0.1.

³ The number of blocks is 3. The inferior blocks are 0, 0.2, and 0.4.

⁴ The Gaussian kernel is used.
### Table 5. Unit Cost Estimates for Arrest, Conviction, Incarceration, Victim Loss, and Wage Loss

<table>
<thead>
<tr>
<th>Type of crime</th>
<th>Arrest¹</th>
<th>Conviction¹</th>
<th>Incarceration²</th>
<th>Victim Loss¹</th>
<th>Wage Loss²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predatory³</td>
<td>$6,292</td>
<td>$3,352</td>
<td>$109</td>
<td>$51,613</td>
<td>$23</td>
</tr>
<tr>
<td>Property</td>
<td>$5,048</td>
<td>$1,720</td>
<td>$109</td>
<td>$5,997</td>
<td>$23</td>
</tr>
<tr>
<td>Drugs</td>
<td>$5,048</td>
<td>$1,720</td>
<td>$109</td>
<td>$0</td>
<td>$23</td>
</tr>
<tr>
<td>Other⁴</td>
<td>$287</td>
<td>$670</td>
<td>$109</td>
<td>$0</td>
<td>$23</td>
</tr>
</tbody>
</table>

Note: Current-year dollars in specific years have been converted to 2001 dollars using the inflation calculator from the Bureau of Labor Statistics, U.S. Department of Labor.


³ The unit cost for predatory crimes is calculated as the average costs of murder, forcible rape, robbery, and aggravated assault weighted by the percentage of each crime in New Jersey, 2001, http://www.disastercenter.com/crime/njcrimn.htm

⁴ Other types of crime are mainly misdemeanors.
<table>
<thead>
<tr>
<th></th>
<th>Treatment Group (N = 176)</th>
<th>Control Group (N = 395)</th>
<th>Cost Difference</th>
<th>p-value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of re-arrest</td>
<td>$1,132 (159)</td>
<td>$1,173 (107)</td>
<td>-$41</td>
<td>0.83</td>
</tr>
<tr>
<td>Cost of re-conviction</td>
<td>$498 (60)</td>
<td>$601 (42)</td>
<td>-$103</td>
<td>0.17</td>
</tr>
<tr>
<td>Cost of re-incarceration</td>
<td>$4,797 (774)</td>
<td>$7,825 (659)</td>
<td>-$3,028</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Victim loss</td>
<td>$239 (89)</td>
<td>$735 (265)</td>
<td>-$496</td>
<td>0.22</td>
</tr>
<tr>
<td>Wage loss</td>
<td>$1,012 (163)</td>
<td>$1,651 (139)</td>
<td>-$639</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total cost</td>
<td>$7,678 (1,058)</td>
<td>$11,985 (887)</td>
<td>-$4,307</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Notes: Standard errors are reported in the parentheses. Costs have been converted to 2001 dollars.

¹ Student’s t-test for expense differences between treatment and control groups.
Table 7. Estimated Treatment Effect on Costs Related to Criminal Activity over Follow-Up Period

<table>
<thead>
<tr>
<th>Method</th>
<th>Cost Difference</th>
<th>p-value$^5$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unmatched difference</td>
<td>-$4,307</td>
<td>0.0044</td>
</tr>
<tr>
<td>OLS regression</td>
<td>-$4,323</td>
<td>0.0051</td>
</tr>
<tr>
<td>Propensity score matching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nearest neighbors$^1$</td>
<td>-$6,209</td>
<td>0.0007</td>
</tr>
<tr>
<td>Radius$^2$</td>
<td>-$4,611</td>
<td>0.0005</td>
</tr>
<tr>
<td>Stratification$^3$</td>
<td>-$4,505</td>
<td>0.0011</td>
</tr>
<tr>
<td>Kernel-based$^4$</td>
<td>-$4,497</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

$^1$ Matching with 3 closest neighbors in the control group.

$^2$ The size of radius is 0.1.

$^3$ The number of blocks is 3. The inferior of blocks are 0, 0.2, and 0.4.

$^4$ The Gaussian kernel is used.

$^5$ Student's t test.
Figure 1: Kaplan-Meier Survival Probability for No Re-arrest During the One-Year Period Following Release

Kaplan-Meier Survival Probability Estimated

Days without re-arrest in one year past release

Survival probability

The Treatment Group

The Control Group

_ = The Treatment Group
_ = The Control Group