Published in final edited form as:

Addiction. 2008 August ; 103(8): 1333–1342. doi:10.1111/j.1360-0443.2008.002238.x.

A randomized clinical trial of methadone maintenance for prisoners: findings at 6 months post-release

Michael S. Gordon¹, Timothy W. Kinlock^{1,2}, Robert P. Schwartz^{1,3}, and Kevin E. O'Grady⁴

¹ Friends Research Institute, Baltimore, MD, USA

² Division of Criminology, Criminal Justice and Social Policy, University of Baltimore, MD, USA

³ Open Society Institute, Baltimore, MD, USA

⁴ and Department of Psychology, University of Maryland, College Park, MD, USA

Abstract

Aims—This study examined the effectiveness of methadone maintenance initiated prior to or just after release from prison at 6 months post-release.

Design—A three-group randomized controlled trial was conducted between September 2003 and June 2005.

Setting—A Baltimore pre-release prison.

Participants—Two hundred and eleven adult pre-release inmates who were heroin-dependent during the year prior to incarceration.

Intervention—Participants were assigned randomly to the following: counseling only: counseling in prison, with passive referral to treatment upon release ($n = 70$); counseling + transfer: counseling in prison with transfer to methadone maintenance treatment upon release ($n = 70$); and counseling + methadone: methadone maintenance and counseling in prison, continued in a community-based methadone maintenance program upon release ($n = 71$).

Measurements—Addiction Severity Index at study entry and follow-up. Additional assessments at 6 months post-release were treatment record review; urine drug testing for opioids, cocaine and other illicit drugs.

Findings—Counseling + methadone participants were significantly more likely than both counseling only and counseling + transfer participants to be retained in drug abuse treatment ($P = 0.0001$) and significantly less likely to have an opioid-positive urine specimen compared to counseling only participants ($P = 0.002$). Furthermore, counseling + methadone participants reported significantly fewer days of involvement in self-reported heroin use and criminal activity than counseling only participants.

Conclusions—Methadone maintenance, initiated prior to or immediately after release from prison, increases treatment entry and reduces heroin use at 6 months post-release compared to counseling only. This intervention may be able to fill an urgent treatment need for prisoners with heroin addiction histories.

Correspondence to: Michael S. Gordon, Friends Research Institute, Inc., 1040 Park Avenue, Suite 103, Baltimore, MD 21201, USA. E-mail: mgordon@friendssocialresearch.org.

Declarations of interest

Dr Schwartz serves as a senior fellow at the Open Society Institute-Baltimore, which funded a previous study conducted by Dr Kinlock of drug abuse treatment for re-entering inmates.

Keywords

Heroin addiction; methadone maintenance; prisoners; randomized clinical trial; substance abuse treatment

INTRODUCTION

More than 2 million adults are incarcerated in the United States [1], with approximately 12–15% having pre-incarceration histories of heroin addiction [2,3]. While the rate of incarceration in the United States is estimated at four times higher than other industrialized nations such as Canada, England, Germany and France [4], rapid relapse to opioid (principally heroin) addiction following incarceration is a continuing, world-wide problem. Moreover, re-addiction to heroin is accompanied by increased criminal activity [5–7], risk of human immunodeficiency virus (HIV) infection [8–10], hepatitis B and C infections [11,12], overdose death [13,14] and re-incarceration [15,16]. Therefore, the development, implementation and evaluation of effective drug abuse treatment strategies for incarcerated offenders with heroin addiction histories is needed urgently [17–19].

Prisons provide an important opportunity to engage individuals with heroin addiction histories in drug abuse treatment, as most heroin-dependent people do not receive such treatment while incarcerated or upon release [10,19–21], contributing further to the vicious cycle of relapse, recidivism and re-incarceration. Forty years of experience and research evidence in community-based settings have shown that opioid agonist therapy, involving primarily methadone maintenance, is highly effective in reducing heroin addiction, crime and HIV transmission [19,22–24]. Furthermore, methadone maintenance has been found to be superior to other treatment modalities with regard to retaining patients in treatment [24,25]. Moreover, the use of maintenance therapy in prisons has been increasing throughout Puerto Rico, Europe, Australia, Canada and Asia [26–28].

Despite substantial evidence of effectiveness in reducing heroin addiction and its adverse public health and public safety consequences, and its widespread use in other nations, opioid agonist treatment programs have rarely been implemented in jail and prison settings in the United States. The first such experimental program, described by Dole *et al.* [29], indicated that 12 inmates who began methadone maintenance approximately 10 days before their release and were referred to community-based maintenance treatment for aftercare had lower re-addiction and re-incarceration rates at 7–10 months post-release than did 16 untreated controls. Subsequently, a jail-based methadone program, named Key Extended Entry Program (KEEP), has been operating continuously in New York City since 1987 [30,31]. Baltimore's pilot project was, to our knowledge, the first in the United States that focused upon prison inmates who had longer periods of incarceration and who were previously, but not currently, heroin-dependent. Results indicated that it was feasible to enroll pre-release prison inmates in maintenance treatment [32].

In contrast to the mainland United States, a number of European countries offer opioid-substitution treatment routinely, consisting of methadone and/or buprenorphine [31,33]. Moreover, prison-based opioid maintenance treatment has been found to be effective in other countries where injection drug use in prison has been estimated to be between 11% and 53% [28,34,35]. In Puerto Rico, a pilot study using methadone in prison was found to be acceptable for heroin addicted inmates [28]. A randomized controlled trial of methadone maintenance in an Australian prison system found that those participants receiving methadone reported lower levels of injection drug use and needle sharing compared to the control group [27]. A

subsequent study in Puerto Rico found that buprenorphine treatment was found to be feasible with pre-release prisoners and facilitated post-release community-based treatment entry [26].

The present study

The present study is, to our knowledge, the first randomized controlled clinical trial of prison-initiated methadone maintenance treatment conducted in the United States. In the present study, imprisoned males with pre-incarceration heroin dependence who were nearing release and met criteria for opioid agonist treatment were assigned randomly to one of three conditions, as follows. (i) Counseling only: counseling in prison without methadone with passive treatment referral upon release; (ii) counseling + transfer: counseling in prison without methadone and with transfer to methadone maintenance in the community upon release; or (iii) counseling + methadone: counseling and methadone in prison with transfer to methadone maintenance in the community upon release. Counseling in prison and methadone treatment were delivered by the same community treatment provider, which continued to offer treatment upon release to participants in the counseling + transfer and counseling + methadone conditions.

Previous reports detailed 1- and 3-month post-release results that showed methadone maintenance, either initiated in prison and/or begun in the community, to be more effective than counseling only in terms of categorical measures of heroin use (urine testing and self-report), treatment entry and crime [36,37]. Because most prisoners with heroin addiction histories relapse typically within 1 month of release [25] and the first 3 months after release is a crucial adjustment period for newly released prisoners [38], these proximal findings, although limited, are of importance. The present paper examines whether outcomes measured continuously over a longer period of time will remain similar to the shorter-term findings at 1 and 3 months post-release. Furthermore, the paper will determine whether the longer-term outcomes support the superiority of initiating methadone treatment in prison prior to release compared to shortly after release and counseling only. This paper reports on results for 201 participants, and focuses upon comparing the three study groups on the outcomes described below—180 days after participants were released from prison. Results of these analyses provide valuable information on longer-term post-institutional outcomes—during a period in which most untreated prisoners have returned to addiction [17,39].

METHODS

Overview

This is a brief description of the study methods, described in more detail elsewhere [36,37]. Males incarcerated in a Baltimore pre-release facility who met study eligibility criteria (see below) and consented to participate were assigned randomly to one of the three treatment conditions. All participants received an individual intake and were scheduled subsequently to receive, within treatment condition, 12 weekly sessions of group psychoeducation. Immediately prior to scheduled release, all participants were scheduled to meet with the study's counselor individually for a discharge planning session. This study was approved by the Friends Research Institute's Institutional Review Board, whose membership included a prisoner advocate/representative.

Eligibility/exclusion criteria

Inmates must have met the following criteria: (i) 3–6 months remaining to serve before release from prison; (ii) history of heroin dependence [meeting *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV); [40] criteria of dependence at time of incarceration] and being physiologically dependent during the year prior to incarceration; (iii) suitability for methadone maintenance as determined by medical evaluation; (iv) willingness to enroll in prison-based methadone maintenance treatment; and (v) residing in Baltimore following release. Further,

individuals who did not meet the heroin-dependence criterion were eligible if they were enrolled in opioid agonist maintenance treatment in the year before incarceration. Inmates with pending charges and/or pending parole hearings were excluded.

Participant screening and recruitment

Participants were recruited between September 2003 and June 2005, inclusive, from male prisoners in a Baltimore pre-release facility who would have met US federal criteria for methadone maintenance treatment at the time of their incarceration. Participants were recruited by group orientation sessions and word of mouth. Inmates willing to enroll were screened individually for participation by study personnel. Eligible inmates then met with research staff for informed consent. There was an informed consent to participate in the study which was obtained immediately prior to the baseline assessment. This consent provided prospective participants with specific information about the potential risks and benefits of study participation. Final determination for study enrollment was made by the methadone program's medical director following a physical examination (Fig. 1). During the multi-step informed consent process, first the research assistant and subsequently the study physician explained both verbally and in writing that methadone can produce physical and psychological drug dependence. In addition, immediately after randomization, participants randomized to the counseling + methadone condition provided their written informed consent to begin methadone maintenance treatment.

Six-month post-release follow-up assessments were conducted on 201 (95.3%) of the 211 participants due for this assessment; 63 of 70 (90.0%) in the counseling only condition, 68 of 70 (97.1%) in the counseling + transfer condition and 70 of 71 (98.6%) in the counseling + methadone condition.

Interventions

Counseling only participants were informed at release by treatment staff to seek drug abuse treatment in the community in any of the publicly funded programs in Baltimore according to those programs' standard admission procedures. Counseling + transfer participants were informed at release by treatment staff to report to the community-based methadone program within 10 days to begin methadone at 5 mg, with dose increases of 5 mg every eighth day to a target minimum dose of 60 mg. Participants randomized to the counseling + methadone condition began at 5 mg of methadone and increased by 5 mg every eighth day during incarceration to a target dose of 60 mg. At release, they were advised by treatment staff to report to the program's community-based methadone program within 10 days for continuing care. Counseling + methadone participants were not given any take-home methadone upon their release from prison. The protocol arranged for the participant to be administered methadone on the day of release from prison. Counseling + methadone participants were told by the prison counselor and research staff to report to the treatment clinic the day following release to continue their medication. Although participants were encouraged strongly to report to the clinic on the day following release, they were given a grace period of up to 10 days to report in order to be medicated as part of the study. Once they arrived at the program, methadone dosage could be increased or decreased based on clinical need. These slow induction rates were followed because participants were not physiologically tolerant to opioids at the time medication was initiated.

The study funding paid for methadone treatment in the community for up to 12 months per participants in counseling + methadone and counseling + transfer conditions. The study did not provide funding for participants in the counseling only condition. Counseling only participants were referred to any drug abuse treatment in the community (including methadone, out-patient drug-free or residential treatments) to which they wished to attend. These treatments

in the public sector in Baltimore are available on a sliding scale, and no one is refused treatment for inability to pay.

Assessments

Assessments included demographic information and histories of drug abuse, drug abuse treatment, criminal activity and criminal justice system involvement. Measures administered at baseline (study entry) and 6-month follow-up included the Addiction Severity Index (ASI) [41], which assesses problem severity in seven life-functioning areas: alcohol use, drug use, medical, psychiatric, family/social, employment and legal. Additional, more detailed historical information about criminality, criminal justice system sanctions, drug abuse and drug abuse treatment than provided by the ASI were obtained at baseline and follow-up from a supplemental self-report questionnaire based on previous research on heroin-dependent offenders [7]. Follow-up assessments scheduled 6 months after release from prison consisted of treatment record review and urine drug testing for opioids, cocaine and other illicit drugs.

Outcome measures

The primary outcome measures examined during the 6-month follow-up period were: (i) urine drug test results for (a) opioids and (b) cocaine; and the frequency or number of days in the past 180 days that the participant reported: (ii) being in drug abuse treatment; (iii) using heroin; (iv) using cocaine; (v) being involved in other illegal activity (excluding illicit drug use and/or possession); and (vi) re-incarcerated. Urine drug test results were obtained for the presence of opioids and cocaine metabolites using the enzyme multiplied immune test (EMIT). Urine tests were conducted either at the research office or in the community and used for research purposes only. Data on drug abuse treatment status were obtained from treatment program records and participant self-report. Data on self-reported heroin use, cocaine use, criminal activity, re-incarceration status and the number of days incarcerated were obtained from the ASI and the supplemental questionnaire. The continuous outcome measures excluding number of days incarcerated were based on the percentage of days that they were in the community and, therefore, had full opportunity to use drugs and commit crime.

Statistical analysis

The 201 participants were compared by treatment condition with regard to each outcome variable listed above using logistic regression [42,43] for the analyses of dichotomous outcome variables and Poisson regression for the continuous variables [44]. A small set of control variables was chosen for the regression analyses because of the relatively small sample size. Behavioral variables that had predicted responsiveness to drug abuse treatment in previous research with offender populations were included, such as age at first crime [15,45,46]; a history of previous cocaine use [47,48]; and completion of prison treatment [49,50]. Control variables in all regression analyses included: (i) age; (ii) age at first crime; (iii) previous cocaine use, measured as the number of self-reported days used cocaine in the 30 days in the community before the current incarceration; and (iv) completed prison treatment. For the analysis of each outcome variable, the predictor variable of primary interest, treatment condition and the control variables were entered simultaneously in the relevant regression analysis for each dependent variable.

Participant characteristics

Most participants in each of the three study conditions were African American, between 35 and 45 years of age, had not completed high school and had had at least six previous incarcerations. Participants in each condition, on average, began heroin use in their late teens, generally 4–5 years after the onset of criminal activity. In the 30 days prior to their current incarceration, participants in each condition reported, on average, using heroin and committing

crime nearly every day. While at least two-thirds of members of each study condition reported previous drug abuse treatment, approximately 20–25% reported previous methadone maintenance treatment.

There were no statistically significant differences between the three treatment conditions on the variables mentioned above. In addition, the 10 participants not assessed at 6 months post-release (see Consort diagram, Fig. 1) were compared on baseline characteristics to the 201 study participants who were located and completed a 6-month follow-up interview. The only significant difference was that those participants not assessed at 6-month post-release had higher rates of self-reported heroin use 30 days prior to incarceration (29.7 versus 27.2; $P = 0.026$).

RESULTS

Treatment participation in prison

The respective proportions, by condition, of participants who began their respective treatment in prison were: counseling only (71.4%); counseling + transfer (84.3%) and counseling + methadone (94.3%). Furthermore, counseling + methadone participants were more likely than counseling only ($P = 0.001$) and counseling + transfer participants ($P = 0.046$) to initiate treatment in prison. Moreover, only 52.8% of counseling only participants remained in treatment upon release, compared with 75.7% of counseling + transfer and 70.4% of counseling + methadone participants. Both counseling + transfer ($P = 0.004$) and counseling + methadone ($P = 0.024$) had a greater proportion of members in treatment upon release than did counseling only. The major reason that participants assigned to the counseling only condition failed to engage in treatment during prison was that these individuals wanted to be randomized to the counseling + methadone or counseling + transfer conditions.

Urine testing at 6 months post-release

Table 1 shows results for the logistic regression analyses predicting opioid- and cocaine-positive urine results. Ninety-five per cent confidence intervals and odds ratios for each of the predictor variables in the logistic regression analyses are presented.

Urine drug testing for opioids—Urine testing for opioids was predicted significantly by the set of five predictor variables. The percentages of participants in each condition that tested positive for opioids were, respectively, counseling only 65.0% ($n = 26$), counseling + transfer 47.7% ($n = 19$) and counseling + methadone 27.9% ($n = 12$). Treatment condition was the only significant predictor variable, with counseling only participants more likely to test positive compared to counseling + methadone participants ($P = 0.002$) (Table 1).

Urine drug testing for cocaine—Urine testing results for cocaine was not predicted significantly by the set of five predictor variables. The percentages of participants in each condition that tested positive for cocaine were, respectively, counseling only 75.0% ($n = 30$), counseling + transfer 53.8% ($n = 21$) and counseling + methadone 58.1% ($n = 25$). Counseling + transfer participants were significantly less likely to test positive for cocaine compared to counseling only participants ($P = 0.041$) (Table 1).

Treatment, drug use, criminal activity and re-incarceration at 6 months post-release

Table 2 presents the results for continuous outcome variables (treatment days, heroin use days, cocaine use days, crime days and re-incarceration days).

Days in treatment—Days in community-based treatment was predicted significantly by the set of five predictor variables ($P < 0.0001$). As shown in Table 2, those participants in the

counseling + methadone ($P = 0.0001$ compared to counseling only and counseling + transfer) condition were more likely to spend more days in treatment compared to counseling only and counseling + transfer participants (mean treatment days = counseling + methadone 100.4, counseling + transfer 57.5, counseling only 13.8). Furthermore, those in the counseling + transfer condition were more likely than the counseling only participants to remain in treatment longer ($P = 0.0001$). Age was also a statistically significant predictor ($P = 0.009$), with the regression coefficient indicating that older participants were more likely to be retained in treatment. Finally, as expected, those participants that completed prison treatment were more likely, on average, to have longer durations of community-based treatment ($P = 0.0001$) than were those participants who failed to complete prison treatment. In addition, the number and proportion of those in methadone treatment, respectively, were 48.5% in the counseling + transfer ($n = 31$) and 68.55% in the counseling + methadone ($n = 48$) group. None of the counseling only participants entered methadone maintenance treatment.

Heroin use days—Self-reported heroin use in the past 180 days post-release was predicted significantly by the set of five predictor variables ($P < 0.0001$). Treatment condition was the only significant predictor variable. Those participants in the counseling + methadone (49.2 versus 85.8 days, $P = 0.009$) reported fewer days of heroin use compared to counseling only participants. In addition, the proportions of participants reporting one or more days of heroin use by condition were, respectively, counseling only 82.5%; counseling + transfer 77.9%; and counseling + methadone 62.8%. However, 11 participants reported using heroin for the entire 180 days (counseling only, $n = 7$; counseling + transfer, $n = 3$; counseling + methadone, $n = 1$).

Cocaine use—Self-reported cocaine use in the past 180 days post-release was predicted significantly by the set of five predictor variables ($P < 0.0001$). Those participants in the counseling + transfer (25.0 versus 51.9 days, $P = 0.034$) reported fewer days of heroin use compared to counseling only participants. As might be expected, higher levels of self-reported cocaine use in the 30 days prior to the current incarceration was related to reporting having used cocaine more frequently at 180 days post-release ($P = 0.0001$).

Criminal activity days—Self-reported criminal activity in the past 180 days post-release was predicted significantly by the set of five predictor variables ($P < 0.0001$). As shown in Table 2, treatment condition was the only significant predictor variable ($P = 0.043$). Those participants in the counseling + methadone ($P = 0.025$) and counseling + transfer conditions ($P = 0.053$) reported fewer days of criminal activity, on average, compared to participants in the counseling only condition (mean criminal activity days = counseling + methadone 28.5, counseling + transfer 35.6, counseling only 56.5).

Number of days re-incarcerated—Re-incarceration days were predicted significantly by the set of five predictor variables ($P < 0.0001$). Age was the only significant predictor variable. Younger participants were more likely to be re-incarcerated for more days ($P = 0.006$) than were older participants. Treatment condition was not statistically significant (mean re-incarceration days = counseling + methadone 21.4, counseling + transfer 23.3, counseling only 21.4).

DISCUSSION

Participant characteristics

The 201 participants resembled previous samples of incarcerated offenders from large American cities with histories of heroin addiction regarding the following characteristics: disproportionately African American [6,10,17,51]; low educational attainment compared to

the general population [17,51]; early onset of both drug use and crime during the teenage years, [5,7,17]; more involvement with incarceration than with drug abuse treatment [10,17]; and rapid relapse to heroin addiction following prior incarcerations [17,38,41].

Outcomes at 6 months post-release

This study suggests that opioid agonist maintenance treatment, provided to prisoners with pre-incarceration histories of heroin addiction, may be an effective intervention for interrupting the cycle of relapse typically experienced by individuals with heroin addiction histories who are released from prison. The present results confirm and extend the conclusions of our previous pilot study on the effectiveness of such treatment [17,32] and on findings from Puerto Rico [26,28] and Australia [27,52]. The current investigation, involving 201 participants in a rigorously conducted randomized clinical trial, indicates that in-prison opioid maintenance facilitates community treatment entry and retention and reduces self-reported heroin use and opioid use measured by urine testing as well as self-reported criminal activity at 6 months post-release.

The findings regarding treatment outcome extended those on categorical outcomes measured in this study at 1 and 3 months post-release [17,37]. In both the pilot study [17,32] and the current report, participants who received prison-initiated maintenance treatment were significantly more likely to be retained in community-based treatment for more days than inmates who received either information on how to access drug abuse treatment after release or counseling only.

Methadone maintenance initiated in prison was superior to the counseling only condition with regard to post-release treatment retention, opioid-negative urine test results and self-reported heroin use and criminal activity. Compared to counseling only participants, those who received counseling + methadone spent more than eight times the number of days in drug abuse treatment in the 6 months following release. Furthermore, counseling only participants' frequency of self-reported criminal activity (57 of 180 days—excluding illicit drug use or possession) was twice as high as that reported by counseling + methadone participants (29 days).

Counseling + transfer participants, who were intended to begin maintenance treatment in the community, generally showed post-release outcomes that were superior to those of counseling only, although not as pronounced as the contrast between counseling only and counseling + methadone. Counseling + transfer respondents were significantly more likely than counseling only individuals to have more days in treatment by 6 months post-release and to report significantly lower frequencies of cocaine use.

Findings for re-incarceration were not significant with regard to treatment condition. In terms of re-incarceration, it is possible that a number of the re-incarcerations could have been for offenses that were not captured by self-report (i.e. possession of illicit substances and/or violations of parole and/or probation). Furthermore, only a small percentage of crimes result in arrest and incarceration [53].

Although longer-term follow-up results are needed in order to draw more definite conclusions, because opiate addiction is a chronic relapsing disorder [54], these 6-month post-release results of the first controlled clinical trial of in-prison methadone maintenance treatment in a US prison build upon both those obtained in our initial pilot study [32,37,46] and results found at earlier points in time in the current study with categorical outcomes [36,37]. Results indicate further that the current intervention may meet an urgent need in ensuring continuity of drug abuse treatment spanning the institution and the community, a goal emphasized by the Office of National Drug Control Policy [55]. Moreover, the results are consistent with the recommendations of Rich and his colleagues [18,56] that far more prison and jail inmates with

heroin addiction histories need to have access to methadone maintenance treatment that continues in the community in order to interrupt the cycle of re-addiction, related risk behavior and crime among this population.

Limitations

There are several limitations to this study. First, it was not feasible to obtain urine samples on all of the 201 participants, due mainly to re-incarceration, hospitalization or interviewed at a later follow-up interval. Understandably, the availability of urine drug screening on all 201 participants would have allowed a more precise comparison of the effects of treatment condition on heroin use and cocaine use. Secondly, the sample involved only male prisoners from Baltimore. Therefore, the findings cannot be generalized to female prisoners or to prison inmates from other geographic locations. Thirdly, at the time of this writing, objective arrest data on study participants were not available.

Acknowledgements

This study was funded by the National Institute on Drug Abuse, Grant R01 DA 16237, awarded to the second author (Principal Investigator: Kinlock). The authors would like to thank the Maryland Department of Public Safety and Correctional Services, the staff of the Metropolitan Transition Center, and the staff of Man Alive Inc. In addition, we would like to thank the project staff: Kathryn Couvillion, Bernard Fowkles, Donnette Randolph and Melissa Harris for their efforts related to this study. In addition, I wish to thank Thomas Hanlon PhD for reviewing the manuscript and Ms Melissa Harris for manuscript preparation. Trial Registration: ClinicalTrials.gov, NCT00378079.

References

1. Sabol, WJ.; Minton, TD.; Harrison, PM. Prison and Jail Inmates at Midyear 2006. Washington, DC: Bureau of Justice Statistics; 2007.
2. Chaiken, JM. Correctional Population of the United States, 1997, no. NCJ 177613. Washington, DC: US Department of Justice; 2000.
3. Karberg, JC.; James, DJ. Bureau of Justice Statistics Special Report, NCJ 209588. Washington, DC: US Department of Justice; 2005. Substance Dependence, Abuse, and Treatment of Jail Inmates, 2002.
4. Hartney, C. US Rates of Incarceration: A Global Perspective. Oakland, CA: National Council on Crime and Delinquency; 2006.
5. Chaiken, JM.; Chaiken, MR. Drugs and predatory crime. In: Tonry, M.; Wilson, JQ., editors. Drugs and Crime (Crime and Justice: A Review of Research). 13. Chicago, IL: University of Chicago Press; 1990. p. 203-19.
6. Kinlock TW, O'Grady KE, Hanlon TE. Prediction of the criminal activity of incarcerated drug-abusing offenders. *J Drug Issues* 2003;33:897-920.
7. Nurco DN. A long-term program of research on drug use and crime. *Subst Use Misuse* 1998;33:1817-37. [PubMed: 9718181]
8. Centers for Disease Control (CDC). Epidemiology of HIV/AIDS—United States, 1981. *MMWR Morb Mortal Wkly Rep* 2006;55:589-92. [PubMed: 16741494]
9. Chitwood, D.; Comerford, M.; Weatherby, N. The initiation and use of heroin in the age of crack. In: Inciardi, JA.; Harrison, L., editors. *Heroin in the Age of Crack-Cocaine*. Thousand Oaks, CA: Sage; 1998. p. 51-76.
10. Inciardi, JA.; McBride, D.; Surratt, H. The heroin street addict: profiling a national population. In: Inciardi, JA.; Harrison, L., editors. *Heroin in the Age of Crack-Cocaine*. Thousand Oaks, CA: Sage; 1998. p. 31-50.
11. Edlin BR. Prevention and treatment of hepatitis C in injection drug users. *Hepatology* 2002;36:S210-19. [PubMed: 12407596]
12. Hagan H, Snyder N, Hough E, Yu TJ, McKeirnan S, Boase J, et al. Case-reporting of acute hepatitis B and C among injection drug users. *J Urban Health* 2002;79:579-85. [PubMed: 12468677]
13. Mark TL, Woody GE, Juday T, Kleber HD. The economic costs of heroin addiction in the United States. *Drug Alcohol Depend* 2001;61:195-206. [PubMed: 11137285]

14. Weatherburn D, Lind B. Heroin harm minimization: do we really have to choose between law enforcement and treatment? *NSW Crime Just Bull* 1999;46:1–11.
15. Hanlon TE, Nurco DN, Bateman RW, O'Grady KE. The response of drug abuser parolees to a combination of treatment and intensive supervision. *Prison J* 1998;78:31–44.
16. Substance Abuse and Mental Health Services Administration (SAMHSA). Year-End 1999 Emergency Department Data from the Drug Abuse Warning Network. Rockville, MD: SAMHSA; 2000.
17. Kinlock TW, Battjes RJ, Schwartz RP. A novel opioid maintenance program for prisoners: preliminary findings. *J Subst Abuse Treat* 2002;22:141–7. [PubMed: 12039617]
18. Rich JD, Boutwell AE, Shield DC, Key RG, McKenzie M, Clarke JG, et al. Attitudes and practices regarding the use of methadone in US state and federal prisons. *J Urban Health* 2005;82:411–19. [PubMed: 15917502]
19. Smith-Rohrberg D, Bruce RD, Altice FL. Research note—review of corrections-based therapy for opiate-dependent patients: implications for buprenorphine treatment among correctional populations. *J Drug Issues* 2004;34:451–80.
20. Kinlock, TW.; Gordon, MS. Substance abuse treatment: new research. In: Bennett, LA., editor. *New Topics in Substance Abuse Treatment*. Hauppauge, NY: Nova Science Publishers, Inc; 2006. p. 73–111.
21. Taxman FS, Cropsey KL, Young DW, Wexler H. Screening, assessment, and referral practices in correctional settings: a national perspective. *Crim Just Behav* 2007;34:1216–34.
22. Johnson RE, Chutuape M, Strain EC, Walsh SL, Stitzer ML, Bigelow GE. A comparison of levomethadyl acetate, buprenorphine, and methadone for opioid dependence. *N Engl J Med* 2000;343:1290–7. [PubMed: 11058673]
23. Joseph HS, Stancliff S, Langrod J. Methadone maintenance treatment (MMT): a review of historical and clinical issues. *Mt Sinai J Med* 2000;67:347–64. [PubMed: 11064485]
24. Platt, JJ.; Widman, M.; Lidz, V.; Marlowe, D. Methadone maintenance treatment: its development and effectiveness after 30 years. In: Inciardi, JA.; Harrison, L., editors. *Heroin in the Age of Crack-Cocaine*. Thousand Oaks, CA: Sage; 1998. p. 160–87.
25. Nurco DN, Kinlock TW, Hanlon TE. The nature and status of drug abuse treatment. *Md Med J* 1994;43:51–7. [PubMed: 8183085]
26. Albizu-Garcia C, Caraballo Correa G, Hernandez Viver AD, Kinlock TW, Gordon MS, Antron Avila C, et al. Buprenorphine–naloxone treatment for pre-release opioid-dependent inmates in Puerto Rico. *J Addict Med* 2007;1:126–32.
27. Dolan, K.; Shearer, J.; White, B.; Wodak, A. A randomized controlled trial of methadone maintenance treatment in NSW prisons Technical Report no. 155. Sydney: National Drug and Alcohol Research Centre; 2003.
28. Heimer R, Catania H, Newman RG, Zambrano J, Brunet A, Ortiz AM. Methadone maintenance in prison: evaluation of a pilot program in Puerto Rico. *Drug Alcohol Depend* 2006;83:122–9. [PubMed: 16332415]
29. Dole V, Robinson J, Orraga J, Towns E, Searcy P, Caine E. Methadone treatment of randomly selected criminal addicts. *N Engl J Med* 1969;280:1372–5. [PubMed: 4890477]
30. Magura S, Rosenblum A, Lewis C, Joseph H. The effectiveness of in-jail methadone maintenance. *J Drug Issues* 1993;23:75–99.
31. Tomasino V, Swanson AJ, Nolan J, Shuman H. The Key Extended Entry Program (KEEP): a methadone treatment program for opiate-dependent inmates. *Mt Sinai J Med* 2001;68:14–20. [PubMed: 11135501]
32. Kinlock TW, Battjes RJ, Schwartz RP. A novel opioid maintenance treatment program for prisoners: report of post-release outcomes. *Am J Drug Alcohol Abuse* 2005;31:433–54. [PubMed: 16161728]
33. Dolan K. Can hepatitis C transmission be reduced in Australian prisons? [Editorial]. *Med J Aust* 2001;174:378–9. [PubMed: 11346077]
34. Cravioto P, Medina-Mora ME, de la Rosa B, Galvan F, Tapia-Conyer R. Patterns of heroin consumption in a jail on the northern Mexican border: barriers to treatment access. *Salud Publica Mex* 2003;45:181–90. [PubMed: 12870419]in Spanish

35. Dolan K, Hall W, Wodak A. Methadone maintenance reduces injecting in prison. *BMJ* 1996;312:1162. [PubMed: 8620161]
36. Kinlock TW, Gordon MS, Schwartz RP, O'Grady K, Fitzgerald TT, Wilson M. A randomized clinical trial of methadone maintenance for prisoners: results at one-month post-release. *Drug Alcohol Depend* 2007;91:220–7. [PubMed: 17628351]
37. Kinlock TW, Gordon MS, Schwartz RP, O'Grady KEA. Study of methadone maintenance for male prisoners: three-month post-release outcomes. *Crim Just Behav* 2008;35:34–47.
38. Nurco DN, Hanlon TE, Kinlock TW. Recent research on the relationship between illicit drug use and crime. *Behav Sci Law* 1991;9:221–42.
39. Maddux, JF.; Desmond, DP. *Careers of Opioid Users*. New York: Praeger; 1981.
40. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. Washington, DC: Author; 1994.
41. McLellan AT, Kushner H, Metzger D, Peters R, Grissom G, Pettinati H, et al. The fifth edition of the Addiction Severity Index: historical critique and normative data. *J Subst Abuse Treat* 1992;9:199–213. [PubMed: 1334156]
42. Agresti, A. *Categorical Data Analysis*. New York: Wiley; 1990.
43. Hosmer, D.; Lemeshow, S. *Applied Logistic Regression*. New York: Wiley; 1989.
44. McCullagh, P.; Nelder, JA. *Generalized Linear Models*. 2. New York: Chapman and Hall; 1989.
45. Hiller ML, Knight K, Simpson DD. Risk factors that predict dropout from corrections-based treatment for drug abuse. *Prison J* 1999;79:411–30.
46. Kinlock TW, Schwartz RP, Gordon MS. The significance of interagency collaboration in developing opioid agonist programs for inmates. *Corr Compend* 2005;30:6–9. 28–30.
47. Magura S, Nwakeze P, Densky S. Pre- and in-treatment predictors of retention in methadone treatment using survival analysis. *Addiction* 1998;93:51–61. [PubMed: 9624711]
48. Rowan-Szal GA, Chatham LR, Simpson DD. Importance of identifying cocaine and alcohol-dependent methadone clients. *Am J Addict* 2000;9:38–50. [PubMed: 10914292]
49. Butzin CA, Martin SS, Inciardi JA. Evaluating component effects of a prison-based treatment continuum. *J Subst Abuse Treat* 2002;22:63–99. [PubMed: 11932131]
50. Prendergast ML, Wexler HK. Correctional substance abuse treatment programs in California: a historical perspective. *Prison J* 2004;84:61–80.
51. Inciardi JA, Martin SS, Butzin CA, Hooper RM, Harrison LD. An effective model of prison-based treatment for drug-involved offenders. *J Drug Issues* 1997;27:261–78.
52. Sheareer, J.; Wodak, A.; Dolan, K. *The prison opiate dependence treatment trial Technical Report no 199*. Sydney: National Drug and Alcohol Research Centre (NDARC), University of New South Wales; 2004.
53. Inciardi, JA. *The War on Drugs III*. Boston, MA: Allyn and Bacon; 2001.
54. Dennis ML, Perl HI, Huebner RB, McLellan AT. Twenty-five strategies for improving the design, implementation and analysis of health services research related to alcohol and other drug abuse research. *Addiction* 2000;95:S281–308. [PubMed: 11132359]
55. Office of National Drug Control Policy. *The National Drug Control Strategy Annual Report*. Washington, DC: Author; 2001. American Association for the Treatment of Opioid Dependence. AATOD's five-year plan for methadone treatment in the United States. [accessed 16 August 2004]. Available at: http://www.aatod.org/factsheet4_print.htm
56. Rich JD, McKenzie M, Shield DC, Wolf FA, Key RG, Poshkus M, et al. Linkage with methadone treatment upon release from incarceration: a promising opportunity. *J Addict Dis* 2005;24:49–59. [PubMed: 16186082]

Figure 1.
Consort diagram of recruitment

Table 1

Results of logistic regression analyses examining 6-month post-release urine tests

Condition	Opioids [†]		Cocaine [‡]	
	OR	95% CI	OR	95% CI
CO versus C + T	0.53	0.21–1.35	0.34 ^{*§}	0.12–0.96
CO versus C + M	4.68 ^{*§}	1.77–12.43	2.14	0.78–5.85
C + M versus C + T	2.46	0.95–6.37	0.73	0.29–1.86
Age	1.03	0.97–1.09	1.05	0.99–1.12
Age at first crime	1.03	0.95–1.11	1.02	0.94–1.11
Cocaine 30	1.00 [*]	0.97–1.09	1.03	0.99–1.06
Completed prison treatment	1.42	0.59–3.41	0.80	0.33–1.96

Urinalyses obtained; CO: $n = 40$; C + T: $n = 39$; C + M: $n = 43$. OR: odds ratio; CO: counseling only; C + T: counseling + transfer; C + M: counseling + methadone.

^{*} $P < 0.05$.

[†] Omnibus tests $\chi^2 = 14.84$; $P = 0.022$.

[‡] Omnibus tests $\chi^2 = 12.30$; $P = 0.056$.

[§] Statistical comparison with CO.

Table 2
Results of Poisson regression analyses of days retained in treatment, days used heroin, days used cocaine, days committed crime, and days re-incarcerated

Outcome variable															
Treatment				Heroin				Cocaine				Crime			
χ^2	P	M	SE	χ^2	P	M	SE	χ^2	P	M	SE	χ^2	P	M	SE
58.13 Ref.	0.0001	11.26		46.31 Ref.	0.0001	85.41		13.55 Ref.	0.080	32.74		6.27 Ref.	0.043	50.44	
12.85	0.0001*	35.33	0.32	2.88	0.090	57.06	0.24	4.49	0.034*	17.56	0.29	3.76	0.053	28.01	0.30
32.53	0.0001**†	64.80	0.31	6.83	0.009*	46.17	0.24	2.47	0.116	21.17	0.27	5.02	0.025*	26.33	0.29
21.44 Ref.	0.0001	54.83 15.92	0.27	2.59 Ref.	0.107	51.73	-0.32	0.16 Ref.	0.687	24.22 21.86	0.10	0.09 Ref.	0.771	34.69 32.12	0.26
χ^2	P	OR	SE	χ^2	P	OR	SE	χ^2	P	OR	SE	χ^2	P	OR	SE
6.82	0.009	0.03	0.01	0.29	0.589	-0.01	0.01	0.01	0.946	0.01	0.02	0.06	0.807	-0.01	0.02
0.12	0.724	0.01	0.02	0.26	0.609	0.01	0.02	1.67	0.197	-0.04	0.03	1.37	0.242	-0.03	0.03
0.11	0.736	-0.01	0.01	2.41	0.12	0.01	0.01	20.62	0.001	0.05	0.01	1.48	0.224	0.01	0.01

tment ($\chi^2 = 7329.0$; $P = 0.0001$); heroin ($\chi^2 = 1321.84$; $P = 0.0001$); cocaine ($\chi^2 = 2264.16$; $P = 0.0001$); crime ($\chi^2 = 819.27$; $P = 0.0001$); re-incarceration ($\chi^2 = 584.68$; $P = 0.0001$). Counseling only served as the reference condition in the analyses. M: the exponentiated least squares model-derived mean; OR: the exponentiated regression coefficient, sometimes

significant in comparison with counseling only.

significant in comparison with counseling + transfer.