

Abstinence-contingent recovery housing and reinforcement-based treatment following opioid detoxification

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ABSTRACT

Aims To conduct a randomized, controlled trial of abstinence-contingent recovery housing delivered with or without intensive day treatment among individuals exiting residential opioid detoxification. **Design** Random assignment to one of three conditions: recovery housing alone (RH), abstinence-contingent recovery housing with reinforcement-based treatment RBT (RH + RBT) or usual care (UC). RH and RH + RBT participants received 12 weeks of paid recovery housing contingent upon drug abstinence. RH + RBT participants also received 26 weeks of RBT, initiated concurrently with recovery housing. Assessments were conducted at 1, 3 and 6 months after treatment enrollment. **Setting** Out-patient drug-free substance abuse treatment program in Baltimore, Maryland. **Participants** Patients ($n = 243$) who completed medication-assisted opioid detoxification. **Measurements** Primary outcome was drug abstinence (opioid- and cocaine-negative urine and no self-reported opioid or cocaine use in the previous 30 days). Secondary outcomes included abstinence at all time-points (1, 3 and 6 months), days in recovery housing and employment. **Findings** Overall rates of drug abstinence were 50% for RH + RBT, 37% for RH and 13% for UC ($P < 0.001$). At 6 months, RH + RBT participants remained more likely to meet abstinence criteria than UC participants (37% versus 20%, $P = 0.016$). Length of stay in recovery housing mediated abstinence outcomes and was longer in RH + RBT (49.5 days) than in RH (32.2 days; $P < 0.002$). **Conclusions** Abstinence-contingent recovery housing improves abstinence in opioid-dependent adults following medication-assisted detoxification. The addition of intensive 'reinforcement-based treatment' behavioural counseling further improves treatment outcomes, in part by promoting longer recovery house stays.

Keywords Abstinence, day treatment, detoxification, opioid, reinforcement-based treatment, recovery housing.

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INTRODUCTION

Pharmacotherapies such as methadone or buprenorphine are effective in the treatment of opioid dependence [1,2], but many patients are not interested in these medications, or simply have no access to them [3,4]. For opioid-dependent individuals who enter drug-free treatment, the road to recovery typically begins with detoxification. However, detoxification appears to be ineffective as a stand-alone treatment for opioid dependence, with relapse rates that range from 65 to 80% at 1 month post-discharge [5,6].

Out-patient substance abuse treatment that includes housing may be especially attractive to opioid-dependent

patients who have completed a detoxification program. Individuals recovering from substance use disorders frequently report their need for housing as a top priority [7]. Drug users who return to their former housing after leaving a controlled environment, such as in-patient detoxification, may encounter environmental cues that could precipitate relapse to drug use [8]. Several recent controlled studies show that housing improves outcomes for substance users [9,10], and that making housing contingent upon drug abstinence produces higher rates of drug abstinence than non-contingent housing [11–14]. In Baltimore City, recovery houses are operated typically by individuals in recovery and require that residents pay rent, remain abstinent and obey house policies.

The current study investigated the utility of abstinence-contingent housing for maintaining drug abstinence following medication-assisted detoxification.

In previous research with recently detoxified opioid-dependent patients, abstinence-contingent housing was provided in the context of reinforcement-based treatment (RBT), a multi-component intensive day-treatment program based in part on the community reinforcement approach [15–17]. RBT includes cognitive-behavioral group therapy [18], abstinence-contingent recreational activities, vocational assistance and individual counseling in addition to housing support. In a short-term evaluation, RBT participants were more likely to be enrolled in a treatment program at 1 month compared to usual-care controls (61% versus 17%, respectively), and more likely to be continuously abstinent from opioids and cocaine (50% versus 21%, respectively) during the first month after detoxification [19]. However, abstinence rates of RBT participants declined once abstinence-based incentives were removed. In a similar but larger study ($n = 130$), RBT participants were significantly more likely than usual-care controls to be drug-abstinent at 1- and 3-month follow-up, but not at 6- or 12-month follow-up [20]. However, RBT participants had higher rates of employment and legal earnings at 6- and 12-month follow-up compared to usual care. Although abstinence-contingent housing is a major component of RBT, the specific contribution of housing to improved outcomes has not been examined.

The purpose of this randomized study was to determine whether abstinence-contingent recovery housing (RH) is an effective intervention for sustaining abstinence in opioid-dependent patients exiting residential detoxification and whether outcomes are further improved when abstinence-contingent housing is delivered in the context of a day treatment program (RH + RBT). We hypothesized that RH + RBT would have the best overall outcomes, and that RH would have better outcomes than usual care. The specific role of RH as a mediator of primary outcomes was also explored.

METHOD

Study participants

Participants ($n = 243$) were recruited from one of two programs providing detoxification services on the Johns Hopkins Bayview Medical Campus. The treatment durations were 3 days and 7–14 days, respectively. Study-eligible patients were between 18 and 60 years of age, met DSM-IV criteria for current opioid dependence and completed a medication-assisted detoxification program. Study applicants were excluded if they were prescribed opioid agonist medication, were experiencing acute

medical or psychiatric illness, or were pregnant. Figure 1 shows participant flow through the study.

Baseline assessment

On day of discharge from the detoxification program research staff escorted study participants to the outpatient clinic, where they completed an initial assessment battery that consisted of the Structured Clinical Interview for DSM-IV (SCID-I, e-module) [21] to determine life-time and current DSM-IV substance abuse/dependence diagnoses and the Addiction Severity Index (ASI) [22] to assess drug use and psychosocial functioning. ASI and SCID training and fidelity procedures for study personnel have been described previously [20].

Randomization

Following completion of the assessment battery, participants were stratified on four variables: (1) medication-assisted detoxification program (3 or 7–14 days), (ii) male (yes/no), (iii) antisocial personality disorder (yes/no) and (iv) currently on probation or parole (yes/no). Following stratification, a random assignment to treatment condition was generated using a modified dynamic balanced randomization procedure [23].

Treatment conditions

Usual care (UC)

UC-condition participants ($n = 80$) were given referrals to after-care substance abuse treatment and to other community resources. The UC condition in the current study is similar to the UC condition described in a prior study [20].

Recovery housing alone (RH)

RH-condition participants ($n = 83$) who agreed to enter a recovery house were escorted to recovery housing immediately following completion of the assessment battery. The houses provided a structured drug-free environment. The treatment program paid rent directly to the owner at a rate of US\$105/week per participant. Rent payment was available for 12 weeks, contingent upon submission of urine specimens negative for cocaine and opioids collected twice weekly at the recovery house. In the event of a drug-positive urine test, participants were removed from the recovery housing and placed in previously identified alternative housing. Participants were tested daily at the clinic following a relapse and were returned to recovery housing upon submission of a drug-negative urine sample.

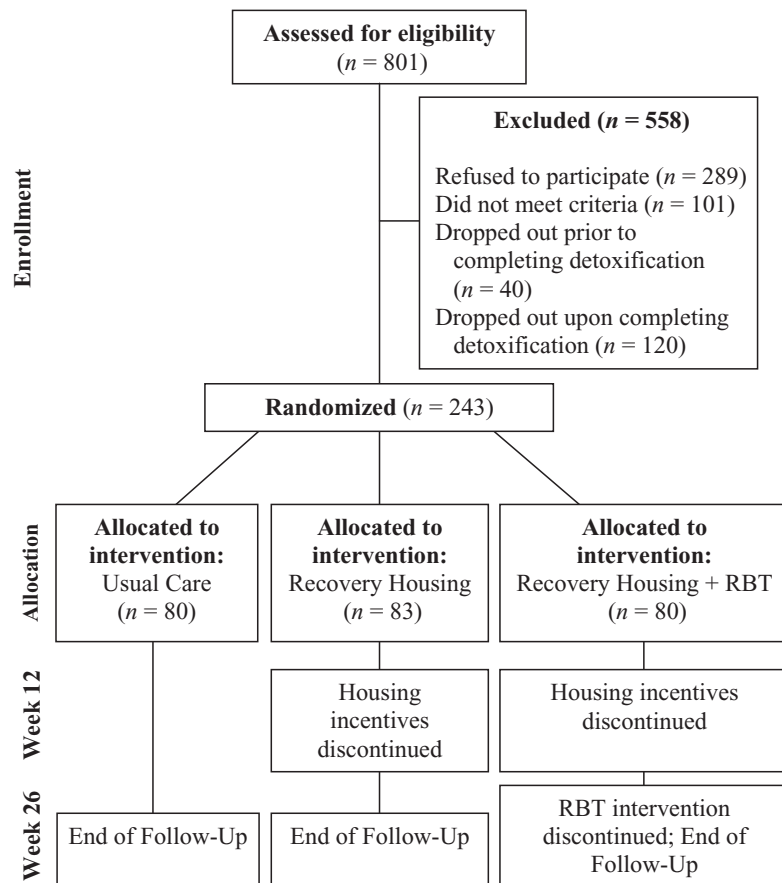


Figure 1 Patients screened, excluded and randomized. RBT: reinforcement-based treatment

Reinforcement-based intensive out-patient treatment (RH + RBT)

RH + RBT ($n = 80$) participants met with their RBT therapist for an individual session and engaged immediately in the scheduled treatment activities. At the end of the treatment day, participants who agreed to enter a recovery house were escorted to recovery housing. Participants were also transported the following morning from their housing to the RBT program and subsequently received bus tokens for transportation to treatment for 12 weeks. As in the RH condition, rent payment was available for 12 weeks and participants were removed from the recovery house if drug use was detected and placed into previously identified alternative housing. Re-entry was facilitated by therapists for those who re-initiated abstinence from opioids and cocaine following a relapse.

Participants were expected to attend the RBT clinic daily during the first 3 weeks of treatment, 4 days per week in weeks 4–12 and twice per week in the final 12 weeks of the 26-week program. If participants failed to show for a session therapists began a systematic outreach protocol to re-engage them, including phone calls, letters and home visits.

Urine testing for opioids and cocaine was conducted at each clinic visit using the On-Track TesTstik™ assay test

sticks with concentration cut-offs of 300 ng/ml. Participants testing negative for opioids and cocaine could participate in the full range of treatment components, which included skills-building group [18], lunch on campus, Job Club [24] and a program-sponsored recreational activity in the community. On Fridays, 'social club' promoted peer reinforcement and goal planning. Individual counseling sessions were scheduled two to three times a week. Four behavioral goals were identified for each participant (e.g. drug abstinence, treatment attendance, employment-seeking, recreational activities), and progress was depicted in behavior graphs that were reviewed weekly. Provision of a drug-positive urine sample resulted in time-out from paid housing and group activities. A functional assessment of the relapse was conducted, a revised treatment plan was implemented and daily individual therapy sessions were held; following urine-verified abstinence, the individual was once again eligible for paid housing and program group activities. RBT was provided over the course of the study by eight Master's level therapists and one Bachelor's level therapist. The counseling staff were primarily female (60%) and Caucasian (90%). Caseloads ranged from five to 12 participants. Supervision was provided by a study co-investigator and was aided by a formal adherence assessment and review of audio-taped individual sessions.

Follow-up assessments

Follow-up assessments were scheduled at 1, 3 and 6 months after random assignment to treatment condition. The ASI was administered and an observed urine sample was collected. Samples were tested off-site for opioids, methadone, cocaine and benzodiazepines using the enzyme-multiplied immunoassay technique (EMIT; Syva Corp., Palo Alto, CA, USA). Participants were compensated \$25 for completing each assessment. Overall, 85% of all scheduled follow-up interview assessments were completed and 77% of urine samples were collected. Follow-up urine sample collection rates for both RH + RBT (mean = 84%) and RH (mean = 79%) were consistently higher than UC (mean = 68%) and significantly higher at the 1- and 3-month follow-up time-points ($P = 0.041$ and 0.035 , respectively).

Measures

The primary outcome measure was opioid and cocaine abstinence at each follow-up assessment, as defined by the submission of an opioid- and cocaine-negative urine sample and self-reported opioid and cocaine abstinence in the past 30 days. Secondary outcome measures included the proportion of participants who were opioid- and cocaine-abstinent at all three assessment time-points, and the proportion of participants who failed to meet abstinence criteria at any of the three assessment time-points. For RH and RH + RBT participants, days in recovery housing was tracked until supported rent payment ceased (84 days). Also examined were several ASI variables relevant to the goals of RBT, including employment earnings [any earnings (yes/no), average earnings among those with any earnings, and average earnings

among all participants], days of employment and days of illegal activity. Self-reported engagement in non-drug-related recreational activity in the past 30 days (yes/no) also was assessed.

Statistical analysis

Treatment conditions were compared using χ^2 goodness-of-fit tests for categorical and t -tests for continuous demographic variables. For dichotomous outcome measures, significance testing was conducted using generalized estimating equations (GEE) with the assumption of an exchangeable correlational structure. Tukey's *post-hoc* tests were used to explore between-group differences further. For continuous outcome measures, a mixed-model approach was used. Because these measures were count variables, they were assumed to follow a Poisson distribution. Mediation analyses to determine whether recovery house residence-mediated 6-month drug use outcomes employed a Sobel test [25] and a bootstrap analysis to provide additional support for the result [26]. For the primary outcome analysis, missing data were treated as positive. A second analysis was also performed with missing data treated as missing. An alpha level of $P < 0.05$ was set for all analyses.

RESULTS

Participants

Table 1 shows that groups were well balanced on demographic, pre-treatment and stratification variables, with no significant between-group differences. All participants had opioid-positive urine samples at detoxification program enrollment and were physiologically dependent;

Table 1 Demographic and pre-treatment characteristics^a.

	Total sample	Usual care	RH	RH + RBT	$F(d.f.)$ or $\chi^2(d.f.)$	P
Gender (% male) ^b	74.1	75.0	78.8	68.7	$\chi^2(2) = 2.21$	0.332
Race (% African American)	67.9	61.3	65.1	77.5	$\chi^2(2) = 5.31$	0.070
Age, mean (SD)	38.7 (8.5)	37.3 (8.6)	39.7 (8.1)	38.9 (8.7)	$F_{(2, 1.64)}$	0.197
Education, mean (SD) years	11.5 (1.9)	11.5 (2.0)	11.4 (1.9)	11.5 (1.8)	$F_{(2, 0.04)}$	0.963
Marital status (% single)	59.3	55	69.9	52.5	$\chi^2(2) = 10.72$	0.218
Employment (% unemployed)	95.9	95	96.4	96.3	$\chi^2(2) = 0.24$	0.888
On probation/parole (%) ^b	24.7	22.5	25.3	26.3	$\chi^2(2) = 0.33$	0.849
Unstable housing (%) ^c	27.6	34.6	21.0	27.2	$\chi^2(2) = 3.75$	0.153
Antisocial personality disorder (%) ^b	22.6	20.0	22.5	25.3	$\chi^2(2) = 0.66$	0.721
Days of opioid use, past 30 days, mean (SD)	28.4 (4.8)	28.6 (4.6)	28.6 (4.4)	28.1 (5.4)	$F_{(2, 0.27)}$	0.766
Days of cocaine use, past 30 days, mean (SD)	12.4 (12.4)	11.5 (11.8)	11.5 (12.4)	14.3 (13.1)	$F_{(2, 1.32)}$	0.268
Cocaine dependence (%) ^d	66.1	62.5	71.3	64.6	$\chi^2(2) = 2.01$	0.734
Entered study from 3-day detox (%) ^b	58.4	63.8	51.3	60.2	$\chi^2(2) = 2.74$	0.254

^aDemographic and pre-treatment characteristics prior to detoxification admission. ^bVariables used in stratification. ^cUnstable housing defined as no permanent housing or living with other drug users. ^dAssessment was not collected for one usual care, one recovery housing (RH), and two RH + reinforcement-based treatment (RBT) participants. These missing data were excluded from this analysis. SD: standard deviation.

158 participants (65%) met DSM-IV criteria for cocaine dependence. One hundred and forty-two participants (58%) entered the study after completing a 3-day detoxification program and 101 (42%) entered after completing a 7–14-day detoxification program (mean = 12.2 days). Participants who completed the 3-day versus the 7–14-day detoxification programs did not differ with respect to any of the assessed demographic variables.

Opioid and cocaine abstinence

The overall percentage of follow-up assessments at 1, 3 and 6 months that met drug abstinence criteria was 50% for RH + RBT, 37% for RH and 13% for UC. Figure 2 shows that the proportion of participants meeting criteria for drug abstinence decreased over time in the experimental conditions and increased slightly over time in the UC condition. GEE analysis with missing data treated as positive indicated a main effect for condition ($F_{(2)} = 27.62, P < 0.001$), time ($F_{(2)} = 7.56, P = 0.023$) and their interaction ($F_{(4)} = 13.61, P = 0.009$). *Post-hoc* comparisons showed that all three conditions differed significantly from one another at the 1- and 3-month time-points, while RH + RBT participants remained significantly more likely than UC participants to abstain from opioid and cocaine use at the 6-month time-point (37% versus 20% drug abstinent, respectively, $P = 0.016$). Results for the analysis with missing data treated

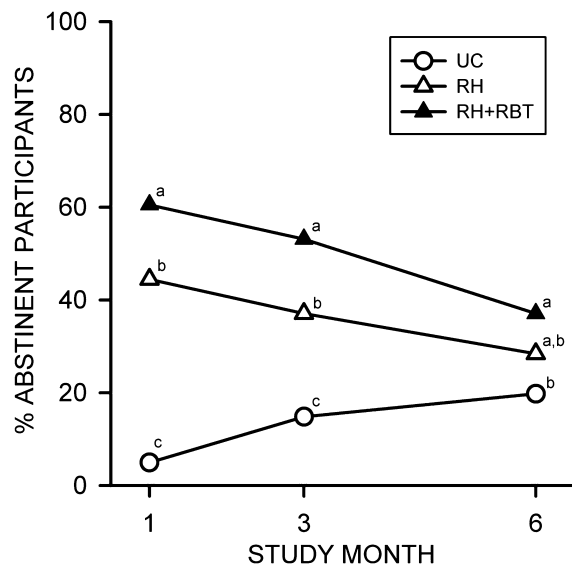


Figure 2 Percentage of participants classified as abstinent at each time-point with abstinence defined as submission of a drug (opioid/cocaine)-negative urine and 30-day self-report of no opioid or cocaine use. Participants with missing data (urine test or self-reports) were treated as non-abstinent. Tukey's *post-hoc* comparisons at individual time-points were significant for points with unshared superscripts. RH: recovery housing; RBT: reinforcement-based treatment; UC: usual care

as missing also supported significant differences between both experimental conditions versus UC, but differences between the RH and RH + RBT conditions were no longer significant at any time-point. When drug-positive samples were submitted ($n = 554$ samples including intake and follow-up assessments), 70% were positive for both opioids and cocaine, 28% were positive for opioids only and 2% were positive for cocaine only.

Consistent abstinence across all follow-up assessments

As shown in Fig. 3, RH + RBT participants were 10 times more likely than UC participants to meet abstinence criteria for opioids and cocaine at all three study assessment time-points (25.9% versus 2.5%; $\chi^2_{(2)} = 16.42, P < 0.001$) and twice as likely to meet these criteria as participants in the RH condition (12.3% versus 25.9%; $\chi^2_{(2)} = 3.99, P = 0.046$). RH was also significantly better than UC on this measure (12.3% versus 2.5%; $\chi^2_{(2)} = 4.41, P = 0.036$). Conversely, UC participants were significantly more likely than those in the other treatment conditions to be non-abstinent (i.e. fail to meet abstinence criteria) at all time-points (usual care versus RH $\chi^2_{(2)} = 19.79, P < 0.001$; UC versus RH + RBT $\chi^2_{(2)} = 33.85, P < 0.001$), but RH and RH + RBT did not differ on this measure.

Days in recovery housing

RH + RBT participants stayed in recovery housing longer than RH alone participants, with mean days of 49.5 and 32.2, respectively (Fig. 4, $P < 0.002$). Additionally, 54% of RH + RBT participants versus 31% of RH participants remained in recovery housing for more than 60 days ($\chi^2_{(2)} = 10.15, P = 0.006$).

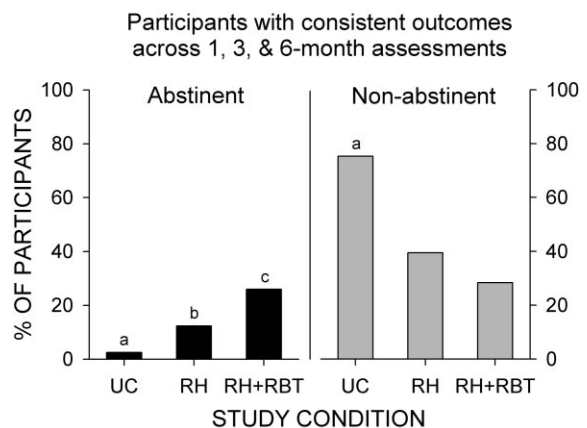


Figure 3 Percentage of participants in each study condition who qualified as being consistently abstinent at all follow-ups or consistently non-abstinent. For each bar, $n = 81$; χ^2 comparisons of conditions were significant for bars with unshared letters. RH: recovery housing; RBT: reinforcement-based treatment; UC: usual care

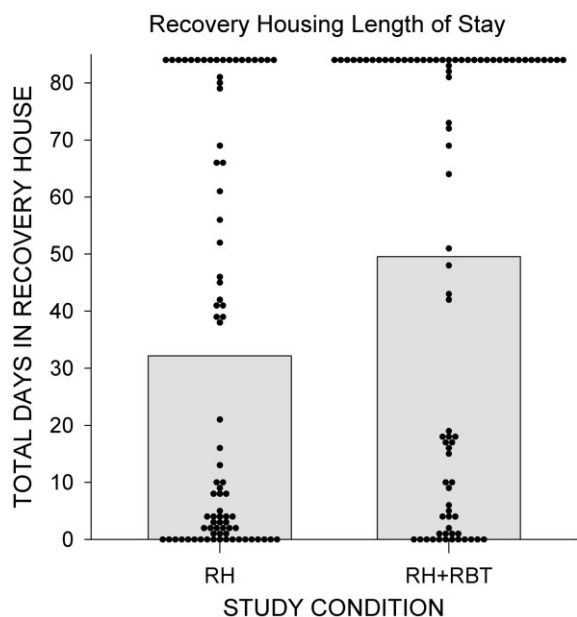


Figure 4 Days in recovery housing for participants in the recovery housing (RH) and RH + reinforcement-based treatment (RBT) study conditions. Bars show condition means and dots show individual participants' length of stay. The difference between study conditions was significant ($P=0.0014$, $U=2382.5$)

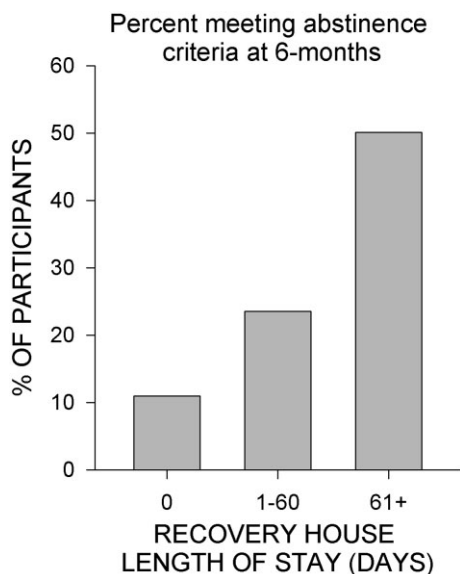


Figure 5 Percentage of recovery housing (RH) and RH + reinforcement-based treatment (RBT) participants ($n=162$) who met abstinence criteria for opioids and cocaine at the 6-month study time-point as a function of recovery house length of stay

Mediation of abstinence by recovery housing length of stay

Figure 5 shows that length of stay in recovery housing during weeks 1–12 mediated drug abstinence at the 6-month time-point, irrespective of study condition

assignment [bootstrap (ab path = 0.456, 95% confidence interval (CI) = 0.14–0.90) and Sobel (2.48, $P=0.013$). Further, the relationship was still apparent at the 6-month follow-up. Among participants who remained in recovery housing for more than 60 days, 51% were drug-abstinent at the 6-month time-point compared to 24% of those who remained in housing for 1–60 days, and 10% of participants who never went to recovery housing.

Other psychosocial outcomes

As seen in Table 2, significant group effects or group \times time interactions were seen for any recreational activities, any employment earnings and employment income (full sample). Figure 6 (top panel) shows that RH + RBT participants were significantly more likely to engage in recreational activity than participants assigned to RH or UC conditions at the 1-month ($P < 0.001$ and $P < 0.001$) and 3-month ($P = 0.01$ and $P < 0.001$) time-points, but this effect was not maintained at 6 months after financial support from the treatment program for these activities ended. Figure 6 (bottom panel) shows that participants in both recovery house conditions were significantly more likely than those in UC to be earning money from employment at 3 months ($P = 0.008$ and $P < 0.002$), and this effect was maintained for participants in the RH + RBT condition at the 6-month time-point ($P < 0.001$). Although the recovery house conditions reported fewer days of illegal activity than the UC condition at all study time-points (Table 3), the differences were not significant.

DISCUSSION

This randomized trial showed a graded relationship between level of treatment support and drug abstinence over a 6-month period (see Fig. 1), with drug abstinence outcomes greatest in the condition that received abstinence-contingent housing and intensive counseling, intermediate in the condition receiving abstinence-contingent housing support alone and lowest in the UC condition. A study comparing the community reinforcement approach (CRA) plus vouchers versus a voucher-only condition also showed benefits associated with the addition of counseling, particularly on the measures of drinking frequency, days of paid employment and decreases in legal problems [27]. This finding is consistent with other research showing a relationship between service intensity and improved treatment outcomes [27]. The observation that intensive RBT was more efficacious than UC replicates findings of a prior randomized trial of the model with a similar sample [20]. In the current study, between-group differences were significant at each

Table 2 Outcome comparisons for main effects.

	Main effect for condition		Main effect for time		Condition × time interaction	
	Test statistic	P	Test statistic	P	Test statistic	P
Any recreational activity (yes/no)	$\chi^2_{(2)} = 12.09$	0.002	$\chi^2_{(3)} = 69.34$	<0.001	$\chi^2_{(6)} = 31.8$	<0.001
Any employment earnings (yes/no)	$\chi^2_{(2)} = 7.22$	0.027	$\chi^2_{(3)} = 8.40$	0.038	$\chi^2_{(6)} = 18.34$	0.005
Employment, days	$F_{(2, 240)} = 0.32$	0.726	$F_{(3, 627)} = 1.95$	0.120	$F_{(6, 627)} = 1.36$	0.230
Employment income, \$ ^a	$F_{(2, 239)} = 2.52$	0.083	$F_{(3, 221)} = 11.50$	<0.001	$F_{(6, 221)} = 1.17$	0.326
Employment income, \$ ^b	$F_{(2, 239)} = 6.38$	0.002	$F_{(3, 614)} = 6.81$	<0.001	$F_{(6, 614)} = 1.87$	0.084
Illegal activity, days	$F_{(2, 239)} = 1.85$	0.160	$F_{(3, 614)} = 4.25$	0.006	$F_{(6, 614)} = 0.59$	0.739

^aAmong participants with non-zero earnings. ^bAll participants included.

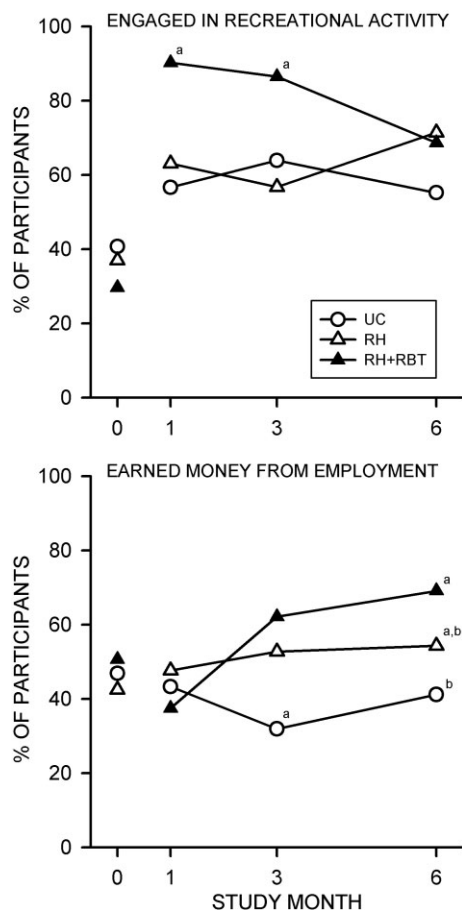


Figure 6 Percentage of participants in each study condition who engaged in recreational activity (top panel) and earned any money from employment (bottom panel) at each study month. Tukey's *post-hoc* comparisons at individual time-points were significant for points with unshared superscripts. RH: recovery housing; RBT: reinforcement-based treatment; UC: usual care

follow-up point, whereas the prior study showed significant differences at 1 and 3 months but not at 6 months. The extended benefits of RBT at 6 months in the current study may be related to the slightly larger sample size and resulting power to detect differences.

The RH condition produced better drug abstinence outcomes than UC at the 1- and 3-month time-points, corresponding to the time that abstinence-contingent recovery housing was available to RH participants. This finding, and the similarity of the RH and RH + RBT conditions on some measures, suggests that abstinence-contingent recovery housing is an active component of RBT that may account for a substantial portion of the combined treatment's efficacy. The results for recovery housing alone add to previous literature showing that provision of housing can be an efficacious intervention for drug and alcohol users [9,10,12], and individuals with chronic health problems [28,29]. One issue that is not addressed by this study is whether there are differences in treatment outcomes when housing is provided contingent upon drug abstinence versus independently of drug use [9,10]. The decision to use contingent housing in this case was consistent with the treatment model and with the norms of community recovery house providers who typically require drug abstinence as a condition of residence.

RBT counseling was associated with increased lengths of stay in recovery housing (Fig. 4). This is important because of the clear association demonstrated between length of stay and outcomes in both the current study (Fig. 5) and a previous study of abstinence-contingent housing for substance users [12]. In particular, recovery housing residence for >60 days was a significant independent mediator of drug abstinence at the 6-month follow-up. There may be several reasons for the longer lengths of stay in RH + RBT participants, including the active facilitation of housing re-entry following a relapse as well as conflict resolution interventions offered by therapists to address issues during recovery housing residence. The improved abstinence rates among those remaining in recovery housing for longer periods is consistent with literature showing that, during treatment, response is predictive of longer-term abstinence [30].

Exposure to recreational activities during the first 12 weeks of treatment did not generalize to greater

Table 3 Secondary outcome measures, mean (standard deviation).

	<i>Usual care</i>	<i>RH</i>	<i>RH + RBT</i>
Employment, days			
Intake	6.0 (8.9)	4.1 (6.3)	6.6 (9.4)
Month 1	5.3 (7.8)	4.9 (7.0)	4.4 (7.5)
Month 3	4.6 (8.4)	8.0 (8.8)	9.6 (10.0)
Month 6	5.2 (8.5)	8.6 (9.5)	13.2 (11.1)
Employment income, \$^a			
Intake	631 (590)	670 (720)	771 (920) ^c
Month 1	667 (645)	374 (370)	665 (625)
Month 3	787 (779) ^c	759 (527)	1078 (996)
Month 6	614 (572)	940 (770)	1223 (775)
Employment income, \$^b			
Intake	296 (511)	281 (570)	386 (754) ^c
Month 1	289 (536)	178 (315)	249 (498)
Month 3	244 (562) ^c	400 (539)	670 (942)
Month 6	244 (468)	510 (735)	827 (858)
Illegal activity, days			
Intake	16.0 (14.1)	12.1 (13.5)	18.7 (13.3)
Month 1	5.2 (10.6)	1.2 (5.0)	0.8 (4.5)
Month 3	6.0 (11.2)	1.1 (5.1)	1.6 (6.2)
Month 6	3.7 (9.6)	1.5 (6.0)	4.3 (9.9)

^aAmong participants with non-zero earnings. ^bAll participants included. ^cOutlier removed. RH: recovery housing; RBT: reinforcement-based treatment.

recreational involvement at 6 months. It may be that recreational involvement decreased after the initial 12 weeks because recreation was no longer paid for by the program (Fig. 6). However, RBT increased the proportion of participants who reported earning money from employment as well as the associated amount of earnings from employment above levels seen in the UC condition, and this was still apparent at the 6-month follow-up (Fig. 6). This is consistent with results from another study that demonstrated higher long-term employment rates for an intensive counseling program that included a similar vocational component [31]. In this study, relatively high rates of employment were also seen in the recovery housing alone condition. This may be because the recovery houses also encouraged residents to work, and in some cases provided jobs for residents (i.e. carpentry work on new recovery houses). Participants in RBT who became employed tended to earn more than those in RH (Table 3), suggesting that they may have obtained higher-paying jobs. More detailed data on the type and duration of employment is needed to understand more clearly any between-group differences on this outcome. None the less, it is notable that RBT promoted sustained employment among participants.

One important study limitation is the self-selected nature of the participant sample, which may inflate positive outcomes for all conditions. Nevertheless, this sample represents a clinically relevant group of individuals willing to consider recovery house entry. Other limita-

tions relate to urine-testing procedures. Follow-up assessments were conducted on a fixed rather than random schedule, although the results of these assessments had no consequences for study participants. More importantly, urine monitoring and feedback differed across the conditions during the intervention period, with no systematic testing in the UC condition. These different monitoring intensities could have contributed to condition differences, although the methods used are consistent with external validity of the interventions. That is, individuals exiting detoxification do not typically receive routine urine testing because they are not engaged in after-care. The lower follow-up rate for UC versus recovery housing groups is not surprising; however, it means that results for this group have a greater degree of uncertainty than those for the experimental groups. The lack of follow-up data beyond 6 months is another limitation of the study, especially as RH + RBT participants could maintain therapeutic contact with the treatment program for the full 6 months. Finally, the study did not include a condition that received RBT counseling without recovery housing. This therapy-only condition could have provided valuable information on the independent contribution of the counseling component of the treatment.

The study supports the efficacy of abstinence-contingent recovery housing for treating a population of inner-city opioid and cocaine users. It also highlights the importance of abstinence-contingent recovery

housing as a key component of RBT. Consistent with other research supporting the association between good outcomes and longer treatment participation [27], the most favorable outcomes were seen in those who remained in recovery housing for longer periods, an outcome that was facilitated by the counseling component of RBT. Abstinence-contingent housing promotes drug abstinence and employment. These outcomes can be enhanced further when housing is combined with intensive behavioral counseling.

CLINICAL TRIAL REGISTRATION

Clinicaltrials.gov. Identifier: NCT00685620.

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Declarations of interest

The authors declare no conflict of interest.

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