

A Reinforcement-Based Therapeutic Workplace for the Treatment of Drug Abuse: Six-Month Abstinence Outcomes

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This study evaluated a novel drug abuse treatment, the Therapeutic Workplace. In this treatment, patients are paid to perform jobs or to participate in job training. Salary is linked to abstinence by requiring patients to provide drug-free urine samples to gain access to the workplace. Pregnant and postpartum drug abuse patients ($N = 40$) were randomly assigned to a Therapeutic Workplace or usual care control group. Therapeutic Workplace participants were invited to work 3 hr every weekday for 6 months and could earn up to \$4,030 in vouchers for abstinence, workplace attendance, and performance. On average, 45% of participants attended the workplace per day. Relative to controls, the Therapeutic Workplace nearly doubled patients' abstinence from opiates and cocaine (33% vs. 59% of thrice-weekly urine samples drug negative, respectively, $p < .05$). The Therapeutic Workplace can effectively treat heroin and cocaine abuse in pregnant and postpartum women.

Reinforcement of drug abstinence is one of the most effective means of promoting abstinence in drug-dependent individuals. In abstinence reinforcement procedures, drug abuse patients experience some type of desirable event (e.g., receiving money or privileges) contingent on providing objective evidence of drug abstinence. Abstinence reinforcement procedures are rooted in an extensive body of laboratory and clinical research that shows that drug use can be operant behavior that is maintained and modifiable by its consequences (Bigelow & Silverman, 1999). For more than 25 years, researchers have demonstrated the efficacy and broad applicability of abstinence reinforcement procedures in the treatment of drug abuse (Higgins & Silverman, 1999). These procedures have been effective in promoting abstinence from a wide range of drugs and in diverse patient populations (e.g., Crowley, MacDonald, Zerbe, & Petty, 1991; Hall, Bass, Hargreaves, & Loeb, 1979; Higgins et al., 1994; Kidorf & Stitzer, 1993; Milby, Garrett, English, Frits-

chi, & Clarke, 1978; Milby et al., 1996; Miller, 1975; Shaner et al., 1997; Stitzer, Bigelow, & Liebson, 1980; Stitzer, Iguchi, & Felch, 1992).

One of the most effective and versatile abstinence reinforcement interventions was developed for the treatment of cocaine dependence (Higgins et al., 1991). In this intervention, patients receive monetary vouchers contingent on providing cocaine-free urine samples. The vouchers can be exchanged for goods and services purchased by staff for the patients. An important aspect of this voucher system is that the monetary value of the voucher increases as the number of consecutive cocaine-free urine samples increases. This schedule of escalating reinforcement for sustained abstinence is designed to promote long periods of sustained abstinence. Higgins and colleagues have used this voucher system to produce some of the most impressive effects in the published literature on the treatment of primary cocaine-dependent outpatients (Higgins et al., 1991, 1993, 1994; Higgins, Wong, Badger, Ogden, & Dantona, 2000).

The efficacy and versatility of this voucher-based abstinence reinforcement intervention have been further demonstrated in a series of studies in intravenous cocaine abusing methadone maintenance patients. These studies have shown that the intervention can promote sustained cocaine abstinence in a large percentage of these patients (Silverman, Higgins, et al., 1996; Silverman, Wong, et al., 1998). In addition, the intervention had important beneficial effects beyond its effects on cocaine use: Specifically, voucher-based reinforcement of cocaine abstinence decreased patients' self-reported cocaine craving and increased abstinence from opiates, even though patients did not have to provide opiate-free urine samples to earn vouchers. Although the intervention has not been effective in all patients, sustained cocaine abstinence has been promoted in extremely treatment-resistant patients by increasing the magnitude of voucher reinforcement (Silverman, Chutuaue, Bigelow, & Stitzer, 1999). Finally, although many patients relapse to cocaine use when the voucher intervention is discontinued, long-term exposure to the abstinence rein-

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forcement intervention appears to be effective in preventing relapse, at least as long as the abstinence reinforcement is maintained (Silverman, Robles, Bigelow, & Stitzer, 2000).

Few psychosocial and no pharmacological treatments evaluated in randomized controlled trials have been demonstrated to be effective in treating cocaine abuse (Cornish & O'Brien, 1996; Higgins & Wong, 1998; Silverman, Bigelow, & Stitzer, 1998; U.S. General Accounting Office, 1996). In this context, the studies demonstrating the effectiveness of voucher-based abstinence reinforcement in treating cocaine abuse, both in primary cocaine-dependent patients and in cocaine abusing methadone patients, illustrate the potential and promise of this intervention. However, this intervention suffers from one critical shortcoming that could preclude its widespread use: its apparent impracticality. The studies described above suggest that for optimal effectiveness in the treatment of cocaine abuse, abstinence reinforcement procedures must use and sustain high-magnitude reinforcement over extended periods of time. These contingencies require financial resources that are not readily available in existing drug abuse treatment programs. Practical funding mechanisms must be developed if this treatment is going to have wide applicability.

The current study is an initial evaluation of a potential practical application of the voucher-based abstinence reinforcement technology. The intervention integrates abstinence reinforcement contingencies into an employment setting in an attempt to use the salary that drug abusers earn for work to reinforce drug abstinence (Silverman & Robles, 1999). Under this intervention, referred to as the Therapeutic Workplace, substance abuse patients are hired and paid to work in a model work program. Salary is linked to abstinence by requiring patients to provide objective evidence of abstinence (e.g., drug-free urine) to gain and maintain entrance to the workplace. In this way, patients can work and earn salary only when they remain abstinent. Reinforcement is arranged according to a schedule of escalating reinforcement for sustained abstinence in which the daily salary increases to a daily maximum value as the patient's duration of sustained abstinence and workplace attendance increases. Thus, under this procedure, patients are required to emit two responses sequentially (abstinence and then work) to earn money. This chaining approach (Ferster & Skinner, 1957) could be useful because it does not require an independent source of funds to address the abstinence issue but rather makes use of the potentially reinforcing effects of work-based salary to reinforce abstinence. The approach is somewhat analogous to workplace drug testing programs, but it incorporates more therapeutic features (i.e., an intensive testing schedule, immediate consequences for abstinence and detected drug use, repeated exposure to the contingencies over time, and a schedule of escalating salary for sustained abstinence). Because employment can be sustained for years, this approach also offers the distinct advantage of allowing for the possibility of maintaining high-magnitude salary-based abstinence reinforcement over extended periods of time. This initial evaluation of the Therapeutic Workplace intervention was conducted in a group of methadone patients enrolled in the

Center for Addiction and Pregnancy (CAP), a comprehensive drug abuse treatment program for pregnant and postpartum women in Baltimore.

Method

General Procedures

Screening and Intake Process

Study participants were enrolled from October 30, 1996, to January 21, 1998. Participants were patients receiving treatment at CAP, a comprehensive treatment program for pregnant substance abusing women located at the Johns Hopkins Bayview Medical Center in Baltimore. Interested patients signed an initial screening consent form and participated in the screening process. As screening slots opened, patients were invited to participate in the initial screening process if they were in methadone treatment at CAP and if they had provided at least one urine sample positive for opiates or cocaine during the 6 weeks of CAP treatment prior to consideration for an initial screening interview. CAP collected a urine sample under observation from each patient on one randomly selected day per week. Potentially eligible CAP patients were identified and invited to participate in an initial screening process to determine eligibility for the study.

During screening, patients provided a urine sample under observation and completed several interviews, tests, and self-report assessments including the Addiction Severity Index (ASI; McLellan et al., 1985), the Structured Clinical Interview for the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; *DSM-III-R*; SCID; Spitzer, Williams, Gibbon, & First, 1988), the Beck Depression Inventory (BDI; Beck & Steer, 1987), the Symptom Check List-90—Revised (SCL-90-R; Derogatis, 1977), an AIDS risk questionnaire (adapted from Centers for Disease Control, 1992), and the Wide Range Achievement Test (WRAT3; Wilkinson, 1993). The ASI is a clinical research interview designed to assess psychosocial functioning in seven areas commonly affected by drug abuse (Medical, Legal, Alcohol, Drug, Employment, Family, and Psychiatric). The BDI is a 21-item self-report questionnaire that yields total scores designed to screen for severity of depression. The SCL-90-R is a self-report inventory measuring psychiatric distress levels across nine subscales (Somatization, Obsessive-Compulsive, Depression, Anxiety, Hostility, Interpersonal Sensitivity, Phobic Anxiety, Paranoid Ideation, and Psychoticism) and three global indices of distress. The AIDS risk questionnaire asks the participant whether or not (yes-no) she had engaged in different sexual and drug-related HIV risk behaviors. The questionnaire focuses on two time intervals, the past 5 years and since 1980. The WRAT3 is a brief standardized test that assesses academic skill levels for reading, spelling, and arithmetic.

Inclusion-Exclusion Criteria and Study Consent

CAP patients were eligible for this study if they were between the ages of 18 and 50 years old, were unemployed, were currently receiving methadone maintenance treatment, and provided at least one urine sample positive for opiates or cocaine during the 6 weeks prior to being reviewed for screening. Patients were excluded if they were considered to be at risk for suicide or had a psychiatric disorder that might disrupt their workplace functioning or limit their ability to provide informed consent (e.g., schizophrenia). Responses on the ASI, SCID, BDI, and SCL-90-R, in conjunction with clinical judgment by CAP staff, were used to determine risk of suicide and psychiatric suitability. Eligible patients were invited to provide written informed consent to participate in the main

portion of the study for a duration of 6 months. All patients in the study were repeatedly re-enrolled in the study in 6-month blocks to examine the long-term effects of the Therapeutic Workplace intervention. This long-term evaluation is still ongoing. This article describes the results for the initial 6-month period of the study. The protocol was approved by the Johns Hopkins Bayview Medical Center Institutional Review Board.

Standard Treatment Services

All participants were enrolled in treatment at CAP at the time of study entry and were allowed to continue to receive treatment there during participation in this study. The CAP program is designed to meet the needs of pregnant drug abusing women (see Jansson et al., 1996, for a detailed program description; see also Svikis et al., 1997). The staff includes specialists in obstetrics and gynecology, clinical psychology, psychiatry, pediatrics, nursing, and social work. Drug abuse treatment involving individual and group therapy is provided along with obstetric, gynecological, and family planning services on-site. Certified nurse-midwives and obstetricians are available 24 hr per day. CAP also provides methadone maintenance services. Transportation to and from the program and child care are provided at no cost to patients. All pregnant women admitted to the program begin treatment on the residential unit with a minimum length of stay of 7 days. Outpatient treatment is then provided, which consists of three phases of decreasing intensity. During Phase 1 women are expected to attend the program for 6.5 hr per day 7 days per week for 28 days. During Phases 2 and 3, women are expected to attend the program for progressively fewer hours per day and fewer days per week. Treatment in Phases 2 and 3 could continue for more than 1 year. Participants were not enrolled in this study during Phase 1 of CAP treatment because of the substantial amount of time required of patients during that phase. Participants continued in this study even after their treatment at CAP was discontinued.

Outcome Measures: Urine Collection and Toxicology

Collection of urine samples was directly observed by research staff using procedures designed to ensure the validity of the urine collection. Samples were provided directly into Commode Specimen Containers (Catalog No. 00077, Sage Products, Crystal Lake, IL) that were placed directly on the toilet. Samples were immediately temperature tested. Only samples between 94.0 °F and 99.0 °F were accepted as valid. Samples were immediately tested for metabolites of cocaine (benzoylecgonine) and opiates (morphine) using OnTrak Abuscreen (Roche Diagnostic Systems, Montclair, NJ). The OnTrak identifies samples as positive for cocaine and opiates if metabolite concentrations are at or above 300 ng/ml. All participants from both groups (see below) were paid \$3.50 per urine sample to provide a urine sample on Monday, Wednesday, and Friday of each week. Analyses of these urine samples provided the primary outcome data for this study. In addition, patients assigned to the Therapeutic Workplace group (see below) also provided urine samples on Tuesday and Thursday of each week for treatment purposes.

Because a large percentage of urine samples scheduled for collection were not collected (i.e., were missing), the urinalysis data were analyzed two different ways; the results of both types of analyses are presented below. The two analyses differed in terms of the way missing urine samples were handled. In the primary analysis, all missing urine samples were considered positive ("missing positive"). In the secondary analysis, missing samples were considered positive for a given drug only if a sample pro-

vided immediately before or after the missing sample (or missing group of samples) was positive for that drug ("missing values interpolated"); other missing samples were considered negative. The results of the secondary analysis were essentially the same as those of the primary analysis. Therefore, except where specifically noted, all results reported in this article are based on the primary, missing positive analysis.

Experimental Design and Groups

Forty women who provided informed consent were randomly assigned to one of two groups, a Therapeutic Workplace group ($n = 20$) or a usual care control group ($n = 20$). A modified dynamic balanced randomization (Signorini et al., 1993) was used to randomize patients sequentially to the treatment conditions. This method was designed to balance groups on important baseline characteristics that might independently influence outcome. The five stratification variables on which groups were balanced were percentage of urine samples positive for cocaine ($\geq 80\%$ vs. $< 80\%$ cocaine positive) and percentage positive for opiates ($\geq 80\%$ vs. $< 80\%$ opiate positive) in the 6 weeks prior to intake enrollment, antisocial personality disorder (yes-no; using *DSM-III-R* criteria as assessed in the SCID interview), usual employment pattern (employed full-time during most of the 3 years prior to intake; yes-no; based on the ASI interview), and academic achievement (≥ 9 th grade in reading, arithmetic, and spelling; yes-no; based on the WRAT3).

Therapeutic Workplace Intervention

The intent of the initial phase of the Therapeutic Workplace intervention is to initiate abstinence and to establish basic academic and job skills that participants will need to function effectively in the workplace. Participants assigned to the Therapeutic Workplace group were invited to attend the Therapeutic Workplace 3 hr per day, Monday through Friday, for 6 months. Each day when a participant reported to the workplace, she was required to provide a urine sample (see the description of collection and testing procedures above). If the sample tested negative for opiates and cocaine, she was allowed to work that day. Participants who gained entrance to the workplace participated in basic skills education and job skills training throughout each 3-hr work shift. After completing the 3-hr work shift, patients received a base-pay voucher. Patients could also earn vouchers for appropriate professional demeanor, for meeting daily learning aims, and for data entry productivity.

Education and Training

Participants were taught the skills that they would need to perform office data entry jobs. The focus on office data entry jobs and the inclusion of basic academic and job skills training were adopted based on previous research on the occupational interests and academic skills of patients from CAP (Silverman, Chutuaue, Svikis, Bigelow, & Stitzer, 1995). That research showed that most individuals in this population were interested in obtaining a variety of office jobs but lacked many of the academic and job skills required to obtain and sustain those jobs. Participants received training in the Therapeutic Workplace in reading, arithmetic, writing, spelling, typing, number entry, and data entry.

The Therapeutic Workplace makes use of two basic types of teaching procedures, Direct Instruction (Engelmann & Carnine, 1982) and fluency training (Johnson & Layng, 1992). Reading was taught using the Direct Instruction corrective reading curriculum

(Engelmann, Hanner, & Johnson, 1989) in combination with the Morningside reading fluency system (Johnson, 1993e). Math tool skills were taught with the Morningside mathematics fluency system (Johnson, 1993a, 1993b, 1993c, 1993d). Basic writing skills were taught with the Direct Instruction expressive writing curriculum (Engelmann & Silbert, 1983, 1985) in combination with the Morningside language fluency curriculum (Johnson, Ford, & Peters, 1996). Spelling was taught using the Direct Instruction corrective spelling curriculum (Dixon & Engelmann, 1979). Typing and numeric keypad entry were taught with an in-house computerized typing program. Data entry training in which participants could learn to enter printed alphanumeric data into computer spreadsheets was also available, but no student progressed far enough in the prerequisite curriculum to receive this training during the first 24 weeks reported here. Training in the different areas was provided based on the need of each participant and availability of staff to provide the needed training. One full-time bachelor's-level staff person served as the teacher and was assisted when possible by part-time college students. Training was provided to a maximum of 13 participants at one time, although class size was typically less than that.

The Voucher Reinforcement System

Voucher reinforcement contingencies were arranged primarily to promote abstinence and to maintain workplace attendance. Additional modest voucher reinforcement was arranged to promote professional demeanor, learning, and productivity. Under the voucher system, patients earned monetary vouchers exchangeable for goods and services for engaging in a variety of defined behaviors as described below. The procedures for implementing the voucher system in this study were based on the procedures developed by Higgins and his colleagues (Higgins et al., 1991, 1993, 1994) and adapted in previous studies with methadone patients (e.g., Silverman, Chutuape, Bigelow, & Stitzer, 1996; Silverman et al., 1999; Silverman, Higgins, et al., 1996; Silverman, Wong, et al., 1998). On enrollment in the Therapeutic Workplace group, participants were read instructions describing the details of the voucher system and completed a quiz to ensure that they understood them. Quizzes were graded and errors were reviewed with each participant. Similar quizzes (seven additional quizzes) were given repeatedly throughout the initial weeks of the study. Under the voucher program, when a patient earned a voucher, she received a paper voucher showing the number of voucher dollars earned. The paper itself was not negotiable but only served to inform the patient of the earnings. The amount printed on the voucher was electronically entered by the research staff into the patient's voucher account; patients could not directly access the account. When a patient wanted to make a purchase, she completed a paper purchase order and submitted it to the research staff. If there were sufficient voucher dollars in the patient's account, the staff went into the community to make the requested purchase and deducted the amount of the purchase from the patient's voucher account. Patients could use earnings to order goods and services. Restrictions on these purchases were kept to a minimum. Purchases were made only if the item requested was for the patient or for a person in the patient's immediate family and if a verifiable receipt could be obtained. Earnings could not be used to purchase weapons or alcohol or to pay for recently obtained traffic tickets or legal fines.

Reinforcement for abstinence and attendance. The majority of voucher earnings were available in base-pay vouchers that were contingent on abstinence and workplace attendance. Patients earned base-pay vouchers according to a schedule of escalating reinforcement for sustained behavior (cf. Higgins et al., 1991; Silverman, Chutuape, et al., 1996; Silverman, Higgins, et al.,

1996). Under the escalating reinforcement schedule, a patient received a voucher worth \$7 on the first day that she provided a drug-free (negative for opiates and cocaine) urine sample and completed a 3-hr work shift. An important feature of this schedule is that the value of the vouchers increased by \$0.50 for each consecutive successful day, to a maximum of \$27 per day. If a patient either provided a drug-positive urine sample or failed to attend the workplace on a scheduled workday, the value of the next day's voucher was reset back to \$7. After a patient's voucher value had been reset, the base-pay voucher value increased to the highest level previously achieved after 9 consecutive days of sustained abstinence and workplace attendance.

Each patient was allowed 1 personal vacation day every 4 weeks. Patients could cumulate these days over successive 4-week blocks. Although patients were not paid for these days, the significance of this policy is that they could miss days without resetting the value of base pay vouchers under the escalating reinforcement schedule. Patients were free to take these days whenever they chose; approval by a staff member was not required. We allowed for unavoidable absences due to illness or other emergencies (e.g., a death in the family) by not resetting the escalating pay for sustained behavior if the patient provided documentation by a physician that an absence was due to her own illness or the illness of a child or if the patient provided documentation of another emergency (e.g., documentation of a funeral). However, patients were required to provide a urine sample every Monday, Wednesday, and Friday, whether or not they worked on those days. If a patient failed to provide a urine sample on one of those days, the patient did not receive a voucher that day, and the value of the next voucher was reset to \$7 as though she had provided a drug-positive urine sample.

Reinforcement for punctuality. Punctuality was promoted through use of an explicit reinforcement contingency for punctuality. In order to be considered in attendance at the workplace on a given day, a patient had to arrive at the workplace within 15 min of the scheduled start of the workday. A time clock was used to determine the time patients entered the workplace. If a patient arrived late, the patient did not receive the base-pay voucher for that day, and the value of her next base-pay voucher was reset to \$7. Some flexibility for unavoidable problems in getting to work was provided: Patients were allowed to arrive late to the workplace 1 day every 4 weeks without resetting the value of their vouchers. Patients could cumulate these late-not-reset days across 4-week blocks. Although patients did not receive base-pay vouchers on days that they reported late to the workplace, they were allowed to work and to earn pay for professional demeanor, learning, and work productivity.

Reinforcement for professional demeanor. To prevent disputes between patients and to promote professional demeanor, we used a schedule of differential reinforcement of other behavior (DRO; Favell, 1977) in which each patient could earn a \$1 voucher for every 30-min period that elapsed without the patient's having engaged in any one of a list of unprofessional behaviors (i.e., cursing, eating food in the workplace, arguing in an unprofessional manner with staff or other patients, criticizing or harassing other patients, or sleeping in class). An additional \$1 was available for appropriate professional demeanor whenever the patient was in the research unit between classes (i.e., during nonwork hours). To inform patients that they had earned their professional demeanor voucher for a 30-min time period, the staff person initialed a square on each patient's time sheet corresponding to that time interval. If a patient engaged in one of the unprofessional target behaviors, the staff person placed a numeral corresponding to that target behavior in the square for that time interval.

Reinforcement for learning and productivity. Patients received \$0.25 in vouchers for each daily learning aim they met. The

curriculum was designed so that participants should be able to meet approximately four learning aims per hour, thus earning \$1 per hour. Voucher payment for data entry work consisted of \$1 in vouchers for each batch of data patients completed. As a means of discouraging errors, \$0.02 was subtracted from that \$1 for every incorrect character in the batch. For a batch completed with four errors, for example, the patient would earn \$0.92. As a means of providing further reinforcement for work productivity, patients earned 10 min of paid vacation for every batch completed, minus 12 s per error.

Pregnancy leave. Some participants gave birth during their participation in this study. As a means of encouraging patients to spend time with their newborn infants, and consistent with CAP program policies, patients were not allowed to attend the Therapeutic Workplace for 8 weeks postpartum. During this period, patients could continue to earn base-pay vouchers for providing urine samples negative for opiates and cocaine. To earn those vouchers, patients were required to come to the research unit the first Monday, Wednesday, or Friday after they were discharged from the hospital. From that point on, they could receive a base-pay voucher every weekday that they provided a urine sample negative for opiates and cocaine. Thus, unlike the routine Therapeutic Workplace contingency under which patients had to provide a drug-free urine sample and complete a work shift to earn a base-pay voucher, during the pregnancy leave patients only had to provide drug-free urine samples to earn vouchers. Missed urine samples on Monday, Wednesday, and Friday of any week during their leave of absence reset the value of their next base-pay voucher back to the initial value of \$7. Because these women were visiting the Johns Hopkins Bayview Medical Center on a routine basis during this time to receive their methadone treatment from CAP, the requirement to provide observed urine samples three times per week did not entail a substantial amount of additional travel.

Patients were allowed to return to work in the workplace 8 weeks after delivery. However, to provide additional flexibility, we allowed patients to continue earning base-pay vouchers for 4 additional weeks after the 8-week minimum pregnancy leave. After the 12-week period, the regular requirements for base-pay reinforcement (i.e., attendance and abstinence) were resumed. Although patients could opt to stay out of work for 12 weeks after delivery, if they returned to work before that time (i.e., between 8 and 12 weeks after delivery), the regular requirements for base-pay voucher reinforcement resumed and patients were not allowed to return to the condition in which they could earn vouchers for drug-free urines alone. Seven Therapeutic Workplace patients delivered their babies while participating in this study. Four of those patients did not participate consistently in Therapeutic Workplace before, during, or after their pregnancy leave period; during their pregnancy leave those 4 patients received 8% or fewer of available base-pay vouchers. The remaining 3 participants earned over 60% of the available base-pay vouchers during the pregnancy, and their rates of earning base-pay vouchers were similar to their rates of earning during other times in the study.

Maximum earnings. In total, over the 24-week period reported in this article, patients could earn a maximum of about \$4,030 in vouchers: \$2,830 in base-pay vouchers, \$840 in professional demeanor vouchers, and approximately \$360 in vouchers for learning and productivity. There was no fixed maximum amount that participants could earn for learning and productivity because the amount was based on each patient's rate of learning and productivity; however, the rate of pay for learning and productivity was designed so that participants could earn approximately \$1 per hour or \$360 in total over the 24-week period.

Data Analyses

All analyses comparing the two groups were performed with *t* tests. Statistical tests were two-tailed and considered significant at $p = .05$.

Results

Participant Characteristics

Table 1 shows characteristics of participants in the two groups. Both groups of participants reported high rates of chronic unemployment and behaviors that have been associated with increased risk of contracting HIV and AIDS, including smoking crack, using intravenous drugs, engaging in sex for money or drugs, and sharing needles, and most patients in both groups met *DSM-III-R* criteria for cocaine dependence. There were no significant differences between the two groups on any of the characteristics shown in this table.

Standard Treatment Services

All patients were receiving methadone treatment from CAP when they were enrolled in this study. However, 12 control participants (60%) and 9 Therapeutic Workplace participants (45%) were discharged from CAP before the end of the 24-week study reported here. Almost all patients were discharged from CAP for violating or failing to comply with CAP program rules or for failing to attend treatment; 2 patients were discharged because of incarceration. During this study, control participants received a mean of 15.1 ($SD = 8.4$) weeks of CAP treatment, and Therapeutic Workplace participants received a mean of 18.6 ($SD = 7.2$) weeks, $t(38) = 1.40$, $p = .17$. All patients in both groups received methadone maintenance treatment while enrolled in CAP. The daily maintenance dose of methadone received by patients in the control and Therapeutic Workplace groups averaged 57 ($SD = 15$) and 54 ($SD = 15$) mg, respectively, and the two groups did not differ significantly from each other, $t(38) = 0.58$, $p = .56$.

Therapeutic Workplace Attendance and Earnings

Figure 1 shows that 8 patients (Participants 4, 11, 12, 14, 15, 18, 20, and 44; 40% of all Therapeutic Workplace participants) maintained high rates of attendance throughout most of the 24 weeks of this study. Six of those patients (Participants 12, 14, 15, 18, 20, and 44) had long periods of sustained attendance lasting 12 or more consecutive weeks. Several patients (e.g., Participants 35, 39, 45, and 46) attended the workplace fairly often during the first 12 weeks of the study but then stopped coming for the remainder of the 24-week period. On average, 45% of participants attended the workplace per day.

On average, the 20 participants assigned to the Therapeutic Workplace group earned \$706 (range = \$0 to \$2,240) in base pay, \$239 (range = \$0 to \$662) in professional demeanor pay, and \$68 (range = \$0 to \$241) in pay for meeting daily learning aims. In total, participants' total voucher earnings averaged \$1,013 (range = \$0 to \$3,126).

Table 1
Characteristics of Study Participants (N = 40)

Variable	Group	
	Control (n = 20)	Therapeutic Workplace (n = 20)
Demographic characteristics		
Age, mean years ($\pm SD$)	31.6 (4.8)	31.9 (2.5)
Race (%)		
Black	80	85
White	20	15
Married (%)	5	10
Twelve years of education (%)	60	70
Employed full-time (%)		
At intake	0	0
Usual pattern during 3 years prior	10	10
Addiction Severity Index, past 30 days		
Income ($\pm SD$)		
Legal	\$691.30 (\$1,029.80)	\$570.50 (\$290.30)
Illegal	\$108.00 (\$306.30)	\$ 2.50 (\$11.20)
Drug-related HIV risk behaviors (%)		
Intravenous drug use	35	40
Crack use	60	80
Intravenous or crack use	85	100
Composite scores, mean ($\pm SD$)		
Medical	0.18 (0.29)	0.20 (0.27)
Employment	0.93 (0.16)	0.89 (0.19)
Alcohol	0.00 (0.01)	0.03 (0.07)
Drug	0.24 (0.10)	0.26 (0.06)
Legal	0.08 (0.15)	0.08 (0.18)
Family	0.20 (0.26)	0.24 (0.19)
Psychiatric	0.05 (0.18)	0.08 (0.14)
SCID diagnoses (% current dependence)		
Opioid	100	100
Cocaine	70	80
Alcohol	15	10
Cannabis	5	10
Sedative	5	0
Other drug	5	0
AIDS risk questionnaire (% in past 5 years)		
Injected drugs	45	45
Shared needles	15	25
Traded sex for drugs	40	30
Traded sex for money	45	40
Traded sex for drugs or money	50	40
Beck Depression Inventory total score, mean ($\pm SD$)	16.3 (12.9)	10.1 (9.1)
WRAT3 grade score, mean ($\pm SD$)		
Reading	9.0 (3.2)	9.3 (3.4)
Spelling	8.4 (3.3)	8.5 (3.0)
Arithmetic	6.9 (1.7)	7.2 (2.4)

Note. SCID = Structured Clinical Interview for the *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.); WRAT3 = Wide Range Achievement Test.

Opiate and Cocaine Use

The primary outcome measure in the study was percentage of urine samples negative for opiates and cocaine, the target for the abstinence reinforcement contingency. Table 2 shows the effects of the Therapeutic Workplace intervention on opiate and cocaine urinalysis results. The table shows that the percentage of urine samples that were negative for both opiates and cocaine was almost twice as high in the Therapeutic Workplace participants as in the control group, and the difference was statistically significant for both the missing positive and missing interpolated analyses. Analyses for cocaine alone and opiates alone showed that the

Therapeutic Workplace participants had more cocaine negative and more opiate negative urine samples than did control participants, but these differences were not all statistically significant. The rates of missing urine data for the control and Therapeutic Workplace groups did not differ significantly (55% vs. 38% of urine samples missing for the two groups, respectively), $t(38) = 1.75$, $p = .09$.

Figure 2 shows individual participant data not available in Table 2. It shows the percentage of urine samples that were negative for both opiates and cocaine during the 24-week study period. This figure shows that 40% of the Therapeutic Workplace participants had drug-free results

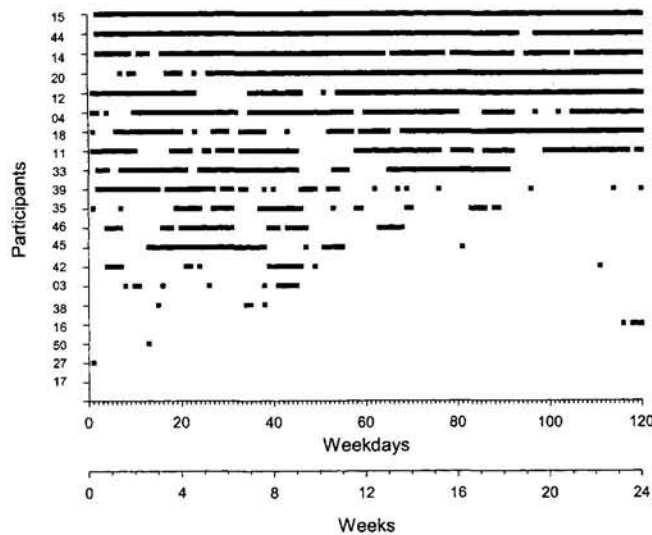


Figure 1. Days in attendance in the Therapeutic Workplace across consecutive weekdays for each of the 20 Therapeutic Workplace participants. Each horizontal line represents the attendance results for a different individual across the consecutive weekdays of the study. The solid portions of lines indicate that the participant attended the workplace on that day. Participants are arranged in order of attendance rate with those showing the lowest attendance rates at the bottom of the figure and those with the highest attendance rates at the top. The ordinates numerals represent participant numbers. Patients were considered in attendance if they attended and completed a work shift or if they had an excused absence (e.g., standard program vacation day, personal day, or sick with a note from a physician). Monday, Wednesday, or Friday absences were not considered excused unless a urine sample for that day was provided and was negative. Because patients had to provide drug-free urine samples to gain access to the workplace each day (and on Monday, Wednesday, and Friday of each week even if they took a personal or sick day), continuous solid lines also show consecutive days of abstinence. In addition to showing patterns of attendance and abstinence, a break in a line shows where the voucher value for a patient was reset.

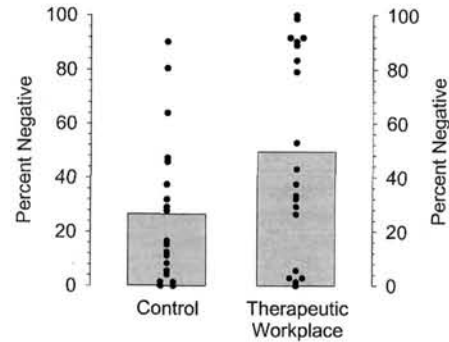


Figure 2. The percentage of urine samples that were drug negative (i.e., negative for both opiates and cocaine) over the 24 weeks of the study for control and Therapeutic Workplace patients. Points represent data for individual patients; bars represent group means. Data are based on urine samples collected on Monday, Wednesday, and Friday of each week. All missing urine samples were considered positive.

(i.e., urine samples negative for both opiates and cocaine) on 75% or more of testing occasions; in contrast, only 10% of the control participants did so. The correlation between Therapeutic Workplace attendance and drug abstinence for Therapeutic Workplace participants was statistically significant, $r(18) = .99, p < .01$.

Pearson product-moment correlation coefficients were calculated between the primary outcome measure (percentage of urine samples that were negative for opiates and cocaine) and eight different patient characteristics assessed at intake: BDI total score; the Alcohol, Drug, Legal, Family, and Psychiatric composite scores on the ASI; the number of days that participants reported using heroin in the 30 days prior to intake; and the number of days that participants reported using cocaine in the 30 days prior to intake. However, no significant correlations were found.

Discussion

This randomized controlled study demonstrated that the Therapeutic Workplace intervention can promote abstinence.

Table 2
Percentage of Drug-Negative Urine Samples During the First 24 Weeks of Treatment

Test type	Group				<i>t</i> (38)	<i>p</i>
	Control		Therapeutic Workplace			
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>		
Missing positive						
Opiate and cocaine	27	6	50	9	2.23	.032
Opiate	33	6	52	8	1.94	.060
Cocaine	32	6	54	9	2.11	.042
Missing interpolated						
Opiate and cocaine	33	7	59	9	2.29	.028
Opiate	47	8	62	9	1.34	.188
Cocaine	45	8	65	9	1.73	.092

nence from heroin and cocaine in a population of opiate and cocaine dependent methadone patients who appeared refractory to a state-of-the-art drug abuse treatment program for pregnant and postpartum women. Patients were selected for this study only if they continued to use heroin and/or cocaine while exposed to an intensive and comprehensive substance abuse treatment program for pregnant and postpartum women. Patients who continued to receive only that treatment during this study (i.e., control patients) continued high rates of heroin and cocaine use (see Figure 2), confirming the inadequacy of that conventional treatment approach for the patients in this study. Patients randomly assigned to the Therapeutic Workplace group had significantly higher rates of abstinence from opiates and cocaine than control patients. High rates of abstinence from opiates and cocaine ($\geq 75\%$ of urine samples drug negative) were rare in this population, except among patients in the Therapeutic Workplace group (as shown in Figure 2). The Therapeutic Workplace intervention maintained high rates of attendance throughout the 24 weeks of this study in a little less than half of the participants (see Figure 1). Furthermore, as shown in the correlational analysis between workplace attendance and abstinence, high rates of abstinence occurred primarily in Therapeutic Workplace participants who attended the workplace consistently.

The relatively high rates of missing urinalysis data in this study prevent a full evaluation of the treatment under study. As mentioned above, in an effort to evaluate accurately the effects produced by the Therapeutic Workplace intervention, we conducted two analyses of the data that differed in how missing data were handled (the missing positive or missing interpolated analyses). Independent of the method of analysis, the Therapeutic Workplace group had significantly higher rates of urine samples negative for opiates and cocaine than the control group. This consistency provides a firm basis for concluding that the differences between the two groups are real and are not an artifact of the method of collecting or analyzing the urinalysis data. Although the rates of missing data in this study prevent unequivocal conclusions, overall the results provide good evidence that the Therapeutic Workplace intervention increased abstinence from heroin and cocaine in the study population.

This study does not determine which aspect(s) of the Therapeutic Workplace intervention produced the abstinence outcomes. The intervention includes many components such as daily work, abstinence reinforcement, and training. Although work in and of itself may have beneficial effects by restricting the amount of time available for drug use, there is little evidence that work alone will produce robust effects on drug use (see Silverman & Robles, 1999, for a detailed discussion of this issue). Descriptive studies have shown that employment is associated with lower rates of drug use in the general population as well as within populations of drug abuse treatment patients; however, experimentally controlled evaluations of employment interventions in individuals who abuse drugs have failed to show consistent effects on drug use (Silverman & Robles, 1999). The experimental studies on employment have had a variety of methodological limitations (Hall, 1990), and so further experimental evaluations of the effects of employment on

drug use are still required. It will be important to determine experimentally the separate effects of the various features of the Therapeutic Workplace, most notably employment versus the salary-based abstinence reinforcement, on drug use.

This study provides some support to the notion that salary for work can be used to reinforce drug abstinence. However, this initial study does not demonstrate that this principle can be implemented in a practical and cost-effective manner. To address this issue, we are attempting to establish a model income-producing data entry business that will employ Therapeutic Workplace participants who achieve sustained abstinence and who acquire critical prerequisite and job skills in the abstinence initiation and training phase of the Therapeutic Workplace intervention described in this article. Participants who progress to this second phase of the Therapeutic Workplace intervention will perform real jobs and will be paid in cash instead of vouchers in a manner that is consistent with existing labor laws. Most important, the central feature of the Therapeutic Workplace intervention, the salary-based abstinence reinforcement contingency and schedule of escalating reinforcement for sustained abstinence, will be maintained.

The Therapeutic Workplace intervention as implemented in this study was designed for poor and chronically unemployed substance abusers. This is an important sector of the general population because drug abuse disproportionately affects the poor, the unemployed, and the undereducated (Substance Abuse and Mental Health Services Administration, 1996). The associations between substance abuse and homelessness, unemployment, and poverty may exacerbate those problems, impede their resolution, and jeopardize the success of ongoing social initiatives, most notably welfare reform (Olson & Pavetti, 1996; Young & Gardner, 1997). Indeed, substance abuse in general and cocaine abuse in particular have been suspected to be a major obstacle preventing many welfare recipients from obtaining gainful employment and leaving the welfare rolls (Olson & Pavetti, 1996; Department of Health and Human Services, 1994). An important feature of the Therapeutic Workplace business we are developing is that it can be integrated into the nation's welfare-to-work program. Indeed, such mechanisms already exist in some states. Our program, for example, is being integrated into Baltimore City's Grant Diversion Program, a government program designed to encourage employers to train and hire welfare recipients. Specifically, under that program, the Baltimore City Department of Social Services will pay our program up to \$300 per month for 6 months for every welfare recipient that we employ in our Therapeutic Workplace business. During this time, the employed welfare recipients will not receive their cash assistance checks because they will be receiving a regular salary from the Therapeutic Workplace business. In essence, the welfare recipients' cash assistance will be diverted to our program to subsidize their work-based salary.

The research on voucher-based abstinence reinforcement considered in conjunction with this study suggests that the Therapeutic Workplace treatment can be an effective means of promoting abstinence in adult methadone patients with histories of chronic heroin and cocaine abuse and chronic unemployment. Given the scarcity of effective interventions

for this population, this is an important and encouraging demonstration. The next stage of development of this intervention, the development of the income-producing Therapeutic Workplace business, will be critical to its wide scale utility and implementation. Public and private funds to support interventions such as the Therapeutic Workplace are often scarce and subject to large variations over time based on changes in general economic conditions and political and social attitudes toward the poor and disadvantaged. If such Therapeutic Workplace businesses could be established and financially successful, they could generate the income to be self-sustaining and could thereby operate independently of public funding or charitable donations (see Shore, 1999, for discussion of similar practices in not-for-profit organizations). Through the integration of the Therapeutic Workplace technology, socially conscious businesses could serve valuable roles in the treatment of drug abuse as vehicles for funding, implementing, and sustaining abstinence reinforcement contingencies of sufficient magnitude and duration to produce long-term effects in a large percentage of adults with histories of chronic unemployment and substance abuse.

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