

Costs and Effectiveness of Substance Abuse Treatments for Homeless Persons

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Abstract

Background: Several reviews of the effectiveness of drug abuse treatment have concluded that treatment works. However, studies analyzing cost-effectiveness or cost-benefits of drug treatment have been limited. Consequently, policy decisions regarding substance abuse treatment have utilized educated guesses or consensus of experts in the absence of controlled and scientifically rigorous studies of the benefits and costs of treatment.

Aims of the Study: This study presents a cost analysis of two randomized controlled studies comparing four drug addiction interventions for homeless persons. The studies controlled for some limitations of previous research in this area including random assignment. Findings are based on treatment costs obtained from actual expenditures and treatment outcomes of drug abstinence from toxicology tests. Cost-effectiveness is considered from the viewpoint of the treatment program. Cost-effectiveness from a societal viewpoint is discussed, but not calculated.

Methods: This is a retrospective analysis of treatment and treatment outcome costs from two randomized controlled drug addiction treatment outcome studies: Homeless 1 and Homeless 2. Both studies were two-group-usual versus enhanced-care designs with similar treatment components, outcome variables and assessment points, but different research questions. Both studies investigated the efficacy of a contingency management intervention specifically designed for persons who are homeless. This costs analysis reports direct costs of treatment by service category and costs of abstinence at 2-, 6-, and 12-month points by study and study treatment group. Treatment costs and costs per week abstinent are reported for four substance abuse treatments across two studies for persons homeless and addicted primarily to crack cocaine. Treatment components for each program included counseling, housing, work, administrative, and other expenses.

Results: Drug abstinence rates by treatment program for each study revealed superior outcomes for the enhanced interventions with the

greatest abstinence found at the earlier time points (up to 6 months) as established by previous research. Abstinence rates at 12 months failed to differentiate treatment groups. Average costs per abstinent week were generally greater for the enhanced programs compared to usual care, except early in treatment where these were similar. The incremental direct cost ratios (in year 2000 dollars) for these enhanced programs to increase abstinence by one average week were similar (\$1,244 and \$1,007) for the Homeless 1 and 2 projects at 12-months. These figures are compared to figures of other "life saving" events.

Discussion: When only the direct costs of programs and their abstinence rates are considered, treatments that involve abstinent contingent work and housing have incremental cost ratios that are within the range of many other common social and medical interventions. These enhanced programs are more cost effective earlier in treatment than at 12-month follow-up due to relapse common among existing drug treatment. A methodological limitation of this study is that direct program costs do not measure the societal value of reducing homelessness itself.

Implications for Health Policies: Usual and improved treatment methods offer a cost-effective approach to improving abstinence among addicted homeless persons. Policy makers might reasonably choose to implement enhanced treatment programs that also reduce homelessness because the incremental cost of these programs is within a reasonable range compared to other common societal interventions.

Implications for Further Research: Methods and data need to be developed to better measure the societal benefit to communities of reducing the numbers of homeless persons with addictive drug problems.

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Background

This paper examines the cost-effectiveness of two randomized controlled studies that have tried to effectively treat homeless person with substance use disorders, primarily crack cocaine. Research reviews of drug abuse treatment have generally concluded that treatment works.¹⁻³ However, only limited studies analyzing the cost-effectiveness or cost-benefits of drug treatment have been conducted.⁴ Consequently, policy decisions regarding substance abuse treatment have had to rely on educated guesses or the consensus of experts in the absence of controlled and scientifically rigorous studies of the

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benefits and costs of treatment.⁵ This paper responds to the demand that health care services meet criteria for outcomes and undergo economic evaluation in response to rising health care costs.⁵

An early review in 1991 by Asper revealed no rigorous cost-effectiveness analyses of drug abuse treatment.⁶ The few studies that addressed the issue of cost-effective drug abuse treatment were limited by lack of control groups and valid cost measurements. However, rigorous studies of cost-effectiveness of drug treatment programs have recently emerged. The cost effectiveness of 3 intervention strategies for patients with co-existing substance use disorders and other mental disorders was examined by Jerrell *et al.*⁷ Societal costs for these problems were reduced by 43%. Differences in outcomes, alcoholism treatment utilization and treatment type costs were studied by Humphreys and Moos.⁸ Treatment costs per person attending AA groups were 45% (or \$1,826) lower than the costs for the outpatient treatment group with similar outcomes. Another study by Tabbush revealed residential drug treatment for heroin addicts produced the highest benefit-cost ratio as compared to outpatient drug-free and methadone maintenance.⁹ Finally, the potential dollar value of avoiding adverse health consequences as a result of successful drug-abuse interventions was estimated by French *et al.*¹⁰ Results indicated that estimated avoided morbidity values can vary significantly across the range of health consequences associated with drug abuse. For example, the value of avoiding only the morbidity associated with a single case of HIV/AIDS was approximately \$157,811.

In 1995, French reviewed several cost-effectiveness studies related to drug and alcohol abuse and identified design limitations and important conceptual considerations when conducting such research.¹¹ Average costs of drug treatment are often used to calculate program cost and cost-effectiveness ratios. Some cost evaluations assume that quasi-experimental comparisons of pre-treatment and post-treatment outcomes are comparable to clinical trials. The use of controlled treatment outcome studies is recommended when possible for more valid measures of cost-effectiveness. Poorly designed cost-effectiveness studies do not accurately measure the most important or relevant outcomes of the treatment intervention.

Recent work, however, has found that non-experimental data can be insightful provided that the analysis controls for selection bias. Lu and McGuire analyzed outpatient treatment for substance abuse and found that more treatment for drug abuse initially improves outcomes although the marginal productivity of treatment eventually declined.¹²

The purpose of this study is to present a cost analysis of two randomized controlled studies comparing four drug addiction interventions for homeless persons. Two of these interventions included innovative contingency management programs specifically designed for homeless persons with cocaine disorders. The studies controlled for limitations of previous research in this area due to lack of random assignment. Findings are based on treatment costs that were obtained from actual expenditures and treatment outcomes of drug abstinence obtained with objective measures.

Homeless 1 and Homeless 2 Studies

The Homeless 1 and 2 studies were the result of collaboration between university researchers and providers of health care services for the homeless. The Homeless studies were run consecutively beginning in 1991 and ending in 1997. The purpose of their cooperation was to develop and study innovative substance abuse services for homeless persons through linkage of academic and community systems.

Homeless 1 Study: Substance Abuse Treatment for Homeless Cocaine Abusers

The Homeless 1 study (1990-1992) was a demonstration project designed to develop an innovative approach to treat homeless persons with substance use disorders and compare this new treatment to existing care.¹³ Homeless 1 utilized a randomized controlled experimental design to compare a control usual care intervention (UC) with the experimental enhanced care program (EC) on treatment outcomes of substance use, homelessness and unemployment. Outcomes at follow-up points up to one year from study entry were assessed.

Treatment efficacy findings by treatment group for Homeless 1 were reported for alcohol use, cocaine use, homelessness and employment. The sample consisted of 131 mostly male and African American participants with primarily crack cocaine disorders who were treated for six months and followed for one year. Significant between group differences in favor of EC were found longitudinally for self-reported alcohol use in the past 30 days and percent cocaine-positive urine toxicology tests across all time points using Wei-Lachin longitudinal analysis. The greatest between group differences in cocaine use were at the 2- and 6-month follow-up points. Cocaine abstinence rates for both groups regressed toward baseline at 12-months. There were no longitudinal between group differences for employment, but the EC group did show significant increases in days employed from baseline to 12-months. EC reported significantly fewer days homeless over 12 months than the UC group which showed no change in homelessness. This is the first demonstration that homeless persons with cocaine addictions can be retained and effectively treated over a 6-month period.

Homeless 2 Study: Initiating Abstinence in Homeless Cocaine Abusers

The Homeless 2 study (1995- 1997) followed Homeless 1 and was designed to determine what about the experimental treatment of Homeless 1 made it more successful than usual care.^{14,15} Specifically, how important was abstinent contingent housing and work? To answer this, Homeless 2 compared an experimental condition of behavioral day treatment plus abstinent contingent housing and work therapy (DT+) with a control condition consisting of behavioral day treatment only (DT).

Preliminary treatment outcome findings from Homeless 2 at 2- and 6-month follow-up points were reported on drug abstinence, homelessness, and employment for 110 participants

Table 1. Description of treatment components by phase for Homeless 1 and Homeless 2.

		Homeless 1		Homeless 2	
		UC	EC	DT	DT+
Phase I	Counseling	12 Step	Day Treatment	Day Treatment	Day Treatment
	Housing	—	—	—	Free ACH
Phase II	Counseling	Aftercare	Aftercare	Aftercare	Aftercare
	Housing	—	Rented ACH	—	Rented ACH
	Work	—	Paid ACWT	Vocational Rehab.	Paid ACWT
Phase III	Counseling	—	—	Aftercare	Aftercare

Notes:

Homeless 1: UC (Usual Care-control), EC (Enhanced Care-experimental)
 Homeless 2: DT (Day Treatment-control), DT+ (Day Treatment Plus-experimental)
 Phase I: 2 months, Phase II: 4 months, Phase III: 6 months
 Free ACH: Program provided Abstinence Contingent Housing at no costs
 Rented ACH: Program provided Abstinence Contingent Housing for subsidized rent
 Paid ACWT: Program provided Abstinence Contingent Work Therapy for minimum wage
 Vocational Rehab: Program provided vocational counseling.

who were mostly male and African American. Significant differences at both time points were revealed in percent days drug abstinent based on weekly random urine toxicology tests favoring the DT+ treatment group. DT+ was 30% more days abstinent than DT at 2-months and 26% more days abstinent at 6-months. Other measures of drug abstinence were consistent in favoring DT+ over DT. For homelessness, DT+ participants were more securely housed than DT at the 6-month point only. There were no differences between groups for employment, but both groups increased days employed at 12-months. Final analysis of the complete sample of 141 and the 12-month follow-up point confirm superior drug abstinence rates for DT+ as compared to DT at 2- and 6-month points.¹⁴ Significant within group improvements, but lack of between treatment group differences in drug abstinence were revealed at 12-months. Results demonstrate the short-term efficacy of abstinence contingent housing and work therapy interventions for homeless persons in drug addiction treatment. Long lasting treatment effects failed to be demonstrated.

Description of Interventions

Phases and intervention components for Homeless 1 and 2 are presented in **Table 1**. Both studies utilized a similar three phase structure separated by assessment points over a twelve month period. Program provided and supervised housing in refurbished community houses or apartments was made available to participants based on a contingency management model. Housing was used as reinforcement for those who initiated and stayed abstinent from alcohol and all other addictive substances as measured by urine toxicology testing.

The work therapy program was also operated using a contingency management model. Participants were eligible for work therapy during Phase II. Work therapy consisted of supervised and paid work hardening and skills training experiences. Details of methods, results, and discussion for these studies are found elsewhere.¹³⁻¹⁵

Methods

Participants

Participants were volunteers who enrolled in the Homeless 1 and Homeless 2 studies described above. Eligibility criteria for both studies were similar: (i) homeless, (ii) substance use disorder, primarily cocaine, (iii) non-psychotic-mental illness, (iv) no psychiatric or physical illness requiring inpatient hospitalization, and (v) cognitive ability to provide informed consent. The characteristics of subjects by treatment group in Homeless 1 and Homeless 2 studies are presented in **Table 2**.

Design

This study is a retrospective analysis of treatment costs and treatment outcome costs from a program viewpoint for the Homeless 1 and 2 randomized controlled drug addiction treatment outcome studies. Both studies had similar treatment components and outcome variables. Reported are costs of treatment by service category and costs by drug abstinence outcomes by treatment group by study.

Table 2. Characteristics of subjects by treatment group in Homeless 1 and Homeless 2 studies.

Characteristic		Homeless 1 *			Homeless 2 **		
		Total	UC	EC	Total	DT	DT+
Sample size	# (%)	131	62	69	141	69	72
Male	# (%)	104 (79.4)	54 (87.1)	50 (72.5)	102 (72.0)	54 (78.2)	48 (66.6)
African Am.	# (%)	126 (96.2)	62 (100)	64 (92.8)	117 (83.0) †	55 (79.7)	62 (86.1)
Veteran	# (%)	46 (35.1)	24 (38.7)	22 (31.9)	33 (24.0) †	18 (26.1)	15 (20.8)
Cocaine primary	# (%)	94 (71.7)	49 (79.0)	45 (65.2)	114 (81.0)	53 (76.8)	61 (84.7)
Age	M (SD)	35.9 (6.39)	35.7 (6.2)	36.0 (6.6)	37.7 (7.1) ‡	38.4 (7.4)	37.0 (6.8)
Education (yrs)	M (SD)	12.2 (2.09)	12.2 (2.1)	12.2 (2.1)	13.1 (2.4) ‡	13.1 (2.6)	13.1 (2.2)
Homeless (mos)	M (SD)	13.7 (18.0)	13.2 (17.8)	14.1 (18.3)	26.9 (44.9) ‡	25.8 (43.2)	28.0 (46.0)
Longest job (mos)	M (SD)	54.2 (55.1)	50.5 (57.0)	57.6 (52.4)	57.2 (48.9)	57.4 (48.5)	56.9 (49.9)

* UC (Usual Care-control), EC (Enhanced Care-experimental)

** DT (Day Treatment-control), DT+ (Day Treatment Plus-experimental)

† Totals significantly different using Chi-square tests, $df's = 1$, $p's < 0.05$

‡ Totals significantly different using two sample t-tests assuming unequal variances, $p's < 0.05$

Treatment Costs and Revenues

The study considers the direct costs of the Homeless studies. Direct costs include treatment and counseling expenses net of any related revenues. All figures are in Year 2000 dollars using the GNP implicit price deflator. Treatment costs and revenues for Homeless 1 and 2 studies are presented in **Table 3** and **Table 4**, respectively.

The study did not attempt to measure the indirect costs of treatment, which are still under investigation. Indirect costs were expenses not immediately within the control of the study intervention. They would include the costs of crime attributable to drug addiction, deterioration in property values due to the presence of drug addicted homeless persons, medical costs arising from drug addiction including emergency

room visits or the transmission of diseases such as hepatitis and AIDS, and the loss of earnings due to lost employment. Reductions in these costs may be classified as benefits under some evaluation schemes.¹⁶ The Homeless studies did collect information concerning homelessness and employment. Long-term employment of study participants is currently being tracked.

Treatment costs were derived from accounting records for Homeless 1 and 2 studies. Treatment costs were categorized into five categories: Counseling, Abstinent Contingent Housing (Housing), Abstinent Contingent Work Therapy (Work), Administration, and Other Expenses. Counseling costs consisted of all expenses incurred in providing Twelve Step, day treatment, and aftercare services. These included clinical staff salaries and fringe, follow-up and re-engagement

Table 3. Treatment costs by treatment category, group and phase for Homeless 1. (Year 2000 dollars)

	UC *			EC *		
	Phase I	Phase II	TOTAL	Phase I	Phase II	TOTAL
Counseling	\$92,986	\$28,925	\$121,910	\$360,118	\$107,680	\$467,798
Housing	—	—	—	—	\$37,466	\$37,466
Work	—	—	—	—	\$103,030	\$103,030
Administration	\$67,678	\$29,917	\$97,595	\$64,443	\$31,993	\$96,436
Other Expenses	\$71,260	\$16,039	\$87,299	\$121,734	\$30,399	\$152,132
Total	\$231,923	\$74,881	\$306,804	\$546,295	\$310,567	\$856,862
Rent revenues					\$(18,264)	
Housing revenues					\$(42,149)	
Total (-revenues)					\$250,154	\$796,449

* UC (Usual Care-control), EC (Enhanced Care-experimental)

Table 4. Treatment costs by treatment category, group and phase for Homeless 2. (Year 2000 dollars)

	DT*				DT+*			
	Phase I	Phase II	Phase III	TOTAL	Phase I	Phase II	Phase III	TOTAL
Counseling	\$121,866	\$40,735	\$20,789	\$183,390	\$121,866	\$40,735	\$20,789	\$183,390
Housing	—	—	—	—	\$49,238	\$86,487	\$13,356	\$149,080
Work	\$9,126	\$2,104	\$1,076	\$12,305	\$15,662	\$296,166	\$717	\$312,545
Administration	\$28,734	\$7,237	\$4,113	\$40,085	\$28,734	\$10,332	\$4,114	\$43,181
Other Expenses	\$31,633	\$7,801	\$4,012	\$43,446	\$31,633	\$11,263	\$4,012	\$46,908
Total	\$191,360	\$57,877	\$29,990	\$279,226	\$247,133	\$444,983	\$42,987	\$735,103
Rent revenues						\$(47,651)		
Housing revenues						\$(127,729)		
Total (-revenues)						\$269,603		\$559,723

* DT (Day Treatment-control), DT+ (Day Treatment Plus-experimental)

incentives, tracker salary, laboratory testing for urine toxicology screening, and social/recreational vouchers. Housing expenses consisted of money to buy houses for refurbishing, supplies used to refurbish the houses, and utility costs incurred from program provided housing. Work costs consisted of work therapy staff salaries, expenses of a training subcontractor, and client work therapy stipends. Administration costs were personnel salaries and fringe for the executive director, chief financial officer, administrative secretary, medical director, security staff, data entry staff, and temporary help. Finally, Other Expenses consisted of costs for travel, space rental, utilities, rental equipment, vehicle maintenance, insurance, telephone, pagers, postage, personnel recruitment, license fees, printing, mileage, and supplies. Expenses attributable to research were ignored. Relative treatment costs were allocated to the appropriate phase and treatment group for both studies based on judgments and post hoc decisions made by the principal investigators.

Two categories of revenues were identified: client rent and housing equity. During the four-month Phase 2, clients paid the project a modest rent for abstinent contingent housing. Rent for housing in Homeless 1 was \$5.00 per day or \$150.00 per month and \$5.76 per day or \$172.80 per month for Homeless 2. For Homeless 1, rent was estimated by multiplying four months of rent by the number of participants who participated in the housing component and rent revenues for Homeless 2 were more accurately obtained through accounting records. Housing equity was another category of revenue. At completion of each study, housing equity or the value of each of the fully owned project houses was obtained from the tax assessors office and credited as a revenue to the study.

Drug Abstinence Variables

For the purpose of calculating costs of drug abstinence, abstinence was defined for both Homeless 1 and 2 studies as

persons abstinent and weeks abstinent from all addictive drugs and alcohol at the completion of Phases I, II, and III or at 2-, 6-, and 12-month research follow-up points, respectively. Since both Homeless 1 and 2 measured abstinence at scheduled research follow-up points, but only Homeless 2 measured abstinence randomly each week throughout treatment, weeks abstinent was estimated for Homeless 1 and reported directly for Homeless 2.

Persons abstinent were defined as the number of persons abstinent or negative for the presence of addictive drugs, primarily alcohol, cocaine, and marijuana as assessed at scheduled research follow-up points by observed OnTrack urine toxicology testing¹³⁻¹⁴. Average weeks abstinent was estimated by multiplying the number of persons abstinent by the number of weeks completed at the end of each Phase and then divided by the number of study participants by treatment group for each study. For example, as shown in **Table 5**, for the Homeless 1 UC treatment group at the completion of Phase I or 8 weeks, (16 persons abstinent * 8 weeks of Phase I) / 62 participants in the UC group = 2.1 average weeks abstinent after the completion of Phase I. Average weeks abstinent were calculated and average costs per average weeks abstinent were compared in this way for both Homeless 1 and 2 studies in **Table 5** and **Table 6**. Since Homeless 2 measured abstinence randomly on a weekly basis, actual weeks abstinent and average costs per average weeks abstinent are presented in **Table 7**.

Costs Analysis Variables

Cost analysis variables included costs of treatment, average costs per person, average costs per average weeks abstinent, and incremental costs. Costs of treatment (minus revenues) were derived as stated above and reported cumulatively by Phase and treatment group for both studies in **Tables 5-7**. Specifically, the costs of treatment at the end of Phase I are only those costs associated with conducting the 8 weeks of Phase I. The costs at the end of Phase II are those costs

Table 5. Average and incremental costs of treatment (in Year 2000 dollars) by Phase measuring abstinence at follow-up points: Homeless 1.

Treatment group * and sample size	Costs of treatment †	Average costs per person	Persons abstinent N (%)	Average weeks abstinent	Average costs per average weeks abstinent	Incremental Cost Effectiveness ratio
Phase I completion (2-months)						
UC (n = 62)	\$231,658	\$ 3,741	16 (25.8%)	2.1	\$1,781	
EC (n = 69)	\$546,295	\$ 7,917	33 (47.8%)	3.8	\$2,083	\$2,459
Phase I + II completion (6-months)						
UC	\$306,804	\$ 4,948	18 (29.0%)	6.7	\$739	
EC	\$796,449	\$11,543	28 (40.6%)	10.3	\$1,121	\$1,832
12-month follow-up						
UC	—	—	17 (27.4%)	14.4	\$344	
EC	—	—	23 (33.3%)	19.7	\$586	\$1,244

* UC (Usual Care-control), EC (Enhanced Care-experimental)

† Excluding rent and housing revenues.

Note: Because Homeless 1 ended treatment at the end of Phase II/6-months, there were no additional treatment costs at the 12-month follow-up.

associated with 24 weeks of Phase I and II. Phase III costs are the cumulative costs of 53 weeks of Phases I, II, and III. Since there were no treatment services provided in Phase III for the Homeless 1 study, the costs at the end of Phase III were the same as at the end of Phase II.

Average costs per person was calculated by dividing the costs of treatment by the number of participants for each treatment group. Average costs per average weeks abstinent was calculated by dividing the average costs per person by the average weeks abstinent. These were calculated for each study, by Phase and treatment group.

Finally, the primary measure of cost-effectiveness was the incremental cost-effectiveness ratio defined as the difference in average costs of per person divided by the difference in the average weeks abstinent achieved by the treatment and control groups.¹⁷ Thus:

$$\text{Incremental Cost-Effectiveness} = \frac{(\text{Cost}_T - \text{Cost}_C)}{(\text{Abstinent}_T - \text{Abstinent}_C)}$$

where subscripts indicate the treatment (T) and control (C) groups, respectively. The ratio measures the additional cost of obtaining one more average week of abstinence at the end of each Phase by implementing the treatment condition. If the numerator is negative and the denominator is positive, the treatment is clearly advantageous. If the numerator is positive and the denominator is negative, the treatment is clearly wasting money since it costs more and achieves less than the control. If both numerator and denominator are positive, policy makers must decide if the additional cost is worth the gain in abstinent persons. This cost-effectiveness measure can be defined at any time point. We emphasize in this paper the 12 month endpoint because it gives us insight into how the programs compare after all costs have been incurred and after

participants have left active treatment. The 12-month end point may thus be the best predictor of the long term outcomes of drug addiction treatment.

Results

Participants

Table 2 presents sample sizes and demographic characteristics of the Homeless 1 and 2 study participants by treatment group. Significant differences in total sample characteristics between Homeless 1 and 2 were analyzed using chi-square tests for the categorical variables and two sample t-tests assuming unequal variances for continuous variables at the $\alpha=.05$ level of significance. Significant differences in total sample characteristics between Homeless 1 and 2 were revealed for the following variables: Race (there were fewer African Americans in Homeless 2), Veteran (there were fewer veterans in Homeless 2), Age (participants were older in Homeless 2), Education (participants had more years of education in Homeless 2), and Homelessness (participants had more months of homeless in Homeless 2).

Treatment Costs for Homeless 1

Treatment costs and revenues by treatment category, group and phase for Homeless 1 are presented in **Table 3**. All figures are in year 2000 dollars using the GNP implicit price deflator. Total costs for conducting EC (minus revenues) were two and one half times that of UC (\$796,449 vs. \$306,615) after \$60,413 were returned from EC rent and housing revenues. Among treatment categories, Counseling represented the category with the greatest costs for both treatment groups

Table 6. Average and incremental costs of treatment (in Year 2000 dollars) by Phase measuring abstinence at follow-up points: Homeless 2.

Treatment group * and sample size	Costs of treatment †	Average costs per person	Persons abstinent N (%)	Average weeks abstinent	Average costs per average weeks abstinent	Incremental Cost Effectiveness ratio
Phase I completion (2-months)						
DT (n=69)	\$ 191,360	\$ 2,773	34 (49.3%)	3.9	\$ 711	
DT+ (n=72)	\$ 247,133	\$ 3,441	53 (73.6%)	5.9	\$583	\$334
Phase I + II completion (6-months)						
DT	\$ 249,237	\$ 3,612	24 (34.8%)	9.5	\$380	
DT+	\$ 516,735	\$ 7,177	32 (44.4%)	13.0	\$ 552	\$1,019
Phase I + II + III completion (12-months)						
DT	\$ 279,226	\$4,047	19 (27.5%)	19.4	\$209	
DT+	\$ 559,722	\$ 7,774	26 (36.1%)	23.1	\$337	\$1,007

* DT (Day Treatment-control), DT+ (Day Treatment Plus-experimental)

† Excluding rent and housing revenues.

with EC spending almost four times as much on Counseling as UC (\$467,798 vs. \$121,910). Administration costs were similar for both treatment groups, EC spent almost twice as much on Other Expenses than UC, and UC had no costs or programs for Housing or Work. Phase I was three times more costly than Phase II for UC (\$231,923 vs. \$74,881) and one and one half times more costly for EC (\$546,295 vs. \$310,567). **Table 5** shows that costs per person in the EC intervention were approximately twice that of the UC intervention at the completion of Phase I (\$7,917 vs. \$3,741) and Phase II (\$11,543 vs. \$4,948).

Treatment Costs for Homeless 2

Treatment costs for Homeless 2 (in Year 2000 dollars) are shown in **Table 4**. DT+ was also twice as costly as DT (\$559,723 vs. \$279,226) after \$175,380 was returned in rent and housing revenues from the DT+ condition. Counseling represented the most costly treatment category for the UC treatment with no differences in costs between treatment groups (\$183,390) because both groups were designed to receive the exact same counseling services. Work was the most costly for the DT+ group due to the number of houses purchased and the supplies needed to renovate them. Administrative and Other Expenses costs were similar between treatment groups and DT had substantially less Work costs compared to DT+ (\$12,305 vs. \$312,545) because DT received minimal vocational counseling as compared to an extensive abstinent contingent work therapy training program with paid stipends for DT+. No Housing costs were accrued for DT as there was no housing component in this group. Total Housing costs for DT+ were \$149,080. Phase I was more costly than Phase II for DT (\$191,360 vs. \$57,877) and Phase II was more costly than Phase I for DT+ (\$444,983 vs. \$247,133). This is because

significantly more Housing and Work costs were incurred in Phase II for the DT+ group than for DT. Phase III was the least costly phase for both treatment groups.

Table 6 reports that for Homeless 2, costs per person after Phase I were almost equivalent for DT and DT+ (\$2,773 vs \$3,441). However, at the completion of Phase II, the difference in costs per person between the DT and DT+ almost doubled (\$3,612 vs. \$7,177). The same pattern was revealed at the completion of Phase III. As in Homeless 1, costs per person per treatment month were greater for DT+ at the completion of each Phase and decreased as the number of treatment months increased.

Costs of Drug Abstinence for Homeless 1

Table 5 shows abstinence variables and average costs per average weeks abstinent and incremental costs by Phase when measuring abstinence at follow-up points for Homeless 1. There were 17, 10, and 6 more abstinent persons for EC as compared to UC at the end of each of the three Phases. There were 1.7, 3.6, and 5.3 more average weeks abstinent for EC than UC at the end of each of the three Phases. Average costs per average weeks abstinent were greater for EC than UC with similar differences at each Phase. These costs significantly decreased as treatment lengthened for both treatment groups. At the 12-month point, average costs per average week abstinent were \$344 for UC and \$586 for EC. The incremental cost effectiveness ratio at the end of Phase I for Homeless 1, calculated as described in the methodology above, equaled \$2,459 or $(\$7,917 - \$3,741) / (3.8 - 2.1)$. That is the additional cost necessary to increase abstinence outcome one average week as a function of enhancing treatment with the EC treatment condition. The incremental costs at the end of Phases II and III were \$1,832 and \$1,244, respectively.

Table 7. Average and incremental costs of treatment (in Year 2000 dollars) by Phase measuring abstinence throughout treatment: Homeless 2.

Treatment group * and sample size	Costs of treatment †	Average costs per person	Average weeks abstinent	Average costs per average weeks abstinent	Incremental Cost Effectiveness ratio
Phase I completion (2-months)					
DT (n=69)	\$ 191,360	\$ 2,773	3.1 (2.8)	\$ 894	
DT+ (n=72)	\$ 247,133	\$ 3,441	5.0 (2.8)	\$ 700	\$ 366
Phase I + II completion (6-months)					
DT (n=69)	\$ 249,237	\$ 3,612	6.1 (6.1)	\$ 592	
DT+ (n=72)	\$ 516,735	\$ 7,177	12.2 (8.1)	\$ 588	\$ 584
Phase I + II + III completion (12-months)					
DT (n=69)	\$ 279,226	\$4,047	<i>not available</i>	<i>not available</i>	
DT+ (n=72)	\$ 559,722	\$ 7,774	<i>not available</i>	<i>not available</i>	<i>not available</i>

* DT (Day Treatment-control), DT+ (Day Treatment Plus-experimental)

† Excluding rent and housing revenues.

Costs of Drug Abstinence for Homeless 2

Table 6 shows abstinence variables and average costs per average weeks abstinent and incremental costs by Phase when measuring abstinence at follow-up points for Homeless 2. There were 19, 8, and 7 more abstinent persons for DT+ as compared to DT at the end of each of the three Phases. There were 2.0, 3.5, and 3.7 more average weeks abstinent for DT+ than DT at the end of each of the three Phases. Average costs per average weeks abstinent were greater for DT+ than DT at the end of Phases II and III, but not at the end of Phase I. At this point, DT (\$711) was actually more costly per average week abstinent than DT+ (\$583). These costs gradually decreased as treatment lengthened for both treatment groups. At the 12-month point, average costs per average week abstinent were \$209 for DT and \$337 for DT+. The incremental cost effectiveness ratio at the end of Phase I for Homeless 2, calculated as described in the methodology above, equaled \$334 or $(\$3,441 - \$2,773) / (5.9 - 3.9)$. That is the additional cost necessary to increase abstinence outcome one average week as a function of enhancing treatment with the DT+ treatment condition. The incremental costs at the end of Phases II and III were \$1,019 and \$1,007, respectively.

As described in the methodology, Homeless 2 collected continuous and random abstinence measures throughout the first two Phases of treatment and are considered more rigorous than only the scheduled research point abstinence measures in Homeless 1. **Table 7** replicates **Table 6** results using actual measures of weeks abstinence. While costs of treatment and average costs per person remain the same, average weeks abstinent differ somewhat. When measured weekly as compared to estimated, the difference in average weeks abstinent between DT+ and DT were similar at the end of Phase I, but was twice as large at the end of Phase II, due to

an over estimation of weeks abstinent for the DT group. This resulted in a similar incremental cost-effectiveness ratio at the completion of Phase I and a difference of \$1,019 to \$584 in the incremental cost at the completion of Phase II when comparing estimated to actual weeks abstinent.

Discussion

We have compared the results of two randomized controlled trials where homeless persons with drug addictions were assigned to different forms of treatment. Our main interest has been to determine the cost-effectiveness of the various treatment approaches from the perspective of direct program costs.

Treatment Costs: Role of Work and Housing Components

Comparisons of treatment costs revealed that for both studies the experimental treatments were approximately two times more costly than the controls. This was primarily due to the expenses incurred from the housing and work programs. In Homeless 1, the housing and work components represented approximately 16% of the total costs before revenues for the EC condition. In the DT+ treatment for Homeless 2, significantly more of the total costs, that is 63%, were represented by housing and work. In Homeless 2, however, more housing and work costs were incurred in the DT+ condition due to the additional housing needed in Phase I. Additionally, more houses were purchased in Homeless 2 than in Homeless 1 and Homeless 2 was more cost efficient, especially with regard to counseling costs. Running these

experiments consecutively enabled the investigators to utilize existing counseling, administrative and other resources from Homeless 1 to Homeless 2.

While most drug addiction treatment agencies have administrative and counseling infrastructures and budgets, replicating the contingency management work and housing interventions will represent an additional financial burden and the biggest challenge to dissemination of this research. Two solutions to this problem are revenues and utilization of existing work and housing resources. This research demonstrated returns in costs related specifically to housing can help defray initial investments in these components. Specifically, 7% of the total costs for Homeless 1 and 24% for Homeless 2, were returned to the agency in the form of rent and housing revenues. The work-and-housing interventions might become more cost effective compared to their control groups if they focused on building new housing in affluent communities where profits should be higher than on rehabilitating housing in disadvantaged neighborhoods. An alternative to providing work and housing is utilizing existing resources in the community. The present decade has seen a significant rise in government funds devoted to public housing and rent vouchers for persons in drug addiction treatment. Furthermore, most states have existing vocational rehabilitation programs that can be integrated with drug addiction treatment programs to save dollars.

Finally, one of the most innovative alternatives to providing work programs, is reaching out to private employers and contracting with them to provide drug free employees for job slots. Initial attempts at recruiting private industry to participate in abstinent contingent work has resulted in a surprising number of interested employers.

Costs of Drug Abstinence

The main issue for cost effectiveness evaluation is the familiar question of: which drug abuse treatment produces the greatest “bang for the buck”? For this study, we focused on drug abstinence. What are the relative costs of the various treatments and what do they yield in terms of weeks or persons abstinent from drugs? Of course, drug abstinence is not the only treatment outcome of interest or solely indicative of an effective treatment program. Stable housing, employment, and reduction of health care utilization and criminal behavior are obvious outcomes of interest, but are not addressed in this study.

First, differential treatment outcome must be determined. We consider the issue of effectiveness as measured by drug abstinence only. Experimental treatments in both studies had higher levels of abstinence overall than the corresponding control conditions.^{13,14} At 12-month follow-up, however, the treatment group differences in abstinence rates as measured failed to differ. This paper examines the potential cost effectiveness of Homeless 1 and 2 under the hypothesis that the furthest follow-up, 12 months results represent real and repeatable differences in the average abstinence rates. This assumption is worth investigation because there have been only two experiments thus far and because repeated experiments

would increase sample size and narrow estimates of the variances to some extent. If the difference is assumed to be zero due to statistical insignificance, the control group is clearly the more cost-effective.

Previous research has clearly demonstrated in both Homeless 1 and 2 that the enhanced or experimental intervention was superior in increasing drug abstinence.^{13,14} A more detailed look at the data, however, revealed that abstinence rates regressed toward baseline after 2-months (not uncommon due to relapse after treatment) and treatment groups failed to differ after the 6-month assessment point. Continuous measures of abstinence used at 2- and 6-months have been found by the authors more reliable at detecting treatment group change¹⁴ and might have been more sensitive at detecting change at 12-months if available. These challenging characteristics of the effectiveness and measurement of the effectiveness of drug addiction treatment interventions makes determining the simple worth of any intervention over the other more difficult. Despite this, the costs of abstinence have been calculated in this study and provide a means for determining the relative worth of the interventions from a cost perspective. Homeless 1 revealed that at the completion of each Phase, average costs per average weeks abstinent for the UC program were less than for the EC treatment. The EC group averaged more weeks abstinent at each Phase but the extra costs of the EC program offset this benefit. The incremental cost-effectiveness ratio was only \$ 1,244 at the 12-month point. For Homeless 2, a similar pattern was revealed, except for a reverse in cost-benefit at the completion of Phase 1 point. Here, average costs per average weeks abstinent was less for the more expensive DT+ intervention than DT. The incremental cost-effectiveness ratio at 12 months was \$ 1,007. How these costs compare to other “life saving” costs is discussed below.

Limitations

In this paper we do not measure the indirect costs or benefits of the Homeless studies and we do not formally evaluate cost effectiveness from a wider societal perspective. We do offer, however, the following observations on these societal issues. First, even though the work and housing treatment is expensive relative to the various counseling-only alternatives, the treatment is not expensive relative to other social or medical interventions.

One interpretation of the Homeless studies is that a person who has become abstinent was “saved” from a wasted and unproductive life. The average person in these studies was about 38 years old. The normal life expectancy for the sex-race mix of Homeless 2 was slightly more than 35 years. From this perspective, the incremental cost per year of life “saved” was \$1,144 (=280,496/(7*35)) for Homeless 2 DT+ and \$1,273 (=267,498/(6*35)) for Homeless 1 EC. These numbers are optimistic because they ignore the possibility of recidivism and they do not compare actual mortality rates between persons actively using and those in recovery. However, a literature review of 587 life-saving interventions has found that the median cost per year-of-life-saved (in 2000

dollars) was \$21,602 for medical interventions, \$54,575 for injury reduction and \$3,184,000 for toxin control.¹⁸ These estimates are based on actual differences in mortality but they serve as a useful benchmark for the Homeless studies under the assumption that becoming and staying abstinent is equivalent to saving a life.

Second, another societal perspective is to consider the value of the gain in productivity that might result from becoming abstinent. An employed person with the education (mean of 12 years) and demographics (predominantly black male) of the homeless studies participants would have earnings worth about \$657,000 in present value (year 2000 dollars) using a 3 percent discount rate with adjustments for life expectancy. After subtracting the 40 to 80 thousand dollars required to save an additional person with the more expensive treatment arms of the Homeless studies, there remains a net present value of \$617,000 (657,000 - 40,000) to 537,000 (657,000 - 80,000) in future earnings. It would require a discount rate ("internal rate of return") of 88% to 44%, respectively, to reduce the net present value to zero. These are rough and optimistic calculations because we do not know much about the long term employment prospects of recovered addicts. We are currently tracking the employment rates of the study participants.

Conclusion and Implications

When only the direct costs of programs and their abstinent rates are considered, treatments that involve abstinent contingent work and housing have incremental cost ratios that are within the range of many other common social and medical interventions. These enhanced programs are more cost-effective early on in treatment than at 12-month follow-up due to relapse common among existing drug treatment. A methodological limitation of this study is that direct program costs do not measure the societal value of reducing homelessness itself.

Usual and improved treatment methods offer a cost-effective approach to improving abstinence among addicted homeless persons. Policy makers might reasonably choose to implement enhanced treatment programs that also reduce homelessness because the incremental cost of these programs is within a reasonable range compared to other common societal interventions. Methods and data need to be developed to better measure the societal benefit to communities of reducing the numbers of homeless persons with addictive drug problems.

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