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Healthcare service utilization in substance abusers receiving contingency management and standard care treatments

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Abstract

Aim—To determine the impact of standard care and contingency management treatments on the utilization of general healthcare services by substance abusers.

Participants, Design and Measurements—This secondary analysis pooled 1,028 treatment-seeking substance abusers from five randomized clinical trials that compared the effects of standard care (SC, $n = 362$) to standard care plus contingency management (CM, $n = 666$). In each trial, subjects in the CM condition showed significantly greater reductions in substance use than their SC counterparts. For each subject, utilization of 15 general healthcare services was measured one year prior to treatment intake and up to nine months following treatment intake. Post-intake utilization data were prorated to be comparable to the one-year pre-intake data. Paired t -tests evaluated changes in service utilization pre- and post-intake, and difference-in-differences regression models were used to estimate the impact of CM, compared to SC, on changes in the utilization of each of the 15 health services.

Setting—Outpatient community substance abuse clinics in Connecticut and Massachusetts, USA.

Findings—Utilization of several types of outpatient services significantly increased between the pre-intake and post-intake periods (e.g., dental visits (+0.47, $P < 0.001$), community health center visits (+0.50, $P < 0.001$), visits to a mental health professional office (+1.03, $P = 0.001$)), while inpatient hospital care for mental health problems decreased significantly (−3.50 nights, $P < 0.001$). A substantial portion of these changes occurred during the treatment period. No significant differences were found between the two treatment conditions.

Conclusions—Initiating outpatient substance abuse treatment is associated with changes in general healthcare service utilization, independent of the type of treatment offered.

Keywords

contingency management; health services utilization; difference-in-differences

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INTRODUCTION

Contingency management (CM) is an empirically based intervention in which patients receive tangible reinforcers for evidence of positive behavior change. In a meta-analysis of interventions for substance use disorders [1], CM had the largest effect size of all psychosocial treatments. Other meta-analyses of CM [2,3] likewise point to the efficacy of CM across a range of substance use disorders and clinical settings.

In addition to being efficacious [2,3,8,9], data also suggest that CM may be cost effective [4–7]. Relative to standard care, the incremental costs of CM, including direct prize reinforcement and administrative costs, to extend continuous periods of drug abstinence by one week range from \$75–\$258 per patient [5–7]. Although these cost estimates may be useful for informing policy related to treatment decisions, to date no studies have considered the impact of CM on general healthcare costs, which are also important for guiding decision making processes. This dearth of information is not unique to the CM literature. Little information exists on healthcare service utilization among substance abusers in treatment programs in general [10], and the available data reveal mixed and complex findings.

As drug abusers initiate treatment and reduce their alcohol and illicit drug use, they may be more inclined to seek and receive services for other health and mental health problems. An important aspect of comprehensive drug abuse treatment is to link patients to appropriate preventive and primary care services, as well as needed psychiatric care [11]. Thus, medical and psychiatric outpatient services may increase when patients are receiving drug abuse treatment relative to periods prior to treatment, when they are actively using drugs. Some data are consistent with this expectation, with substance abusers reporting they rarely or never sought general medical or psychiatric care while using [12]. Other data suggest that medical and psychiatric services may need to be accessible in the same physical space as substance abuse treatment for utilization of outpatient services to increase [11,13].

Although outpatient and preventive healthcare service utilization may be low among non-treated substance abusers, emergency room visits and inpatient hospitalizations tend to be high [14,15]. Use of these services theoretically should decrease when substance abusers are involved with effective drug abuse treatment and are more stable. Again, some data are consistent with this hypothesis, but emergency care and inpatient hospitalizations also appear to vary by substance use diagnosis and other patient characteristics [10,16–19].

This paper examines the effect of CM and standard care treatments on the utilization of general healthcare services. It utilizes a unique dataset comprising detailed service utilization reports of medical, substance use and other psychiatric services, including both in and outpatient treatments, collected during five CM trials involving over 1000 substance abusing patients. All patients were treatment-seeking substance abusers. As such, results of this study do not necessarily apply to substance abusers in general (e.g., substance abusers identified through screening and/or brief interventions in primary care settings). We hypothesized that utilization of some services (e.g., outpatient substance use, medical, and psychiatric visits) would increase as patients initiated substance abuse treatment relative to the period preceding their entry to drug abuse treatment, and other more expensive services (e.g., emergency room, inpatient hospitalizations) would decrease. We also investigated whether CM differentially impacts service utilization compared to standard care. Because of its beneficial effects on extending time in outpatient drug abuse treatment and improving drug use outcomes, CM may differentially impact utilization of healthcare services.

METHODS

Data for the present study were pooled from five clinical trials that compared the effects of standard care (SC, $n = 362$) to standard care plus contingency management (CM, $n = 666$) on substance use outcomes [20–24]. All five trials were conducted by a single investigator (Petty) and designed with parallel procedural elements, which facilitated combining samples for secondary analyses. Specifically, in all trials (a) subjects were randomized to either SC or CM, (b) all subjects (including those randomized to CM) received standard care treatments that were similar in type (group counseling), orientation (cognitive behavioral, daily planning, plus 12-step), intensity (intensive outpatient followed by aftercare), duration (12 weeks), and setting (outpatient community substance abuse clinics), (c) subjects completed health services utilization surveys at intake (covering the one-year period prior to intake) and again at 1, 3, 6, and 9 months post-intake (covering the period since the last survey was completed), and (d) subjects in the CM condition averaged significantly longer durations of continuous abstinence during the treatment period than their SC counterparts (see Table 1). As seen in Table 1, there were differences across the trials with respect to sample sizes, populations, targeted behaviors for reinforcement in the CM conditions, and the average dollar value of reinforcement earned. Table 2 summarizes demographic and baseline characteristics of the 1,028 subjects in the present study.

Column 1 of Table 3 shows the specific services included in the health services utilization (SU) survey [25]. Note that services were partitioned by inpatient vs. outpatient settings and by medical (i.e., non-mental health) vs. mental health problems (i.e., drug or alcohol abuse, emotional or psychiatric problems). Outpatient utilization was measured as numbers of visits and inpatient utilization was measured as numbers of nights spent. Specifically, for the SU survey administered at treatment intake, subjects reported the number of visits to each outpatient setting and the number of nights spent in each inpatient setting during the past year. For each SU survey administered post-intake, subjects reported the number of visits or nights since the last SU survey was completed. Thus, if a subject missed the 1-month SU survey, the 3-month SU survey would capture all visits or nights since treatment intake. Of the 1,074 subjects randomized to treatment across the five trials, 100% completed the SU survey at intake, 96% ($n = 1,028$) completed at least one of the post-intake SU surveys, and 68% ($n = 726$) completed all of the post-intake SU surveys. Because at least one post-intake SU survey was needed to implement the analyses described below, the present study excluded the 4% of subjects who did not complete any post-intake SU surveys.

Analyses

The pre-intake period for all subjects was exactly one year while the post-intake period was approximately nine months. To make the pre-intake data comparable to the post-intake data, the post-intake data were prorated for a one year period. Although previous studies have prorated utilization data assuming utilization rates are constant during the entire post-intake period [26,27], Figure 1 shows that this assumption was invalid for many of the services examined in our study (e.g., visits to a dental office or psychiatric clinic). Specifically, utilization rates were often significantly higher during the active treatment period (covered by the 1-month and 3-month SU surveys) compared to the follow-up period (covered by the 6-month and 9-month SU surveys). However, with the exception of visits to a substance abuse treatment clinic, there were no significant differences in utilization rates during the time periods covered by the 6-month and 9-month SU surveys for any of the services. Thus, for each service (except visits to a substance abuse treatment clinic), we imputed the last few months of utilization for each subject by multiplying the number of days remaining in the year by the average of the daily utilization rates from the subject's 6-month and 9-month SU surveys. For example, if the daily utilization rates for a given subject's dental office visits during the 6-month and 9-month follow-up periods were .010 and .011, respectively, and the

subject's 9-month SU survey was completed 280 days after intake, then we imputed the number of dental visits that occurred during the subject's remaining 85 (i.e., 365–280) days of the year as $85 \times (.010 + .011)/2 = 0.8925$ visits. Utilization rates for visits to a substance abuse treatment clinic decreased significantly across each successive post-intake assessment period, so we assumed a negative time trend when imputing the last few months of visits to a substance abuse treatment clinic for each subject. Paired *t*-tests then evaluated first differences (i.e., differences in service utilization between the one-year pre-intake and prorated one-year post-intake periods) for the pooled study sample.

We used difference-in-differences regression models to estimate the impact of CM versus SC on the utilization of each of the 15 health services. For each service, we compared the change in utilization over time (i.e., pre-intake vs. post-intake) observed in the SC condition to the change in utilization over time observed in the CM condition. Formally, the classic two-period difference-in-differences (DD) model used to estimate the differential impact of CM on the utilization of each of the 15 health services is as follows [28]:

$$Y = \beta_0 + \beta_1 TP + \beta_2 CM + \beta_3 TP * CM + \mu \quad (1)$$

where *Y* is the outcome variable under study (i.e., the total number of visits to a given outpatient setting or the total number of nights spent in a given inpatient setting), *TP* is a dummy variable indicating the observation occurred during the post-intake period, *CM* is a dummy variable indicating membership in the CM condition, *TP*CM* is the interaction of the *TP* and *CM* dummy variables ('1' if the subject was randomized to the CM condition and the observation is in the post-intake period; '0' otherwise), and μ is the error term. The coefficient of interest, $\hat{\beta}_3$ is known as the difference-in-differences estimator and measures the effect of CM, compared to SC, on *Y*. That is, $\hat{\beta}_3$ can be expressed as [28]:

$$\hat{\beta}_3 = (\bar{Y}_{POST,CM} - \bar{Y}_{PRE,CM}) - (\bar{Y}_{POST,SC} - \bar{Y}_{PRE,SC}) \quad (2)$$

where $\bar{Y}_{POST,CM}$ refers to the average utilization of a given service during the prorated one-year post-intake period by subjects in the CM condition, $\bar{Y}_{PRE,CM}$ refers to the average utilization of a given service during the one-year pre-intake period by subjects in the CM condition, and so on. In other words, $\hat{\beta}_3$ measures the difference between conditions (i.e., SC vs. CM) in the difference in average utilization over time (i.e., pre-intake vs. post-intake). Equation (1) was estimated using ordinary least squares regression for each of the 15 health services listed in Table 3. To account for the fact that all subjects appear twice in the data (i.e., observations are not independent), we clustered the standard errors by subject.

Robustness checks

Several additional analyses were conducted to examine the robustness of our results. First, consistent with high rates of recidivism among people with substance use disorders (SUDs), 41% of our sample had visited a substance abuse treatment clinic during the 1-year pre-intake period. To examine the sensitivity of our results to subjects' prior exposure (i.e., within the last year) to substance abuse treatment, we re-estimated the first differences and difference-in-differences separately for those subjects who made at least one visit to a substance abuse treatment clinic during the 1-year pre-intake period (*n* = 420) and those subjects that made no such visits (*n* = 608). Second, as evidenced by the "Average Earned (\$)" column in Table 1, the strength of the CM reinforcers varied across the five trials in the study. To examine the sensitivity of the DD results to variations in CM reinforcers (and other differences) across trials, we re-estimated the difference-in-differences separately for each trial and tested whether the DD results varied significantly across the trials. Third, Table 2 shows that significant baseline differences between the conditions existed in the

pooled data with respect to the percentage of cocaine-dependent subjects and average drug abuse problem scores on the Addiction Severity Index. To determine whether these two baseline differences affected the DD results, both of these covariates were added to equation (1) and the results were re-estimated. Fourth, inasmuch as the effects of CM may attenuate after treatment is completed [3], we re-estimated the DD results using only the SU surveys completed at intake, 1-month post-intake, and 3-months post-intake (i.e., during the time period when CM was likely to have the greatest impact).

RESULTS

Column 8 of Table 3 shows the changes (i.e., first differences) in average health services utilization that occurred within the pooled study sample between the one-year pre-intake period and the prorated one-year post-intake period. Overall, as seen in Table 3, subjects showed a significant *increase* in the number of visits to a dental office, visits to a medical doctor office, day surgeries, visits to a community health center, visits to a psychiatric clinic, visits to a mental health professional office, and visits to a substance abuse treatment clinic. Subjects also showed a significant *decrease* in the number of inpatient hospital nights due to a mental health problem.

To shed light on the timing of these significant changes, Figure 1 shows, for each service, the average daily utilization rates during each assessment period. As seen in Figure 1, for the seven services that experienced a significant increase in utilization between the pre-intake and post-intake periods, a substantial portion (but clearly not all) of these increases occurred during the treatment period (covered by the 1-month and 3-month SU surveys). Moreover, three of the four significant outpatient medical services experienced pronounced spikes during the first month following treatment initiation. In contrast, inpatient hospital care for a mental health problem decreased substantially during the first month of treatment and stayed depressed throughout the entire post-intake period. Although several services (e.g., hospital outpatient clinic) had elevated utilization rates during the post-intake period (compared to the pre-intake period), these did not translate into a significant increase in overall utilization during the prorated one-year post-intake period.

Column 9 of Table 3 shows the difference-in-differences (i.e., second differences) that measure the differential effect of CM, over and above that of SC, on the change in the average utilization of health services between the pre-intake and post-intake periods. None of the difference-in-differences in column 9 were significant, meaning that *compared to SC*, CM did not significantly affect utilization of any of the 15 health services examined in this study.

The results of the robustness checks (not shown but available from the authors) for the first differences and difference-in-differences were all consistent with our main findings that (a) subjects significantly increased utilization of several types of outpatient services between the pre-intake and post-intake periods, while utilization of inpatient mental health services significantly decreased during the same timeframe, and (b) CM does not significantly affect utilization of healthcare services relative to SC.

DISCUSSION

Using this unique dataset, we found that beginning an episode of substance abuse treatment is associated with several changes in healthcare service utilization. First, despite the absence of a case manager and any on-site medical or psychiatric services at the study clinics, substance abusers significantly increased their use of several types of medical and psychiatric outpatient services during the prorated one-year post-intake period (e.g., visits to

a dental office, medical doctor office, community health center, psychiatric clinic). Moreover, a substantial portion of these increases occurred during the active treatment period (see Figure 1), perhaps due to counselors' efforts to connect patients with needed outpatient services. Clinics that offer on-site medical, psychiatric, and case management services are likely to show even more profound effects of increasing outpatient visits [11,13,31].

Second, with respect to inpatient hospitalizations and ER visits, our results suggest important differences by medical vs. mental health problems. Specifically, initiation of substance abuse treatment was related to a significant reduction in the number of hospital inpatient days for *mental health* problems, with inpatient care decreasing substantially during the first month following treatment initiation and staying depressed for the duration of the post-intake period. In contrast, reduction in inpatient hospitalizations for *medical* problems was insubstantial and non-significant. In addition, changes in ER visits for medical and mental health problems, while non-significant, moved in opposite directions. That is, ER visits for *medical* problems spiked during the month following intake (perhaps due to uninsured patients seeking outpatient medical care, similar to the 1-month post-intake spikes observed in dental, medical doctor, and community health center visits), while ER visits for *mental health* problems decreased during the month following intake and stayed depressed for the entire post-intake period (perhaps due to improved mental health from receiving substance abuse treatment, similar to the pattern observed for inpatient hospital care for mental health problems).

Third, because dental visits are important for dental health as well as early identification of some cancers and other medical conditions [29,30], increased utilization of dental care may be an important, and as yet unrecognized, byproduct of substance abuse treatment.

Finally, compared to SC, CM did not differentially affect the utilization of any of the 15 health services examined in this study. Thus, it appears that the beneficial effects of CM observed in the five underlying trials (e.g., retaining patients in substance abuse treatment longer, greater improvements in drug use outcomes) [20–24] did not translate into additional general healthcare costs compared to SC during the first nine months after initiating treatment.

Together, these results suggest patterns of service utilization associated with substance abuse treatment that may be relevant to healthcare providers and payors. It appears that substance abuse treatment in general, although not CM specifically, was associated with enhanced access to some outpatient services and reductions in one costly inpatient service—mental health hospitalizations. Because of the large number of services and providers patients accessed, we did not attempt to estimate costs of services received. Further evaluation of the costs of in- and outpatient services received may address the overall cost benefits of substance abuse treatment from provider and payor perspectives.

Strengths of this study include a large sample size of over 1000 substance abusing patients receiving treatment at seven different clinical sites. Patients provided detailed information about healthcare utilization across a range of services, spanning a nearly two year period. The assessment schedule of every one to three months post treatment initiation and high rates of follow-up participation allowed for relatively frequent contact to improve the likelihood of obtaining accurate data during the post-intake period.

Limitations of this study relate to generalization of these effects. Although these data were drawn from over 1000 substance abusing (primarily cocaine dependent) patients receiving treatment at seven different clinics, these data cannot be generalized to patients with other substance use disorders, non-treatment seeking patients (e.g., non-treatment seeking

substance abusers in the community, or substance abusers identified via the legal system or SBIRT programs), or other treatment modalities (e.g., methadone maintenance, residential, or inpatient substance abuse settings). All the substance abuse clinics, as well as most of the other outpatient and inpatient settings from which the patients reported receiving services, were located in one of two Northeastern states. Further, most of these patients were uninsured or receiving Medicaid, although actual insurance status was not collected as part of this survey. The extent to which these data generalize to insured patients or other states where access to substance abuse and other psychiatric and medical services differs from that in the Northeastern US remains unknown.

These results are also limited by a reliance on self reports. In closed systems (e.g., the Veteran's Administration, private insurers), especially those utilizing electronic medical records, objective indicators of service utilization could more accurately gauge use of services pre- and post- substance use treatment initiation. In addition, the typical post-intake recall period (one to three months) was shorter than the pre-intake recall period (one year), thereby potentially biasing responses in favor of reporting more visits during the post-intake period. However, although this potential source of bias might affect the first differences (and so these results should be interpreted with caution), there is no reason to believe that it would vary by treatment condition or otherwise affect the DD results.

Another limitation of this study is that the duration of follow-up was relatively short. Benefits of successful substance abuse treatment may not be realized in the short term, as most of the significant medical complications associated with substance abuse – such as hepatitis, cirrhosis, and HIV – manifest years later.

To our knowledge, these detailed data are unique in the substance abuse field, and they enhance our understanding of healthcare service utilization in the periods before and after individuals access substance abuse treatment. Additional and longer term research in this area may have important implications for extending substance abuse and other treatment services. To this end, areas for future research include examining the generalizability of our findings to (1) patients with other SUDs; (2) non-treatment seeking patients (e.g., substance abusers in the community, or those identified through SBIRT programs in primary care settings or through the legal system); (3) patients with private insurance; (4) other types of treatment modalities; and (5) substance abuse clinics that offer case management services and/or provide directly linked medical and psychiatric services. Future research should also examine changes in both short-and long-run general healthcare costs associated with substance abuse treatment.

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* Service experienced a significant *increase* in utilization between the one-year pre-intake period and the prorated one-year post-intake period.

**Service experienced a significant *decrease* in utilization between the one-year pre-intake period and the prorated one-year post-intake period.

Figure 1.

Average Daily Utilization Rates - By Service & Assessment Period

For each service, the average daily utilization rate during each assessment period. MH = mental health; PRE = pre-intake period; M1 = 1-month post-intake; M3 = 3-months post-intake; M6 = 6-months post-intake; M9 = 9-months post-intake.

Table 1

Characteristics of the Five Contingency Management Clinical Trials

Trial #	N (SC/CM)	Intake Period	Targeted Population	Targeted behaviors	Average Earned (\$)	LDA in Treatment			p-value ^a
						SC (weeks)	CM (weeks)	CM – SC (weeks)	
1. Petry et al. (2005)	142 (38/104)	2001–2002	Cocaine or heroin dependence	Abstinence and activities	\$346	4.5	7.2	2.7	<.001
2. Petry et al. (2011)	239 (122/117)	2005–2009	Cocaine or heroin or alcohol abuse or dependence	Abstinence and group attendance	\$203	4.1	5.3	1.2	.014
3. Petry et al. (in press)	442 (142/300)	2003–2008	Cocaine dependence	Abstinence or group attendance	\$180	3.2	5.0	1.8	<.001
4. Petry et al. (2006)	131 (40/91)	2000–2003	Cocaine or heroin abuse or dependence	Abstinence or activities	\$136	3.5	5.4	1.9	.008
5. Petry et al. (2004)	120 (37/83)	1998–2001	Cocaine abuse or dependence	Abstinence and activities	\$51	2.5	4.2	1.7	.022

N = sample size

SC = standard care

CM = contingency management

LDA = longest duration of abstinence

^a All p-values were determined using t-tests.

Table 2

Demographic and Baseline Characteristics of Subjects

	SC (n = 362)	CM (n = 666)	CM - SC	p-value ^a
Age, yrs	37.2	36.8	-0.4	0.481
Male, %	51.1	47.9	-3.2	0.326
Years of education, yrs	11.8	12.0	0.2	0.087
Currently married, %	11.3	11.0	-0.3	0.859
Employed, full-time, %	39.0	41.0	2.0	0.524
Past year income, \$	\$11,883	\$11,188	-\$695	0.493
Ethnicity, %				0.590
African American	40.1	42.2	2.1	
Caucasian	45.3	41.1	-4.2	
Hispanic	12.4	13.8	1.4	
Other	2.2	2.9	0.7	
Tested negative for cocaine, opioids and alcohol at treatment intake, %	21.5	21.8	0.3	0.924
Cocaine dependent, %	82.6	89.0	6.4	0.004
Heroin dependent, %	34.5	30.6	-3.9	0.228
Alcohol dependent, %	55.0	54.1	-0.9	0.778
Addiction Severity Index Scores				
Medical	0.27	0.24	-0.03	0.181
Employment	0.73	0.74	0.01	0.803
Alcohol	0.24	0.23	-0.01	0.497
Drug	0.17	0.19	0.02	0.003
Legal	0.14	0.12	-0.02	0.234
Family/social	0.20	0.19	-0.01	0.609
Psychiatric	0.27	0.29	0.02	0.196

SC = standard care; CM = contingency management

^aThe p-value for ethnicity was determined using a chi-square test. All other p-values were determined using t-tests.

Table 3

Average Utilization of Health Services by Time and Treatment Condition; First Differences and Difference-in-Differences

	Pre-Intake				Post-Intake				First Diffs ^{a,b}		Difference in Differences ^c
	All		SC		All		SC		All		
	1028	362	666	1028	362	666	1028	362	666	1028	
Outpatient Medical (Non-Mental Health) Visits											
Dental office	0.77	0.75	0.79	1.24	1.23	1.24	0.47 (<001)				-0.03 (.873)
MD office	1.44	1.69	1.30	1.92	1.78	1.99	0.48 (.031)				0.60 (.221)
Health care (non-MD) office	0.31	0.43	0.24	0.61	0.56	0.63	0.30 (.146)				0.26 (.607)
Outpatient clinic at hospital	1.09	0.73	1.28	1.43	1.44	1.42	0.34 (.214)				-0.56 (.295)
Emergency room at hospital	0.84	0.80	0.86	0.95	0.86	1.00	0.11 (.178)				0.07 (.643)
Day surgery (medical office or hospital)	0.05	0.06	0.03	0.09	0.07	0.10	0.04 (.013)				0.05 (.146)
Community health center	1.15	1.23	1.11	1.65	1.46	1.76	0.50 (<001)				0.42 (.167)
Outpatient Mental Health Visits											
Community mental health center	2.76	3.45	2.39	3.94	3.59	4.14	1.18 (.069)				1.61 (.286)
Psychiatric clinic	0.57	0.55	0.58	1.13	0.94	1.23	0.56 (.004)				0.26 (.504)
Emergency room at hospital	0.19	0.15	0.22	0.11	0.11	0.12	-0.08 (.103)				-0.05 (.505)
Mental health professional ofc (MD or non-MD)	1.98	2.33	1.80	3.01	3.63	2.68	1.03 (.001)				-0.41 (.568)
Substance abuse treatment clinic	27.1	30.5	25.2	54.3	56.1	53.2	27.2 (<001)				2.46 (.641)
Inpatient Treatment Nights											
Hospital for a medical problem	1.44	1.77	1.26	1.09	1.43	0.91	-0.35 (.225)				0.00 (.997)
Hospital for a mental health problem	6.40	6.33	6.43	2.90	3.16	2.76	-3.50 (<001)				-0.50 (.651)
Residential/rehabilitation facility for a mental health problem	11.7	12.7	11.2	9.58	9.14	9.87	-2.12 (.072)				2.27 (.354)

SC = standard care; CM = contingency management

^aFirst Diff^a = First Differences = Post-intake - Pre-intake^bThe *p*-values (in parentheses) for the first differences were determined using paired *t*-tests.^cThe *p*-values (in parentheses) for the difference-in-differences were determined using difference-in-differences regression models with clustering by subject.