Acupuncture in drug treatment: Exploring its role and impact on participant behavior in the drug court setting

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Abstract. The originators of the Miami drug court incorporated acupuncture into the substance abuse treatment regimen that has been widely imitated in hundreds of drug courts since 1989. Although there is some evidence to suggest that acupuncture may be an effective adjunct to treatment more generally, research has not yet examined its role and impact in the drug court setting. This paper describes an effort to study the impact of acupuncture on offender behavior and progress in treatment in the Clark County, (Las Vegas) Nevada Drug Court using a prospective modified experiment, where 336 new participants were randomly assigned to acupuncture and no-acupuncture conditions. However, significant treatment contamination hindered straightforward analysis, as nearly 40% of the control group received at least some acupuncture. To compensate for the treatment compliance problem, two-stage least-squares (2SLS) regression is employed with original group assignment as an instrumental variable and acupuncture exposure as a predictor. Results indicate no significant difference along a range of criminal justice and treatment outcomes, with the exception of one measure of treatment progress. The paper concludes with a discussion of the implications of the findings and the need to design studies that are better able to separate the effects of acupuncture from other treatment and court interventions.

Key words: acupuncture, drug court, drug treatment

> *I feel like it's gotta help some...*
> *I think the needling is cool...*
> *I didn't like the needling 'cause it didn't do anything for me...*
> *I think it's unconstitutional and cruel and unusual punishment...*[1]

Introduction

In 1989 officials in Dade County (Miami), Florida, developed the nation's first drug court, linking active participation in intensive, outpatient substance abuse

treatment to the criminal court, and creating a more informal, supportive, hands-on role for the judge, with a non-adversarial philosophy in the courtroom (Goldkamp 1994). As difficult as the Miami drug court innovation was for many court systems to accept, the use of acupuncture in its drug treatment regimen was, to put it mildly, viewed as one of its most unorthodox elements. As the drug court innovation spread to hundreds of other jurisdictions throughout the United States and abroad during the 1990s and beyond, many new jurisdictions adapted the 'Miami model' to their own treatment approach, often including its use of acupuncture. As a growing body of research is addressing the impact of drug courts themselves (see, e.g., Wilson et al. 2002; Belenko 1998), few studies have focused on the effects of acupuncture when broadly applied in the drug court setting.

This article describes an examination of the contribution of acupuncture to a drug court treatment regimen in the Clark County, Nevada (Las Vegas) Drug Court using a modified experimental design, where 336 newly admitted participants were randomly assigned to acupuncture and non-acupuncture conditions. Participants in the non-acupuncture condition received relaxation therapy as a therapeutic alternative. The treatment and criminal justice outcomes of the two groups of drug court participants were contrasted over a six-month period. Although the experiment suffered from significant treatment contamination problems – 40% of the relaxation group received acupuncture – two-stage least-squares regression with instrumental variables was employed to assess the impact of acupuncture exposure. Findings indicated few differences in outcomes between the acupuncture and relaxation groups. The article discusses the implications of the findings for assessing the role of acupuncture in the drug court model and the need to design studies that are better able to separate the effects of acupuncture from other treatment and court interventions.

Prior research

The rationale for acupuncture in drug treatment

Although acupuncture was used in drug treatment sporadically in the United States during the 1970s, its formal use in the treatment of substance abuse was initiated at the Lincoln Hospital in New York in 1982 by Dr Michael O. Smith, director of the hospital's division of substance abuse (Center for Substance Abuse Treatment 1995). The medical rationale for the use of acupuncture is based on an understanding of the physiology of addiction and withdrawal. Under this model, addiction is conceived as involving changes in the central nervous system's activity as a result of chronic drug use. Conventional thinking equates addiction with brain disease (Leshner 1999). "The addicted brain is distinctly different from the non-addicted brain, as manifested by changes in brain metabolic activity, receptor availability, gene expression, and responsiveness to environmental cues (Leshner 1999: 14)." When drug use is halted, the body experiences withdrawal symptoms that vary based on substance of abuse and the individual's physiology but typically

include tremors, perspiration, drug craving, nausea, vomiting, insomnia, anxiety, agitation, and possibly delirium or hallucinations (Center for Substance Abuse Treatment 1995). By affecting "central nervous system activity in those regions of the brain affected by substances of abuse (Center for Substance Abuse Treatment 1995: 36)," acupuncture appears to reduce the severity of withdrawal symptoms and the physical craving for drugs (Katims et al. 1992).

Research examining the impact of acupuncture in drug treatment

There is a substantial and methodologically rigorous body of research on the use of acupuncture in substance abuse treatment, and findings regarding its impact are mixed. Berman et al. (2004) note that about half of the studies of auricular acupuncture in substance abuse treatment report positive effects, including reduced drug and alcohol use. Konefal (1997) noted that a reduced craving among heroin and opiate addicts as a result of acupuncture was reported as early as 1972 in China. Both Singer (1992) and Washburn et al. (1993) used experimental designs and found that those who received acupuncture fared better in treatment – including longer stays, more frequent attendance and less desire to abuse drugs and alcohol – when compared to a control group that received 'sham' acupuncture (needles put near but not on specified sites). In their experiment with 82 dually addicted participants (heroin and cocaine), Margolin et al. (2000) randomly assigned participants to three groups: an experimental group that received auricular acupuncture, a control group that received needles in parts of the ear thought to have no effect, and a relaxation group that viewed videotapes displaying relaxing imagery (and received no acupuncture). After eight weeks in treatment, more than half of the acupuncture group tested negatively for illegal substances (54%), compared to 24% of the 'control' group and 9% of the 'relaxation' group (Margolin et al. 2000; see also Schwartz et al. 1999).

In an application of acupuncture to the criminal justice population, Pennell and Martin (1994) examined its use in an outpatient program for parolees with drug problems in San Diego county and found that those receiving acupuncture spent twice as many days in treatment, received more individual and group counseling (and ancillary services), reported less drug use, and recorded fewer subsequent arrests than those not receiving acupuncture. Berman et al. (2004) compared two different forms of acupuncture in a prison setting and found that participants receiving either type reported reduced symptoms of discomfort and improved sleep patterns.

However, a number of other studies have reported no positive effects for acupuncture as an adjunct to substance abuse treatment (Margolin et al. 2001; Sapir-Weise et al. 1999; Bullock et al. 2002; McLellan et al. 1993). Killeen et al. (2002) examined the impact of auricular acupuncture on drug craving among cocaine addicts and found no difference among experimental and control subjects. Bullock et al. (1999) conducted a two-phase single-blind, randomized, placebo-controlled study of auricular acupuncture in treatment of cocaine addiction. In the first phase

of the study, participants were randomly assigned to psychosocial drug treatment, psychosocial treatment plus acupuncture, and psychosocial treatment plus 'sham' acupuncture. In the second phase, participants were randomly assigned to varying doses of true acupuncture (8, 16 and 28 treatments). In both studies, there were no significant differences favoring acupuncture or increased doses of acupuncture (Bullock et al. 1999).

Nevertheless, despite the mixed findings, by 1995, formerly skeptical Federal treatment agencies appeared to accept the practice of acupuncture as a useful adjunct in the treatment of addiction. "Ideally, acupuncture treatment is combined with a comprehensive treatment approach, including counseling, drug testing, and other interventions (Center for Substance Abuse Treatment 1995: 36)."

Acupuncture and the drug court model

In planning the Miami Drug Court strategy, the Honorable Herbert Klein of Florida's 11th Judicial Circuit visited Dr Michael O. Smith's program treating hard-core heroin addicts in New York. At Dr Smith's recommendation, acupuncture was included as a tool in the treatment approach to be taken in the Miami Drug Court. The theory behind the innovative drug court treatment approach was that the combination of the special in-court, hands-on supervision of the judge (and related non-adversarial courtroom procedures), intensive outpatient treatment (rather than reliance on residential treatment), and acupuncture as a treatment adjunct amounted to a treatment modality specially adapted to promote effective treatment of drug abusers in Dade County's felony population.

As drug courts spread throughout the United States strongly influenced by the original Miami model, many incorporated acupuncture into their treatment regimens (Goldkamp 2000; Goldkamp et al. 2001c). Some jurisdictions were unable to incorporate acupuncture into the drug court treatment process because sufficient services were simply not available to them. Other jurisdictions, more influenced by traditional substance abuse treatment perspectives, either rejected acupuncture on principle or saw it as relatively untested in drug treatment (Goldkamp et al. 2001c). Nevertheless, it has been implemented as a routine substance abuse treatment tool in drug courts across the country. Konefal (1997) reports that acupuncture has been employed as a treatment adjunct in more than 40% of state and local drug courts.

Despite the mixed findings regarding the impact of acupuncture in substance abuse treatment generally and its extensive adoption among drug courts, research has yet to examine the role and impact of acupuncture in the drug court setting. Although similarities exist among drug court and traditional substance abuse treatment, there are clearly important differences in the drug court context and among that clientele, such as the intensive judicial supervision, use of threat of sanctions (including jail), and the main focus on reducing criminal activity associated with substance abuse. The impact of these important differences on the effectiveness of acupuncture in drug courts remains unclear, particularly with regard to offender progress in treatment and abstinence from both drug use and criminal activity. This

paper represents a first effort to conceptualize and examine the role and impact of acupuncture in the drug court setting by studying its relationship to treatment and criminal justice outcomes among participants in the Clark County Drug Court (Las Vegas, Nevada).[2]

Methods and data

The study site: The Clark County (Las Vegas) Drug Court

The Clark County Drug Court, one of the oldest in the nation, adopted many of the elements of the original Miami drug court model including outpatient substance abuse treatment at a single provider, a four phase treatment regimen, participation in treatment for a minimum of one year, and individualized treatment plans. Also, drug testing is a central feature of the Clark County Drug Court treatment. Although drug tests are administered less frequently as participants progress through the program, urinalysis provides an on-going indicator of substance abuse among participants. The drug court originally admitted criminal drug defendants to the program through diversion, but since 1995 most participants enroll after pleading guilty to a lesser charge. The program will also admit defendants arrested on non-drug charges (typically property charges) if there is an indication of a substance abuse problem. The Court plays an active role in each participant's treatment progress with frequent appearances in court, graduated rewards and sanctions (including selective use of jail), and the judge using a hands-on, informal and therapeutic approach.

The program requires that all participants in the first phase of treatment receive acupuncture at the clinic location five days per week. The treatment provider employs a clinician licensed to administer auricular acupuncture (ear only). Las Vegas Drug Court participants typically remain in the first phase of treatment for approximately 30 days, though movement to the second phase occurs whenever a participant has produced five consecutive clean urine specimens. After the first treatment phase, acupuncture is strictly voluntary but encouraged by the program to lessen depression, anxiety and insomnia, to reduce or eliminate continuing withdrawal symptoms, and to assist with stress reduction and relapse prevention. In later phases of treatment, the drug court judge may order a struggling participant to receive acupuncture again, usually in response to a positive urinalysis.

Devising an appropriate study of acupuncture in Clark County

The researchers and drug court leadership first agreed to use existing data to examine acupuncture participation and its relationship to treatment and criminal justice outcomes. A retrospective, descriptive study was designed to examine outcomes over a one-year observation period, among randomly selected cohorts of participants from 1993–1997 (using a quasi-experimental approach employing post

hoc statistical controls, $n = 499$). Findings indicated a strong negative relationship between acupuncture and treatment and criminal justice outcomes: the more acupuncture participants received the more likely they were to be re-arrested or terminated from the program. This apparent negative relationship emerged because of the program's reliance on acupuncture as a treatment enhancement for those struggling in the program. In simpler terms, receiving more than the standard amount of acupuncture was indicative of poor performance, while those doing well received the minimum mandatory acupuncture sessions in phase I and did not receive it again. Importantly, the inextricable link between acupuncture use and treatment progress highlighted the need to examine the issue with a classic experimental design, where participants would be randomly assigned to acupuncture and non-acupuncture groups.

Studying acupuncture with a modified experimental design

With approval from the drug court leadership, the researchers employed a prospective experimental design where all participants entering the program from March 8, 1999 through August 13, 1999 were randomly assigned to acupuncture and no acupuncture groups ($n = 336$). Random assignment occurred during their first appearance at the treatment center based on the last digit of their police identification number (participants with an even last digit were assigned to receive acupuncture). As the participant began the intake procedure, the treatment staff person identified the appropriate group – treatment or control – and made a notation in the participant's computerized and hard copy files. This red flag communicated to other members of the drug court team whether or not the participant was to receive acupuncture. Outcomes and performance were examined over a six-month follow-up period. The relatively short follow-up period was employed because the perceived benefits of acupuncture were to apply early on in the treatment process.

A number of key logistical and ethical concerns form an important backdrop to the prospective experiment. One problem facing such an experiment is the traditional ethical problem of denying a presumably beneficial treatment to half of the drug court participant population.[3] This concern represented a significant hurdle for the research team to overcome. Second, unless the experimental design is implemented perfectly, it is difficult to disentangle the effects of acupuncture from all of the other influences on treatment outcomes, which may include external events (Goldkamp et al. 2001a), other elements of treatment (i.e., the 'black box'), and individual characteristics of participants. Last, the implementation of an experiment where all conditions except acupuncture are held constant in an on-going drug court program presents considerable logistical and programmatic problems. For example, consider the following: When will random assignment occur? What, if any, programmatic change will have to be made to fill the treatment 'void' for participants in the no acupuncture group, who have had one of their routine treatment activities simply eliminated? What if a participant in the control group asks for acupuncture?

Given the logical, programmatic and ethical concerns, the classic experimental design was modified in a number of important ways. First, drug court officials insisted that anyone who requested acupuncture would receive the treatment, regardless of their group assignment. Second, couples who began the drug court program together would be assigned to the same group, regardless of the last digit in their identification numbers, to eliminate the appearance of inconsistency in treatment protocol (the last digit of the first to appear at the treatment provider would determine group assignment). Third, treatment officials would need to fill the void in treatment services for the no-acupuncture group during the first phase of treatment. The solution was to replace acupuncture in the control group with a regimen of relaxation therapy of equivalent duration. In this therapy, participants sat in comfortable chairs in very cool and dark rooms while listening to soft music. Participants received educational information and instruction regarding relaxation techniques, and practiced those techniques with the counselor. The overall goal of relaxation therapy was two-fold: 1) to provide participants with a period of time during treatment (35–45 min) where they could unwind and not think about their current problems and life situations (i.e., some 'mental health' time); and 2) to provide them with the skills and techniques needed to relax in other environments (i.e., home, work, school, etc.).

Addressing the treatment integrity problem: Angrist's approach

In operation, the drug court leadership's insistence on providing acupuncture to relaxation group participants as needed presented significant problems to the experimental design. In fact, over the course of the study approximately 40% of the relaxation group received at least some acupuncture. To account for this treatment overlap, the authors adopt an approach used in economics and other fields to account for such problems. Angrist and Krueger (2001) note that instrumental variables can often be employed to estimate the effect of an intervention in a randomized experiment with treatment compliance problems, such as those experienced in this study; resulting in a less conservative, valid measure of the treatment effect (see also Imbens and Angrist, 1994). To accomplish this, two-stage least-squares (2SLS) regression is conducted because it re-scales the reduced-form effect of the instrument into the causal effect of interest – in this case, acupuncture (Angrist 2005, personal communication). In two-stage least-squares regression, the original group assignment variable becomes the instrumental variable while the other side of the regression equation includes the 'actual treatment status' indicator (Angrist and Krueger 2001: 81):

> In a training evaluation, for example, the actual treatment status variable would be a dummy variable that equals one for each treatment and control group member who participated in training, and it would be zero for all those who did not participate in training. This approach yields a consistent estimate of the causal effect of the treatment for the population that complies with their random assignment – that is the population of 'compliers.'

For this study, the actual treatment status measure was created as a dichotomous variable indicating whether the participant received acupuncture: no (pure relaxation, $n = 100$) or yes (originally assigned to acupuncture and the 70 relaxation participants who received some dose of it, $n = 236$). Two-stage least-squares regression is employed with a range of criminal justice and treatment outcomes including arrest, confinement, failure to appear, sanctions, positive drug tests, missed appointments, treatment attendance and treatment progress. Several models are presented with additional covariates as well.

Summary

The primary problems posed by the modified experimental design were that: 1) it compared the effects of two interventions – acupuncture and relaxation therapy – on drug court outcomes without the benefit of a non-intervention control group to serve as a baseline; and 2) a significant percentage of the control group was exposed to the treatment. However, given the lack of study of acupuncture in the drug court setting, the potential implications of findings comparing acupuncture to relaxation therapy (i.e., whether acupuncture is more effective, less effective or as effective compared to relaxation), and the opportunity to apply Angrist's analytic technique in a criminal justice field experiment, the authors pursued this approach.

Results

The Clark County Drug Court acupuncture experiment

Implementation
Random assignment occurred for a five-month period in 1999, resulting in 166 participants in the acupuncture group and 170 participants in the relaxation comparison group. As might be expected in a large volume treatment clinic where all services are offered (including acupuncture and relaxation therapy), there were some problems maintaining the integrity of the treatment received by the two groups. Specifically, 85 participants in the experiment 'mistakenly' participated in at least one treatment session provided to the other treatment group (this amounts to about 25% of the cases). Of these, 15 were acupuncture group participants who received at least one relaxation session and 70 were relaxation participants who received at least one acupuncture session. Thus, the error in maintaining the integrity of treatment assignment was not equally divided. Nearly all of the relaxation group participants who attended acupuncture either specifically asked for it, or they were ordered to receive it by the drug court judge because of a positive drug test (or other form of treatment difficulty).[4] Also, the treatment slippage for these 70 relaxation participants was, by no means, a single occurrence. Although just over one-quarter of the participants received only one acupuncture session, the mean number of acupuncture sessions for all 70 relaxation participants

Table 1. Selected attributes among participants assigned to acupuncture and relaxation groups from March–August 1999.

Attributes	Acupuncture (n = 165) %	Relaxation (n = 170) %	p < 0.05 (chi square)
Race			0.22
White	59	52	
African American	31	33	
Hispanic	7	13	
Other	3	2	
Gender			0.05
Male	79	70	
Female	21	30	
Alias			0.40
No	44	40	
Yes	56	60	
Current case: drugs			0.23
No	28	34	
Yes	72	66	
Current case: serious property/theft			0.10
No	73	65	
Yes	27	35	
Pretrial release			0.61
Immediate release	27	31	
Release from detention	72	68	
Not released	1	1	
Drug court entry			0.35
Diversion	14	14	
Condition of probation	43	36	
Guilty plea	43	50	
Recent prior arrests			0.38
No	16	12	
Yes	84	88	
Serious person prior arrests			0.96
No	63	63	
Yes	37	37	
Drug prior arrests			0.89
No	31	30	
Yes	69	70	
Felony prior arrests			0.81
No	19	18	
Yes	81	82	
Prior convictions			0.91
No	49	50	
Yes	51	50	
Prior FTAs			0.29
No	44	39	
Yes	56	61	

Table 1. Continued.

Attributes	Acupuncture (n = 165) %	Relaxation (n = 170) %	p < 0.05 (chi square)
Positive drug test at entry			0.12
No	52	44	
Yes	48	56	
Cocaine use indicated			0.42
No	72	68	
Yes	28	32	
Marijuana use indicated			0.10
No	49	58	
Yes	51	42	
Methamphetamine use indicated			0.97
No	58	58	
Yes	42	42	
Education			0.58
Not a high school graduate	35	34	
High school graduate	49	53	
Some college	16	13	
Employment			0.56
Unemployed	48	57	
Full-time	41	35	
Part-time/other	11	8	
Marital status			0.89
Married/living with S/O	24	22	
Divorced/separated	18	18	
Never married	58	60	

is 9.8 (i.e., they received a substantial dose of the 'wrong' treatment). This compared to a mean number of acupuncture sessions for the acupuncture group of 20.3.

Table 1 shows selected attributes among the acupuncture and relaxation groups, including demographics, prior criminal history, and assessment information. Chi square analysis indicates that differences in attributes of the two groups were not statistically significant, with the exception of gender (p <0.05) where the relaxation group is slightly more female. These findings suggest that, despite the modifications and problems with treatment contamination, the two groups are still similar on nearly all measured attributes.

Treatment outcomes

Performance in treatment was monitored for participants in each group over a period of six months, and results are shown in Table 2. Among treatment out-

Table 2. Comparative treatment and criminal justice outcomes (by %) among participants assigned to acupuncture and relaxation groups from March–August 1999.

Treatment outcomes	Acupuncture (n = 165) %	Relaxation (n = 170) %	p < 0.05 (chi square)
Sanctions			0.380
No	75	71	
Yes	25	29	
Positive UA			0.383
No	25	21	
Yes	75	79	
Missed appointment			0.986
No	18	18	
Yes	82	82	
Most advanced treatment phase			0.146
Did not advance past Phase I	27	32	
phase II	19	24	
phase III	54	44	
phase IV	0	0	
Treatment status			0.473
Still active, released	60	62	
Fugitive	27	21	
Still active, jailed	1	1	
Terminated	12	16	
Criminal justice outcomes			
Failure to appear			0.491
No	42	45	
Yes	58	55	
Confinement			0.357
No	51	46	
Yes	49	54	
Re-arrest (new charges only)			0.812
No	55	54	
Yes	45	46	
Re-arrest-bench warrant			0.344
No	64	59	
Yes	36	41	
Re-arrest-serious person charge			0.431
No	94	92	
Yes	6	8	
Re-arrest – drug charge			0.226
No	86	81	
Yes	14	19	

comes, the proportions of participants in each group receiving sanctions, recording positive drug tests, and missing at least one appointment were nearly identical: approximately one-quarter were sanctioned, three-quarters recorded a positive drug test, and four-fifths missed at least one appointment. Table 2 does show a slight difference in most advanced treatment phase, with a greater percentage of the

Table 3. Comparative treatment and criminal justice outcomes (by mean with independent samples *t*-tests) among participants assigned to acupuncture and relaxation groups from March–August 1999.

Treatment outcomes	Acupuncture (n = 165) Mean	Relaxation (n = 170) Mean	T value	p < 0.05 (t-test)
Sanctions	0.43	0.45	−0.160	0.873
Positive UA's	5.17	5.20	−0.042	0.966
Missed appointments	8.58	9.56	−0.704	0.482
Days to first sanction	62.26	64.78	−0.275	0.784
Days to first positive UA	19.42	11.45	1.849	0.066
Days to first missed appointment	21.54	21.04	0.155	0.877
Days confined (from Drug Court)	7.03	9.94	−1.336	0.182
Days in each treatment phase				
Phase I	64.15	57.38	1.061	0.289
Phase II	50.88	47.32	0.797	0.426
Phase III	37.40	28.25	2.106	0.036
Phase IV	0	0	–	–
Days in treatment	122.44	112.91	1.579	0.115
Number of treatment contacts	52.03	55.58	−0.527	0.598
Criminal justice outcomes				
Days confined during follow-up	13.95	17.59	−1.134	0.258
Time to first re-arrest	71.01	68.48	0.308	0.758

acupuncture group advancing to phase III. At the end of the six-month observation period, approximately 60% of both groups were still active in the program, though a slightly larger percentage of the acupuncture group was in fugitive status (and a smaller percentage had been terminated). None of the differences were statistically significant ($p < 0.05$, using chi square analysis).

Table 3 shows the mean number of each type of treatment failure (sanction, positive drug test, and missed appointment), as well as the mean days for a variety of other treatment outcomes.[5] The outcomes are similar between the two groups for the mean number of sanctions (0.43 vs. 0.45), positive drug tests (5.17 vs. 5.20) and missed appointments (8.58 vs. 9.56), as well as the mean days to first sanction (62.26 vs. 64.78), first missed appointment (21.54 vs. 21.04), days confined attributable to drug court (7.03 vs. 9.94), and the total number of treatment contacts (52.03 for acupuncture and 55.58 for relaxation). Results from independent samples *t*-tests (shown on the right) indicate that none of these mean differences are statistically significant. There are a few outcomes favoring the acupuncture group, including mean days to first positive drug test (19.42 vs. 11.45), and mean days active in treatment (122.44 vs. 112.91), but neither is statistically significant

Table 4. Results from linear and two-stage least-squares regression (2SLS) with criminal justice and treatment outcomes*.

Outcome variables	Linear regression			2SLS regression		
	B	S.E.B.	Signif.	B	S.E.B.	Signif.
Criminal justice outcomes						
Follow-up arrests	−0.161	0.166	0.332	−0.274	0.282	0.332
Time to first follow-up arrest	2.532	8.220	0.758	4.547	14.705	0.758
Number of days confined	−3.641	3.211	0.258	−6.093	5.385	0.259
Follow-up confinements	−0.122	0.129	0.348	−0.206	0.220	0.351
Follow-up failures to appear	0.023	0.116	0.844	0.039	0.197	0.844
Treatment outcomes						
Time to first sanction	−2.529	9.200	0.784	−4.777	17.380	0.784
Time to first positive drug test	7.969	4.252	0.062	14.132	7.665	0.066
Time to first missed appointment	0.502	3.228	0.877	0.891	5.735	0.877
Days in treatment	9.530	6.054	0.116	16.268	10.306	0.115
Number of treatment contacts	−3.546	6.726	0.598	−6.029	11.477	0.600
Missed appointments	−0.989	1.405	0.482	−1.681	2.410	0.486
Sanctions	−0.013	0.083	0.873	−0.023	0.142	0.873
Positive drug tests	−0.027	0.631	0.966	−0.045	1.072	0.966
Days confined-Drug Court	−2.914	2.180	0.182	−4.856	3.637	0.183
Days in phase I	6.780	6.391	0.289	11.526	10.820	0.288
Days in phase II	3.556	4.464	0.426	6.045	7.614	0.428
Days in phase III	9.151	4.346	0.036	15.556	7.429	0.037

*In linear regression, the diagnostics are for original group assignment. In 2SLS, the diagnostics are for actual treatment status – acupuncture exposure – and original group assignment is employed as an instrumental variable.

(again, using independent samples *t*-tests). Finally, the mean days spent in each treatment phase are similar for phases I and II, but participants in the acupuncture group progressed much further in phase III than their relaxation counterparts (37.40 vs. 28.25; *t*-test results indicate this difference is statistically significant, $p < 0.05$).

Criminal justice outcomes

Table 2 shows that similar percentages of participants in both groups failed to appear in court, were confined, and were re-arrested – overall and for bench warrants, serious person and drug offenses. Regardless of group assignment, a significant number of participants got themselves into trouble with the justice system again (i.e., nearly half re-arrested).[6] Table 3 shows mean days confined during the six-month observation period, as well as mean days to first re-arrest, and both outcomes favor the acupuncture group: for days confined, 13.95 vs. 17.59 days, and for time to arrest, 71.01 vs. 68.48 days (*t*-test results indicate that these mean differences are not statistically significant).

Table 5. Results from linear and two-stage least-squares regression (2SLS) with criminal justice and treatment outcomes, selected models with covariates*.

Outcomes	Linear regression			2SLS regression		
	B	*S.E.B.*	*Signif.*	*B*	*S.E.B.*	*Signif.*
Follow-up arrests						
Positive UA-assessment	0.440	0.161	0.006			
Prior FTAs	0.610	0.162	0.000			
Any indication of cocaine use	0.665	0.200	0.000			
Group	−0.047	0.159	0.768	−0.061	0.282	0.829
Follow-up Confinements						
Positive UA-assessment	0.718	0.123	0.000			
Any indication of cocaine use	0.334	0.134	0.013			
Group	−0.042	0.123	0.733	−0.068	0.2190	0.756
Follow-up FTAs						
Positive UA-assessment	0.534	0.112	0.000			
Recent prior arrests	0.442	0.161	0.006			
Group	0.090	0.111	0.420	0.166	0.196	0.397
Treatment contacts						
Prior FTAs	−24.986	6.746	0.000			
Group	−5.108	6.651	0.443	−8.976	11.548	0.438
Missed appointments						
Positive UA-assessment	7.592	1.355	0.000			
Group	−0.260	1.354	0.848	−0.677	2.397	0.778
Days in Phase III						
Positive UA-assessment	−28.547	3.950	0.000			
Prior FTAs	−19.933	3.993	0.000			
Group	5.215	3.907	0.183	9.351	7.420	0.209

*The selected models represent a general overview of all available outcomes. In linear regression, the group variable is original groups assignment. In 2SLS regression, covariates are included in the model as instrumental variables (along with original group assignment), and the diagnostics presented are for actual treatment status (acupuncture exposure).

Addressing treatment contamination with instrumental variables and two-stage least squares regression

Results in Tables 2 and 3 are not overly persuasive with regard to the posited treatment effect of acupuncture. However, because more than 40% of the relaxation group ($n = 70$) received acupuncture and a substantial dosage of it (mean number of acupuncture sessions for this mixed group of 70 was 10), it is possible that the hypothesized relationship between acupuncture and improved outcomes is 'washed out' by the treatment contamination. In simpler terms, the analyses described above may present too conservative a view with regard to the impact of acupuncture. Borrowing from Angrist (Angrist and Krueger 2001; Angrist and Evans 1998; and Imbens and Angrist 1994), the authors employ linear regression and two-stage least-squares regression to provide an estimate of the impact of acupuncture exposure that takes into account the treatment contamination problem.

Table 4 shows the results of both linear regression – with original group assignment only, the reduced form effect – and two-stage least-squares regression – using original group assignment as an instrumental variable (to account for treatment compliance) and actual treatment status as the endogenous variable – with a range of criminal justice and treatment outcomes including:

- number of follow-up arrests
- time to first follow-up arrest
- number of days confined
- number of follow-up confinements and failures to appear
- time to first sanction, positive drug test and missed appointment
- number of sanctions, positive drug tests and missed appointments
- days in treatment and number of treatment contacts
- number of days in each treatment phase.

Even with this less conservative approach, the results are much the same. Exposure to acupuncture is not significantly associated with any of the criminal justice or treatment outcomes, except for the number of days spent in treatment phase III (those receiving acupuncture spent more time in phase III). Results in Table 5 show the same sets of analyses for selected outcomes, this time with additional covariates. Again, there is little evidence of a treatment effect for acupuncture (and in fact, the treatment effect found with days spent in phase III has disappeared).

Discussion

Interpreting the findings from the acupuncture experiment

This study employed a modified experimental approach to examine whether acupuncture contributed positive effects to drug treatment among the criminal justice-involved population in the Clark County Drug Court. There were significant problems with the experimental design, despite fairly rigorous allocation procedures, as more than 40% of the relaxation comparison group received at least one acupuncture session. Comparison of treatment and criminal justice outcomes over a six-month observation period revealed few differences between the two groups, with the exception of treatment progress (recall the significant *t*-test for mean number of days in phase III from Table 3). In an effort to control for the treatment compliance problems, the authors employed two-stage least-squares regression with original group assignment as an instrumental variable and acupuncture exposure as a predictor.[7] The analyses were conducted in two ways, with and without additional covariates. Results still indicate no significant difference in outcomes except for days in treatment phase III (when no other covariates are in the model).

The problems with treatment integrity in this study are by no means unique, and in fact they are fairly common in criminal justice field experiments. Consider the

treatment compliance problems in such classic works as the Kansas City Preventive Patrol Study (Kelling et al. 1974) – in which police officers drove through 'control' sectors – and the Minneapolis Domestic Violence Experiment (Sherman and Berk 1984) – in which officers made arrests when the treatment protocol dictated otherwise. The traditional response to such compliance problems by researchers has been to acknowledge the limitations they present to the study, but to argue that a 'broken experiment' is better than no experiment at all. Indeed, since experimental designs are rare in criminal justice research, this is not a difficult argument to make. Yet, the approach employed here with two-stage least squares regression (and instrumental variables) represents a relatively new way to handle the treatment compliance problem that improves upon the traditional 'shrugging the shoulders' researcher response. This method allows for a more definitive test of the actual treatment effect, and in this case, provides additional evidence of 'no treatment effect' for acupuncture.

Nevertheless, there are three important points to bear in mind when considering these findings. First, the mostly non-significant findings from the experiment suggest that acupuncture participants did as well and certainly performed no worse than those receiving relaxation therapy. However, a weakness in the design – the absence of a baseline drug court group receiving no equivalent treatment enhancement – prevents strong conclusions about whether both interventions improved treatment retention and success, or whether neither is beneficial. In fact, all we can tell is that the impact of acupuncture and relaxation appear to be similar (without knowing if both are better, worse or the same as receiving no treatment enhancement). Second, an equally important question involves whether the exposure to acupuncture helped those 70 relaxation group participants who were struggling (this group of 70 received an average of 10 acupuncture sessions). In simpler terms, would their outcomes have been worse had they been denied acupuncture? Unfortunately, the analyses cannot definitively answer the question. Nevertheless, it is at least possible that the struggling relaxation participants would have continued to perform poorly (or would have performed worse) if they had been denied acupuncture. Lastly, the study did not compare acupuncture to no treatment – a comparison group *not* in the drug court – because of ethical and practical considerations; such a comparison almost certainly would have produced significant results (based on results from the larger evaluation; Goldkamp et al. 2001c).

Implications of the research

More research is needed to continue to investigate the role and impact of acupuncture in substance abuse treatment in the drug court setting. Based on prior research examining its impact in traditional substance abuse treatment (i.e., not drug court) and the findings from the modified experiment described here, the evidence supporting its posited impact – an effective adjunct to help alleviate detoxification symptoms – is still not in. Simply put, there is no convincing evidence indicating that those drug courts without acupuncture should add it im-

mediately. However, at the very least, there is also no evidence to suggest that those drug courts employing acupuncture should abandon its use because of unintended deleterious effects.

The larger study (Goldkamp et al. 2001c) of which this experiment formed a part identified a range of complex issues involved in the development, implementation and on-going operation of a drug court program. Certainly, the leadership of a drug court program should consider the use of acupuncture in treatment within the larger context of the philosophical goals and more practical objectives of the program. For example, is acupuncture consistent with the philosophy of treatment providers in the jurisdiction? Are there acupuncture services available in the jurisdiction, and if so, in sufficient number to fully service the drug court clientele? How much would it cost the program to either contract for existing acupuncture services or to train treatment staff to be able to provide new services? Recent estimates indicate that acupuncture costs approximately $17 per session, per client (Finigan 2005, personal communication). Given nearly universal budget crises at the local and state level, drug court programs may wish to think carefully about the relative cost – and cost-effectiveness – of offering acupuncture. (Note that the cost effectiveness question is not addressed in this study. We have not compared the costs of providing acupuncture with the costs of providing relaxation therapy. Thus the acupuncture costs should not be analyzed as if compared to no cost for an alternative therapy.)

Another important consideration involves whether the political environment in the jurisdiction would be supportive of using acupuncture? To illustrate this last point, early reactions to the drug court in Miami were unflattering, often seizing on the image of criminal drug defendants with long needles in their ears to dismiss the program as too far from the mainstream of punitive justice. In Las Vegas, the drug court program refers to acupuncture as 'needling' to avoid the negative connotations associated with acupuncture. In sum, given the current state of research on the role and impact of acupuncture in drug court treatment, important questions still remain unanswered and programs should continue to make decisions about its use based on their own assessments of its costs and benefits.

Clearly, the most valuable future research examining acupuncture use in drug courts will employ an experimental design with random assignment and a true no-conditions control group. Researchers are likely to face resistance among program leadership regarding the adoption of a true experimental design, particularly with regard to logistical and philosophical barriers. However, there is a growing body of evidence – much of it in this area – demonstrating that these reservations can be overcome and experimental designs can be employed (i.e., Bullock et al. 1999; Margolin et al. 2000; Berman et al. 2004). If the reticence of justice and treatment officials cannot be overcome, modified approaches using alternative treatment regimens, or perhaps using 'sham acupuncture' (placing needles near but not on specified sites – see Singer 1992; Washburn et al. 1993; and Margolin et al. 2000) will be necessary. Or, for those drug courts just beginning its use, perhaps the program can be convinced to implement acupuncture on a limited basis, allowing for random assignment to treatment and control conditions. Angrist's statis-

tical technique using two-stage least-squares regression represents a promising approach for handling the treatment overlap problems that frequently occur in field experiments.

Future research should also begin to examine whether acupuncture is more effective for certain types of participants and certain types of drugs of abuse – perhaps even stages of the treatment process. It could be that acupuncture effectively reduces detoxification symptoms resulting from heroin and opiate use, but not symptoms from methamphetamine use. Or perhaps acupuncture should be required in later phases of treatment for participants abusing certain types of drugs, but not for others. Given that conventional wisdom in drug treatment emphasizes the need for individualized treatment plans, rather than a 'cookie-cutter' approach for all participants, future research should begin to investigate *when* the use of acupuncture contributes significantly to the likelihood of treatment success, and if there are circumstances when its use is not necessary or important (e.g., perhaps among marijuana smokers).

Recently, scholars have called for research to get into the 'black box' of drug treatment to identify its core components (see Harrell 2003; Goldkamp 2003; Goldkamp et al. 2001a–c), and this call extends to the use of acupuncture. Is acupuncture a core component that contributes positively to participant outcomes? Is it unnecessary and too expensive? Or is it a technique that for some addicts – but not all – helps to manage the sometimes severe symptoms associated with detoxification? These questions will remain unanswered until additional research with methodologically rigorous designs is carried out to further investigate the role and impact of acupuncture in the drug court model.

Acknowledgements

Notes

1 These quotes came from focus groups conducted with drug court participants in Clark County, Nevada. In Las Vegas, acupuncture is referred to as 'needling.'
2 This study of the use of acupuncture occurred within the context of the larger national evaluation of drug courts (Goldkamp et al. 2000, 2001c) funded by the National Institute of Justice under grant number 98-DC-VX-K001.
3 The issues in the acupuncture experiment are not as serious as those faced in clinical trials of a new medical treatment (where implications may involve life or death), but the ethical concerns remain.
4 The authors have chosen to leave these 'contaminated' cases in the analyses because removing them would significantly reduce the number of cases available for analysis and

bias the samples (i.e., removing the 70 contaminated cases from the relaxation group would leave that group with participants who were mostly doing well, since those who were not doing well were typically ordered to receive acupuncture).

5 For days to first sanction, first positive UA and first missed appointment, the mean and subsequent independent samples t-test is calculated only with those participants who experienced each negative outcome. Cases without those negative outcomes are excluded from the analyses.

6 Although the percentage re-arrested seems high, given the six-month follow-up, these findings are consistent with additional research in Clark County over a much longer period of time (see Goldkamp et al. 2001c). Earlier research also shows that the Clark County Drug Court has targeted a difficult population, with extensive criminal histories and serious, long-term drug problems.

7 This study represents one of the first times that such an approach has been used by criminologists to address treatment contamination in a field experiment. See also the articles by Angrist and Gottfredson in this issue. The authors thank Dr Joshua Angrist and Dr David Weisburd for their suggestions and assistance.

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