Published in final edited form as:
J Subst Abuse Treat. 2007 June ; 32(4): 321–329.

INNOVATION ADOPTION IN SUBSTANCE ABUSE TREATMENT: EXPOSURE, TRIALABILITY, AND THE CLINICAL TRIALS NETWORK

Lori J. Ducharme, PhD, **Hannah K. Knudsen, PhD**, **Paul M. Roman, PhD**, and **J. Aaron Johnson, PhD**
Institute for Behavioral Research, University of Georgia, Athens, GA 30602−2401, USA

Abstract

Researchers and policymakers are increasingly focusing on factors that facilitate or impede the diffusion of evidence-based treatment techniques into routine clinical practice. One potentially fruitful avenue of research is the influence of involvement in research networks as a predictor of organizational innovation. The Clinical Trials Network (CTN) is examining a number of behavioral and pharmacological treatment techniques in controlled multisite studies. Using data from participating CTN treatment programs and large samples of programs outside the CTN, these analyses examine the influence of exposure to clinical trials on the subsequent adoption of buprenorphine and voucher-based motivational incentives. The analyses show that, controlling for a variety of organizational characteristics, direct exposure to buprenorphine clinical trials in the CTN significantly increased the odds of subsequent adoption. By contrast, the adoption of motivational incentives was entirely explained by organizational characteristics. The findings suggest that adoption of treatment innovations is a function of exposure, organizational resources, nature of innovations, and stage of the diffusion process.

Keywords

Innovation; Buprenorphine; Contingency management; Motivational incentives; Addiction treatment

1. Introduction

As the field of addiction treatment increases its emphasis on the use of evidence-based practices, research is needed to identify factors that facilitate and impede their adoption. Identifying structural impediments and resource needs can lead to technical assistance activities that may help pave the way for a successful and more rapid technology transfer in substance abuse treatment settings. A growing body of research is examining processes of technology transfer in addiction treatment organizations (e.g., Saxon & McCarty, 2005; Simpson, 2002). Most of these studies are focused on organizational correlates associated with adoption of treatment innovations. Less research attention has been paid to the influence of interorganizational relationships in promoting the use of innovations.

Studies in other health care specialties have identified the involvement of organizations in research networks as a predictor of innovation adoption (Fennell & Warnecke, 1988; Laliberte, Fennell, & Papandonatos, 2005). Such networks offer organizations exposure to innovations and opportunity to try new techniques. With the creation of the National Institute on Drug Abuse (NIDA)'s Clinical Trials Network (CTN), it is now possible to examine whether involvement in this type of research network enhances the adoption of evidence-based treatment techniques among addiction treatment facilities. Using data collected from

community-based treatment providers affiliated with the CTN and data collected from national comparison samples, this research simultaneously considers the associations between research network affiliation and the adoption of two treatment innovations: buprenorphine and voucher-based motivational incentives.

Although the extant literature on the organizational adoption of pharmacotherapies in substance abuse treatment is small, several correlates of medication adoption are noted across studies. These include the extent of program reliance on commercial insurance, private payers, or both (Fuller, Rieckmann, McCarty, Smith, & Levine, 2005; Roman & Johnson, 2002); a philosophical orientation supportive of innovation (Knudsen, Ducharme, Roman, & Link, 2005; Thomas, Wallack, Lee, McCarty, & Swift, 2003); organizational resources, including program size and access to medical staff (Fuller et al., 2003; Knudsen et al., 2005); client characteristics (Fuller et al., 2005; Roman & Johnson, 2002); and counselor credentials (Fuller et al., 2005; Knudsen et al., 2005; Knudsen & Roman, 2004; Roman & Johnson 2002). Much less research describing the rates and patterns of adoption of evidence-based psychosocial counseling techniques is available. However, when an aggregated set of counseling strategies and medications was examined, some similar predictors were identified, notably those that measure an organization's “absorptive capacity,” or its ability to identify and process new information (Knudsen & Roman, 2004).

Although a number of organizational characteristics have been associated with the adoption of innovative treatment strategies, a more fundamental predictor has received relatively little attention—namely, organizations’ exposure to alternative treatment techniques. Researchers conceptualizing the technology transfer process note that exposure to an innovation is a necessary precursor to its eventual adoption within organizations (Backer, 1993; Simpson, 2002). Exposure may come in a variety of forms, such as attendance at a conference or reading a trade journal; staff participation in training or other hands-on learning activities about the technique; or a temporary trial of the technique on a limited basis within the organization. Although several studies have focused on the attitudes of individual staff members and the processes by which these are influenced (Knudsen et al., 2005; Mark, Kranzler, & Song, 2003; Thomas et al., 2003), the processes by which entire organizations are exposed to innovations and the impact of that exposure on subsequent adoption decisions at the organizational level have not been explored. This article reports on the effects of organizational participation in clinical trials on the subsequent adoption of evidence-based practices for substance abuse treatment. By comparing the characteristics of treatment programs engaged in time-limited clinical trials versus those with no such exposure, we can begin to understand the potential influence of such first-hand experience on the technology transfer process. If found, such influence suggests the importance of increasing organizational interaction between researchers and practitioners.

1.1. The CTN and trialability of innovations

The NIDA's CTN is a major effort to bring together addiction treatment providers and researchers for testing scientifically validated clinical approaches in the diversity of “real-world” treatment settings. The CTN is a network of treatment programs and university-based research centers collaborating on the implementation of multisite research protocols involving a variety of treatment medications and behavioral therapies. In the process of conducting these trials, the CTN seeks to identify the conditions under which empirically validated treatment techniques can be successfully adopted by community-based treatment providers (Hanson, Leshner, & Tai, 2002). In his classic book, Diffusion of Innovations, Rogers (1995) identified “trialability” as a key element in the innovation adoption process. Trialability is the degree to which an innovation may be experimented with on a limited basis. Rogers contends that new ideas or techniques that can be tried on a limited basis reduce uncertainty for potential adopters,

and this experience may be particularly important for early adopters who do not have the benefit of other organizations' experience to draw upon.

The CTN is thus unique in that it provides an opportunity for participating treatment programs to implement, on a time-limited basis, a treatment process with which they have had little prior exposure or experience. By participating in a CTN study protocol, participating programs receive training, study materials, and financial support needed to implement the practice in their organization. In lay terms, these trials provide the equivalent of a "free sample" to participating programs. Even those programs that do not participate directly in a particular clinical trial may also gain exposure to treatment innovations through their involvement in the CTN.

From its initiation, the CTN has had internal committee structures and dissemination mechanisms that offer numerous opportunities for members to observe how particular trials are selected and designed, and to review study progress and results prior to their formal publication. Through face-to-face meetings, committee activities, conference calls, and frequent e-mails, network membership also confers numerous informal opportunities for clinicians to interact with other members and thereby learn about techniques being examined in other treatment programs.

Treatment programs that are affiliated with the CTN and participate in one or more of its study protocols have the opportunity to "try" a new technique without committing to its permanent adoption. Trialability will be an important predictor of adoption if—controlling for organizational characteristics and resources—programs that are directly exposed to a technique are significantly more likely to adopt it after the conclusion of the trial period. To examine the influence of trialability on innovation adoption, we examine two practices that have been the focus of several CTN protocols (buprenorphine and voucher-based motivational incentives) and compare the effects of exposure on the organizational adoption of these treatment techniques.

1.2. Buprenorphine

In October 2002, the U.S. Food and Drug Administration approved buprenorphine (specifically, Subutex and Suboxone, Reckitt Benckiser, UK) for use in the treatment of opioid dependence. Numerous clinical trials have been conducted to examine the effectiveness of buprenorphine (see review in Ling &Wesson, 2003), and the Substance Abuse and Mental Health Services Administration (SAMHSA) has published clinical practice guidelines regarding its use (SAMHSA, 2004; see also Johnson, Strain, & Amass, 2003). Much of the publicity and early dissemination activities at the national level have focused on the delivery of buprenorphine by physicians in office-based practice settings. However, community-based treatment providers are also potential adopters. Treatment programs may either be involved in the delivery of buprenorphine by retaining a physician with the requisite prescribing approvals (SAMHSA, 2004) or involved indirectly by establishing relationships with office-based physicians for whom the treatment programs provide needed counseling and wraparound services. Buprenorphine may present a particularly appealing option for treatment provider organizations that wish to expand their services for opiate-dependent clients but are unwilling or unable to integrate methadone and its attendant regulatory demands into their clinical practices.

The CTN has implemented four protocols related to the use of buprenorphine in various settings and across diverse patient populations (Saxon & McCarty, 2005). Published results indicate that buprenorphine performed favorably compared to clonidine in terms of both treatment retention and drug-free urine tests (Ling et al., 2005). Equally important, buprenorphine protocols were successfully implemented in both inpatient and outpatient settings, including

treatment programs having little or no prior experience with medication-assisted detoxification or maintenance for opioid dependence treatment (Amass et al., 2004). To facilitate the dissemination of buprenorphine to the broader treatment field, NIDA and SAMHSA's Addiction Technology Transfer Centers (ATTCs) have recently developed and made available technology transfer materials, including training materials for interested providers.

1.3. Voucher-based motivational incentives

Although much attention has been paid to the development of effective pharmacotherapies, treatment researchers also recognize that, to improve treatment outcomes, it is necessary to develop interventions that can motivate clients to attend treatment and to initiate and sustain abstinence. Toward that end, a substantial body of research has been devoted to assessing the effectiveness of contingency management techniques for improving treatment retention, attendance, and negative drug test results for substance abuse clients.

Contingency management, or bprize-based reinforcement,Q applies the basic principles of behavior modification in substance abuse treatment settings. Observable indicators of desired outcomes (e.g., attendance at counseling sessions and drug-free urine test results) are reinforced by providing the patient a positive reward (Petry&Simcic, 2002). Rewards may take multiple forms, but the most common include vouchers that may be exchanged for goods or services, prizes, or the granting of some form of privilege. Contingency management approaches have been shown to improve retention and to increase abstinence with various substance-abusing populations, including those dependent on cocaine (Higgins et al., 1994), marijuana (Budney, Higgins, Radonovich, & Novy, 2000), alcohol (Petry, Martin, Cooney, & Kranzler, 2000), and opioids (Bickel, Amass, Higgins, Badger, & Esch, 1997; Silverman, Chutuape, Bigelow, & Stitzer, 1996).

Although there is a growing evidence base behind contingency management strategies for substance abuse treatment, programs may be dissuaded by the financial and administrative burdens associated with obtaining and distributing prizes and incentives. Some research has shown that lower cost incentives and intermittent rewards could also result in significant improvements in retention and drug-use behavior (Petry & Martin, 2002; Petry et al., 2004). As part of its research portfolio, the CTN initiated two study protocols to determine whether the provision of incentives less expensive than those typically used in controlled experiments could yield the same positive outcomes in community treatment programs. Findings from these clinical trial protocols are now in press. They showed that the contingency management techniques tested in the CTN were associated with a greater likelihood of stimulant-free and alcohol-free urine tests and of multiple consecutive clean urines in methadone settings (Peirce et al., 2006), and they improved both drug use and retention in outpatient “drug-free” settings (Petry et al., 2005). Dissemination materials are now being developed by ATTCs for distribution to the field at large, and at least one case study documenting the successful adoption and adaptation of these techniques in a large hospital system as a result of CTN exposure has been published (Kellogg et al., 2005).

In sum, these CTN trials have demonstrated that “real world” treatment programs can effectively implement buprenorphine and voucher-based motivational incentives in the context of time-limited and externally funded clinical trials. Remaining to be seen is whether program participation has a measurable effect on subsequent adoption and whether CTN exposure provides programs with a measurable advantage over those outside the CTN. Thus, this article has three goals: (1) to examine the extent to which exposure to innovative treatment techniques influences organizational adoption of those techniques; (2) to examine the impact of the CTN on the diffusion of these two treatment approaches; and (3) to assess whether similar predictor variables explain the adoption of behavioral and pharmacological innovations.

2. Methods

Data for these analyses were pooled from three related studies of innovation in substance abuse treatment settings. All studies collected data via face-to-face interviews with program administrators between mid-2002 and mid-2004. The University of Georgia's Institutional Review Board approved the protocols for each of the studies.

Two of the studies involved representative samples of (a) publicly funded and (b) privately funded substance abuse treatment centers throughout the United States. Eligible centers were identified by enumerating the population of treatment facilities in sampled counties. To be eligible, treatment centers were required to provide treatment for alcohol and drug dependence at an intensity at least equivalent to structured outpatient programming, as defined by ASAM's patient placement criteria (Mee-Lee, Gartner, Miller, Schulman, & Wilford, 1996). Programs were also required to be community-based (i.e., available to the general public). Together, these criteria excluded correctional facilities, Veteran's Health Administration programs, counselors in private practice, halfway houses, assessment programs, and driving-under-the-influence services. Programs exclusively providing methadone maintenance services and those exclusively providing psychiatric services were ineligible for the study. However, units offering either of these services, along with other substance abuse treatment services, were eligible and comprise a measurable proportion of the sample.

Centers were classified as “publicly funded” if they received a majority of their annual operating revenues from government grants or contracts, including block grant funds and criminal justice contracts. By contrast, centers were classified as “privately funded” if they received a majority of their annual operating revenues from private sources such as commercial insurance and clients’ out-of-pocket payments. Overall, centers in the public sample received an average of 81% of their annual operating revenues from government grants and contracts, whereas centers in the private sample received <20% of their revenues from such sources. During the study period, the administrators of 363 public and 403 private treatment centers were interviewed, representing response rates of 80% and 88%, respectively.

A third study collected similar data from 240 individual treatment units affiliated with NIDA's CTN. At the time of data collection, the CTN comprised 17 “nodes,” which were clusters of university-based research centers and community-based treatment programs. In total, 109 unique treatment organizations were affiliated with the CTN; these organizations operated 262 administrative units or “cost centers.” Generally speaking, units within a larger organization were defined by service population or modality; for example, an organization might operate three distinct “programs”: methadone services, adolescent residential services, and adult outpatient services. Each of these programs constituted a unit of analysis for this study. Administrative units that were dedicated to prevention/education/outreach services, correctional services, or assessment services were not interviewed, as they were unlikely to have direct involvement in any of the CTN research protocols. During the study period, administrators of 240 units within 104 organizations were interviewed, representing a response rate of 91.6% of all eligible CTN-affiliated treatment units.

In addition to the face-to-face interviews conducted with program administrators, brief telephone follow-ups were conducted 6 months later to identify any major changes in program operations, including the recent adoption of a number of evidence-based practices. Dependent variables for these analyses are drawn from follow-up contacts. Of the 1,006 programs completing face-to-face interviews, 904 (89.9%) completed 6-month follow-up interviews. There were no significant differences across samples in overall follow-up rates, and no significant differences between responding and nonresponding units on independent variables used in these analyses (data not shown).

2.1. Measures

Two dependent variables are modeled in these analyses: The first is organizational adoption of buprenorphine, which is measured as a dichotomous variable where 0 = no use of buprenorphine and 1 = buprenorphine was used in the program for opiate detoxification or as maintenance therapy; and the second is organizational adoption of voucher-based motivational incentives, which is measured similarly such that 0 = no adoption and 1 = use of voucher-based incentives. Both variables are measured on the 6-month follow-up interview. It should be noted that this definition of "adoption" is distinct from either implementation or institutionalization. Adoption refers to any use of the technique in the program, as distinct from the number of patients receiving the technique or the routineness with which the technique is employed. Adoption represents an early stage of diffusion of new treatment techniques and is thus an appropriate point of focus for these analyses.

Focal predictor variables measure direct and indirect exposures to these treatment techniques via involvement in clinical research. These and all other independent variables were measured at the time of the baseline interview. Two sets of variables about direct exposure, measuring the extent of organizational exposure to buprenorphine and voucher-based incentives via CTN protocols, were constructed for these analyses. Each set of variables categorizes treatment programs into one of three exclusive groups: Treatment center is outside the CTN (used as the reference category); center is in the CTN but its organization is not involved in the protocol in question; and center is in the CTN and its organization is involved in one of the protocols testing buprenorphine or motivational incentives. Because treatment programs have other opportunities for involvement in research outside the CTN, we also include a variable indicating whether the treatment center had previously been involved in a clinical research study involving its patients (1 = yes; 0 = no). Although this is not a direct measure of exposure to focal practices, it should provide some indication of whether "research-oriented" settings are differentially receptive to these two treatment techniques.

Exposure to innovations influences adoption decisions in the broader context of an organization's structure and resources. Thus, several additional predictor variables are included in these analyses. Because an organization's revenue streams can affect both willingness and ability to modify its treatment service offerings, a dummy variable is used to differentiate programs relying predominantly on public revenues (i.e., block grants and criminal justice contracts) from those relying predominantly on private revenues (i.e., commercial insurance and client fees). Similarly, an organization's profit orientation may influence decisions about innovation adoption as they seek more efficient or profitable service delivery methods. Profit orientation is a dummy variable measured such that 1 = for-profit organizations and 0 = not-for-profit organizations, including government-operated facilities.

Two indicators of program quality are included. Accreditation is measured as a dummy variable such that 1 = program is accredited by JCAHO or CARF and 0 = not accredited by either organization. Additionally, each program indicated whether it routinely surveys third-party payers and referral sources as to their satisfaction with the program's treatment services. Organizations more attuned to the satisfaction of their major "buyers and suppliers" may be more likely to adopt evidence-based treatment techniques. This variable is coded as 1 = treatment center routinely collects organizational satisfaction data and 0 = otherwise.

Each model includes one measure of the level of care most likely to be associated with adoption of the treatment technique. Because CTN protocols investigated the use of buprenorphine for detoxification, buprenorphine adoption models control for whether the treatment program offered detoxification services (1 = yes; 0 = no). Similarly, because CTN protocols tested motivational incentives in outpatient modalities, the contingency management models control

for whether the treatment center operated on an outpatient-only basis (1 = outpatient only; 0 = inpatient/residential only or mixed inpatient/outpatient).

Three measures of program staff were also examined. First, because larger programs should have greater personnel resources to facilitate the implementation of new treatment approaches, both models control for program size, measured as the number of full-time equivalent (FTE) employees. For ease of interpretation, the absolute number of FTEs is provided in the descriptive statistics, but this measure is log-transformed in the multivariate analyses to adjust for skew. Second, the models control for the availability of physicians at the program. Physicians are necessary to prescribe the medication to clients, and their presence may also be viewed as an indicator of the overall professionalism of the program's staff. A dichotomous variable is used, where 0 = no physicians at the program and 1 = one or more physicians on staff or retained on contract. Third, because the credentials of program staff have repeatedly been associated with organizational-level innovation, both models include a measure of the percentage of counselors holding at least a master's degree.

Client needs may also impact organizational decisions to adopt alternative treatment approaches. Because buprenorphine is indicated for the treatment of opiate dependence and because much of the literature on contingency management focuses on its application to opiate-dependent populations, both models control for the percentage of primary opiate-dependent clients in the center's caseload on the interview date.

Finally, both models control for time. Because interview data for the pooled samples were collected over about a 24-month interval (late 2002 to mid-2004), a measure of time is needed to control for the natural diffusion process that may have occurred over the study period. Programs are grouped into five categories based on the date of the interview (1 = 2002; 2=first half of 2003; 3 = second half of 2003; 4 = first half of 2004; 5 = second half of 2004), and this variable is included in both models. (Modeling time as a set of five dummy variables or as a true continuous variable had no substantive impact on the findings reported here.)

3. Results

3.1. Descriptive statistics

Descriptive statistics are shown in Table 1, along with tests of significance for differences between CTN and non-CTN programs. The groups differed significantly in their adoption of buprenorphine, with 20% of CTN programs having adopted it by the time of the follow-up interview, compared to 11% of non-CTN facilities ($p<.001$). However, there was no difference between groups in the adoption of voucher-based motivational incentives, with roughly one third of all programs reporting the use of this technique.

Although CTN units were no different in terms of the proportion of revenues received from public sources, they were significantly less likely than non-CTN units to operate on a for-profit basis ($p<.03$). Roughly two thirds of the CTN facilities were accredited by either the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) or the Commission on Accreditation of Rehabilitation Facilities (CARF), compared to less than half of non-CTN programs ($p<.001$). Treatment centers outside the CTN were significantly more likely to collect satisfaction data from payers and referral sources ($p<.02$), although the activity was common in both groups.

In terms of services, programs outside the CTN were more likely to offer detoxification services, despite the exclusion of detox-only units from non-CTN samples. Roughly half of all programs surveyed operated on an outpatient-only basis. There were also no differences between CTN and non-CTN units on the three staff measures: number of FTEs, availability of

physicians, or the percentage of counselors holding a master's degree. Treatment programs in the CTN had a significantly larger proportion of clients with a primary diagnosis of opiate abuse or dependence. However, some of this difference was likely attributable to the inclusion of methadone-only programs in the CTN sample, whereas these were excluded from the other samples. Excluding methadone-only units from the CTN sample reduced the average proportion of opiate-dependent clients to 18.3% of their caseloads, yet this was still statistically significantly greater than the proportion of opiate clients (15.9%) in the non-CTN sample ($p < .05$). Finally, there were no differences between CTN and non-CTN units in the likelihood of prior involvement in clinical research.

3.2. Multivariate analyses

Two logistic regression models were estimated to examine the effects of organizational characteristics and exposure on the likelihood of adopting buprenorphine and voucher-based motivational incentives. In each model, the organizational variables are examined first, followed by the variables measuring program exposure to research and focal innovation. Table 2 presents the predictors of adoption of buprenorphine. As shown, one program measure, one staff variable, and one caseload characteristic were significantly associated with buprenorphine adoption. Net of other organizational variables in the model, treatment programs offering detoxification services were 3.5 times more likely to have adopted this medication at the time of the follow-up interview; those with access to a physician were nearly four times more likely to have adopted buprenorphine. Adoption was also significantly associated with the proportion of primary opiate-dependent clients treated in the program. The significant regression coefficient for this variable translates to a 28.2% increase in the likelihood of buprenorphine adoption for a standard deviation (27.6%) increase in the proportion of opiate-dependent clients treated.

With these various organizational characteristics held constant, it is possible to examine whether exposure to the CTN or to its buprenorphine trials differentially impacts program adoption of this medication. First, it is notable that prior involvement in clinical research had no significant effect on the likelihood of buprenorphine adoption. Furthermore, treatment programs that were in the CTN but were uninvolved in the buprenorphine trials were no different than non-CTN programs in their adoption of the medication by the time of the follow-up survey. However, CTN programs that were directly exposed to buprenorphine through one of the clinical trial protocols were five times more likely to have adopted the medication, net of all other variables in the model.

Table 3 presents a similar model predicting the adoption of voucher-based motivational incentives. The model is notably different from buprenorphine analyses in that only structural characteristics are predictive of adoption. Net of the other variables measured, programs operating with revenues predominantly from government grants and contracts were 1.69 times more likely to have adopted motivational incentives relative to those operating on predominantly commercial revenues. For-profit programs were about half as likely as other programs to have adopted incentives, whereas accredited programs were about 35% less likely to have adopted voucher-based incentive strategies. Likewise, the odds of adopting incentives were 35% lower among programs operating on an outpatient-only basis compared to those offering inpatient, residential, or inpatient/outpatient services.

Unlike the buprenorphine models, none of the research exposure variables predicted the adoption of voucher-based motivational incentives once various structural measures had been controlled. Program exposure to research, whether inside or outside the CTN, had no impact on the likelihood of adoption of this treatment technique by the time of the follow-up interview. However, the model as a whole predicted little of the overall variance in the adoption of incentives. Coupled with the significance of revenue sources, profit status, and other structural

indicators, this suggests that additional organizational variables merit further examination for their potential explanatory value.

4. Discussion

Drawing on data collected from three large samples of specialty addiction treatment programs, these findings reveal measurable levels of adoption of two evidence-based clinical practices for the treatment of substance abuse and identify several structural and experiential differences between adopters and nonadopters.

First, these data describe the CTN in terms of the key organizational characteristics of its participating programs. Compared to pooled representative samples of public-sector and private-sector programs, CTN participants were more likely to be nonprofit, accredited, and outpatient-only. They were less likely to offer detoxification services and less likely to survey payers and referral sources regarding their satisfaction with the program's services. Overall, they treated proportionately more opiate-dependent clients than did programs outside the CTN.

CTN sites were significantly more likely to have adopted buprenorphine at 6 months after the baseline interview, but overall rates of adoption in both CTN and non-CTN samples indicate that this medication is still in the early stages of the diffusion process. By contrast, there were no differences between CTN and non-CTN participants in the proportion of programs having adopted voucher-based motivational incentives, which were reported by nearly one third of all programs surveyed.

In terms of the impact of network exposure and trialability on innovation adoption, these models provide mixed results. Net of a host of organizational variables and controlling for time, treatment programs having direct involvement in a CTN buprenorphine trial were five times more likely to have adopted the medication 6 months after the baseline interview. However, neither general research experience nor specific CTN exposure emerged as a predictor of adoption of voucher-based motivational incentives. Structural variables (principal revenue source, profit status, accreditation, and modality) were the only significant predictors of voucher adoption in these models.

There are several potential explanations for these divergent results. First, the differences in the explanatory power of the two models may be related to the technique itself. Medications are discrete, relatively unalterable technologies that require the expertise of a limited number of staff (physicians) for the treatment of clients with specific medical indications. By contrast, psychosocial counseling techniques are more difficult to define, more subject to local adaptation, and may be used by some or all staff for the treatment of some or all clients. The inherent differences in the two technologies may result in different sets of variables predicting their adoption.

Second, the use of buprenorphine requires the negotiation of a number of potential structural barriers, which may have been facilitated by participation in the CTN trials. CTN sites received considerable up-front and ongoing training for both prescribing physicians and other clinical staff, assistance when needed in negotiating local regulatory requirements, and coverage of the cost of the medication—an expense that many clients cannot otherwise cover. Treatment programs outside CTN protocols, even if highly motivated to adopt buprenorphine, may have had difficulty negotiating these nontrivial logistical barriers—barriers that were largely irrelevant for the adoption of motivational incentives. The predictors used in these models were unable to directly measure such impediments.

A third potential explanation relates to the “newness” of these innovations and the length of time for which each has been available. Buprenorphine had only recently received Food and

Drug Administration approval when data collection for these studies began; therefore, treatment providers had a relatively short window of time in which adoption was possible. By contrast, research on motivational incentives has been available in the addiction literature for a markedly longer time, and treatment providers were not required to wait for regulatory clearances or for the accumulation of a clinical evidence base before incorporating these reinforcements into treatment. In the final analysis, roughly one third of treatment programs inside and outside the CTN reported the use of voucher-based incentives, indicating that this technique is comparatively farther along the "S-shaped curve" that characterizes the diffusion of innovations (Rogers, 1995). It may be that different models are needed to understand the adoption of innovations in the earlier stages versus the later stages of diffusion.

Some limitations of this research should be noted. The non-CTN samples excluded methadone-only facilities, whereas these were included among CTN respondents. As a result, these data cannot directly address the extent to which opioid treatment programs outside the CTN have adopted these techniques. Additional data collection is currently underway to address this shortcoming. In addition, these models focused on the adoption of alternative treatment techniques as distinct from implementation. Further research is needed to identify the extent to which these techniques are routinely used in these programs, with how many clients, and for what indications. Similarly, these analyses focused on basic measures of the use of these techniques, but we are unable to address the fidelity with which their use adheres to CTN protocols. Future research should examine whether and how providers have "adapted" these techniques in ways that may be inconsistent with published research results, and what effect those adaptations have had on client outcomes.

Understanding the technology transfer process is critical to the ultimate goal of moving evidence-based practices from research settings into routine clinical use. By examining the unique experience of programs affiliated with the CTN, these analyses have begun to explore the potential importance of networking and trialability on the adoption of two relatively new practices for the treatment of substance abuse and dependence. At least in the case of medication adoption, these variables appear to enhance the explanatory power of models of the diffusion process, in addition to reinforcing the importance of considering the structural, environmental, and resource contexts in which adoption decisions are made.

Acknowledgment

The authors gratefully acknowledge the support of research grants R01DA13110 and R01DA14482 from the NIDA. The opinions expressed here are those of the authors and do not represent the official position of the NIDA.

Acknowledgements

This manuscript uses data collected under research grants R01DA13110 and R01DA14482 from the National Institute on Drug Abuse (NIDA).

References

Amass L, Ling W, Freese T, Reiber C, Annon JJ, Cohen AJ, et al. Bringing buprenorphine–naloxone detoxification to community treatment providers: The NIDA Clinical Trials Network field experience. American Journal on Addictions 2004;13:S42–S66. [PubMed: 15204675]

Backer TE. Information alchemy: Transforming information through knowledge utilization. Journal of the American Society for Information Science 1993;44:217–221.

Bickel WK, Amass L, Higgins ST, Badger GJ, Esch R. Behavioral treatment improves outcomes during opioid detoxification with buprenorphine. Journal of Consulting and Clinical Psychology 1997;65:803–810. [PubMed: 9337499]

Budney AJ, Higgins ST, Radonovich KJ, Novy PL. Adding voucher-based incentives to coping skills and motivational enhancement improves outcomes during treatment for marijuana dependence. Journal of Consulting and Clinical Psychology 2000;65:803–810.

Fennell, ML.; Warnecke, RB. The diffusion of medical innovations. Plenum; New York: 1988.

Fuller BE, Rieckmann T, McCarty D, Smith KW, Levine H. Adoption of naltrexone to treat alcohol dependence. Journal of Substance Abuse Treatment 2005;28:273–280. [PubMed: 15857728]

Hanson GR, Leshner AI, Tai B. Putting drug abuse research to use in real-life settings. Journal of Substance Abuse Treatment 2002;23:69–70. [PubMed: 12220602]

Higgins ST, Budney AJ, Bickel WK, Foerg FE, Donham R, Badger GJ. Incentives improve outcome in outpatient behavioral treatment of cocaine dependence. Archives of General Psychiatry 1994;51:568–576. [PubMed: 8031230]

Hosmer, DW.; Lemeshow, S. Applied logistic regression. Wiley; New York: 1989.

Johnson RE, Strain EC, Amass L. Buprenorphine: How to use it right. Drug and Alcohol Dependence 2003;70:S59–S77. [PubMed: 12738351]

Kellogg SH, Burns M, Coleman P, Stitzer ML, Wale JB, Kreek MJ. Something of value: The introduction of contingency management interventions into the New York City Health and Hospital Addiction Treatment Service. Journal of Substance Abuse Treatment 2005;28:57–65. [PubMed: 15723733]

Knudsen HK, Ducharme LJ, Roman PM, Link T. Buprenorphine diffusion: The attitudes of substance abuse treatment counselors. Journal of Substance Abuse Treatment 2005;29:95–106. [PubMed: 16135338]

Knudsen HK, Roman PM. Modeling the use of innovations in private treatment organizations: The role of absorptive capacity. Journal of Substance Abuse Treatment 2004;26:51–59.

Laliberte L, Fennell ML, Papandonatos G. The relationship of membership in research networks to compliance with treatment guidelines for early-stage breast cancer. Medical Care 2005;43:471–479. [PubMed: 15838412]

Ling W, Amass L, Shoptaw S, Annon J, Hillhouse M, Babcock D, et al. A multi-center randomized trial of buprenorphine–naloxone versus clonidine for opioid detoxification: Findings from the National Institute on Drug Abuse Clinical Trials Network. Addiction 2005;100:1090–1100. [PubMed: 16042639]

Ling W, Wesson DR. Clinical efficacy of buprenorphine: Comparisons to methadone and placebo. Drug & Alcohol Dependence 2003;70(2 Suppl):S49–S57. [PubMed: 12738350]

Mark T, Kranzler HR, Song X. Understanding US addiction physicians' low rate of naltrexone prescription. Drug & Alcohol Dependence 2003;71:219–228. [PubMed: 12957340]

Mee-Lee, DL.; Gartner, L.; Miller, MM.; Schulman, GD.; Wilford, BB. Patient placement criteria for the treatment of substance-related disorders. 2nd ed. ASAM; Chevy Chase, MD: 1996.

Peirce JM, Petry N, Stitzer M, Blaine J, Kellogg S, Satterfield F, et al. Effects of lower-cost incentives on stimulant abstinence in methadone maintenance treatment. Archives of General Psychiatry 2006;63:201–208. [PubMed: 16461864]

Petry NM, Martin B. Lower-cost contingency management for treating cocaine-abusing methadone patients. Journal of Consulting and Clinical Psychology 2002;70:398–405. [PubMed: 11952198]

Petry NM, Martin B, Cooney JL, Kranzler HR. Give them prizes and they will come: Contingency management for the treatment of alcohol dependence. Journal of Consulting and Clinical Psychology 2000;68:250–257. [PubMed: 10780125]

Petry NM, Peirce JM, Stitzer ML, Blaine J, Roll JM, Cohen A, et al. Effect of prize-based incentives on outcomes in stimulant abusers in outpatient psychosocial treatment programs. Archives of General Psychiatry 2005;62:1148–1156. [PubMed: 16203960]

Petry NM, Simcic F. Recent advances in the dissemination of contingency management techniques: Clinical and research perspectives. Journal of Substance Abuse Treatment 2002;23:81–86. [PubMed: 12220605]

Petry NM, Tedford J, Austin M, Nich C, Carroll KM, Rounsaville BJ, et al. Prize reinforcement contingency management for treating cocaine users: How low can we go, and with whom? Addiction 2004;99:349–360. [PubMed: 14982548]

Rogers, EM. Diffusion of innovations. 5th ed. Free Press; New York: 1995.

Roman PM, Johnson JA. Adoption and implementation of new technologies in substance abuse treatment. Journal of Substance Abuse Treatment 2002;22:1–8. [PubMed: 11849902]

Saxon AJ, McCarty D. Challenges in the adoption of new pharmacotherapies for addiction to alcohol and other drugs. Pharmacology & Therapeutics 2005;108:119–128. [PubMed: 16055196]

Silverman K, Chutuape MA, Bigelow GE, Stitzer ML. Voucher-based reinforcement of attendance by unemployed methadone patients in a job skills training program. Drug and Alcohol Dependence 1996;41:197–207. [PubMed: 8842632]

Simpson DD. A conceptual framework for transferring research to practice. Journal of Substance Abuse Treatment 2002;22:171–182. [PubMed: 12072162]

Substance Abuse and Mental Health Services Administration (SAMHSA). Clinical guidelines for the innovation adoption and the CTN use of buprenorphine in the treatment of opioid addiction (Treatment Improvement Protocol #40). SAMHSA; Rockville, MD: 2004.

Thomas CP, Wallack SS, Lee S, McCarty D, Swift R. Research to practice: Adoption of naltrexone in alcoholism treatment. Journal of Substance Abuse Treatment 2003;24:1–11. [PubMed: 12646325]

Table 1

Descriptive Statistics

Variable	Outside CTN (n=766)	Within CTN (n=240)	Significance (p)
Adopted buprenorphine[a]	11.1	20.0	<.001
Adopted motivational incentives[a]	31.2	33.8	ns
Operating revenues from public sources (M)	47.8	51.9	ns
For-profit structure	17.9	12.4	<.029
Accredited by JCAHO or CARF	48.1	65.6	<.001
Surveys buyers, suppliers, or both	77.3	70.1	<.016
Offers detoxification services	29.1	18.6	<.001
Outpatient-only services	46.9	52.7	ns
FTEs (M)	34.0	33.7	ns
Physician(s) on staff or contract	69.3	71.8	ns
Master's level counselors	44.5	44.5	ns
Primary opiate clients[b]	15.9	41.8	<.000
Program experience in clinical research	41.7	41.1	ns

[a] Adoption of buprenorphine and incentives was measured on 6-month follow-up interview. All other variables were measured at baseline interview.

[b] Removal of methadone units from CTN sample reduced the average opiate clients to 18.3% of CTN caseloads, which is still significantly higher than in non-CTN settings ($p<.05$).

Table 2

Logistic regression results predicting buprenorphine adoption as a function of organizational characteristics and CTN exposure (N=898)

Variable	b	Odds ratio
Predominantly public revenues	−.181	
For-profit structure	.205	
Accredited by JCAHO or CARF	.499	
Surveys buyers, suppliers, or both	−.256	
Offers detoxification services	1.279	3.594[a]
FTEs (log)	−.011	
Physician(s) on staff or on contract	1.370	3.936[a]
Percent master's level counselors	.667	
Percent primary opiate clients	.009	1.009[b]
Period of survey	.146	
Program experience in clinical research	.121	
Program not a CTN member (reference category)	---	
Program in CTN but not in buprenorphine trials	−.236	
Program participated in CTN buprenorphine trial(s)	1.640	5.153[a]
Constant	−3.874	

Note. Pseudo-R^2 (.155) calculated as (model chi sq / original -2LL) (Hosmer & Lemeshow, 1989).

[a] p<.01

[b] p<.05

Table 3

Logistic regression results predicting the adoption of voucher-based incentives as a function of organizational characteristics and CTN exposure (N=888)

Variable	b	Odds ratio
Predominantly public revenues	.527	1.693[a]
For-profit structure	−.537	.585[b]
Accredited by JCAHO or CARF	−.436	.646[b]
Surveys buyers and suppliers	−.194	
Outpatient-only services	−.437	.646[b]
FTEs (log)	.141	
Physician(s) on staff or contract	−.242	
Percent master's-level counselors	−.182	
Percent primary opiate clients	.000	
Period of survey	.045	
Program experience in clinical research	.030	
Program not a CTN member (reference category)	---	
Program in CTN but not in MIEDAR protocol	.042	
Program participated in CTN MIEDAR protocol	.914	
Constant	−.651	

Note: Pseudo R2 (.052) calculated as (mpdel chi sqare / original -2LL) (Hosmer & Lemeshow, 1989).

MIEDAR = Motivational Incentives for Enhanced Drug Abuse Recovery.

[a] p<.01

[b] p<.05