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Timing of buprenorphine adoption by privately funded substance abuse treatment programs: The role of institutional and resource-based inter-organizational linkages

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Abstract

Identifying facilitators of more rapid buprenorphine adoption may increase access to this effective treatment for opioid dependence. Using a diffusion of innovations theoretical framework, we examine the extent to which programs' inter-organizational institutional and resource-based linkages predict the likelihood of being an earlier, later, or non-adopter of buprenorphine. Data were derived from face-to-face interviews with administrators of 345 privately funded substance abuse treatment programs in 2007–2008. Results of multinomial logistic regression models show that inter-organizational and resource linkages were associated with timing of adoption. Programs reporting membership in provider associations were more likely to be earlier adopters of buprenorphine. Programs that relied more on resources linkages, such as the detailing activities by pharmaceutical companies and the NIDA website, were more likely to be earlier adopters of buprenorphine. These findings suggest that institutional and resource-based inter-organizational linkages may expose programs to effective treatments, thereby facilitating more rapid and sustained adoption of innovative treatment techniques.

1. Introduction

The 2002 Food and Drug Administration (FDA) approval of buprenorphine for the treatment of opioid dependence marked a significant change in the substance use disorder (SUD) treatment field. Prior to its approval, options for medication-assisted treatment for opiate dependence were limited to methadone administered by opioid treatment programs (OTPs), tablet naltrexone, or LAAM which had not been widely adopted by non-OTP treatment programs (Ling & Smith, 2002; Roman & Johnson, 2002). Although the effectiveness of treating opioid dependence with buprenorphine has been demonstrated in numerous clinical trials (Fudula et al., 2003; Johnson et al., 2000; Johnson, Jaffe, & Fudula, 1992; Ling et al., 2005; Lintzeris, Bell, Bammer, Jolley, & Rushworth, 2002; Pani, Maremmani, Pirastu,

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Tagliamonte, & Gessa, 2000; Petitjean et al., 2001), research has repeatedly shown its adoption by SUD treatment programs has been limited (Ducharme & Abraham, 2008; Friedmann, Jiang, & Alexander, 2010; Koch, Arfken, & Schuster, 2006; Knudsen, Abraham, Johnson, & Roman, 2009; Thomas et al., 2008; Wallack, Thomas, Martin, Chilingerian, & Reif, 2010). As a result, many opioid dependent individuals who might benefit from buprenorphine are not receiving this medication. Lack of access to evidence-based treatment practices (EBPs) is not unique to the case of buprenorphine, as a persistent gap between research and practice has been observed in the SUD treatment system (Garner, 2009; Godley, Garner, Smith, Meyers, & Godley, 2011; Lamb, Greenlick, & McCarty, 1998; Saxon & McCarty, 2005).

A number of studies have identified organizational correlates of buprenorphine adoption in SUD treatment programs (Friedmann et al., 2010; Koch, Arfken, & Schuster, 2006; Knudsen, Roman, Ducharme, & Johnson, 2005; Rieckmann, Daley, Fuller, Thomas, & McCarty, 2007). For instance, research has shown that larger programs, those that are accredited, programs located within hospitals, organizations offering detoxification services, and programs using tablet naltrexone or methadone are more likely to adopt buprenorphine (Ducharme et al., 2007; Ducharme & Abraham, 2008; Friedmann et al., 2010; Koch et al., 2006; Knudsen, Ducharme, and Roman, 2006; Knudsen et al., 2009; Oser & Roman, 2008; Wallack et al., 2010). Most of the literature on buprenorphine adoption has focused on the characteristics of organizations rather than how inter-organizational linkages, such as institutional and resource-based linkages, may facilitate adoption. Using data from a nationally representative sample of privately funded substance abuse treatment programs (N = 345) collected in 2007–2008, this paper estimates the influence of three measures of inter-organizational institutional and resource-based linkages—membership in provider associations, interactions with pharmaceutical representatives, and use of the National Institute on Drug Abuse (NIDA) website--on the likelihood of adopting buprenorphine. A key contribution is our consideration of the extent to which inter-organizational linkages are related to timing of buprenorphine adoption and its sustainability over time.

1.1. Inter-organizational linkages and knowledge transfer

The broader management literature has documented the importance of inter-organizational networks (i.e., cooperative relationships among distinct but related organizations) in facilitating both the adoption and implementation of innovations in a wide range of organizations and industries (Becker, 1970; Coleman, Katz, & Menzel, 1966; Erickson & Jacoby, 2003; Gibbons, 2007; Goes & Park, 1997; Mansfield, 1971; Pittaway, Robertson, Munir, Denyer, & Neely, 2004; Powell, Koput, & Smith-Doerr, 1996; Rogers, 2003; Westphal, Gulati, & Shortell, 1997). A possible explanation for the influence of inter-organizational networks on adoption is that participation in such relationships facilitates the flow of information about the conditions necessary for adopting and implementing innovations (Erickson & Jacoby, 2003). The utility of inter-organizational links may be even greater for organizations facing institutional pressures for conformity (Powell, 1990) as such links may provide opportunities for shared learning, transfer of technical knowledge, legitimacy, and resource exchange (Nohria & Eccles, 1992). For example, a study on the adoption of hospital services and technology found that inter-organizational linkages had positive effects on innovation capacity (Goes & Park, 1997).

Institutional and resource-based linkages are two types of inter-organizational linkages (Goes & Park, 1997) relevant to the study of adoption of innovations in SUD treatment organizations. Institutional linkages are typically formed around elements of common interest or practice, such as industry and trade associations or regional and national groups (Zuckerman & D'Aunno, 1990). These linkages create channels of information flow and enhance organizational capacity to acquire and interpret information (Thomas & Trevino,

1993). Such links may help organizations avoid uncertainty and enhance social legitimacy when pursuing innovations (Goes & Park, 1997). Resource-based linkages more directly involve the exchange of resources, including the exchange of personnel, financial resources, and information (Goes & Park, 1997). While inter-organizational institutional and resource-based linkages have been shown to influence innovation adoption in other fields, the extent to which these mechanisms impact the timing of adoption has received minimal attention, particularly in the SUD treatment literature.

1.2. The timing of innovation adoption and inter-organizational linkages

This study is unique in its examination of the timing of buprenorphine adoption by privately funded SUD treatment programs, particularly its focus on the extent to which inter-organizational linkages influence the timing of adoption. Rogers' (2003) classic theory of innovation diffusion identified five adopter categories based on timing of adoption: innovators, early adopters, early majority adopters, late majority adopters, and laggards. Moore (1991) contends that behavior may not be distinctly different across each of the five categories, but rather a more pronounced differentiation exists between those adopting an innovation earlier as opposed to later. Given that only five years had elapsed between FDA approval of buprenorphine in 2002 and data collection for the present study, we categorized programs as earlier or later adopters of buprenorphine based on the year they initiated use. It is important to note that our categorization of adoption also includes the element of sustainability, in that these adopters were still using buprenorphine in 2007–2008.

Rogers (2003) posited that earlier adopters tend to be more interconnected, or linked to others, through interpersonal connections in their social system than later adopters. Earlier adopters are also more likely to be engaged in linkages that exceed the boundaries of their local system. Rogers refers to this as cosmopoliteness, exemplified by a tendency for earlier adopters to travel and possess an orientation beyond the boundaries of their local community.

To date, consideration of the role of inter-organizational linkages in the adoption of buprenorphine has been limited to research conducted within the formal inter-organizational research network known as the National Drug Abuse Treatment Clinical Trials Network (CTN). The experience of being in the CTN, in which treatment programs are involved in considerable inter-organizational communication as well as clinical research on treatment effectiveness, has been noted as a promising facilitator of innovation diffusion (Forman, Bovasso, & Woody, 2001; Roman et al., 2010). Indeed, programs in the CTN are more likely to adopt medications than non-CTN programs, even though medications that have not been the focus of its clinical trials (Abraham et al., 2010; Ducharme et al., 2007; Knudsen et al., 2009). While the CTN is an important inter-organizational system for studying innovation adoption, participation by treatment programs is limited to those who partner with university-based researchers in a successful grant application, making it a relatively "closed" inter-organizational system.

In contrast, other types of inter-organizational linkages, such as provider associations, are more open to members of the addiction treatment field. Some national provider organizations have placed the adoption of evidence-based treatment practices (EBPs) as central to their mission. For example, the National Association of Addiction Treatment Programs (NAATP, 2011) describes that their mission is to "…promote, assist and enhance the delivery of ethical, effective, research-based treatment for alcoholism and other drug addictions. NAATP will seek to accomplish this mission by: (1) providing its members and the public with accurate, responsible information and other resources related to the treatment of these diseases; (2) advocating for increased access to and availability of quality treatment for those who suffer from alcoholism and other drug addictions; and (3) working in

partnership with other organizations and individuals that share NAATP's mission and goals." It is less clear whether state provider associations have taken similar stances regarding the diffusion of EBPs, and whether state associations influence organizational decisions about innovations. To date, studies of medication adoption have not considered how provider associations may facilitate more rapid technology transfer.

Detailing activities of pharmaceutical companies represent another relevant type of inter-organizational linkage in which informational resources are shared with treatment organizations. These activities have the potential to increase exposure of SUD treatment providers to innovative pharmacotherapies for the treatment of SUDs. The degree of detailing activities is a result of both pharmaceutical companies' decisions about where to market their product and the extent to which programs allow companies access to staff (Alkhateeb et al., 2009). Multiple studies have shown that detailing activities have a considerable influence on prescribing behaviors (Lichstein, 1992; McCormick, Tomlinson, Brill-Edwards, & Detsky, 2001; Wazana, 2000), suggesting that programs reporting greater contact with pharmaceutical companies may be more likely adopt medications such as buprenorphine. Previous research in the SUD treatment field found a positive association between more frequent contact with pharmaceutical companies and the number of evidence-based practices adopted by programs (Knudsen & Roman, 2004).

A much different knowledge source that offers exposure to EBP information is the National Institute on Drug Abuse (NIDA) website. Committed to the dissemination of research results to "significantly improve prevention, treatment and policy as it relates to drug abuse and addiction" (NIDA, 2011), NIDA's website is both a reputable and mission-driven source of innovation information. It includes a specific section about buprenorphine (see http://archives.drugabuse.gov/drugpages/buprenorphine.html). We hypothesize that greater reliance on the website for innovation information may help organizations to weigh their options when making decisions about innovations.

This study examines the extent to which institutional and resource-based linkages are associated with treatment programs' innovativeness, as defined by the timing of buprenorphine adoption. Specifically, we compare three types of programs--early adopters, later adopters, and non-adopters--on measures of inter-organizational linkages while controlling for basic organizational characteristics. We hypothesize that membership in provider associations, detailing activities by pharmaceutical companies, and reliance on NIDA's website are likely to enhance a program's capacity to be innovative, as demonstrated by earlier and sustained adoption of buprenorphine.

2. Methods

The data analyzed in this paper were collected as part of the National Treatment Center Study (NTCS) between February 2007 and July 2008 via face-to-face interviews with administrator and/or clinical directors of 345 privately funded treatment programs. The sample consists of prior participants in the NTCS and replacement centers that were randomly selected to account for attrition in the sample over time. Full details of the sampling procedures have been published elsewhere (Abraham & Roman, 2010; Knudsen, Abraham, and Roman, 2011). Telephone screening established eligibility for the study, and ineligible facilities were replaced at random from the same geographic stratum. The final sample of 345 programs represented a response rate of 67%.

To be eligible for the study, programs had to receive at least 50% of annual operating revenues from commercial insurance, patient fees, and income sources not defined as governmental grants or contracts (e.g. federal block grants, state contracts for services,

contracts with Departments of Corrections). Additionally, eligible programs had to offer a minimum level of care at least equivalent to structured outpatient services as defined by the American Society of Addiction Medicine's patient placement criteria (Mee-Lee, Gartner, Miller, Shulman, & Wilford, 1996) and be open to the public. Excluded from the study were counselors in private practice, transitional living facilities, methadone-only treatment programs, court-ordered driver education classes or detoxification services, corrections-based programs, and programs located in Veterans Health Administration facilities. All research procedures were approved by the University of Georgia's Institutional Review Board.

2.1 Measures

The dependent variable of buprenorphine adoption consists of three mutually-exclusive categories. Programs that did not prescribe buprenorphine at the time of data collection in 2007–2008 were coded as non-adopters. Those reporting that buprenorphine was currently prescribed to opioid-dependent patients were asked to identify the year they began prescribing. Programs adopting buprenorphine prior to 2005 were categorized as early adopters and programs adopting in 2005 or later were coded as later adopters.

This study investigates three measures of institutional and resource-based inter-organizational linkages. Administrators indicated whether the program was a member of at least one provider association (1 = provider association membership; 0 = no provider association membership). For programs with at least one association membership, an open-ended question asked for a description of the association. Administrators also rated the importance two communication channels as sources of innovation information: 1) personal contacts/materials from pharmaceutical companies and 2) the National Institute on Drug Abuse (NIDA) website. Respondents rated the extent to which the center's knowledge about innovations came from these communication channels on a scale of 0 to 5, where 0 indicated "no extent" and 5 represented "a very great extent."

Consistent with prior research, three structural characteristics and two measures of treatment services were selected as control variables. Programs were coded based on location within a hospital setting (1 = hospital; 0 = non-hospital). Program size was measured by the number of full-time equivalent employees (natural log transformed to adjust for skew). Accreditation status was indicated by program accreditation by either the Joint Commission (JC) or the Commission on Accreditation of Rehabilitation Facilities (CARF) (1= accredited; 0 = not accredited). Finally, we measured availability of detoxification services (1= available, 0= not available) and the levels of care offered by the center. Levels of care were measured by three dummy variables which differentiated programs that only offered inpatient and/or residential treatment services, programs offering a combination of inpatient/residential and outpatient, and those that only provided outpatient treatment services (reference category).

2.2. Analytic strategy

Statistics were calculated for a subset of privately funded treatment programs (N=322) with complete data on the study variables. Bivariate comparisons were made between the three adopter types and key independent variables using oneway ANOVAs and chi-square analyses. Multinomial logistic regression was then used to examine the associations between the categorical measure of adopter type and the variables measuring inter-organizational linkages. When estimating the effects of a set of independent variables on an unordered categorical dependent variable with more than two values, multinomial logistic regression is an appropriate analytical technique (Long & Freese, 2006). Multinomial logistic regression produces standardized coefficients, which can be expressed as relative risk ratios (RRR).

This provides a useful means for examining the extent to which an independent variable is associated with odds of belonging to a particular group relative to a reference category.

Given recommendations that there should be 5–9 events of the dependent variable per independent variable (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996; Vittinghoff & McCulloch, 2007), we included a limited number of covariates in a series of three multinomial logistic regression models. The models controlled for the same set of organizational characteristics, while introducing a different measure of inter-organizational linkages. The first model included membership in provider associations; the second and third models included the communication-oriented items assessing the importance of pharmaceutical company contacts and NIDA's website, respectively. Data analyses were conducted using Stata 11.0 (StataCorp, College Station, TX).

3. Results

3.1. Descriptive statistics

Descriptive statistics by adopter type (i.e., early, later, and non-adopters) are presented in Table 1. In 2007–2008, approximately 37% of privately funded treatment programs used buprenorphine for detoxification or maintenance. There were significant differences in organizational structure across the three adopter categories. For instance, programs that were larger, hospital-based, and offered detoxification services were more likely to fall into either the earlier or later adopter types as opposed to the non-adopter group. Programs offering outpatient only levels of care were less likely to belong to one of the adopting groups and more likely to belong to the non-adopting group; about 65% of non-adopters only offered outpatient treatment ($\chi^2 = 28.88$, $p < .01$, $df=2$). In contrast, offering mixed levels of care was more prevalent among earlier and later adopters (55% and 49%, respectively) than non-adopters, of which just 25% offered mixed levels of care ($\chi^2 = 23.16$, $p < .01$, $df=2$). Across all three levels of care, there were significant differences between earlier and non-adopting centers as well as between later and non-adopters ($\chi^2 = 29.78$, $p < .01$, $df=2$). Accreditation, a proxy measure for social status and quality, was much more prevalent among earlier and later adopter groups than the non-adopting group ($\chi^2 = 23.41$, $p < . 01$, $df=2$).

The more social nature of earlier adopters was reflected by two of the measures of inter-organizational linkages in Table 1. Programs reporting membership in provider associations were more likely to belong to the earlier adopter category than either the later or non-adopting groups ($\chi^2 = 8.46$, $p < .05$, $df=2$). Importance of pharmaceutical contacts as a source of innovation information was rated higher among members of both adopting groups relative to the non-adopting group. The three adopters groups did not differ significantly in their ratings of the importance of NIDA's website as a source of innovation information.

3.2. Multinomial logistic regression models of three categories of adoption

In the first model, membership in provider associations was statistically significant, indicating that programs with this institutional link were twice as likely to be earlier adopters, relative to the odds of being a non-adopter, than programs which were not members of provider associations (RRR = 2.14, 95% CI = 1.02–4.51, $p < .05$). The comparison of later adopters to earlier adopters revealed that membership in provider associations decreased the odds of belonging to the later adopter group by 57% (95% CI = 0.19–0.94, $p < .05$). In other words, programs that were members of provider associations tended to be early adopters of buprenorphine rather than non-adopters or later adopters.

The second model examined whether reliance on pharmaceutical contacts as a source of innovation information was associated with the timing of buprenorphine adoption. Programs attributing greater importance to detailing activities were more likely to be early adopters

(RRR = 1.32, 95% CI = 1.03–1.70, $p < .05$) or later adopters of buprenorphine (RRR = 1.47, 95% CI = 1.19–1.81, $p < .01$) than non-adopters. This measure of detailing did not differentiate earlier adopters from later adopters.

The third model included the importance of NIDA's website as an information resource. Higher ratings of NIDA's website decreased the odds of having adopted later as opposed to earlier by 26% (95% CI = 0.55–0.99, $p < .05$); put another way, greater reliance on the NIDA website was positively associated with the likelihood of being an early adopter relative to the odds of being a later adopter.

For the control variables, there were only two associations of note. Consistently across the models, the availability of detoxification was positively associated with being either an earlier or later adopting program, relative to the non-adopting group. Consistent with prior research, offering detoxification services decreased the odds of adopting later as opposed to earlier. Center size was statistically significant in two of the three models, with size being positively associated with the odds of being a later adopter relative to the odds of non-adoption. Location in a hospital setting, accreditation, and levels of treatment services were not associated with buprenorphine adoption.

3.3. Analysis of provider association details

To further explore the role of provider association membership, we examined open-ended responses to a question that asked programs to identify the provider associations in which they were members. The number of membership associations reported by programs ranged from 0 to 6, with a mean of 1. Earlier adopters reported the highest number of associations (M=1.04, SD=1.40), later adopters the next highest (M=.66, SD=1.02), and non-adopters reported the least (M=.54, SD=.89). The difference between the number of associations reported by the earlier adopters and the non-adopters (.50) was significant ($F = 4.85$, $p < .01$). Although the open-ended item on provider association type yielded a variety of responses, common themes included the mention of the National Association of Addiction Treatment Programs (NAATP) and official state or national associations. A comparison of association types across the adopter categories revealed that state associations were the type most often mentioned by programs categorized as later or non-adopters, whereas national associations were mentioned most often by earlier adopters ($\chi^2 = 30.14$, $p < .01$, $df = 2$).

4. Discussion

Although several studies have examined the organizational correlates of buprenorphine adoption in the initial years of its availability (Ducharme & Roman, 2009; Ducharme & Abraham, 2008; Friedmann et al., 2010; Knudsen et al., 2006; Knudsen et al., 2009; Koch et al., 2006; Rieckmann et al., 2007; Thomas et al., 2008; Wallack et al., 2010), this is the first study to compare earlier, later, and non-adopters by types of inter-organizational institutional and resource-based linkages. We found that inter-organizational linkages may play a promising role in the technology transfer process and may contribute to closing the research-to-practice gap.

Of the three measures of inter-organizational linkages, membership in provider associations was most strongly related to the odds of being an early adopter. Unlike structural characteristics of organizations, membership in provider associations may be more amenable to change. Our findings also suggest that the qualitative nature of the provider association linkages may influence timing of buprenorphine adoption, such that involvement in national associations appears to be more influential than state or local associations. National associations, particularly NAATP, have made strong commitments toward promoting the adoption of evidence-based practices. In the case of NAATP, adoption of EBPs has been

incorporated into their mission statement which is a clear signal to their members that EBP adoption may increase social legitimacy for their organization. This finding is also consistent with Rogers' (2003) argument that early adopters of innovations tend to engage in activities beyond their local community. Furthermore, the strong relationship based on provider association involvement, particularly at the national level, may be partially explained by Granovetter's (1973) "strength of weak ties" network theory, which describes how relationships that cross social system boundaries (i.e., weak ties), as opposed to those shared at a more local level, enable the flow of ideas and information that might otherwise be inaccessible. Membership in provider associations may connect programs to trade resources and industry-wide representatives, whereas linkages at the local level may not facilitate access to such information. Byosiere and colleagues (2010), drawing on the work of Polanyi (1966), further argue weak ties can facilitate the transfer of explicit forms of knowledge. In this way, national associations may have helped to facilitate the diffusion of buprenorphine, an example of explicit knowledge, to programs sooner than those reporting membership in provider associations only within their state.

Inter-organizational resource based linkages that involve the exchange of information were also associated with buprenorphine adoption. Early adopters reported greater reliance on the NIDA website than later adopters. This finding suggests that promoting NIDA's website within programs may further facilitate information dissemination that can inform organizational decisions about innovation adoption, particularly when innovations are new to the field.

Reliance on detailing activities of pharmaceutical companies, an additional type of resource-based linkage, was related to the odds of adopting buprenorphine, but it did not differentiate earlier from later adopters. The lack of influence of detailing on the specific timing of adoption may be a function of the fact that detailing activities are ongoing, which would remove the element of timing from their influence on organizational decisions to adopt this pharmacological innovation. Regardless, since programs control whether they allow pharmaceutical representatives to visit (Alkhateeb et al., 2009), this represents another area amenable to change considering the low level of detailing activities reported by administrators. Given that addressing the needs of opioid dependent patients with buprenorphine marks a shift for many physicians working in non-OTP settings, detailing activities may reduce some barriers to prescribing (Kissin, McLeod, Sonnefeld, & Stanton, 2006).

4.1 Limitations

While this study used data from a national sample of privately funded treatment programs, there are several limitations that should be noted. First, the cross-sectional nature of the data limits our ability to establish causality. Ideally, the hypothesized causal factors would have been derived from an earlier wave, which would allow for analyses such as survival analysis. However, a longitudinal analysis was not possible since the measures of inter-organizational linkages were not captured in earlier waves of data collection. Second, the category of non-adopters identified in this study may be a fluid group, consisting of some programs that may still adopt buprenorphine in the future. Third, these results may not generalize to treatment programs in the public sector, opioid treatment programs, and those embedded in the Veterans Administration health system since the sample included only privately funded SUD treatment organizations. In addition, the self-reported measures from administrators regarding reliance on the NIDA website and contact with pharmaceutical companies may not fully reflect the influence of these types of activities. For example, pharmaceutical companies may direct their efforts toward physicians rather than administrators, so their influence may be under-reported in these data. Incorporating data directly from physicians and other staff about use of informational resources, and

aggregating such data into organization-level measures that can be used as covariates of innovation adoption, represent important avenues for future research.

4.2. Directions for Future Research

This study found support for Rogers' (2003) hypothesis that earlier adopters of an innovation are more interconnected within the broader social system through national provider associations than later adopters. One direction for future research is the examination of the content, participants, and meeting processes (e.g., frequency, leadership, content of meetings) within provider associations while being attentive to how different types of associations may be related to program-level adoption behavior. The degree to which programs and staff participate in provider associations is a function of management-based decisions and may be a feasible way to increase a program's connections to institutional types of inter-organizational linkages.

Our findings also suggest that investing in collaborative relationships may expose programs to effective treatment options with which they may be otherwise unfamiliar and in turn facilitate more rapid rates of technology transfer to practice. Future studies could compare both the rates and speed of adoption of innovations by types of inter-organizational linkages to further understand this relationship and identify opportunities for knowledge transfer. Additionally, an assessment of attitudes toward collaboration and inter-organizational relationships may provide insight into the varying levels of networking across programs.

4.3. Conclusions

Buprenorphine is an effective medication for the treatment of opioid dependence, yet these data from a sample of privately funded treatment programs continue to show that its adoption in SUD treatment programs is limited. By focusing on the timing of adoption, this study revealed that membership in a provider association was a key institutional linkage that was strongly associated with the likelihood of earlier adoption. Closer analysis suggested that membership in national associations were particularly important for earlier adoption of buprenorphine. The resource-based linkage of detailing by pharmaceutical companies was associated with both earlier and later adoption, suggesting that its influence may be more general than temporally-specific. These findings suggest that further consideration of institutional and resource-based inter-organizational linkages may represent important directions for future research on the adoption of other EBPs.

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Table 1

Descriptive statistics and comparisons across adopter groups

Variable	All (N=322)	Earlier (N=47)	Later (N=72)	Non (N=203)	χ^2/F-values†
Buprenorphine adopted by center (%)	36.96				
Hospital-based (%)	29.19	42.55	38.89	22.66	11.52^{**b,c}
Accredited (JC or CARF) (%)	56.52	72.34	75.00	46.31	23.41^{**b,c}
Center size in FTE (natural log) [mean (*SD*)]	2.65 (1.22)	3.21 (.97)	3.15 (1.16)	2.34 (1.19)	19.50$^{\dagger **b,c}$
Offer detoxification services (%)	40.06	82.98	61.11	22.66	74.94^{**a,b,c}
Levels of care:					29.78^{**b,c}
Outpatient only (%)	53.73	29.79	37.50	65.02	28.88^{**b,c}
Inpatient only (%)	11.49	14.89	13.89	9.85	1.48
Inpatient and outpatient (%)	34.78	55.32	48.61	25.12	23.16^{**b,c}
Measures of inter-organizational linkages:					
Belong to provider association (%)	40.68	59.57	40.28	36.45	8.46^{*a,c}
Personal contacts/materials from pharmaceutical companies [mean (*SD*)]:	1.80 (1.49)	2.30 (1.47)	2.44 (1.41)	1.46 (1.41)	16.17$^{\dagger **b,c}$
NIDAs website [mean (*SD*)]:	3.13 (1.46)	3.40 (1.28)	2.86 (1.54)	3.16 (1.46)	2.10†

Note.

^{a}significant difference between earlier and later adopters (p<.05);

^{b}significant difference between later and non-adopters (p < .05);

^{c}significant difference between early and non-adopters (p < .05).

†Denotes F-values; otherwise chi-square values.

*Significant difference across categories of adoption (p < .05);

**Significant difference across categories of adoption (p < .01).

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Table 2

Multinomial logistic regression of three categories of adoption (N=322)

Variable	Model 1			Model 2			Model 3		
	Earlier vs. non-adopters RRR (95% CI)	Later vs. non-adopters RRR (95% CI)	Later vs. earlier adopters RRR (95% CI)	Earlier vs. non-adopters RRR (95% CI)	Later vs. non-adopters RRR (95% CI)	Later vs. earlier adopters RRR (95% CI)	Earlier vs. non-adopters RRR (95% CI)	Later vs. non-adopters RRR (95% CI)	Later vs. earlier adopters RRR (95% CI)
Hospital-based	1.71 (0.74–3.97)	1.51 (0.77–2.96)	.88 (0.37–2.09)	1.48 (0.63–3.45)	1.24 (0.62–2.49)	.84 (0.35–1.99)	1.83 (0.80–4.19)	1.50 (0.76–2.96)	.82 (0.35–1.94)
Accredited (JCAHO/CARF)	1.13 (0.46–2.80)	1.74 (0.86–3.52)	1.55 (0.57–4.22)	1.05 (0.42–2.58)	1.61 (0.78–3.31)	1.54 (0.57–4.10)	1.18 (0.48–2.90)	1.69 (0.83–3.43)	1.43 (0.53–3.88)
Center size (log of FTEs)	1.17 (0.77–1.78)	1.43* (1.03–1.99)	1.22 (0.79–1.90)	1.28 (0.85–1.92)	1.37 (0.99–1.91)	1.08 (0.71–1.64)	1.32 (0.88–1.99)	1.43* (1.03–1.97)	1.08 (0.70–1.65)
Offers detoxification services	14.56** (5.35–39.65)	3.37** (1.57–7.21)	.23** (0.08–0.70)	13.42** (4.85–37.11)	2.96** (1.35–6.50)	.22** (0.07–0.67)	14.04** (5.17–38.15)	3.43** (1.59–7.39)	.24* (0.08–0.74)
Treatment services[a]									
Inpatient only	.87 (0.21– 3.53)	.75 (0.25–2.24)	.87 (0.20–3.86)	.76 (0.19–3.09)	.87 (0.29–2.66)	1.15 (0.26–4.98)	0.72 (0.18–2.91)	.74 (0.25–2.18)	1.03 (0.23–4.51)
Inpatient and outpatient	.66 (0.21–2.06)	.75 (0.31–1.81)	1.13 (0.33–3.86)	.66 (0.21–2.06)	.90 (0.36–2.25)	1.36 (0.41–4.57)	.66 (0.21–2.02)	.69 (0.28–1.71)	1.05 (0.31–3.59)
Measures of inter-organizational linkages:									
Member of provider association	2.14* (1.02–4.51)	.91 (0.49–1.69)	.43* (0.19–0.94)						
Importance of pharmaceutical contacts				1.32* (1.03–1.70)	1.47** (1.19–1.81)	1.11 (0.85–1.44)			
Importance of NIDAs website							1.21 (0.92–1.60)	.89 (0.73–1.10)	.74* (0.55–0.99)
Pseudo R^2	0.163			0.179			0.162		
χ^2	95.15***			104.55***			94.44***		

[a] Outpatient only is the reference group;

* $p<.05$.

** $p<.01$.

*** $p<.001$.