Early Adoption of Injectable Naltrexone for Alcohol-Use Disorders: Findings in the Private-Treatment Sector*

AMANDA J. ABRAHAM, PH.D.,[†] AND PAUL M. ROMAN, PH.D.

Institute for Behavioral Research, 112 Barrow Hall, University of Georgia, Athens, Georgia 30602-2401

ABSTRACT. Objective: The U.S. substance-abuse treatment system has been slow to adopt medications for the treatment of alcohol-use disorders (AUDs). The objectives of this study are to (a) determine how the inherent characteristics of injectable naltrexone (i.e., relative advantage, complexity, trialability, observability, compatibility) shape organizational-level decisions to adopt the medication and (b) identify key predictors of adoption and barriers that impede adoption. **Method:** This study uses data from a nationally representative sample of 345 privately funded U.S. substance-abuse treatment programs to examine adoption (current use) of injectable naltrexone. **Results:** Sixteen percent of private treatment programs are early adopters of injectable naltrexone. Multivariate logistic regression models reveal that organizational size and percentage of patients paying with private insurance are significant predictors of adoption. The most salient predictor of adoption is innovation compatibility,

measured by program use of other AUD pharmacotherapies. Barriers to adoption include cost, lack of access to prescribing physicians, and lack of knowledge about the medication. Injectable naltrexone, however, is addressing the patient compliance barrier, demonstrated by 70% of patients receiving at least 2 months of medication. **Conclusions:** The adoption of AUD pharmacotherapies remains low, with only half of the sampled programs prescribing any AUD pharmacotherapies. Patterns of early adoption of injectable naltrexone are, however, promising. Results highlight innovation compatibility and relative advantage as explanations of organizational decisions to adopt injectable naltrexone. Future research will move beyond issues of adoption and provide a more detailed examination of the implementation process. (*J. Stud. Alcohol Drugs*, 71, 460-466, 2010)

MEDICATIONS FOR THE TREATMENT OF alcohol-use disorders (AUDs) have been shown to be effective but are neither widely used nor well known in specialty treatment (O'Brien, 2005). In the last two decades, the U.S. Food and Drug Administration has approved three AUD medications: tablet naltrexone (Revia) in 1994; acamprosate (Campral) in 2004, and an extended-release injectable suspension of naltrexone (Vivitrol) in 2006. These medications join disulfiram (Antabuse), an aversive medication that has been available since 1949, as the currently available medication options for AUD patients.

As part of a broader movement to improve quality in medical and psychiatric care delivery, U.S. federal agencies (Agency for Health Care Policy and Research, 1999; Center for Substance Abuse Treatment, 1998; National Institute on Alcohol Abuse and Alcoholism, 2005; National Institute on Drug Abuse, 1999) have heavily promoted medication-assisted therapies for the treatment of AUDs. Understanding the diffusion of medication-assisted therapy in specialty

treatment is a crucial health services research issue. Implementation of medication-assisted therapy is important to clinicians desiring to fully customize approaches to AUD treatment and deliver the highest standard of care to patients, and to patients themselves, who seek access to the full range of evidence-based alternative approaches to recovery.

Rates of pharmacotherapy adoption have been relatively low in community-based treatment settings. Barriers to adoption include strong commitments to traditional treatment models that emphasize 12-step approaches and psychosocial counseling, perceived efficacy of medication-assisted therapy, patient noncompliance, lack of knowledge, resource constraints, and access to prescribing staff (Fuller et al., 2005; Mark et al., 2003a, 2003b; Thomas et al., 2003; Thomas and Miller, 2007; White, 1998).

This article focuses on the early adoption and implementation of the newest and perhaps the most technically challenging of the pharmacotherapies—injectable naltrexone. Injectable naltrexone directly addresses the barrier of patient noncompliance by providing a 30-day dose of the medication, and recent efficacy studies indicate positive results for the use of injectable naltrexone to increase rates of abstinence, reduce heavy drinking days, and reduce time to first drinking day (Garbutt et al., 2005; Gastfriend et al., 2005; Kranzler et al., 2004; O'Malley et al., 2007). Although prior research has examined the adoption of disulfiram, tablet naltrexone, and acamprosate in community-based treatment

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[†]Correspondence may be sent to Amanda J. Abraham at the above address or via email at: aabraham@uga.edu.

settings, this is the first study to examine the adoption of injectable naltrexone in the U.S. substance-abuse treatment system.

Diffusion theory as an organizing framework

Diffusion theory identifies inherent characteristics of innovations that influence decision makers when considering adoption (Rogers, 2003). An innovation has a greater likelihood of being adopted if it (a) carries a *relative advantage* over other options; (b) has a low degree of *complexity*; (c) offers “*trialability*,” or the opportunity for experimental use before commitment to full implementation; (d) produces readily *observable* results; and (e) is *compatible* with potential adopters’ existing values, experience, and needs.

This framework provides a useful organizing tool for examining treatment organizations’ behavior in the early adoption of injectable naltrexone (i.e., willingness to “try out” the innovation). A monthly injection should offer a relative advantage to both patients and treatment providers over the daily dosing of tablet naltrexone or acamprosate by directly addressing the patient noncompliance barrier (Harris et al., 2004; Hermos et al., 2004). It is unclear, however, if dosing via injection will be perceived by potential adopters as an “advantage” over oral delivery. Relative to prescribing tablets, the preparation and administration of injectable naltrexone is considerably more complex; the medication must be refrigerated as separate components (i.e., a vial containing naltrexone microspheres and a vial containing the diluent), and these must be mixed in a specific manner to avoid breaking the microspheres just before the medication is injected. Adding further to complexity, the injection must be delivered by a medical professional trained in the above techniques, requiring that the treatment program have access to such a person.

Injectable naltrexone can be used on a trial basis without a significant investment on the part of programs in gaining licensure. This is in contrast to administration of opioid treatment medications such as buprenorphine (Suboxone and Subutex), which requires physicians to complete a specific credentialing process, or methadone (Dolophine and Methadose), for which programs must address a number of security and diversion control issues.

Observability could play a significant role in both the treatment providers’ initial decision to adopt injectable naltrexone and the decision to continue using the medication after an initial trial period. Initially, access to sources of information about the effectiveness of the medication may influence the adoption decision, and continued use may be affected by the extent that clinicians see significant improvements in these patients relative to those on other AUD medications or patients receiving counseling only.

Injectable naltrexone is more likely to be compatible (or “fit”) with the treatment program if the clinical staff has a

“platform of receptivity” for the use of AUD medications. Programs already using alcohol pharmacotherapies have overcome at least some of the barriers associated with the adoption of AUD medications (e.g., philosophical barriers and access to prescribing staff). Compatibility can be assessed using Rogers’ concept of a *technology cluster*, in which innovations are viewed as an interrelated bundle of ideas (Rogers, 2003). Thus adoption of one innovation may facilitate the adoption of other innovations viewed as part of the bundle. To the extent that potential adopters view injectable naltrexone as part of an alcohol pharmacotherapy-technology cluster (i.e., bundled with disulfiram, tablet naltrexone, and/or acamprosate), programs should be more likely to adopt the medication (Knudsen et al., 2007).

Adoption of tablet naltrexone, organizational correlates, and barriers

Existing research on the organizational-level adoption of alcohol pharmacotherapies in the U.S. treatment system focuses largely on the adoption of tablet naltrexone (Fuller et al., 2005; Heinrich and Hill, 2008; Oser and Roman, 2007, 2008; Roman and Johnson, 2002). In a New England study, Fuller et al. (2005) found that agency mission, program size, counselor educational level, involvement with managed care, and use of selective serotonin reuptake inhibitors were associated with tablet naltrexone adoption. Studies using nationally representative data revealed that program size, accreditation, counselor education level, and percentage of patients paying with private insurance were predictive of tablet naltrexone adoption (Fuller et al., 2005; Roman and Johnson, 2002). Oser and Roman (2007, 2008) identified internal organizational structure (e.g., use of prescription drugs), organizational culture (e.g., not holding 12-step meetings onsite), familiarity with innovative treatments, and organizational communication behavior as significant predictors of tablet naltrexone adoption. Heinrich and Hill (2008) found that programs offering hospital in-patient substance-use-disorders treatment were more likely to prescribe tablet naltrexone compared with programs without access to medically trained staff, as were programs offering a greater variety of services.

Organizational barriers to the adoption of tablet naltrexone include ideological barriers, lack of knowledge about the medication, resource constraints, and lack of access to prescribing staff (Ducharme et al., 2006; Fuller et al., 2005; Thomas and Miller, 2007; Thomas et al., 2008). Studies of clinician attitudes identify patient noncompliance, cost, ideological barriers, and lack of information as prominent barriers (Mark et al., 2003a, 2003b; Thomas and Miller, 2007; Thomas et al., 2003).

Prescription and insurance claim data highlight patient noncompliance as a persistent barrier. Assuming that continuous receipt of prescriptions is a proxy for compliant use

of a medication, a Department of Veterans Affairs study showed that less than 50% of patients received tablet naltrexone prescriptions for more than 2 months and approximately 20% of patients received their prescription for 6 months or more (Hermos et al., 2004). In another study, paid health insurance claims data revealed that less than 20% of patients in this population were supplied tablet naltrexone for more than 1 month (Harris et al., 2004). In addition, a study of prescription persistence in a healthcare organization revealed that more than 85% of patients failed to fill their prescription for 80% or more of a 6-month treatment period (Kranzler et al., 2008).

The current study examines what diffusion theory calls the "early adoption" of injectable naltrexone. "Adoption," or the initial decision to use an innovation, should not be confused with "implementation," which follows adoption and is defined as the routine use of an innovation. First, we describe the use of pharmacotherapies in our nationally representative sample of treatment programs. Second, we compare the characteristics of early injectable naltrexone adopters with nonprescribing programs. Third, we test multivariate logistic regression models predicting the adoption of injectable naltrexone. Fourth, we use descriptive data to identify barriers to the adoption of injectable naltrexone. Fifth, we examine patient compliance with the injectable naltrexone treatment regimen.

Method

Data for this study were taken from the fifth wave of the National Treatment Center Study, a nationally representative study of privately funded substance-use-disorders treatment programs (see Oser and Roman, 2007, and Roman and Johnson, 2002, for complete details of the research methods). Data were collected via face-to-face interviews with clinical directors of 345 private-sector treatment programs conducted between February 2007 and July 2008. Participating organizations were selected via a two-stage random sampling approach. First, all U.S. counties were assigned to 1 of 10 strata based on population and were then randomly sampled within strata. This process ensured inclusion of a mixture of urban, suburban, and rural areas. In the second stage, using national and state directories, all substance-use-disorders treatment facilities in the sampled counties were enumerated. Treatment programs were then proportionately sampled across strata, with telephone screening used to establish eligibility for the study. Facilities screened as ineligible were replaced by random selection of alternative treatment programs from the same geographic stratum. Recruitment continued for an 18-month period, and the 345 programs in the final sample represented a 67% response rate.

Treatment programs were defined as *private sector* if at least 50% of their annual operating revenues came from commercial insurance, patient fees, and income sources

other than "block" funding such as government grants or contracts. Medicaid and Medicare, which are reimbursements received by programs on an individual patient basis, were not regarded as "block" funding. As a further inclusion criterion, programs were required to offer alcohol and drug treatment at a level of intensity at least equivalent to American Society of Addiction Medicine Level 1 outpatient services (Mee-Lee et al., 1996). Eligibility requirements excluded counselors in private practice, halfway houses, and transitional living facilities; programs offering exclusively methadone maintenance, court-ordered driver education classes, or detoxification services; and programs located in correctional and Veterans Health Administration facilities.

A primary goal of the study was to monitor the adoption, implementation, and diffusion of innovative treatment practices. Respondents were queried about the adoption of a variety of evidence-based pharmacotherapies and counseling techniques, including a detailed module on injectable naltrexone. The interview approach offered several advantages in ensuring data quality. Interviewers ensured that respondents focused on a single medication at a time; the follow-on questions allowed interviewers to check for internal consistency of respondents' answers and for real-time clarification and correction. All research procedures were approved by the University of Georgia's Institutional Review Board.

Measures

Dependent variable. The dependent variable measured the adoption (current use) of injectable naltrexone. Programs currently prescribing injectable naltrexone were coded "1" and nonprescribers were coded "0" on the dependent variable.

Independent variables. Consistent with research on medication-assisted-therapy adoption, several organizational, staff, and patient characteristics were included in the analyses (Ducharme et al., 2006; Fuller et al., 2005; Knudsen and Roman, 2004; Oser and Roman, 2007, 2008). Profit status and hospital-based were dichotomous variables (1 = *for profit*, 0 = *nonprofit*; 1 = *hospital based*, 0 = *not hospital based*). Organization size was measured by the number of full-time equivalent employees (natural log transformed to adjust for skew). Professional staff (i.e., proportion of counselors holding at least a master's degree) and staff recovery status (i.e., proportion of counselors in recovery) were continuous variables. We included two continuous measures of patient characteristics—percentage of patients diagnosed with alcohol dependence and percentage of patients paying with private insurance. Programs with a physician on staff or under contract were coded "1" on the physician variable, and programs without access to a physician were coded "0." Finally, we measured innovation compatibility using the alcohol pharmacotherapy-technology cluster variable (Knudsen et al., 2007). Programs that reported currently prescribing

disulfiram, tablet naltrexone, and/or acamprosate were coded "1" and programs that did not currently prescribe disulfiram, tablet naltrexone, and/or acamprosate were coded "0" on the alcohol pharmacotherapy-technology cluster variable.

Statistical analysis

Three analytic techniques were used. First, descriptive statistics indicated adoption of alcohol pharmacotherapies and barriers to injectable naltrexone adoption. Second, mean differences between injectable naltrexone prescribers and nonprescribing programs were estimated using chi-square tests and *t* tests. Third, logistic regression models predicted the adoption of injectable naltrexone. Data were analyzed using Stata 10.0 (StataCorp LP, College Station, TX). We reported McKelvey and Zavonia's pseudo- R^2 measure of logistic regression model fit (Long and Freese, 2006). Diagnostic tests revealed no evidence of multicollinearity.

Results

Descriptive statistics

Table 1 reports descriptive statistics for injectable naltrexone adopters (data column 1) and nonadopters of injectable naltrexone (data column 2); mean differences between injectable naltrexone adopters and nonadopting programs are reported in data column 3. Approximately 16% ($n = 55$) of the total sample adopted injectable naltrexone. The use of alcohol pharmacotherapies was substantially greater in programs that adopted injectable naltrexone compared with nonadopting programs. Roughly 44% of injectable naltrexone adopters prescribed disulfiram to their alcohol-dependent

patients, compared with 20% of nonadopters, $\chi^2(1) = 14.26$, $p < .001$. Although more than 80% of injectable naltrexone adopters prescribed tablet naltrexone or acamprosate to their alcohol-dependent patients, approximately 20% of nonadopting programs prescribed tablet naltrexone, $\chi^2(1) = 74.5$, $p < .001$, or acamprosate, $\chi^2(1) = 83.80$, $p < .001$, to their alcohol-dependent patients. Finally, 96.4% of injectable naltrexone adopters prescribed other alcohol pharmacotherapies; however, only 35.5% of nonadopters prescribed disulfiram, tablet naltrexone, and/or acamprosate to their alcohol-dependent patients, $\chi^2(1) = 9.27$, $p < .001$.

All the programs that adopted injectable naltrexone had access to a prescribing physician, compared with 73% of nonadopting programs, $\chi^2(1) = 19.43$, $p < .001$. A greater percentage of adopting programs were hospital based (41.8%) compared with nonadopting programs (27.2%), $\chi^2(1) = 4.58$, $p < .05$. On average, injectable naltrexone adopters were larger in size, $t(343) = 4.79$, $p < .001$, than nonadopting programs. Injectable naltrexone adopters reported a higher percentage of master's-level or higher counselors, $t(343) = 2.90$, $p < .05$, and a greater percentage of patients paying with private insurance, $t(343) = 4.26$, $p < .001$, compared with nonadopting programs.

Logistic regression models predicting the adoption of injectable naltrexone

Table 2 presents the results of logistic regression. Two organizational characteristics had a significant effect on the likelihood of adoption while accounting for the other variables in the model. Program size, measured by the log of full-time equivalent employees, was a positive predictor of adoption. The significant coefficient translates to a 45%

TABLE 1. Comparisons between injectable naltrexone adopters and nonadopters of injectable naltrexone

Variable	Injectable naltrexone adopters ($n = 55$) M (SD) or % (n)	Nonadopters of injectable naltrexone ($n = 290$) M (SD) or % (n)	Mean comparisons between injectable naltrexone adopters ($n = 55$) and nonadopters ($n = 290$) χ^2 or t tests
Disulfiram	43.6% (24)	20.0% (58)	14.26, 1 df***
Tablet naltrexone	83.6% (46)	23.8% (69)	74.50, 1 df***
Acamprosate	85.5% (47)	22.4% (65)	83.80, 1 df***
Alcohol pharmacotherapy-technology cluster (prescribed disulfiram, tablet naltrexone, and/or acamprosate)	96.4% (53)	35.5% (103)	9.27, 1 df***
Access to prescribing physician	100.0% (55)	72.8% (211)	19.43, 1 df**
For profit	34.5% (19)	36.9% (107)	0.16, 1 df
Hospital based	41.8% (23)	27.2% (79)	4.58, 1 df*
FTEs (log transformed)	3.34 (1.15)	2.54 (1.19)	4.79, 343 df***
% Master's-level or higher counselors	64.6 (32.27)	49.6 (35.77)	2.90, 343 df*
% Recovering counselors	40.72 (28.13)	43.22 (34.88)	0.48, 343 df
% Alcohol-dependent clients	69.6 (21.17)	69.3 (23.6)	0.09, 343 df
% Private insurance	50.4 (29.97)	31.5 (29.80)	4.26, 343 df***

Notes: Analyses were based on chi-square tests or *t* tests. FTEs = full-time equivalent employees.

* $p < .05$; ** $p < .01$; *** $p < .001$; significant differences between injectable naltrexone adopters and nonadopters.

TABLE 2. Logistic regression models predicting the adoption of injectable naltrexone ($N = 345$)

Variable	b (SE)	OR [95% CI]
For profit	0.235 (0.384)	1.265 [0.595-2.687]
Hospital based	0.267 (0.372)	1.306 [0.630-2.710]
FTEs (log transformed)	0.374 (0.169)*	1.454 [1.044-2.026]
% Master's-level or higher counselors	0.006 (0.006)	1.006 [0.994-1.019]
% Recovering counselors	0.003 (0.006)	1.003 [0.990-1.015]
% Alcohol-dependent clients	0.005 (0.009)	1.005 [0.988-1.023]
% Private insurance	0.017 (0.006)**	1.017 [1.005-1.029]
Alcohol pharmacotherapy- technology cluster	3.405 (0.751)***	30.126 [6.908-131.372]
McKelvey and Zavonia's R^2		.582

Notes: OR = odds ratio; 95% CI = 95% confidence interval; FTEs = full-time equivalent employees.

* $p < .05$; ** $p < .01$; *** $p < .001$.

increase in the odds of adopting injectable naltrexone for a 1 *SD* increase in the log of full-time equivalent employees. Private insurance coverage was positively associated with adoption; the odds of adopting injectable naltrexone were greater in programs with a higher percentage of patients paying with private insurance. Profit status, hospital location, and counselor credentials had no net effect on the likelihood of adoption. Consistent with expectations, the likelihood of adoption was most strongly influenced by innovation compatibility; experience with any of the other medications increased by more than 30-fold the likelihood of injectable naltrexone adoption. (We also tested a model controlling for access to a prescribing physician. The physician variable, however, was a perfect predictor of injectable naltrexone adoption. Consistent with recommended statistical procedure, this measure was dropped from the final model; Webb et al., 2004.)

Barriers to injectable naltrexone adoption

The next stage of the analysis identified barriers to the adoption of injectable naltrexone. First, we discuss barriers identified by programs that did not prescribe injectable naltrexone. Second, we report barriers identified by programs that currently prescribed other alcohol pharmacotherapies (i.e., disulfiram, tablet naltrexone and/or acamprosate). Third, we examine the barrier of patient noncompliance through the use of injection data.

Nonprescribing programs were asked the primary reason they did not currently use injectable naltrexone. Cost of injectable naltrexone was most frequently cited as the primary reason, followed by lack of knowledge about injectable naltrexone, inconsistencies with the program's treatment ideology, and access to prescribing staff.

Programs currently prescribing other alcohol pharmacotherapies (i.e., disulfiram, tablet naltrexone, and/or acamprosate) reported a greater likelihood of future adoption of injectable naltrexone as compared with nonprescribers of al-

cohol pharmacotherapy, $t(288) = 3.27$, $p < .001$. Further, prescribers of other alcohol pharmacotherapies overwhelmingly cited cost of injectable naltrexone as the primary reason they did not currently prescribe the medication. Within this part of the sample, inconsistencies with treatment ideology, perceived lack of efficacy, or lack of knowledge about the medication were not viewed as important barriers to future adoption.

Finally, data on the number of injections of naltrexone administered to patients provides an indicator of patient compliance. Injectable naltrexone adopters in our sample were asked how many of their alcohol-dependent patients had received at least one injection since the program began offering the medication. A follow-up question was then asked to determine how many of the patients receiving a first injection of the medication had received at least a second injection. These data showed that the average number of patients receiving at least one injection of injectable naltrexone was 11.58, and the average number of patients receiving at least a second injection of injectable naltrexone was 8.18. In other words, on average, 70.68% of patients receiving a first injection of injectable naltrexone received at least a second injection of the medication, indicating at least 60 days of compliance ($n = 33$; programs that had been prescribing injectable naltrexone for less than 2 months or did not provide complete injection data were excluded.)

Discussion

The adoption of an innovation can be explained largely by five perceived characteristics of the innovation: relative advantage, complexity, trialability, observability, and compatibility (Rogers, 2003). Our data suggest that programs view injectable naltrexone as offering a relative advantage over other treatment options. Indeed, the medication is improving patient compliance, evidenced by the nearly 70% of patients receiving injectable naltrexone for at least 60 days. The cost of the medication, however, may outweigh the

relative advantage of the delivery system versus oral pharmacotherapies. Evidence of repeated injections among the majority of patients may point toward future implementation (i.e., routine use) of injectable naltrexone.

Injectable naltrexone has some degree of complexity because the medication must be refrigerated, the separate components must be mixed before the injection, and the injection must be delivered by a qualified medical professional. Our data show that lack of access to the necessary medical staff to prescribe and deliver the medication is a barrier to adoption. Trialability of injectable naltrexone is plausible in those programs with access to prescribing staff. However, nearly 25% of the sampled programs do not have access to a prescribing doctor. Although trialability is widely used in general and psychiatric medicine, it is less common in addiction treatment settings. The manufacturer of injectable naltrexone recently began offering a free first dose of the medication to eligible patients, which may enhance trialability of the medication (www.vivitrol.com/callout/callOut.aspx).

Early in the diffusion process, before a program has used injectable naltrexone, the observability of information about the medication may also factor into the program's initial decision to adopt injectable naltrexone. Specifically, it may be important to have information that suggests the medication is effective from sources such as peer-reviewed journals (clinical-trial outcome data), informal communication with other treatment providers, or information from the pharmaceutical company. In fact, Oser and Roman (2008) found that organizational communication behavior was associated with the adoption of tablet naltrexone. Data from the current study indicated that lack of information about the medication was a key barrier to adoption in nonprescribing programs, with only 50% of all programs in the total sample reporting that they had heard or read about injectable naltrexone. This finding suggests that greater dissemination efforts targeted at program administrators, clinicians, and other key decision makers in the substance-abuse treatment system are needed.

In prescribing programs, observability will likely play an important role in the program's decision to continue using the medication after the initial adoption period. If clinicians witness significant improvements in patients receiving injectable naltrexone relative to those on other medications or those receiving counseling only, they may be more likely to continue using the medication. Although a majority of treatment programs and clinicians are committed to abstinence as their singular criterion for treatment success, injectable naltrexone has shown efficacy in the reduction of heavy drinking days in conjunction with psychosocial therapy (Garbutt et al., 2005; Lapham et al., 2009; O'Malley et al., 2007). In programs that consider this a treatment success, observation of a reduction in heavy drinking would likely influence the decision to continue using injectable naltrexone.

The data suggest innovation compatibility is a significant factor in the adoption of injectable naltrexone. The results of logistic regression showed that programs currently prescribing other alcohol pharmacotherapies (i.e., disulfiram, tablet naltrexone, and/or acamprosate) were significantly more likely to adopt injectable naltrexone, highlighting the importance of innovation "fit" (i.e., injectable naltrexone is consistent with the values, past experiences, and needs of the program).

Our data indicate several additional barriers to the adoption of injectable naltrexone—namely, the availability of resources at both the program and patient level. Access to prescribing staff is a necessary condition for the adoption and implementation of injectable naltrexone. Interestingly, slightly less than half (41%) of programs with access to a physician do not prescribe any alcohol pharmacotherapies, suggesting that clinicians remain resistant to the use of AUD medications. Despite these barriers, our data indicate that injectable naltrexone is addressing the persistent patient noncompliance barrier associated with the use of oral AUD medications.

Limitations

Several limitations of the current study should be noted. First, these data are representative of the private treatment sector and are, therefore, unlikely to generalize to the public sector where medication adoption rates and access to physicians are substantially lower (Ducharme et al., 2006). Second, the National Treatment Center Study data are based on the report of clinical directors and were not validated with client chart reviews. Third, these data are cross-sectional and coincide only with the earliest phase of injectable naltrexone's availability. Future tracking of this sample will allow us to monitor continued diffusion and implementation of injectable naltrexone. Fourth, the current study focuses only on adoption—the organization's initial decision to begin using the medication. Further research will allow for more detailed examination of the implementation process—that is, the frequency with which the medication is prescribed, specification of patient characteristics most appropriate for injectable naltrexone use, the average number of injections delivered per patient, and maintenance strategies.

References

- Agency for Health Care Policy and Research. (1999). *Pharmacotherapy for alcohol dependence* (Evidence report/technology assessment no. 3, AHCPR Publication No. 99-E004). Rockville, MD: Author.
- Center for Substance Abuse Treatment. (1998). *Naltrexone and alcoholism treatment*. (Treatment Improvement Protocol [TIP] Series 28, DHHS Publication No. [SMA] 98-3206). Rockville, MD: Substance Abuse and Mental Health Services Administration.

- Ducharme, L. J., Knudsen, H. K., & Roman, P. M. (2006). Trends in the adoption of medications for alcohol dependence. *Journal of Clinical Psychopharmacology*, 26 (Suppl. No. 1), S13-S19.
- Fuller, B. E., Rieckmann, T., McCarty, D., Smith, K. W., & Levine, H. (2005). Adoption of naltrexone to treat alcohol dependence. *Journal of Substance Abuse Treatment*, 28, 273-280.
- Garbutt, J. C., Kranzler, H. R., O'Malley, S. S., Gastfriend, D. R., Pettinati, H. M., Silverman, B. L., ... Ehrich, E. W. (2005). Efficacy and tolerability of long-acting injectable naltrexone for alcohol dependence: A randomized controlled trial. *Journal of the American Medical Association*, 293, 1617-1625.
- Gastfriend, D. R., Dong, Q., Loewy, J., Silverman, B., & Ehrich, E. W. (2005). Effect of long-acting injectable naltrexone on durability of drinking outcomes [Abstract]. *Alcoholism: Clinical and Experimental Research*, 29 (5 Suppl.) 77A.
- Harris, K. H., DeVries, A., & Dimidjian, K. (2004). Datapoints: Trends in naltrexone use among members of a large private health plan. *Psychiatric Services*, 55, 221.
- Heinrich, C. J., & Hill, C. J. (2008). Role of state policies in the adoption of naltrexone for substance abuse treatment. *Health Services Research*, 43, 951-970.
- Hermos, J. A., Young, M. M., Gagnon, D. R., & Fiore, L. D. (2004). Patterns of dispensed disulfiram and naltrexone for alcoholism treatment in a veteran patient population. *Alcoholism: Clinical and Experimental Research*, 28, 1229-1235.
- Knudsen, H. K., Ducharme, L. J., & Roman, P. M. (2007). The adoption of medications in substance abuse treatment: Associations with organizational characteristics and technology clusters. *Drug and Alcohol Dependence*, 87, 164-174.
- Knudsen, H. K., & Roman, P. M. (2004). Modeling the use of innovations in private treatment organizations: The role of absorptive capacity. *Journal of Substance Abuse Treatment*, 26, 353-361.
- Kranzler, H. R., Stephenson, J. J., Montejano, L., Wang, S., & Gastfriend, D. R. (2008). Persistence with oral naltrexone for alcohol treatment: Implications for health-care utilization. *Addiction*, 103, 1801-1808.
- Kranzler, H. R., Wesson, D. R., & Billot, L. (2004). Naltrexone depot for treatment of alcohol dependence: A multicenter, randomized, placebo-controlled clinical trial. *Alcoholism: Clinical and Experimental Research*, 28, 1051-1059.
- Lapham, S., Forman, R., Alexander, M., Illeperuma, A., & Bohn, M. J. (2009). The effects of extended-release naltrexone on holiday drinking in alcohol-dependent patients. *Journal of Substance Abuse Treatment*, 36, 1-6.
- Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata* (2nd ed.). College Station, TX: Stata Corporation.
- Mark, T. L., Kranzler, H. R., & Song, X. (2003a). Understanding US addiction physicians' low rate of naltrexone prescription. *Drug and Alcohol Dependence*, 71, 219-228.
- Mark, T. L., Kranzler, H. R., Song, X., Bransberger, P., Poole, V. H., & Crosse, S. (2003b). Physicians' opinions about medications to treat alcoholism. *Addiction*, 98, 617-626.
- Mee-Lee, D. L., Gartner, L., Miller, M. M., Shulman, G. D., & Wilford, B. B. (1996). *Patient placement criteria for the treatment of substance-related disorders* (2nd ed.) Chevy Chase, MD: American Society of Addiction Medicine.
- National Institute on Alcohol Abuse and Alcoholism. (2005). *Helping patients who drink too much: A clinician's guide* (updated 2005 ed., NIH Publication No. 05-3769). Bethesda, MD: Author.
- National Institute on Drug Abuse. (1999). *Principles of drug addiction treatment: A research based guide* (NIH Publication No. 99-4180). Bethesda, MD: Author.
- O'Brien, C. P. (2005). Anticraving medications for relapse prevention: A possible new class of psychoactive medications. *American Journal of Psychiatry*, 162, 1423-1431.
- O'Malley, S., Garbutt, J. C., Gastfriend, D. R., Qunming, D., & Kranzler, H. R. (2007). Efficacy of extended-release naltrexone in alcohol-dependent patients who are abstinent prior to treatment. *Journal of Clinical Psychopharmacology*, 27, 507-512.
- Oser, C. B., & Roman, P. M. (2007). Organizational-level predictors of adoption across time: Naltrexone in private substance-use disorders treatment centers. *Journal of Studies on Alcohol*, 68, 852-861.
- Oser, C. B., & Roman, P. M. (2008). A categorical typology of naltrexone-adopting private substance abuse treatment centers. *Journal of Substance Abuse Treatment*, 34, 433-442.
- Rogers, E. M. (2003). *The diffusion of innovations* (5th ed.). New York: Free Press.
- Roman, P. M., & Johnson, J. A. (2002). Adoption and implementation of new technologies in substance abuse treatment. *Journal of Substance Abuse Treatment*, 22, 211-218.
- Thomas, C. P., Wallack, S. S., Lee, S., McCarty, D., & Swift, R. (2003). Research to practice: Adoption of naltrexone in alcoholism treatment. *Journal of Substance Abuse Treatment*, 24, 1-11.
- Thomas, S., & Miller, P. M. (2007). Knowledge of attitudes about pharmacotherapy for alcoholism: A survey of counselors and administrators in community-based addiction treatment centers. *Alcohol*, 42, 113-118.
- Thomas, S., Miller, P. M., Randall, P. K., & Book, S. W. (2008). Improving acceptance of naltrexone in community addiction treatment centers: A pilot study. *Journal of Substance Abuse Treatment*, 35, 260-268.
- Webb, M. C., Wilson, J. R., & Chong, J. (2004). An analysis of quasi-complete binary data with logistic models: Applications to alcohol abuse data. *Journal of Data Science*, 2, 273-285.
- White, W. (1998). *Slaying the dragon*. Bloomington, IL: Chestnut Health Systems.