The Role of State Governance in the Adoption of Pharmaceutical Technologies in Substance Abuse Treatment

Carolyn J. Heinrich
Professor
LaFollette School of Public Affairs
1225 Observatory Drive
Madison, WI 53706
Tel: (608)262-5443
Fax: (608)265-3233
cheinrich@lafollette.wisc.edu

Carolyn J. Hill
Assistant Professor
Georgetown Public Policy Institute
3520 Prospect Street NW, 4th Floor
Washington, DC 2007 USA
Tel: (202) 687-7017
Fax: (202) 687-5544
cjh34@georgetown.edu

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ABSTRACT

This paper examines policy, institutional, and environmental factors associated with the adoption of a pharmaceutical agent—naltrexone—in the treatment of alcohol dependent clients by substance abuse treatment facilities. The preponderance of clinical research evidence indicates that naltrexone can be effective in treating alcohol dependence, yet naltrexone use remains low more than a decade following its approval as an adjunct to behavioral therapies. We employ a multilevel approach to explore this disconnect between knowledge and practice, controlling for a wide array of treatment facility characteristics and analyzing state-level policy and institutional factors that influence facilities' decisions regarding the adoption of naltrexone as a treatment for alcohol dependence. We find effects of facility characteristics such as treatment focus, affiliation, ownership status, licensing and accreditation, supportive service provision and others that are consistent with prior research on naltrexone adoption. Importantly, we also identify a strong role for specific state policies that facilitate or impede affordable access to pharmacotherapies and influence facility decisions to adopt naltrexone.

INTRODUCTION

The ongoing development of pharmaceutical agents to quell cravings has the potential to expand access to substance abuse treatment and improve the quality of treatment for a large number of alcohol and drug-dependent individuals. An estimated 19 million individuals (approximately 8% of the U.S. population) meet standard diagnostic criteria for an alcohol use disorder, but just 2.4 million seek treatment and only 139,000 receive medication to treat the problem (McLellan, 2006; Medical News Today, 2005). Because public programs account for the majority of spending on substance abuse treatment through Medicaid and block grants, the incentives that these policies create are central to understanding pharmaceutical adoption decisions and usage rates.

State governments have much at stake in designing effective incentives and removing barriers to the use of proven treatments. The direct and indirect costs of alcoholism cost the U.S. approximately $185 billion per year. On average, states spend about $1 of every $7 of their total spending on programs related to substance abuse and its consequences (National Center on Addiction and Substance Abuse, 2001). Yet only a small percentage of these expenditures (less than 5 percent in most states) are spent on prevention, treatment, and research; the bulk of the remainder is spent on incarceration, hospital care, child neglect, poverty, and other social problems associated with substance abuse.

Substance abuse treatment is provided primarily through specialty sector programs that are largely funded through federal block grants to states and beget a myriad of reimbursement arrangements. McLellan (2006) points out that as health care costs have risen, the efforts of governments and employers to reduce costs through managed care have disproportionately fallen on addiction treatment. States have responded to increasing drug costs by adopting policies that

aim to limit pharmaceutical use and increase cost sharing for Medicaid enrollees, and in the face of declining overall budgets, both the number of substance abuse treatment programs in operation and the number of patients in treatment have dwindled (Gencarelli, 2003; McLellan, 2006; Soumerai, 2004). This has occurred despite the plethora of evidence showing that investing in substance abuse treatment benefits not only the individual and his or her family, but also public health and safety, while at the same time reducing health, economic and social costs (Roebuck et al, 2003).

Our research focuses on pharmaceutical agents used in addiction treatment, and in particular, naltrexone, which was approved in 1994 by the Food and Drug Administration (FDA) as an adjunct to the treatment of alcohol dependence. Naltrexone blocks alcohol-induced stimulation of endogenous opioids, dulling the "high" feeling produced by alcohol. Although early misconceptions of naltrexone as a "magic bullet" for treating alcohol dependence were promptly dispelled, growing evidence from clinical trials has confirmed its effectiveness in reducing alcohol abuse, lowering relapse rates, and improving overall treatment outcomes (Bouza et al., 2004; Fuller and Gordis, 2001; Garbutt et al., 1999; Kosten and O'Connor, 2003; McLellan, 2006: Monti et al., 2001; Morris et al., 2001; O'Brien and McLellan, 1997). Importantly, these studies also show that naltrexone may be as effective when prescribed by physicians in primary care settings as in specialized treatment settings (Croop et al., 1997; O'Malley et al., 2003). And furthermore, a recent randomized controlled trial (Anton et al., 2006) found that naltrexone was equally effective alone (in the presence of medical management) as combined with behavioral therapies. Given recent estimates that as many as 16 to 30 percent of primary care patients are problem drinkers (O'Malley et al., 2003), the ability to

expand treatment options for these patients and increase access to treatment through primary care providers may be one of the most important potential benefits of naltrexone.

As a generic drug with no close therapeutic substitutes in the treatment of alcohol dependency, naltrexone[1] should be a widely available treatment option. The formularies of most public and private sector managed care organizations provide blanket coverage of generics. In fact, Harris and Thomas (2004) report that three of the four largest pharmaceutical benefit managers include naltrexone on their standard formularies, and employers typically adopt these same provisions in their employee health plans.

Despite this promise for naltrexone's broader availability and use, estimates of naltrexone prescription rates are low, ranging from 2 to 13 percent among the alcohol dependent in specialty treatment settings and exhibiting even lower use rates among the wider population of adults meeting criteria for alcohol abuse or dependence (Harris and Thomas, 2004). In a recent study, Mark et al. (2003) reported a conservative estimate that less than 3 percent of individuals treated in specialty settings receive naltrexone in a given year. The decision to prescribe naltrexone is ultimately made by a physician or other medical staff in treatment facilities with prescribing privileges. And although the supply of naltrexone may be relatively unrestricted, these treatment decisions may also be influenced by "demand-side" strategies for controlling or limiting use, e.g., co-payments, quantity limits, prior authorization and other discretionary policies. Both researchers and treatment professionals have pointed to the central role that these policies—particularly public health and health care financing policies at the state level—likely play in the decisions of treatment facilities to integrate naltrexone into treatment programs or individual physicians to prescribe naltrexone.

[1] ReVia was the brand name first approved by the FDA in 1994. The first generic equivalent, under the name "naltrexone," was approved in 1998.

In this research, we aim to address this important gap in our understanding of whether and how state-level policies and other governance factors erect barriers or provide positive incentives for facility-level adoption of a cost-effective drug to treat alcohol dependence. We apply a multilevel approach to both the conceptualization of relationships and empirical analysis, focusing on policy or governance factors at the state level while simultaneously investigating (and controlling for) the role of facility characteristics in naltrexone adoption decisions. In undertaking this research, we have assembled data on state policies and other relevant environmental factors and linked this information with data available from the National Survey of Substance Abuse Treatment Services (N-SSATS), a nationally representative survey of substance abuse treatment facilities. Using these data, we test hypotheses about the relationships of state- and facility-level factors to naltrexone adoption, focusing in particular on state strategies aimed at limiting the costs or use of substance abuse treatment services and pharmacotherapies.

Our multilevel analysis confirms the importance of a number of facility-level characteristics on their likelihood of adopting naltrexone in substance abuse treatment, including facilities' focus on general health care, substance abuse, or mental health; affiliation with a hospital; the provision of hospital in-patient treatment and supportive services; licensing and accreditation; ownership, and financing. In addition, both facility-level contracts with managed care organizations for substance abuse treatment and state contracts with managed care organizations to deliver Medicaid benefits increase the likelihood of naltrexone adoption, but even more importantly, the particular specifications in these contracts concerning the discretion allowed contractors in setting policies and the details of state policies governing pharmaceutical use matter greatly to facility naltrexone adoption. In general, state Medicaid policies that make generic drugs more accessible and affordable increase adoption of naltrexone, whereas state

policies limiting access or system capacity to support use of pharmaceutical technologies reduce facilities' adoption of naltrexone in addiction treatment.

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Researchers have begun to explore factors that explain the puzzling gap between naltrexone's potential for effective treatment of alcohol dependency and its low use rates. To date, the literature on naltrexone adoption has focused primarily on organizational characteristics of treatment facilities and attitudes of clinicians. Reference to a broader conceptual framework and to existing research in other substantive areas, however, suggests that additional insight into the naltrexone puzzle might be found by examining state-level policies and other governance factors that influence decisionmaking. In fact, the Committee on Immunotherapies and Sustained-Release Formulations for Treating Drug Addiction[2] (Harwood and Myers, 2004:23) advised that in addition to clinicians' acceptance of new pharmacotherapies in either specialty or primary care settings, these pharmaceutical agents will only be effective to the extent that "their use is facilitated through adequate financing, organizational structures, and community support."

We begin with a conceptual framework, based on our prior work (Lynn, Heinrich, and Hill 2001), that identifies fundamental components of any governance system and guides our empirical research within and across substantive domains. This general framework includes environmental and policy factors, organizational structures, managerial roles and actions, treatment technologies or core processes, client characteristics, and outputs or outcomes. Frameworks with similar elements have been proposed by substance abuse treatment researchers, including Etheridge and Hubbard's (2000) "multilevel conceptual framework" that specifies

[2] The Committee on Immunotherapies and Sustained-Release Formulations for Treating Drug Addiction was established in 2002 by the National Academies at the request of the National Institute of Drug Abuse. The charge to the committee was to identify issues that would be raised in determining who should have access to these medications and therapies and under what circumstances.

seven "critical levels" of variables: (1) the external policy environment, (2) treatment and service systems, (3) structural and operational features of programs, (4) treatment/service interventions, (5) patient characteristics, (6) patient social environment, and (7) patient outcomes. In a recent study of factors that influence naltrexone adoption, Thomas et al. (2003) were likewise guided by a framework that included characteristics of technologies, "systems" (e.g., market factors, public policy), organizations, clinicians, and patients. And in other recent research,[3] Friedmann et al. (2004), Heinrich and Lynn (2002), Heinrich and Fournier (2004), Heinrich (2004), Heinrich and Fournier (2005), and Zhiwei, Friedmann and Gerstein (2003) employed a multilevel model of a substance abuse treatment system to frame their research (see Figure 1). Our current study draws on this framework to characterize existing research and to motivate our empirical analyses.

Naltrexone adoption research

The literature on naltrexone adoption has largely focused on program-level and client-level variables (see Figure 1), such as treatment facility characteristics and clinician attitudes and beliefs. Roman and Johnson (2002) used information obtained through interviews with administrators and clinical directors in approximately 400 private sector drug and alcohol treatment centers to examine characteristics of treatment center structure (ownership, freestanding status, age, size, physician hours per patient); leadership (administrator characteristics), and caseload (percentage covered by managed care arrangements, percentage capacity, percentage relapsed, and referral source). Their multivariate analysis found that naltrexone adoption by treatment centers was positively associated with facility age, administrators' years of experience in the treatment field, the percentage of counselors who had at least a master's degree, and with the percentage of managed care patients and relapsed patients

[3]Dean R. Gerstein, Carolyn J. Heinrich and Laurence E. Lynn, Jr. were principal investigators in a Robert Wood Johnson Foundation (RWJF) Substance Abuse Policy Research Program Project, titled: "Policy Factors that Support the Effective Provision of Substance Abuse Treatment Services."

on the caseload. Roman and Johnson also found that among the drug and alcohol centers that adopted naltrexone, a greater percentage of alcohol-dependent patients received naltrexone if the center administrators held a business or medical degree. As underscored by the Committee on Immunotherapies and Sustained-Release Formulations for Treating Drug Addiction, staff training and experience, and in particular, the presence of medical staff, is a key factor influencing patient access to pharmacotherapies such as naltrexone.

Forman, Bovasso, and Woody (2001) reported findings from a 1999 survey of over 300 staff members (physicians, counselors, and others) in 50 addiction treatment programs in Pennsylvania, New Jersey, and Delaware. Focusing primarily on staff characteristics and their views of addiction treatment, the researchers found that almost half the respondents were "unsure" about whether they would increase the use of naltrexone in the treatment program, while 13 percent did not support its continued use. In interpreting these results, the authors noted that staff members' views could have been influenced by their lack of knowledge about naltrexone and raised the possibility that lack of exposure to naltrexone was due in part to its exclusion from local insurance formularies.

Thomas et al. (2003) also distributed a mail survey to substance abuse treatment center clinicians (both physicians and nonphysicians) in 1999 in Massachusetts, Tennessee, and Washington and analyzed the survey data in a multivariate model of naltrexone adoption. For physician respondents, significant predictors of the decision to adopt naltrexone were primarily patient characteristics and physician training experiences. Factors such as state location, or having a high proportion of Medicaid, self-pay, or free care patients were not statistically significant in these models. In contrast, for nonphysician respondents, organization and financing

factors played a stronger role (statistically and substantively) in their decisions to recommend naltrexone.

Results from more recent surveys of physicians specializing in substance abuse (Mark et al., 2003; Mark, Kranzler, and Song, 2003) found that almost all of those surveyed had heard of naltrexone, and on average, respondents provided a relatively accurate estimate of the effect size for naltrexone (assessed by reference to evidence from clinical trials). Patient characteristics positively associated with naltrexone prescription included compliance orientation, reporting of alcohol cravings, and relapse risk. In addition, a clear majority (63 percent) of physicians indicated that insurance coverage of the medication positively influenced their decisions to prescribe naltrexone. Mark, Kranzler, and Song's multivariate analysis confirmed that higher percentages of patients covered by Medicaid or with no insurance were associated with lower naltrexone prescription rates. Physicians also reported, however, that a need for additional education about the medications was a potential barrier to their prescription. In related research, Miller et al. (2001) and Thomas and McCarty (2004) likewise concluded that both cost (the lack of parity in reimbursement) and the paucity of substance abuse-related training offered in medical schools were important factors limiting primary care physicians' treatment of alcoholism and inhibiting the integration of alcohol and drug treatment with primary care and general health services.

In summary, the existing literature on naltrexone adoption focuses on a relatively narrow set of the program/client-level factors represented in Figure 1 and draws primarily on attitudinal data from physicians and clinicians. While these are important elements of the adoption decision, additional policy-level and program-level variables remain largely unexplored.

Advancing pharmaceutical adoption research

The gap in the literature described above is not unique to naltrexone adoption research. For example, in the application of their conceptual framework to data from the Drug Abuse Treatment Outcome Study (DATOS), Etheridge et al. (1999) were limited in their modeling of the treatment system and program-level factors and did not develop measures of the external policy environment. They indicated that the development of more complex, multilevel models was an important next step in extending the understanding of the separate and combined contributions of policy, program, and treatment process factors to treatment effectiveness.

Similarly, Heinrich and colleagues (referenced above) used data from the National Treatment Improvement Evaluation Study (NTIES), which included only program- and client-level variables and no geographic identifiers for the programs. Their work thus focused on developing better measures of substance abuse treatment organization and program management that could be linked to detailed information on patient characteristics, services received, and treatment outcomes. In general, the existing literature—both specific to naltrexone and more broadly in substance abuse treatment—has not systematically examined the broader effects of state policies on adoption and incentives for facilities' use of treatment technologies.

Policy-level factors and their relationship to facility treatment approaches

Public expenditures on substance abuse treatment through Medicaid and block grants (Coffey et al., 1997) and additional state spending on direct treatment and related services (National Center on Addiction and Substance Abuse, 2001) account for the majority of spending on addiction treatment, and thus, the incentives that state-level financing policies and regulations present for naltrexone adoption may be crucial to explaining the gap between research knowledge about the effectiveness of naltrexone and its low usage rates. Harris and Thomas

(2004) indicate that states exercise their available discretion in Medicaid programs, for example, by charging co-pays, contracting with managed care programs, and imposing prescription limits. Further, the terms by which state Alcohol and Other Drug (AOD) agencies provide funding for substance abuse treatment for persons not covered by Medicaid or other insurance and the types of services they fund vary across states (Drake et al., 2001; Buchanan and Smith 1994; Pascal et al. 1989). Goldman et al. (2001) note that Medicaid coverage is critical to making services available, and Simpson (2002) and Galanter et al. (2000) likewise conclude that managed care and related economic pressures are heavily influencing treatment practice.

The interaction of public policies and other external/environmental factors with treatment organization and management characteristics has also recently begun to receive increased attention in the substance abuse treatment literature. For example, studies show that organizational structure (e.g., ownership and contracting) is inextricably linked to the financing of treatment, with total funding from public sources and the number of publicly-funded clients admitted varying across private sector and public programs (Heinrich and Fournier, 2004; Schmidt and Weisner, 1998; Zarkin et al., 1995). According to Friedman et al. (2003), organizational arrangements also affect timely access to services. At the same time, other interactions among state-level and program-level factors may be more subtle. Mardsen (1998), Harwood and Myers (2004), and Woody and McNicholas (2004) describe how cost containment pressures and inadequate reimbursement for addiction treatment have influenced the internal environment of substance abuse treatment programs, including the involvement of medically trained staff and organization/resource slack, and discouraged the adoption of treatment services, such as naltrexone and other pharmacotherapies.

We turn now to our empirical analysis, in which we aim to advance previous research on addiction treatment (and naltrexone adoption in particular), by modeling the effects of state policies and other external environmental factors on treatment facilities' adoption of pharmaceutical technologies. We begin by describing our data and the newly collected or constructed state-level measures, and we subsequently explicate our modeling strategies, including factor analysis and multilevel (multivariate) analysis, and specify the research hypotheses we test in these analyses.

DATA, METHODOLOGY, AND RESEARCH HYPOTHESES

Data

We have assembled a rich array of state policy variables and other relevant data on each of the 50 states and the District of Columbia that will allow us to examine state-level influences on substance abuse treatment facilities' decisions to adopt naltrexone. These data are generally described in Table 1 and include the following categories of variables: Medicaid enrollments and policies/benefits for mental health, rehabilitation services, and prescription drugs; state health care capacity and financing, including funding for substance abuse prevention and treatment, health care and public assistance firms and expenditures, and primary care/mental health professional shortages; state general fiscal and economic health (unemployment rates, labor force participation, budget account information), and state population characteristics, including the percent with alcohol/illicit drug abuse or dependence, uninsured, below the poverty level, and others. These publicly-available data were collected from a number of sources, including the Centers for Medicaid and Medicare Services (CMS, which is part of the U.S. Department of Health and Human Services (USDHHS)); the Substance Abuse and Mental Health Services Administration (SAMHSA, which is part of USDHHS); the National Conference on State

Legislatures; the Kaiser Commission on Medicaid and the Uninsured; the Bureau of Labor Statistics; the National Center for Health Workforce Analysis (part of USDHHS); the Census Bureau; the Clinical Trials Network, National Institute on Drug Abuse, and the PhRMA Pharmaceutical Industry Profile. Simple descriptive statistics for the measures used in the empirical analysis are shown in Table 2.

We merged these state-level data with facility-level data from the National Survey of Substance Abuse Treatment Services (N-SSATS). The N-SSATS, a joint effort of SAMHSA, state substance abuse agencies, and Mathematica Policy Research, is designed to collect data annually from all public and private facilities that provide substance abuse treatment. Beginning in 2002, the N-SSATS included a question that asked each facility if the pharmacotherapy naltrexone was offered by the facility at that location. A wealth of additional information is collected from facilities in the N-SSATS, including: organizational size, structure, ownership, affiliations and contracts; financing/revenues and payors accepted; treatment modalities; therapies, case management and supportive services; special client programs, and aggregate measures of client characteristics. In this paper, we focus on the 2003 N-SSATS, which includes data on 13,623 treatment facilities (a 95.9% facility response rate). Our analysis sample was restricted, however, to those facilities that did not have missing information on naltrexone adoption and could be matched with a state identifier. These relatively small restrictions (affecting 204 facilities) resulted in a final sample of 13,419 facilities. Table 3 presents descriptive statistics on the facility-level variables used in the analysis.[4]

[4] Although we investigated the possibility of including client-level information through various sources of Medicaid claims data, some preliminary analyses of state drug utilization data suggested that the number of naltrexone prescriptions per year might not be high enough to yield sufficiently large within-state samples of individual clients for a multilevel estimation approach (except for larger states such as New York or California). In addition, the costs of obtaining these data are high and would require a financial investment beyond the scope of this study.

Methodology

Substance abuse treatment researchers, including Broome, Simpson and Joe (1999), Etheridge et al. (1999), Heinrich and Lynn (2002), Hser et al. (1999), and Orwin and Ellis (2000), have made the case for increased use of multilevel modeling techniques in empirical research that attempts to estimate the separate and combined influences of policy and program factors on treatment processes or outcomes. More generally, Bryk and Raudenbush (1992) and Heinrich and Lynn (2001) demonstrate that when modeling relationships in government and social systems that span multiple levels of organization or system structures, multilevel modeling strategies may be more likely to produce unbiased estimates of effects of policy, program or other variables on the outcome variable, depending on the proportion of total variation in the outcome that is between groups or organizations and the extent to which relationships vary across levels of analysis.

In our study, we model the facility-level decision to adopt naltrexone in substance abuse treatment as a function of facility characteristics at one level, and the variation between facilities in the decision to adopt naltrexone as a function of the state-level policy and environmental factors at a second level. Because the number of states limits the degrees of freedom available for modeling at level two, we initially limited the number of state-level explanatory factors that we included in a given model specification. In addition, because we have multiple measures for some state factors/constructs (e.g., health care capacity, poverty and need, economic health, etc.), we used factor analysis to guide our initial level two model specifications.

In conducting the factor analysis, we first identified conceptually-related sets of variables. For example, we identified seven variables that were related to Medicaid benefits for

rehabilitation in each state.[5] We then used factor analysis to empirically confirm (or disconfirm) the intercorrelations among these presumed conceptually-similar variables and to identify distinct underlying constructs. In this example, we identified two underlying factors (based on the variances and rotated factor loadings): rehab reimbursement methodology (fee-for-service or some combination) and rehab coverage limitations (general and substance-abuse specific). In addition to helping us identify underlying constructs, this process also distinguishes sub-constructs under conceptually-related groups. In the above example, a composite variable that combined all seven conceptually-related variables would have been collapsing too many dissimilar variables. In other words, the process helps us to see both empirical similarities and distinctions among presumably conceptually-related variables.

Other criteria also guided our model specifications. A logical criterion is that there has to be sufficient variation across states in policies; for example, all states offered Medicaid prescription drug benefits, so this more general policy measure was not of use in the modeling effort. In addition, variables tested in the models that were found to consistently have no predictive value (coefficients and t-values close to zero) were not kept in the models to preserve degrees of freedom.

In the multilevel analysis, we estimated generalized linear mixed models for a binomial outcome, where the adoption of naltrexone by a facility (the outcome) is coded as a "success." There are two basic types of models of policy, program, and environmental factors on naltrexone adoption that we specified. The first type is a random-intercept model, where the *level one sub-*

[5] These variables for 2003 were: the population covered by Medicaid benefits for rehabilitation services, whether the state required copayments for rehab services, whether the state had general coverage limitations for rehab services, whether the state had substance abuse coverage limitations for rehab services, whether the rehab service reimbursement was fee for service only, whether the rehab service reimbursement was fee for service or other, and whether the rehab service reimbursement was only some other system.

model, shown in Equation [1], is estimated for a given binomial outcome[6] (η_{ij}) where X_{1ij} to X_{nij} are *n* facility-level characteristics for facility *i* in state *j*[7]:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}X_{1ij} + ... + \beta_{nj}X_{nij} \quad [1]$$

A *level two sub-model* is simultaneously estimated, using *k* state-level variables W_{1j} to W_{kj} for state *j* that are hypothesized to explain the variation in naltrexone adoption between states (as captured by the intercept of the level one sub-model, β_{0j}):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + ... + \gamma_{0k}W_{kj} \quad [2]$$

In a random-intercept model specification, all other coefficients in the Equation [1] are assumed to be fixed (i.e., the effects of these facility-level factors on naltrexone adoption do not vary by state-level factors):

$$\beta_{1j} = \gamma_{10}, ..., \beta_{nj} = \gamma_{n0} \quad [3]$$

The second type of model is the "intercepts and slopes as outcomes" model (also known as a random coefficients model, or a cross-level effects model), where one or more of the slope coefficients, β_{1j} to β_{nj}, may also be specified as a function of state-level variables in a level two sub-model, e.g.:

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_{1j} + ... + \gamma_{1n}W_{kj} \quad [4]$$

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[6] η_{ij} is the log of the odds of success for a binomial outcome variable (the logit link function), defined as $\log(\phi_{ij}/1-\phi_{ij})$.

[7] In the equations, we do not show an error term, known as the "random effects" vector in the generalized linear mixed model, or $\hat{u}$. $\hat{u}$ can be obtained from the inverse of the link function, or $\hat{u} = \frac{e^{(X\hat{\beta}+Z\hat{u})}}{1+e^{(X\hat{\beta}+Z\hat{u})}}$.

These latter specifications model the interactions between facility-level characteristics at level 1 and state-level characteristics at level 2. For example, if β_{1j} represents the effect of a facility not accepting state health insurance on facility-level naltrexone adoption, one might hypothesize this effect varies (or is mediated) by the state-level prescription drug benefit and coverage policies (W_{1j} to W_{kj}). In the modeling efforts we present in this paper, we did not observe any statistically significant cross-level effects, and thus, we focus on the specification and estimation of the random intercept model represented in equations [1], [2], and [3].

Simple descriptive statistics calculated from the 2003 N-SSATS indicate that only about 12.4 percent of the 13, 419 substance abuse treatment facilities had adopted naltrexone; in other words, the vast majority of facilities had not adopted this pharmacotherapy, even though the FDA had approved its use eight years earlier. At the same time, considerable variation exists across states in the percentage of facilities (within states) that had adopted naltrexone, from a low of 3.2 percent (Oklahoma) to a high of 32.4 percent (Vermont). Furthermore, we find that 16.2 percent of the total variation in facility-level decisions to adopt naltrexone is explained by their grouping within states (p <0.0001). This preliminary analysis confirms the importance of modeling both facility- and state-level factors to explain facility decisions to provide naltrexone as a pharmacotherapy.

Research hypotheses

Drawing on relevant theory and prior empirical work, we specify some preliminary hypotheses about the relationships of state- and facility-level factors to naltrexone adoption. The policy variables of primary interest in this study are those that capture state strategies aimed at limiting the costs or use of substance abuse treatment services and pharmacotherapies or otherwise promoting (or constraining) their use. We also assess the influence of state capacity

for financing and supporting substance abuse treatment and the role of state fiscal and economic health, in addition to other state demographic and environmental factors.

Preliminary expectations for the relationships of facility-level factors to naltrexone adoption decisions are fairly clear and build on the findings of previous research, and we therefore state them more informally here. In particular, we anticipate that facilities that treat a higher percentage of patients for alcohol abuse and focus on substance abuse treatment, mental health and/or general health care and are affiliated with hospitals (i.e., with medical staff) will be more likely to adopt naltrexone. In addition, those facilities offering hospital in-patient or non-hospital residential substance abuse treatment should be more likely to adopt naltrexone than those facilities without the provision for more intensive treatment or privileges for writing pharmaceutical prescriptions. In light of Heinrich and Fournier's (2005) finding that patients in programs with higher proportions of Medicaid funding spent more time in treatment and received more counseling, we expect that facilities that do not accept state-financed health insurance or Medicaid to be less likely to adopt naltrexone. Likewise, since the concurrent provision of behavioral therapies is recommended with the use of naltrexone, we also hypothesize that facilities offering various types of other therapies, counseling, aftercare and supportive services (e.g., transitional and social services) will be more likely to prescribe naltrexone.

Prior research has also shown the importance of licensing and accreditation to addiction treatment practices and priorities. Friedman, Alexander and D'Aunno (1999) reported that substance abuse treatment organizations' accreditation by the Joint Commission on Accreditation of Health Care Organizations (JCAHO) was associated with facilities' greater expenditures to meet national standards for high quality, comprehensive care and better access to treatment

services, and thus, we expect JCAHO-accredited facilities to be more likely to adopt naltrexone. Licensing/certification by a state substance abuse agency, mental health department, public health department or hospital authority generally reflects the structural placement of state substance abuse agencies within state government. As Gelber and Rinaldo (2006) find, this critically affects the capability for effective collaboration between government agencies, treatment facilities and other stakeholders in delivering effective services. Due to the complexity of these public and private organizational relationships, the exploratory research on this subject does not present clear hypotheses for the effects of licensing. Likewise, although, prior research suggests that privately-owned organizations are less encumbered by government prescription drug policies, private facilities, particularly for-profit organizations, might also be more likely to limit payment arrangements compared to public providers (such as payments from state-financed health insurance), which again suggests no clear expectations for the effects of organizational form on naltrexone adoption.

Among state-level factors, the limited research on this topic and the complex, multi-faceted, and changing nature of public policies designed to manage the costs of and access to prescription drugs and treatment services leads us to have fewer unambiguous expectations about the relationships of these factors to facility-level naltrexone adoption decisions. In general, one might hypothesize that the probability of naltrexone adoption would be lower in states with more restrictive Medicaid or managed care organization (MCO) prescription drug policies (e.g., restrictive preferred drug lists or restricted access to pharmacy networks and other limitations on reimbursements or benefits). For example, a consistent empirical finding in the literature is that even small increases in drug co-payments (e.g., $1-2) lead to decreases in drug use and spending (Kamal-Bahl and Briesacher, 2004; Motheral and Henderson, 1999; Harris et al., 1990). At the

same time, naltrexone is available in generic form, and states are likewise attempting to reign in drug costs by requiring the use of generics. Since generics tend to have lower co-pays, this requirement could make naltrexone more accessible to patients.

Based on our conceptual model and the minimal research on state policy effects, we have formulated some initial hypotheses about the effects of state-level policy and environmental factors on naltrexone adoption. For example, we hypothesize the following:

H1: Substance abuse treatment facilities located in states with generics on the preferred drug list/formulary and lower generic co-payments will be more likely to adopt naltrexone as a pharmacotherapy for their clients.

H2: Substance abuse treatment facilities located in states with more restrictive preferred drug lists and other limitations on substance abuse treatment benefits (e.g. refills/quantity limits) and/or reimbursement will be less likely to adopt naltrexone.

Some states control access to substance abuse treatment services through contracts with managed care organizations (MCOs) or primary care case management (PCCM). The implications of these contracts for access to pharmacotherapies are likely to be mixed, depending in part on the policies they specify or accommodate. For example, we hypothesize that:

H3: Substance abuse treatment facilities located in states that permit MCO/PCCM contractors to establish policies encouraging the use of generic drugs to be more likely to adopt naltrexone.

Alternatively:

H4: Substance abuse treatment facilities located in states that permit MCO/PCCM contractors to establish policies requiring prior authorization and restricting access to pharmaceutical networks to be less likely to adopt naltrexone.

We also expect that states' capacity for financing and supporting substance abuse treatment will affect facility-level finances and pharmaceutical adoption decisions. Although their analysis was exclusively at the facility level, Thomas et al.'s (2003) study confirmed that financial factors had a statistically and substantively important influence on naltrexone adoption decisions. At the same time, greater levels of federal support for medical assistance coming to a state may also reflect greater state need and possibly lower state capacity for substance abuse treatment financing. Thus, our expectations about the relationships of financing and capacity factors to naltrexone adoption decisions are not straightforward. For example, we test the following hypothesis:

H5: Facilities in states with greater federal (lower state) shares of Medicaid assistance expenditures should be more likely to adopt naltrexone as a pharmacotherapy.

States' budgetary health, funding priorities, health care organizational capacity and preferences of the states' citizens are also likely to influence the resources available to local treatment facilities and patients. Greater fiscal resources devoted to substance abuse treatment may indicate preferences for more aggressive treatment or use of innovative technologies to combat substance abuse, suggesting the following hypotheses:

H6: Facilities in states that allocate greater shares of their discretionary budgets for substance abuse treatment will be more likely to adopt naltrexone as a pharmacotherapy.

H7: Facilities in states with higher levels of expenditures on public welfare, health care and hospitals will be more likely to adopt naltrexone.

H8: Facilities in states with higher levels of health care organizational capacity (e.g., greater numbers of state health care and public assistance firms per capita and fewer county-level shortages of mental health professionals or primary care physicians) will be more likely to adopt naltrexone .

We also expect that higher percentages of poor and/or uninsured in the state population are likely to strain substance abuse treatment resources and limit pharmaceutical adoption. This relationship was suggested in Mark, Kranzler, and Song's (2003) empirical study of physician naltrexone adoption decisions, which found that higher percentages of patients covered by Medicaid or with no insurance were associated with lower naltrexone prescription rates.

H9: Facilities in states with higher percentages of poor and/or uninsured in the state population will be less likely to adopt naltrexone as a pharmacotherapy.

Finally, in our empirical analysis, we also control for other state factors that might not be directly related to naltrexone adoption decisions, but that may be important to hold constant in discerning the effects of other policy variables, such as the median age of the population and general economic characteristics. We now present the specific models of naltrexone adoption that we estimated and the findings of the multilevel analysis.

MULTILEVEL MODEL ESTIMATION AND FINDINGS

In estimating the multilevel models of naltrexone adoption, we used the same set of facility-level (level one) variables in each of the models, as their effects were stable, and most were also statistically significant in the predicted directions (Table 4). Before interpreting selected facility-level coefficients, it is useful to review exactly what the intercept ($\hat{\gamma}_{00}$) reflects

and to translate it into a predicted probability. First, the intercept shown in Model 1 (the base model with only facility-level measures) is the average predicted log-odds (across all states) of naltrexone adoption for facilities with zero values on the level one indicator variables and the mean value of the percent of clients treated for alcohol. That is, -2.551 is the predicted log-odds of naltrexone adoption for facilities that are not private (for-profit or nonprofit) organizations, that do not offer hospital in-patient substance abuse treatment, that are not affiliated with a hospital, etc.. Because the log-odds are difficult to interpret, it is easier to calculate a predicted probability of naltrexone adoption for facilities reflected in the model's intercept by using the formula: $\hat{p} = \frac{1}{1+e^{-\hat{\beta}}} = \frac{1}{1+e^{2.551}} = 0.078$, which yields a predicted probability of naltrexone adoption of approximately 7.8 percent.

The second model shown in Table 4, the final multilevel model specification, adds measures of state Medicaid and managed care policies, state financing/funding and capacity, and state population characteristics to the base (facility-level) model. The number of facilities included in the analysis decreases, however, to 9,773, a loss of 26 percent of the level-one observations. This is in part due to missing data on state Medicaid and managed care policies for four states (Alabama, Ohio, Tennessee and Wyoming) that account for the listwise deletion of 839 facilities. The loss of the other 2,678 observations is due to missing values on various facility-level measures, with the number of missing values fairly small (1-2% or less) for most facility-level variables. Missing value indicators were created for these facility-level measures, and alternative specifications of the model of naltrexone adoption were tested including the missing value indicators with their corresponding predictors (in recoded form). The specification that adjusted for missing data on the five variables with the largest number of

missing values included 12,076 facilities in the estimation (an additional 2,303 observations) but did not change the substantive findings or judgment of statistical significance for any predictors.[8] Thus, the specification test results and the general stability of the facility-level coefficients from the base model to the final model (shown in Table 4) suggest that an assumption that these facility-level data are missing at random is likely reasonable.

Findings on facility-level effects

Before discussing the state-level variables that are of primary interest in this study, we highlight some significant findings of facility-level effects on naltrexone adoption (see Model 2 in Table 4). Beginning with the two largest effects, facilities with a general health care focus or substance abuse/mental health mix in treatment are significantly more likely to adopt naltrexone as a pharmacotherapy than those facilities focusing only on substance abuse treatment (odds ratios of $e^{(1.128)} = 3.09$ and $e^{(0.968)} = 2.63$, respectively); in other words, the odds of prescribing naltrexone are 209% higher in facilities with a general health care focus than those focusing only on substance abuse treatment, and 163% higher for those with a substance abuse/mental health mix focus (*ceteris paribus*). Correspondingly, facilities with a hospital affiliation and those offering hospital in-patient substance abuse treatment likewise have higher odds of prescribing naltrexone, 106% and 90%, respectively, than those without this type of access to medically-trained staff. As expected, facilities that do *not* offer behavioral therapies and supportive services such as individual therapy, relapse prevention, case management, and aftercare have significantly lower odds of adopting naltrexone (a range of 18% to 53% lower odds).

[8] The five facility-level variables with the largest number of missing observations were: licensed by mental health department, licensed by a state substance abuse agency, does not accept state-financed health insurance, does not accept Medicaid, and JCAHO accreditation. Since these variables accounted for most missing values (other than the 839 facilities that were dropped due to missing state-level information), other missing value indicators added to this specification were mechanically excluded in the estimation to facilitate model convergence. These results are available in detail from the authors upon request.

Alternatively, facilities offering employment counseling and/or housing assistance and accredited by JCAHO have higher odds of adoption (42% and 89%, respectively), which as indicated earlier, reflects their more comprehensive care and better access to treatment services.

Finally, a few other facility-level findings related to organizational structure and financing are worth noting. Private (for-profit or nonprofit) facilities are less likely to adopt naltrexone compared to public (federal, local, county or community government) organizations in treating addiction; this finding is statistically significant for nonprofits, which have 44% lower odds of adopting naltrexone compared to public organizations. This finding might reflect a lesser willingness on the part of some nonprofits (particularly those that are community-based, religiously-affiliated and/or staffed by ex-addicts) to employ pharmaceutical agents along with or instead of behavioral therapies or 12-step programs/support groups (Anderson and McDaniel, 2000; Succi and Alexander, 1999). Consistent with the findings on facility ownership, facilities that do not accept state-financed health insurance also have significantly lower odds (21%) of adopting naltrexone.

Findings on state-level effects

Among the nine state-level variables included in the model to represent state Medicaid and managed care policies that limit or facilitate the use of pharmaceutical technologies (or substance abuse treatment services/benefits more generally), seven are statistically significant predictors of facilities' adoption of naltrexone (at $\alpha<0.05$), and one measure is close to statistically significant ($p=0.077$) (see again Model 2 in Table 4). The effects of these variables are also in the direction anticipated by our conceptual model and consistent with relationships identified in the literature. For example, state limitations on Medicaid benefits for rehabilitation

services to support substance abuse treatment reduce the odds of facilities' naltrexone adoption by 19.5 percent.

Among these variables, state policies specifically addressing pharmaceutical use in addiction treatment have even more pronounced effects on facility naltrexone adoption decisions. Facilities in states that include naltrexone on their preferred drug list/formulary and that allow managed care organizations or primary care case management providers to set policies encouraging the use of generic drugs have significantly higher odds of adopting naltrexone (46% and 88% higher odds, respectively). Conversely, those states that establish a preferred drug list and set policies restricting access to pharmaceutical networks significantly reduce the odds of facilities adopting naltrexone (by 27% and 49%, respectively). These results confirm the expectations of the first four hypotheses that we specified for state-level policy effects. Interestingly, although the delivery of Medicaid benefits more generally by a managed care organization increases the odds of naltrexone adoption (by 81%), a specific role for managed care organizations (MCOs) in delivering pharmaceutical benefits reduces the odds of naltrexone adoption by 45%. In general, the effects of these six variables suggest that it is critical to understand the details of state-MCO contractual relationships and states' allowances for discretion in setting these policies to anticipate their implications for the adoption of pharmaceutical technologies in addiction treatment.

As indicated earlier, the estimation of an unconditional model showed that approximately 16 percent of the total variation in facility-level adoption of naltrexone is due to facilities' grouping within states. Using the covariance parameter estimates from the unconditional model and the subsequent multilevel models that added state-level variables, it is possible to calculate the percent of this between-facility variation that is explained by the state-level variables

included in different model specifications. The estimation of an intermediate model (not presented here) using the base facility-level model (Model 1 in Table 4) that added just the nine state Medicaid/managed policy variables discussed above showed that 22.3 percent of the total variation *between facilities* in naltrexone adoption is explained by these nine policy variables. Other policy variables that were tested in the models, including co-pay requirements, quantity supply limits, and fail first requirements, had estimated effects or t-ratios close to zero and reduced the model goodness of fit (assessed primarily by the covariance parameter estimates and Aike's Information Criterion/-2 Residual Log Likelihood values), and thus, were not retained in the model. At the same time, the p-value associated with the intercept covariance parameter estimates in this intermediate model (p=0.0043) also indicated that there was still statistically significant between-facility variation left to be explained.

Measures of state-level capacity/financing of health care and substance abuse treatment services delivery and characteristics of state populations and environments were also included in the multilevel model. Model 2 in Table 4 shows the final set of these measures that yielded the overall best model fit. As discussed previously, the factor analysis that preceded our multilevel modeling efforts provided guidance for the preliminary specifications, identifying variables that were strongly intercorrelated and might be substitutes in the estimation (e.g., the percentage of people in poverty and the percentage of households with cash assistance income). The results in Table 4 show that although state-level financing variables (the share of Medicaid Assistance paid by the federal government and state discretionary funding per capita for substance abuse treatment) were not important predictors, higher state public welfare expenditures (in $1,000) per capita increased the odds of naltrexone adoption by 86% (where the average amount in $1,000 spent per capita was $0.219). Likewise related to capacity for delivery of substance abuse

treatment services, adequate mental health professional staffing in counties also influenced naltrexone adoption; a one percent increase in the percent of counties with no mental health professional shortage would increase (on average) the odds of naltrexone adoption by 1.2 percent. The converse relationship emerges for primary care physician staffing, however, where a one percent increase in counties with no shortage of these physicians would reduce facilities' naltrexone adoption by about 0.7 percent. These findings suggest partial support for the seventh and eighth hypotheses specified above.

The final set of variables tested in the multilevel model—controls for state-level environmental factors and population characteristics—generated only a few statistically significant predictors of facility-level naltrexone adoption. The prevalence of alcohol abuse or dependence among adults age 26 and older is a particularly important predictor, with the estimated effect showing that a one percent increase in percentage of these adults with abuse or dependency problems would increase the odds of facility naltrexone adoption by about 20 percent. Close to statistically significant ($p=0.062$), the odds of naltrexone adoption decrease as the median age of the population rises. In general, although we determined it was important to control for and/or explore the possibility of state environmental/population influences on facility adoption decisions, we did not expect a large number of these statewide factors to predict facility-level naltrexone adoption. Additional calculations using the covariance parameter estimates from the final model showed that together, the eighteen state-level variables included in this multilevel model specification (Model 2, Table 4) explained 83.9 percent of the total *between-facility* variation in naltrexone adoption. Furthermore, the p-value associated with the intercept estimate in this model (0.1296) indicates that there is no statistically significant *between-facility* variation in naltrexone adoption that is left unexplained.

Discussion of study findings

In attempting to explain the underutilization of clinically-effective pharmaceutical agents in the treatment of alcohol and drug dependent individuals, prior research has primarily focused on physician and treatment facility characteristics. Since the greater part of total variation in facility-level adoption of the pharmaceutical agent naltrexone is within-facility variation (over 80 percent), incorporating facility-level information into any analysis of naltrexone adoption is imperative. Indeed, our multilevel analysis using the 2003 N-SSATS data substantiated the importance of a number of structural and treatment focus/service characteristics of substance abuse treatment facilities—including their focus on general health care, substance abuse, or mental health, affiliation with a hospital, the provision of hospital in-patient treatment and supportive services, licensing and accreditation, ownership and financing—on their likelihood of adopting naltrexone in substance abuse treatment. The results confirming the role of organizational ties to hospitals, access to hospital in-patient substance abuse treatment, and foci on general health or mental health in increasing naltrexone adoption also lend support to prior research findings on the importance of access to medically-trained staff and on-site prescribing privileges for the use of pharmaceutical technologies (Harwood and Myers, 2004; Knudsen et al., 2006; Roman and Johnson, 2002; Thomas and McCarty, 2004; Thomas et al., 2003). And although recent research employing a randomized controlled trial (Anton et al., 2006) reported that naltrexone was equally effective with or without combined behavioral interventions (such as intensive counseling delivered by treatment specialists), our findings show that facilities that offer other behavioral interventions and comprehensive care services (individual therapy, aftercare counseling, relapse prevention groups, case management and other support services) are significantly more likely to adopt naltrexone as a pharmacotherapy in addiction treatment.

Both the facility-level and state-level findings of our multilevel models showed that contracts with managed care organizations for substance abuse treatment (at the facility level) and state contracts with managed care organizations to deliver Medicaid benefits increased the likelihood that substance abuse treatment facilities adopted naltrexone. What is perhaps the most important finding of this analysis, however, is that the particular specifications in these state contracts concerning the allocation of discretion to set policy details and the details of policies governing pharmaceutical use themselves emerged as critically important to facility naltrexone adoption decisions. State Medicaid policies that support the use of generic drugs and reduce their costs and that also permit managed care organizations to establish policies that encourage the use of generics increased the odds of naltrexone adoption significantly (by up to 88%). Conversely, states that limit access to pharmaceutical technologies through Medicaid preferred drug lists, restricted access to pharmacy networks, and general limitations on the use of Medicaid benefits for rehabilitation for substance abuse treatment reduce treatment facilities' adoption of naltrexone. Other aspects of state capacity for financing and supporting substance abuse treatment were also important to naltrexone adoption, including state public welfare expenditures and adequate mental health professional staffing in counties. In general, this study suggests that states do have at their disposal valuable policy levers for more aggressively promoting the adoption of pharmaceutical technologies such as naltrexone in addiction treatment.

CONCLUSION

A recent survey (Medical News Today, 2005) by the Community Anti-Drug Coalitions of America (CADCA), including over 1,000 adults, 300 general practitioners and 503 persons in recovery, reported that although the general public recognizes the serious impact of alcoholism on the daily lives of 19 million Americans who meet the diagnostic criteria for alcohol abuse or

dependence, only a third of the CADCA survey respondents viewed alcoholism as a disease (rather than a moral deficiency). Consistent with this finding, a survey by the National Institute on Alcohol Abuse and Alcoholism (of more than 43,000 adult Americans) found that only 2.4 million of the 19 million in need of treatment get diagnosed, and just 5.8 percent of those who are diagnosed (or 0.7 percent of those in need of treatment) receive medication during treatment (NIH News, 2004). Furthermore, approximately 33 percent of those who needed treatment (and recognized this need) but did not receive treatment cited cost or insurance problems as a barrier (US DHHS, 2004). Thus, the potential for addressing an unmet need for access to a clinically-proven and cost-effective treatment for alcohol abuse and dependence is enormous, and as indicated above, there are clear policy levers that state governments can use to increase the adoption of pharmaceutical technologies such as naltrexone that would help to meet this need.

A likely impediment to states' efforts to remove policy barriers to pharmaceutical technology adoption, however, are rising state Medicaid costs, now the largest line item in many state budgets. One third of the states instituted new or increased Medicaid co-pays in FY 2005 or FY 2006, and one half expanded their Medicaid managed care policies (Koury and Dovi, 2006). At the same time, the federal Deficit Reduction Act of 2005 has allowed states greatly expanded flexibility for modifying and managing their Medicaid programs, and as Koury and Dovi point out, there is considerable room for improving Medicaid program administration and for eliminating skewed incentives. State policymakers should heed research findings showing that it is cost-effective for state health plans to cover comprehensive substance abuse treatment; for every $1 invested in treatment, $4-7 are returned in reduced drug-related crime and criminal justice costs, and adding health care related savings increases this ratio of savings to costs to $12 to 1 (US DHHS, 1999). In other words, contrary to recent state policy changes which have

sought to limit pharmaceutical use and access to Medicaid benefits for rehabilitation for substance abuse treatment and to increase cost sharing for Medicaid enrollees, states would achieve greater reductions in total spending if they increased access to comprehensive substance abuse treatment, including pharmacotherapies such as naltrexone.

We expect the findings of this study that identify specific policy instruments and barriers to the adoption of naltrexone in substance abuse treatment to have broader implications, including for the adoption of naltrexone for other uses such as the treatment of heroin abuse (Fals-Stewart and O'Farrel, 2003) and treatment for nicotine dependence (i.e., smoking cessation) (George, 2004). In addition, naltrexone is just one example of a health care technology whose use and dissemination has been limited by policy, organizational, and environmental factors. Similar concerns have arisen for other technologies and pharmaceutical agents, such as buprenorphine in the treatment of heroin addiction. Like the naltrexone literature, studies of buprenorphine adoption have focused primarily on physician attitudes and treatment center characteristics (Coffin et al., 2006; Cunningham et al., 2006; Knudsen et al., 2006; and Koch et al., 2006). Interestingly, Knudsen et al.'s study of early adoption of buprenorphine in substance abuse treatment centers found that centers that reported using naltrexone were significantly more likely to have adopted buprenorhpine (i.e., 213% higher odds, $p < 0.001$).

In ongoing research, we are expanding our efforts to empirically model the relationship of state governance/policy factors and the role of facility characteristics in the adoption of antabuse and buprenorphine in substance abuse treatment. Antabuse was approved for use prior to naltrexone, and buprenorphine was approved more recently (in 2002), and thus, it will be of interest to see if the relationships observed for early adoption (of buprenorphine) differ from those of pharmaceutical technologies with a longer history of use or availability. We will also

extend our analysis of these drugs' adoption to additional years (2002 and 2004) to assess the consistency of the relationships and effects of state policies observed for 2003.

Finally, it is important to acknowledge some limitations of this research. Although the N-SSATS data are fairly rich in terms of the substance abuse treatment facility characteristics that they make available, they do not include measures of staff education, training, tenure and treatment philosophies, which as discussed earlier, have been shown by other research to be important to pharmaceutical adoption. In addition, it would be ideal to also have data on substance abuse treatment clients, although obtaining these data for the population of substance abuse treatment facilities in the N-SSATS would likely be impossible. Thus, an analysis that would bring in client-level information would likely limit the number of facilities and states that would be represented, implying a tradeoff in the study of the relationships in Figure 1 at one level versus another. We also recognize that in some states, the county may also be a meaningful unit of analysis in terms of the role of policy and management factors, and we do not include county-level measures in this study. For example, in California, the state has delegated to counties the responsibility for providing care for individuals receiving publicly funded medical assistance, which includes decisions to place naltrexone on the formulary and other guidance for managed care standards and practices for substance abuse treatment.

It is our hope that this research and our ongoing study of how public policies at multiple levels erect barriers or provide incentives for adoption of cost-effective substance abuse treatments will not only motivate further research in this area, but will also draw the attention of policymakers to how some factors limiting pharmaceutical adoption might be overcome through policy change and innovation.

Figure 1: Multilevel model of a substance abuse treatment system

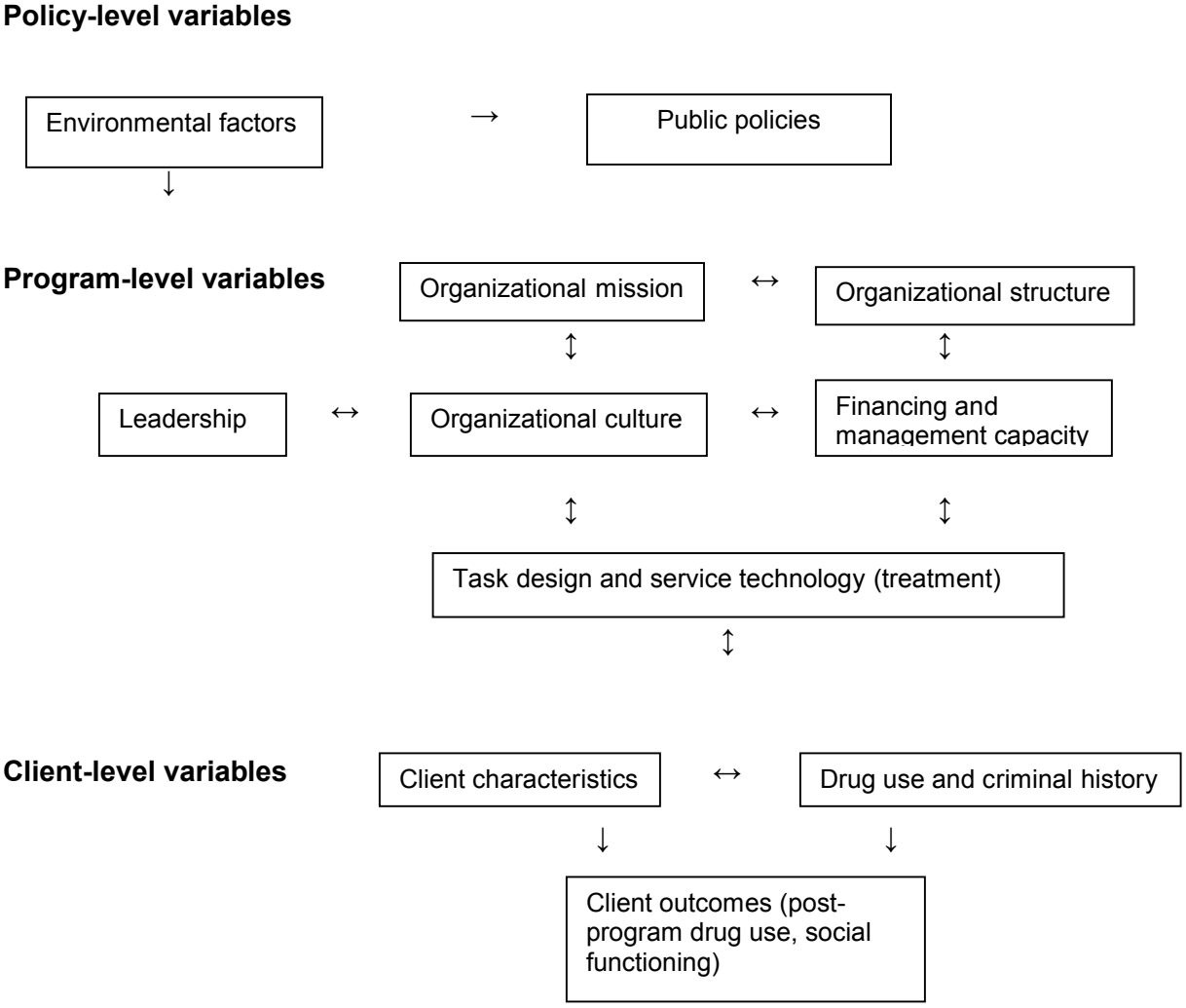

Table 1: General Description of Data Collected on State-level Policy Factors/Characteristics

Medicaid policies: coverage, benefits and financing (Sources:

- Medicaid benefits for mental health and rehab services, including types of benefits offered, populations covered, approval required, co-payments, limits to coverage
- Medicaid policies specific to prescription drugs: existence of a state pharmacy program that helps people with high prescription drug expenses, use of generic drugs required, co-pays and state reimbursement methodologies, state Medicaid drug use monitoring policies, and others
- Medicaid enrollments, enrollments in Medicaid managed care entities
- Federal and state shares of Medicaid assistance expenditures
- Discretion accorded by states to MCO/PCCM in setting policies

State health care capacity and financing

- State government expenditures – public welfare, hospitals, and health
- State funding for substance abuse prevention and treatment
- Federal Medicaid Assistance Percentage (2002)
- State community treatment program and number of community treatment providers
- Number of state health care and public assistance firms per capita
- State government employment data, including full-time equivalent employees in health sector
- Percent of counties with primary care physician shortages
- Percent of counties with mental health professional shortages
- Number of PhRMA companies located in state

State general fiscal and economic health

- Total individual income tax collection per capita
- State budget account information (e.g., deficits)
- Unemployment rate, annual average
- Employment-population ratio, annual average
- State population average number of weeks worked in past 12 months

State population characteristics

- Total population
- Total persons who are uninsured and percent of population
- Total persons below poverty level and percent of population
- Percentage of households with cash assistance income
- Race/ethnicity (White, Black, Hispanic, Asian, and Native American)
- Percent with alcohol abuse or dependence in past year (ages 18-25 and 26+)
- Percent with any illicit drug abuse or dependence in past year (ages 18-25 and 26+)
- Percent needing but not receiving treatment for alcohol problems in past year (ages 18-25 and 26+)
- Percent needing but not receiving treatment for drug problems in past year (for ages 18-25 and 26+)
- Percent with high school education
- Median age of state population
- Percent that speaks language other than English at home

Data sources: Centers for Medicaid and Medicare Services (CMS), Substance Abuse and Mental Health Services Administration (SAMHSA), National Conference on State Legislatures, Kaiser Commission on Medicaid and the Uninsured, Bureau of Labor Statistics, National Center for Health Workforce Analysis, U.S. Census Bureau, Clinical Trials Network, National Institute on Drug Abuse, and the PhRMA Pharmaceutical Industry Profile.

Table 2: Descriptive Statistics of State-Level Measures Used in Empirical Analysis

State-level measure	Valid n	Mean	Std. Dev.	Min	Max
% of Medicaid enrollees in managed care	51	60.006	22.468	0.000	100.000
Medicaid enrollees per capita	51	0.144	0.038	0.071	0.250
Medicaid benefits for rehab-copay required	51	0.110	0.313	0.000	1.000
Medicaid benefits for rehab-SA limitations	51	0.609	0.685	0.000	2.000
Medicaid prescription drugs coverage limitations-quantity supplied	51	0.559	0.497	0.000	1.000
Medicaid prescription drugs-other coverage limitations	51	0.448	0.497	0.000	1.000
Medicaid policy: state preferred drug list	48	0.566	0.496	0.000	1.000
Medicaid policy: number of refills limited	48	0.539	0.498	0.000	1.000
Medicaid policy: fail first requirement	48	0.604	0.489	0.000	1.000
Medicaid policy: lower generic co-pays	48	0.375	0.484	0.000	1.000
Medicaid policy: generic rate paid for brand	48	0.622	0.485	0.000	1.000
Medicaid policy: generics on PDL/formulary	48	0.369	0.482	0.000	1.000
Capitated/MCO delivers Medicaid benefits	47	0.884	0.320	0.000	1.000
State includes Rx cost in MCO capitation rate	47	0.695	0.460	0.000	1.000
State permits MCO/PCCM to set policies regarding formulary/PDL	47	0.724	0.447	0.000	1.000
State permits MCO/PCCM to set policies regarding prior authorization	47	0.724	0.447	0.000	1.000
State permits MCO/PCCM to set policies encouraging generics	47	0.657	0.475	0.000	1.000
State permits MCO/PCCM to set policies restricting access to pharm network	47	0.379	0.485	0.000	1.000
Medicaid policy: MCO delivers Rx	47	0.662	0.473	0.000	1.000
Federal Medicaid Assistance % (2002)	51	56.670	7.094	50.000	76.090
Medicaid benefits fee for service delivery	47	0.774	0.418	0.000	1.000
State discretionary funding for substance abuse treatment (per capita)	48	0.956	1.655	0.110	21.587
Substance abuse prevention and treatment block grant funding per capita	48	5.753	0.918	4.431	12.196
State discretionary funding for substance abuse prevention (per capita)	48	0.559	0.901	0.012	8.939
Number of state health care and public assistance firms per capita	51	2.512	0.258	1.896	3.743
% counties w/no prim care phys shortage	51	23.742	16.414	0.000	68.480
% counties w/no MH prof shortage	51	47.717	23.538	0.000	100.000
State public welfare expenditures per capita	51	0.219	0.354	0.038	3.122
% ages 26+ w/alcohol abuse/dependence	51	6.193	0.800	4.630	8.370
% ages 26+ needing but not receiving treatment for alcohol problems in past year	51	5.781	0.747	4.380	8.030
State pop median age	51	36.136	1.929	27.700	40.200
% of state pop in poverty, 2002-04 average	51	12.024	2.514	5.800	18.800
% of households with cash assistance income	51	2.670	0.858	1.400	7.700
Employment-population ratio	51	62.482	3.337	51.300	71.300
Mean number of weeks worked (past 12 mos)	51	44.205	0.548	41.500	45.340
Unemployment rate (2003)	51	6.012	0.891	3.600	8.200
% of state pop with high school education	51	84.144	3.622	77.400	91.200
% of state pop uninsured, 2002-04 average	51	14.953	3.647	8.300	25.200
State health care expenditures per capita	50	0.037	0.064	0.003	0.502
State hospital expenditures per capita	50	0.023	0.029	0.001	0.137

Table 3: Descriptive Statistics of Facility-Level Measures Used in Multi-level Models

Facility-level measure	Valid n	Mean	Std. Dev.	Min	Max
Dependent variable: Adopted naltrexone	13290	0.124	0.329	0	1
Organizational structure/licensing/focus					
For-profit	13419	0.252	0.434	0	1
Nonprofit	13419	0.604	0.489	0	1
Hospital in-patient SATX	13419	0.074	0.262	0	1
No out-patient SATX	13418	0.192	0.394	0	1
Non-hospital residential SATX	13419	0.271	0.445	0	1
Affiliation w/hospital	13411	0.146	0.353	0	1
Contracts w/MCOs for SATX	13261	0.521	0.500	0	1
Licensed by Mental Health Dept	12651	0.352	0.478	0	1
Licensed by State SA Agency	13014	0.836	0.370	0	1
Accredited by JCAHO	12766	0.260	0.439	0	1
Primary focus: general health care	13409	0.267	0.442	0	1
Primary focus: mental health services	13409	0.086	0.280	0	1
Primary focus: SATX/mental health mix	13409	0.018	0.134	0	1
Primary focus: not SATX/MH/mix	13419	0.285	0.452	0	1
Financing					
Does not use sliding fee scale	13365	0.351	0.477	0	1
No Fed/State/Cty/Local Earmark funds	13318	0.343	0.475	0	1
Does not accept state-finan health ins	12009	0.598	0.490	0	1
Does not accept Medicaid	12951	0.449	0.497	0	1
Treatment services					
No relapse prevention groups	13297	0.203	0.402	0	1
No aftercare counseling	13317	0.221	0.415	0	1
No individual therapy	13367	0.054	0.225	0	1
No case mgmt services	13419	0.308	0.462	0	1
No comprehensive SA assess/diagnosis	13386	0.066	0.248	0	1
No other social service assistance	13339	0.454	0.498	0	1
Offers employment counseling and/or housing assistance	13356	0.518	0.500	0	1
Operates and opiod treatment program	13414	0.079	0.270	0	1

Notes: Data from the National Survey of Substance Abuse Treatment Services (N-SSATS), 2003 (accessible from Inter-university Consortium for Political and Social Research).
SATX is shorthand for “substance abuse treatment.”

Table 4: Multilevel Model Findings on Facilities' Adoption of Naltrexone

Dependent variable: Facility adopted naltrexone as pharmacotherapy						
	Model 1 (N_1=13,290)			Model 2 (N_1=9,773, N_2=47)		
Independent variables	**Coef.**	**Std. Err.**	**P-value**	**Coef.**	**Std. Err.**	**P-value**
Facility-level						
Intercept	-2.551	0.155	<.0001	-2.045	1.455	0.171
For-profit	-0.205	0.117	0.079	-0.223	0.121	0.065
Nonprofit	-0.605	0.093	<.0001	-0.620	0.099	<.0001
Hospital in-patient SATX	0.545	0.119	<.0001	0.642	0.125	<.0001
No out-patient SATX	-0.235	0.114	0.038	-0.426	0.118	0.000
Non-hospital residential SATX	0.096	0.097	0.321	0.192	0.101	0.058
Affiliation w/hospital	0.786	0.107	<.0001	0.724	0.112	<.0001
Contracts w/MCOs for SATX	0.580	0.076	<.0001	0.566	0.079	<.0001
Does not use sliding fee scale	0.181	0.076	0.018	0.310	0.079	<.0001
No Fed/State/Cty/Local Earmark funds	0.311	0.082	0.000	0.238	0.084	0.005
Does not accept state-finan health ins	-0.218	0.078	0.005	-0.231	0.081	0.004
Does not accept Medicaid	0.031	0.085	0.718	0.154	0.090	0.088
Licensed by Mental Health Dept	0.129	0.077	0.096	0.259	0.084	0.002
Licensed by State SA Agency	-0.275	0.088	0.002	-0.400	0.094	<.0001
Accredited by JCAHO	0.592	0.086	<.0001	0.635	0.090	<.0001
% of clients treated for alcohol abuse	0.005	0.001	0.000	0.004	0.002	0.004
Primary focus: general health care	0.999	0.374	0.008	1.128	0.379	0.003
Primary focus: mental health services	0.132	0.139	0.343	0.313	0.144	0.030
Primary focus: SATX/mental health mix	0.957	0.201	<.0001	0.968	0.214	<.0001
Primary focus: not SATX/MH/mix	-0.570	0.371	0.125	-0.648	0.377	0.086
No relapse prevention groups	-0.821	0.106	<.0001	-0.761	0.110	<.0001
No aftercare counseling	-0.139	0.095	0.143	-0.222	0.097	0.022
No individual therapy	-0.464	0.179	0.009	-0.447	0.181	0.014
No case mgmt services	-0.083	0.079	0.296	-0.194	0.082	0.017
No comprehensive SA assess/diagnosis	-0.359	0.188	0.056	-0.367	0.193	0.057
No other social service assistance	-0.041	0.082	0.621	0.037	0.085	0.665
Offers employment counseling and/or housing assistance	0.359	0.079	<.0001	0.350	0.081	<.0001
Operates and opiod treatment program	0.332	0.122	0.006	0.222	0.125	0.077
State-level Medicaid/managed care policies						
Medicaid benefits for rehab-SA limitations				-0.218	0.087	0.019
Medicaid policy: state preferred drug list				-0.313	0.130	0.023
Medicaid policy: lower generic co-pays				0.243	0.132	0.077
Medicaid policy: generic rate paid for brand				-0.101	0.107	0.353
Medicaid policy: generics on PDL/formulary				0.377	0.127	0.006
Medicaid policy: MCO delivers Rx				-0.606	0.220	0.010
Capitated/MCO delivers Medicaid benefits				0.596	0.216	0.010
State permits MCO/PCCM to set policies encouraging generics				0.629	0.221	0.008
State permits MCO/PCCM to set policies restricting access to pharm network				-0.675	0.194	0.002
State-level capacity/financing and environment						
Federal Medicaid Assistance % (2002)				0.013	0.012	0.285
State discretionary funding for substance abuse treatment (per capita)				-0.001	0.031	0.985
State public welfare expenditures per cap				0.622	0.253	0.021
State health care expenditures per capita				-2.354	1.265	0.073
% counties w/no prim care phys shortage				-0.008	0.003	0.027
% counties w/no MH prof shortage				0.012	0.003	0.000
State pop median age				-0.069	0.035	0.062
% ages 26+ w/alcohol abuse/dependence				0.180	0.069	0.014
% of state pop in poverty, 2002-04 average				-0.040	0.024	0.107
Goodness of fit: -2 residual log likelihood	56954.9			53901.9		

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