DISSERTATION APPROVAL

The abstract and dissertation of John Patrick Fitzgerald for the Doctor of Philosophy in Systems Science: Psychology were presented April 10, 2007, and accepted by the dissertation committee and the doctoral program.

COMMITTEE APPROVALS:

George G. Lendaris, Chair

Todd Bodner

Patrick Johnson

Robert Sinclair

Dennis McCarty

James Nash
Representative of the Office of Graduate Studies

DOCTORAL PROGRAM APPROVAL:

George G. Lendaris, Acting Director
Systems Science Ph.D. Program

ABSTRACT

An abstract of the dissertation of John Patrick Fitzgerald for the Doctor of Philosophy in Systems Science: Psychology presented April 10, 2007.

Title: A Multilevel Analysis of Individual and Organizational-Level Effects on Staff Attitudes Towards Use of Medication in Substance Abuse Treatment

Studies consistently indicate a general lack of support for use of medications in the treatment of substance abuse disorders by clinicians, patients, and other stakeholders involved in treatment. Both individual and organizational factors have been shown to influence attitudes towards medications, but the relative contribution of each of these factors remains unclear. Whereas previous studies, by their very design, have generated *multilevel* data structures, they nevertheless have employed analytic strategies that ignore the multilevel dependencies inherent in such data sets.

To address these limitations, this study took a multilevel approach to investigate the influence of individual and organizational factors on treatment staff. Organizational survey data from the National Drug Abuse Treatment Clinical Trials Network workforce surveys, including 1,421 workforce staff nested within 237 treatment units, were analyzed using *hierarchical linear modeling*.

Results of the present study suggest that attitudes towards addiction medications are influenced by both individual and organizational factors simultaneously, albeit the more significant determinants reside at the individual level.

In addition, this study found evidence that a unique blend of factors (individual and organizational) exists for each medication, although two variables proved to be robust predictors across all medications. Higher levels of academic education and support for psychiatric medications were associated with more positive attitudes towards addiction medications. Evidence was also found that staff attitudes towards addiction medications varied significantly between treatment units.

The overall design of the present study was informed and guided by a systems methodological framework, and in this setting, implications for increasing support for addiction medications in practice were also considered and are discussed.

A MULTILEVEL ANALYSIS OF INDIVIDUAL AND ORGANIZATIONAL-LEVEL EFFECTS ON STAFF ATTITUDES TOWARDS USE OF MEDICATION IN SUBSTANCE ABUSE TREATMENT

by

JOHN PATRICK FITZGERALD

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live my dreams. Even more, she shares the joy of parenting my son Trevor, who came along in the midst of my academic journey. For us both, he is our light and the future.

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List of Acronyms

AA	Alcoholics Anonymous
ADR	Adverse Drug Reaction
AOD	Alcohol and Drug
CB1	Cannabinoid-1 (Receptors)
CEU	Continuing Education Unit
CSAT	Center for Substance Abuse Treatment
CTN	Clinical Trials Network (Funded by NIDA)
CTP	Community Treatment Program
DV	Dependent Variable
EBP	Evidence-based Practice
FDA	Food and Drug Administration
HLM	Hierarchical Linear Modeling
IOM	Institute of Medicine
IRB	Institutional Review Board
IV	Independent Variable
LAAM	Levo-alpha-acetymethadol, trade name Orlaam®
MI	Motivational Interviewing
ML	Maximum Likelihood
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIDA	National Institute on Drug Abuse

OHSU	Oregon Health & Sciences University
OLS	Ordinary Least Squares (Regression)
ORC	Organizational Readiness for Change (Assessment)
PIC	Practice Improvement Collaborative
RCM	Random Coefficient Modeling
RCT	Randomized Controlled Trial
SAMHSA	Substance Abuse and Mental Health Services Administration
SMPS	Social Model Philosophy Scale
TIP	Treatment Improvement Protocol
TX	Treatment

Chapter 1: Introduction

Substance abuse is a persistent public health problem, affecting approximately 20 million people at any given time (Institute of Medicine, 2006; Substance Abuse and Mental Health Services Administration, 2005), and costing the United States billions of dollars annually (Institute of Medicine, 1998, 2006). Much of this expense can be linked to crime, lost worker productivity, healthcare, and a wide range of other social ills. But the costs are not just monetary. Those who abuse drugs risk losing intimate relationships, self-esteem, and ultimately their life. The social damage is even more staggering when considering the millions of children of substance abusers that must be factored into the equation. Taken together, substance abuse ranks among the leading causes of suffering in society. Of those who suffer with a substance abuse or dependence disorder, only about 15% receive any kind of professional treatment (Institute of Medicine, 2006; Substance Abuse and Mental Health Services Administration, 2005). Unfortunately, the inability to treat a greater percentage of those in need of help is not the only problem with the present substance abuse treatment system.

In 1998, a report by the Institute of Medicine (IOM) revealed significant deficiencies in the U.S. substance abuse treatment system (Institute of Medicine, 1998). Most notable were gaps in quality of care due in large part to a disconnect between scientific knowledge and clinical practice. The report detailed how interventions that had consistent empirical support, most commonly referred to as *evidence-based practices* (EBPs), were significantly underutilized by the substance

abuse treatment community. EBPs involve the "conscientious, explicit, and judicious use of current best evidence in making decisions about care of individuals" (Sackett, Richardson, Rosenberg, & Haynes, 1997, p. 2). In contrast, the IOM report provided evidence that many substance abuse treatment providers relied instead on *authority-based practices*, where interventions are based on anecdotal experience, opinions of others, popularity, and unchecked intuition (Gambrill, 1999).

Since the publication of the IOM report, there has been a significant push from government sponsored agencies such as the National Institute on Drug Abuse (NIDA), the National Institute on Alcohol Abuse and Alcoholism (NIAAA), the Center for Substance Abuse Treatment (CSAT), and the Substance Abuse and Mental Health Services Administration (SAMHSA) to bridge the gap between practice and research. This dissertation documents many of those efforts, and suggests there is reason to believe the gap is starting to close. Yet in spite of such progress, there remains a consistent lack of support by clinicians and other treatment staff for use of EBPs in the care of individuals with substance use disorders. Several reviews of EBPs specific to substance abuse treatment have reported a wide range of interventions that improve treatment outcomes (Institute of Medicine, 1998; Miller, Brown, Simpson, & et al., 1995; Miller & Wilbourne, 2002; Power, Nishimi, & Kizer, 2005). Further, the reviews have shown that specific EBPs have consistently been linked to better treatment outcomes, including brief interventions, specific psychosocial therapies (e.g., community reinforcement approach, motivational enhancement, skills training), and pharmacological interventions (Miller & Wilbourne, 2002).

Of the different EBPs, use of medications in the treatment of substance abuse disorders represents one of the largest gaps between research and practice. The IOM report illustrated how methadone maintenance therapy, considered among the most effective of all addiction interventions, has struggled to gain widespread acceptance due to stringent federal regulations, ideological barriers, and lack of funding. Naltrexone, approved by the Food and Drug Administration (FDA) in 1994 for the treatment of alcohol dependence, has consistently been shown to improve clinical outcomes when used in conjunction with psychosocial interventions, yet it remains significantly underutilized in practice. These medicines, in addition to many new pharmaceutical agents currently in development, have the potential to help millions of people, but only to the extent they become utilized and supported by the treatment community.

As a practicing clinician treating primarily substance abuse disorders for over eight years, it was not uncommon for me to see patients who had been in treatment multiple times for alcoholism who had never even heard of naltrexone. Often, these patients had received treatment at some of the most prestigious programs in the country. Numerous times I witnessed how the addition of naltrexone to the patient's psychosocial therapy program significantly improved the clinical outcomes (i.e., relapse rates decreased, quality of life measures increased). In addition, I have experienced first-hand many of the attitudes against using addiction medications while traveling to conferences and presenting workshops to clinicians on good treatment practices. Quite often I have been left frustrated as further discussion with clinicians

revealed how little the attitudes are based on scientific knowledge, and how strongly they are correlated with personal experience and myth. Based on empirical evidence explored in detail in this dissertation, there are a number of addiction medicines that when combined with psychosocial interventions, can improve clinical outcomes. I believe patients should at the very minimum be told these medicines exist and be given a choice whether to pursue the use of them in their treatments, particularly if psychosocial interventions alone have historically failed. This belief in large part motivates the present study.

This dissertation focuses on improving the understanding of attitudes towards use of medication in substance abuse treatment. The intent here is not one of promoting use of medications as the only useful EBP, nor is the intent to lessen the credibility of existing psychosocial interventions. Rather, the focus is on discerning and assessing variables that may inhibit and/or facilitate the appropriate use of addiction medications. Such medications are known to consistently rate among the most effective EBPs. Yet, they are also among the most underutilized in routine clinical practice. In a recent review of interventions for alcohol use disorders, Miller and Wilbourne (2002) found that use of medications ranked third and fourth out of 46 different treatment interventions (higher ranking indicating better treatment outcomes from clinical trials). Yet as the literature review in this dissertation illustrates, there is a consistent lack of support for appropriate use of addiction medications in practice despite the evidence of their effectiveness.

As a step toward providing a balanced perspective, this dissertation also provides material related to the potential downsides of increasing medication use. Studies related to medication errors are reviewed in Section 3.1.1, and Section 7.4 explores potential unintended consequences that can arise from medication use. Such consequences include: (a) an over-reliance on use of medications; (b) without buy-in from impacted stakeholders, well-intended policy decisions may lead to adverse outcomes; (c) unbalanced consideration of the benefits, risks, and costs; (d) abuse and diversion of opioid medications; and (e) complex dosing may lead to non-adherence and increased likelihood of relapse. Such issues must be considered among the possibilities when attempting to optimize patient outcomes.

Existing research suggests that both individual staff characteristics and organizational attributes play a role in attitudes towards medication, but the relative contribution of these factors remains unclear. To better understand these factors and learn why new treatment technologies, including medications, have not become more widely adopted, researchers have employed the notion of *diffusion process*, and have put forth conceptual models specific to substance abuse treatment (Simpson, 2002; Thomas, Wallack, Lee, McCarty, & Swift, 2003). These models draw heavily on diffusion theory (Rogers, 1995, 2003), and attempt to illustrate the dynamics involved in technology transfer. The models include both individual and organizational factors, but fall short of indicating the degree to which specific factors play a role in the overall diffusion process.

This dissertation advances these models and fills a gap in the literature by using a multilevel framework to examine the degree to which individual and organization-level factors influence treatment-staff attitudes toward addiction medications. Although past studies have examined treatment-staff attitudes (Forman, Bovasso, & Woody, 2001; Fuller, Rieckmann, McCarty, Smith, & Levine, 2005; Knudsen, Ducharme, Roman, & Link, 2005; Mark, Kranzler, Poole et al., 2003; Mark, Kranzler, & Song, 2003; Mark, Kranzler, Song et al., 2003; Thomas et al., 2003), there is reason to question the validity of these findings. Most researchers have focused their investigations at either the individual *or* organizational level, ignoring the relationships that exist *between* levels. As a result, the methods employed in those studies were based on assumptions that fail to account for the inter-level dependencies that exist in the real world (i.e., individuals nested within organizations nested within geographic regions). The present study addressed these problems by examining both individual and organizational-level factors simultaneously.

Because these multilevel relationships have received little consideration in past studies, a key objective of this study was to identify, hypothesize, and test relationships that have some basis of support in the current literature. To accomplish the above described objectives, this dissertation employed a systems approach to examine complex problems involving variables at different levels of analysis (Lendaris, 1986; Senge, 1990; Sterman, 2000). Further, sophisticated multilevel modeling methods (e.g., hierarchical linear modeling) that appropriately address

dependencies inherent in multilevel data were utilized (Bryk, Raudenbush, & Congdon, 2005; Hox, 2002; Raudenbush & Bryk, 2002).

Collection of data related to substance abuse treatment programs in the National Drug Abuse Treatment Clinical Trials Network (CTN) provided an ideal resource to model the multilevel determinants of treatment staff attitudes towards medication. The CTN is an alliance of 120 community treatment programs and 17 research centers whose purpose is to test emerging substance abuse interventions. Data were collected at the individual, treatment unit, and program levels, but only individual (N = 1,421) and treatment unit (N = 237) data were used in the present study. The program-level data was not included, due to the fact that only one variable of interest existed in that data (primary service setting), and the ability to accommodate this single factor within a two-level model. Initial analyses of staff characteristics and attitudes towards use of medication in substance abuse treatment suggested that treatment staff, in general, were not overly supportive of addiction medications (McCarty et al., 2007).

Based on the literature review, six individual-level factors (prescriber status, academic education, addiction continuing education units, job category, and support for psychiatric medications) and five organizational-level factors (treatment model, use of methadone, primary care on-site, percent of staff in recovery, and service setting) were identified as having strong empirical support for predicting medication attitudes and were tested within a multilevel framework. As hypothesized, this study provided empirical support for the following:

1. Individual and organizational factors simultaneously influence attitudes towards addiction medications. Results indicated that attitudes towards naltrexone were least influenced by organizational determinants (8.6%), while more than a third of attitudes towards methadone were explained at the organizational-level (34.5%), with buprenorphine in the middle (21.5%). These findings also suggest that the primary determinants of medication attitudes are individual-level factors.
2. The determinants of medication attitudes are not consistent across medications. The findings suggest that a unique blend of individual and organizational factors exist for each medication, although some specific factors are robust predictors of attitudes across all medications. This would also suggest that no one intervention to increase support for pharmacotherapy would be successful across all medications.
3. Higher levels of academic education and support for use of psychiatric medications are among the most important factors influencing attitudes supportive of addiction medications. Many of the payees of addiction treatment services have also recognized that graduate-trained counselors are better trained to deliver EBPs, including treatment of mental health disorders, and provide the best cost-benefit outcome for their expenditures. As a result, contracts for services are increasingly requiring that services be delivered by graduate-trained clinicians. The present study provides further support for this latter trend.

4. Staff attitudes towards addiction medications vary between treatment units. Findings pointed to some of the variability between treatment units for naltrexone and methadone being explained by differences in academic education and attitudes towards psychiatric medications, but additional research is needed to further understand the variability between treatment units.
5. Existing models illustrating the factors and processes involved in the adoption of addiction medications could be improved by incorporating factors and processes that more carefully operationalize the relationships between variables, and take into consideration the unique attributes of each medication.
6. A systems approach offers the best framework for examining the complex nature of attitudes towards addiction medications, and for the development of interventions to increase support for addiction medications.

The following chapters begin with an exploration of what is meant by a systems approach (Chapter 2). The limitations of existing literature are discussed in more detail, and the lack-of-support-for-addiction-medications problem is defined more precisely within a systems framework. The contributions of a systems approach to problem solving and intervention development are also presented. The formal literature review (Chapter 3) then examines studies relevant to the context in which the problem being studied is found, and additionally, reviews the current FDA approved

medications to treat substance abuse disorders. Central to Chapter 3 is a review of existing studies that have examined treatment staff's lack of support for addiction medicines, and a discussion of diffusion theory that is inherent in that body of research. The chapter concludes with an overview of the origin of the data set used in the present study. The dissertation continues with a formal problem statement (Chapter 4), overview of the method employed (Chapter 5), and results (Chapter 6). Finally, the discussion (Chapter 7) summarizes the contribution of the findings, and what they say about how best to increase appropriate use of addiction medications.

Chapter 2: The Systems Approach

The *systems approach* is a way of thinking about complex problems and a methodology for developing optimal solutions to those problems. It involves a special type of thinking, often referred to as *systems thinking*, that makes use of several tools to gain powerful insights into the nature of a problem (Richmond, 2001). In essence, it does this by examining the system in which a problem occurs, identifying the core parts of the system, and how they work together to manifest the attributes of the system. Thus, knowledge of a system is both a prerequisite and an ongoing requirement critical to *systems methodology*, which broadly involves the design, construction, implementation, and optimization of an effective solution to a problem (Hall, 1989). Such an approach is most appropriate for problems that are *complex*, meaning they involve multiple variables that interact over time in ways that can be challenging to predict. Examples include living systems, social systems, and the problem of underuse of addiction medications in substance abuse treatment examined in this study. The more that is known about a system, the easier it is to decide how to intervene. Before elaborating on the systems approach and how it guides the present study, it is first useful to consider why such an approach may be necessary.

2.1 The Need for a Systems Approach

Efforts to study treatment staff's lack of support for use of addiction medications in substance abuse treatment programs have relied almost exclusively on survey research methodologies. The approach has led most researchers to focus their efforts at the individual level, or the level where prescribers of medication or other

individuals who may influence prescribing decisions reside (e.g., physicians, counselors, program administrators). Questionnaires have commonly been used to learn about attitudes and behaviors related to medication use, and typically the results are analyzed without regard to dependencies that exist in the populations surveyed (Forman et al., 2001; Fuller et al., 2005; Mark, Kranzler, Song et al., 2003; Thomas et al., 2003). Although this approach has led to a list of reasons why medications are underutilized in practice, it also has suffered from a number of methodological limitations that have hindered further understanding of this issue and the development of interventions to increase support for medication use.

The overemphasis on individual-level variables has resulted in few studies that have investigated the contextual or group-level effects that exist within organizations, and that may also influence prescribing attitudes and behaviors. Existing studies provide evidence that factors such as size (Fuller et al., 2005), funding source (Fuller et al., 2005; Thomas et al., 2003), and patient population of the treatment organization (Roman & Johnson, 2002) can influence usage of medication. But the failure to study the problem from *both* an individual and organizational perspective simultaneously has resulted in study outcomes that do not account for the relationships that exist between levels or the real-world complexity of the problem. This issue has been raised by Kozlowski and Klein (2000) who have argued that organizational research has commonly approached problems either from a micro (individual level) or macro (group/organizational level) perspective, when neither approach adequately accounts for organizational behavior. More specifically:

> The macro perspective neglects the means by which individual behavior, perceptions, affects, and interactions give rise to higher-level phenomena. There is a danger of superficiality and triviality inherent in anthropomorphization. Organizations do not behave; people do. In contrast, the micro perspective has been guilty of neglecting contextual factors that can significantly constrain the effects of individual differences that lead to collective responses, which ultimately constitute macro phenomena (Kozlowski & Klein, 2000, p. 7).

A consequence of ignoring the multilevel framework in which substance abuse treatment organizations exist is that the relationships or dynamics that occur between variables at different levels have received little attention. In part, this is related to the challenges of disentangling the separate and joint effects of predictor variables at different levels. Only in the past decade have sophisticated multilevel modeling programs with the ability to more accurately separate out individual and group-level effects in multilevel data found their way into organizational research (Raudenbush & Bryk, 2002). With the ability to model both individual and group (or organizational) level predictors simultaneously, it is now possible to gain a clearer understanding of how variables at different levels influence individual attitudes about medication. Even more, such an approach provides valuable insight into the *degree* to which specific variables contribute to attitude outcomes. Such knowledge can then be used to design more effective interventions aimed at increasing support for use of medications in substance abuse treatment.

Before reviewing the current literature specific to addiction medications in the next chapter, it is important to understand why outcomes from these prior studies may be misleading and the approach offered here is necessary. As mentioned above, previous studies have relied almost exclusively on statistical methodologies that

assume independence of observations. This assumption means that, for any two observations within a sample population (i.e., individuals, treatment units, or programs), knowing how one of these observations stands relative to the sample population mean tells us nothing about the other observation (Howell, 2002). In other words, knowing the score of a survey from one individual gives you no information about any other individual's survey score. But the referenced prior studies have relied almost exclusively on survey data of individuals and organizations that have inherent dependencies. For example, it is often true that more than one individual from an organization is included in a study population; clearly, by nature of working in the same program, the experience of those individuals are likely to have a relationship. Thus, the independence of their responses should be suspect. Likewise, programs existing in one state may be very similar to each other (e.g., because of legislative policies dictating medication practices, similar funding mechanisms) compared to programs that were randomly sampled from all 50 states. By ignoring these differences and treating all individuals or organizations in a data set as independent, estimates of the standard errors of conventional statistical tests are much too small, leading to a higher probability of rejection of the null hypothesis (Raudenbush & Bryk, 2002).

Nevertheless, researchers have analyzed, and continue to analyze multilevel data sets using traditional multivariate regression techniques. In such cases, analyses are accomplished by either aggregating the individual level data up to the group level using a metric like the statistical average, or disaggregating the group level data down

to the individual level in a similar manner (i.e., all individuals would receive the same average score for a group predictor variable). However, neither approach accurately represents the data, because aggregation results in the potential loss of meaningful variability in individual data, while disaggregation violates a number of statistical assumptions and yet makes inferences about higher level variables based on lower level data (Griffin & Hofmann, 1997; Raudenbush & Bryk, 2002). Multilevel modeling was developed to overcome the above issues, and to accurately model both individual and organizational predictors simultaneously. The power of multilevel modeling is that it not only attempts to explain the differences *between* groups, but at the same time attempts to explain the differences that exist *within* groups.

This study advances the present literature by using multilevel modeling to investigate the variance both within and between treatment units by testing relationships between multilevel variables. A central hypothesis is that the degree to which individual-level variables accurately predict attitudes about addiction medications depends on specific organizational factors. In other words, the importance of education, professional discipline, and addiction-specific education (i.e., all individual-level predictors) depends on whether a treatment program is part of a hospital or medical clinic, has on-site primary care, and the general intervention approach used by treatment staff.

In addition to ignoring the relationships between multilevel variables and the statistical implications of multilevel data, prior studies focusing on lack of support for addiction medications have given scant attention to the additional challenges inherent

in designing effective *intervention* strategies aimed at increasing support for use of addiction medicines. Even with a clearer understanding of the factors that most influence attitudes, knowing how to intervene, be it an individual, treatment program, or group of programs, is not so simple. Sterman (2000) has pointed out how even well designed interventions often have unintentional side effects or consequences when it is difficult to foresee how a change in one part of a system impacts other parts of the system. For example, a newly hired and well-meaning treatment director may take steps to increase use of addiction medications by hiring a part-time prescriber, conducting staff trainings on the benefits of medication use, and issuing a clinic policy requiring that addiction medications be considered as a core component of treatment. Months later, the director may be perplexed when staff turnover doubles and patient dropout rates increase.

Quite often such outcomes arise when those directly impacted by a policy decision are not included in decision-making processes that affect them. Whether it is the counselors or the patients, without a clear understanding of how these two groups (or parts of the system) feel about addiction medications, any sole decision by a director is likely to result in unintended consequences. It may be that counselors (and patients) historically have opposed medications in favor of spiritual interventions (e.g., 12-step approach), but the point of this example is that changes in one part of a system often have unanticipated effects for the entire system. The late biologist Lewis Thomas wrote:

> When you are confronted by any complex social system, such as an urban center or a hamster, with things about it that you're dissatisfied with and anxious to fix, you cannot just step in and set about fixing with much hope of helping. This realization is one of the sore discouragements of our century…You cannot meddle with one part of a complex system from the outside without an almost certain risk of setting off disastrous events that you hadn't counted on in other, remote parts. If you want to fix something you are first obligated to understand…the whole system…Intervening is a way of causing trouble (Thomas, 1974, p. 90).

If we are to follow the wisdom of Dr. Thomas, a systems approach is critical for a number of reasons. First, the problem of lack of treatment staff support for addiction medications is complex. It involves relationships between patients, prescribers, organizations, and the larger health care system, all existing at different levels of analysis. It also includes a technology (medication) that has its own inherent complexities related to costs, benefits, and risks. Further, all these variables may be constantly changing, resulting in what Sterman (2000) describes as *dynamic complexity*. Problems that are dynamically complex involve many variables that change simultaneously, resulting in behavior that is challenging to predict. A systems approach is also necessary to overcome the limitations of traditional research methodologies, such as: (a) focusing on either the individual or organizational level; (b) use of statistical techniques that require independence of observations when the data contain inherent dependencies; and (c) and ignoring the dynamic complexity inherent in social problems. Finally, a systems approach also offers perhaps the best available framework for the development of successful interventions.

2.2 The Systems Approach to Defining the Problem

Central to the systems approach is a need to gain an understanding of the system in which a problem occurs. Such an understanding is aided by a check-list type definition of system. For example, a *system* can be defined as a unit with certain attributes perceived relative to its external environment, and the unit contains within it subunits that operate together to manifest the perceived attributes of the unit (Lendaris, 1986). It is important to realize that this definition is *observer-dependent*, meaning that whatever system is being defined is based on the perception of the person defining it. In the present study, I am the one who defines the system in which lack of support for addiction medication occurs. While there is individual latitude and creativity in the system-defining process, ideally the defined system is based on empirical research. Also, important in the definition is the notion of *multiple perspectives*. Different people may look upon a system (or problem) differently depending on whether they are focusing on the parts of the system, the entire system, or the system as it relates to its defined external environment. It is precisely by examining a problem or system from different perspectives that a greater understanding of its complexity is attained. Also, the above definition makes explicit that it is the behavior of the subunits or parts of a system, that when *operating together*, manifest the perceived attributes of a system. This means that a system cannot be understood simply by examining its individual parts. Imagine understanding how a watch "tells time" if all you were given was a collection of gears and a small spring. While knowledge of the parts is needed,

it is even more important to understand how the parts dynamically interact to manifest the attributes of the defined system.

The above definition also specifies that a system must be defined relative to its external environment, meaning that the beholder of the system must place some boundaries around the system. Although the *environment* is generally defined to be everything outside of a system, when problem solving, the environment is more appropriately defined as the *relevant environment, or context*, in which the problem occurs (Lendaris, 1986). Previously, the term *multilevel* was introduced to describe how researchers have traditionally viewed a phenomenon either from an individual (micro) or organizational (macro) level. It is now more specifically defined as the different levels chosen to represent the relevant environment or context of a problem. Here again, selection of the levels is observer-dependent, meaning that I choose which levels to include in my relevant environment based on my perception of the problem, influenced by the research literature. Variables at each level to be included in the analytic models will be called *multilevel predictors*, and the effects those predictor variables have on each other and the outcome variables will be called *multilevel effects*.

Inherent in a multilevel approach is that the levels are organized *hierarchically*. This means that lower levels are embedded in higher levels, and that what is perceived at the higher level emerges through the interaction and dynamics of the lower-level elements (Kozlowski & Klein, 2000). Put another way, for every level the defined system has a *suprasystem,* a system in the above level of which the defined

system is considered a subunit (*subsystem)* (Lendaris, 1986). A set of data that contains information collected at different levels that are hierarchically organized is defined as a *hierarchical data set*. Such data are also commonly referred to as *multilevel data* or *nested data*, particularly in the language of multilevel modeling.

In summary, the process of using a systems approach to define a problem includes: (a) the observer (or researcher) of a problem first drafts what he/she believes to be the system in which the problem occurs, including the relevant environment/context; (b) the perceived system and its subunits emerge from a combination of sources that include: empirical research, theoretical constructs, commonly held attitudes and beliefs, and the creativity employed by the beholder of the system; (c) the system is then examined from multiple perspectives, ideally both by the beholder of the system, and others who have knowledge of the problem/system; and (d) these efforts occur over time and result in modifications to the perceived system by the beholder as he or she gains greater knowledge of the system.

In the present study, the system of interest is illustrated in Figure 1:

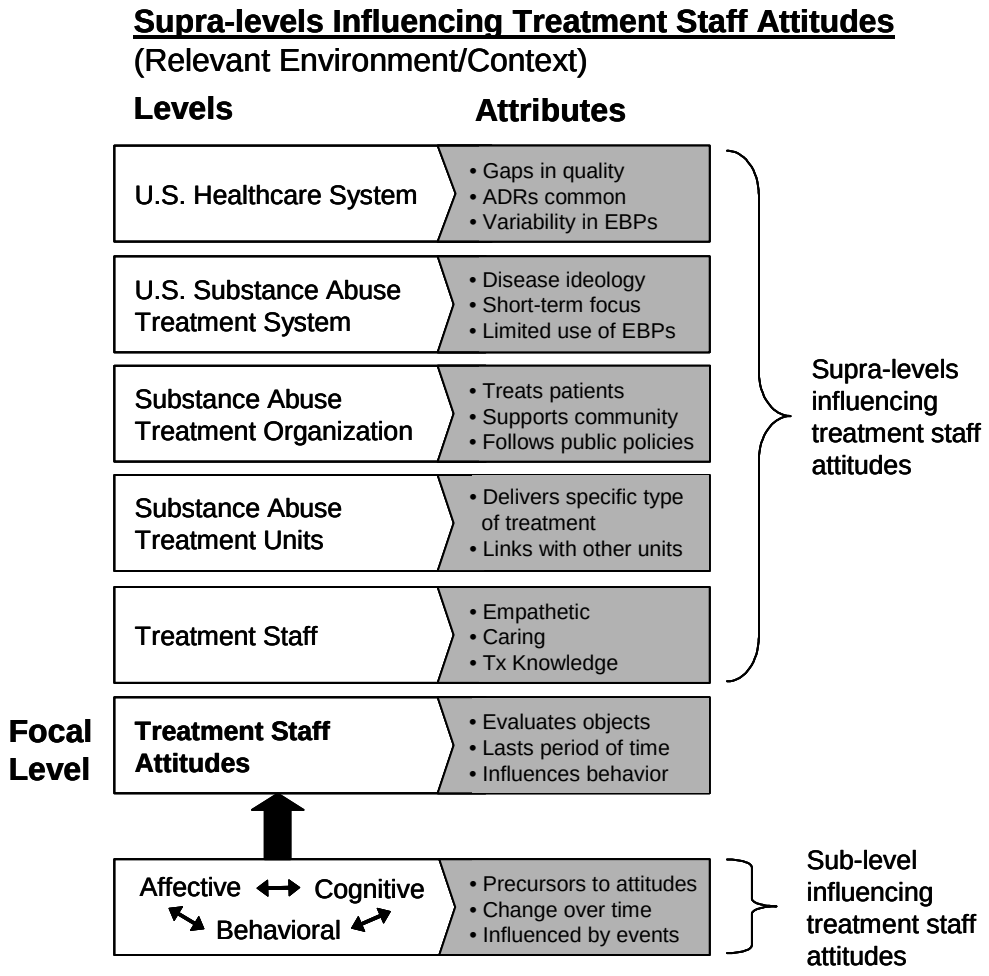

Figure 1. Levels influencing treatment staff attitudes toward use of addiction medications

Although there are numerous systems embedded within the different levels, the one that is most pertinent to the present study is the system related to treatment staff attitudes. The term *focal level* refers to the system that I, the beholder, am choosing to focus on in the study, and the system defining the problem of interest. At this level, attitudes are perceived at the unit-level, while the subunits of that system are found in

the level below (i.e., sub-level). Eagly and Chaiken (1993) suggested that attitudes emerge from the combined interaction of affective, behavioral, and cognitive subunits, and characteristically last for a period of time. The primary attributes of the attitude system pertinent to this study (also called *focal attributes*) include evaluating objects (e.g., value of addiction medications) and influencing behavior. Treatment staff attitudes also are the *dependent variable* of interest in the present study, meaning that an attempt is made to understand what other (independent) variables predict treatment staff attitudes, specifically the attitudes that do not support use of addiction medications.

As mentioned previously, the current literature on attitudes toward addiction medications tends to use research designs that focus on one level of analysis, typically the individual or organizational-level. Such *single-level designs* are common in the literature, but suffer from the limitations discussed earlier. In this study, treatment staff attitudes are predicted from multiple independent variables occurring on two supra-levels: treatment staff and substance abuse treatment units. This *top-down, cross-level research design* facilitates the investigation of how higher-level factors may directly or indirectly affect treatment-staff attitudes (Kozlowski & Klein, 2000). This research design is well supported by the existing CTN data set described in Chapter 1.

In Figure 1, the relevant environment not only includes the system of interest and the levels associated with the data set that influence the system of interest, but it also includes two further supra-levels: the U.S. substance abuse treatment system and the U.S. health care system. Although no data are analyzed in this dissertation related

to either of these levels, they nevertheless indirectly influence the study in a number of ways, and provide a context that significantly contributes to understanding why there exists a lack of support for addiction medications. In the next chapter, the literature review begins by detailing how the U.S. health care and substance abuse treatment systems both struggle with problems related to quality of patient care and the implementation of EBPs that very much influence attitudes of those working within these systems.

2.3 The Systems Approach to Problem Solving

Although the primary objective of this research is to gain greater knowledge about the general lack of support for addiction medications by treatment staff, a second objective is to explore how the study results can influence the development of effective interventions to improve this situation. Here, a systems approach refers to the methodology utilized to achieve an optimal solution to the defined problem. Expanding on the above definition, a *systems methodology* refers to all the steps involved in taking knowledge about a system and applying it to the process of optimizing a solution. A useful characterization of this process is given as a set of seven logical steps (Hall, 1989):

1) ***Problem definition***: Encompasses all the efforts necessary to gain an accurate picture of the problem, including: defining the system and its life cycle, identifying the relevant environment, collecting information about costs, risks and benefits related to stakeholders, and quantifying and clarifying the need

that creates the problem. In essence, this step answers the question: "Where are we now?"

2) ***Value system design***: Involves defining the set of objectives and goals that will guide the process of identifying options for solving the problem. It involves defining a vision of the ideal system or solution, and the values that will be used to guide the process used to reach that optimal solution. This step answers the questions: "Where do we want to be, what values will guide us in the process of getting there, and how do we *measure* attainment of the objective(s)?"
3) ***Systems synthesis***: Requires exploring different alternatives for reaching a solution and applies a decision criterion to whether an alternative is viable. It answers the question: "What are the possible options for solving the problem?"
4) ***Systems analysis***: Examines the various alternatives delineated in the previous step by applying the values, goals, and objectives outlined in the second step. Options are reduced, and the process answers the question: "What are the best alternatives or options for solving the problem based on where we want to be?"
5) ***Optimization***: Involves fine-tuning the most viable options for problem solving, and entails interaction of the previous four steps. This step answers the question: "How can we optimize the alternative solutions so that each is the best it can be?"
6) ***Decision making***: Involves evaluating the alternatives as refined in Step 5 and selecting a solution. Key to this step is the use of decision criteria (defined in

Step 2) that allows for all alternatives to be evaluated in the same way. It answers the question: "What is the ideal solution to the problem?"

7) ***Planning for action***: Encompasses all the tasks involved in communicating the chosen solution to those who will implement it, including allocating the necessary resources and determining how to monitor the outcomes. It answers the question: "How best can we implement the solution?"

These steps provide a logical framework for understanding a problem and how to go about solving it. In the present study, the above steps provide a useful framework for examining interventions specific to addiction medications (cf. Section 7.3).

Thus far, an assumption has been made that if a problem is understood sufficiently by using a systems approach, and the above systems methodology is applied, it is possible to arrive at a useful intervention or solution to that problem. But consider the words of Linstone:

> When we talk about a "problem" we assume a solution exists. We have been brainwashed in school: a textbook presents a problem only if there is a solution (often in the back of the book). Such books do not point out that in the living world every new solution provided by a technology creates new problems. Public health measures cut the death rate; but this result, in turn, fueled a global population explosion. The introduction of European agriculture techniques in Africa produces food in the short term and desertification in the long term. It would be more nearly correct to state that we shift problems rather than solve them (Linstone, 1999, p. 13-14).

Although the intention is not to create more problems by finding ways to increase support for addiction medications, it would be foolish to not at least consider the possibility that such an outcome may have some undesirable side effects. As suggested

above, perhaps the best way to address this issue is by using the systems approach, and examining the related issues from multiple perspectives.

2.4 Multiple Perspectives

As discussed in Lendaris (1986), the definition of system provided in Section 2.2 entails the need to adopt a variety of perspectives – both vertically and horizontally – as well as a variety of consciously selected perceptual filters by the observer/perceiver, to enable a fuller definition and/or understanding of the system of his/her focus. A particular set of perspectives (really, perceptual filters) for the study of *socio-technical* systems were proposed by Linstone (1999), and are among the most effective tools for examining such systems, and for considering how various interventions would be received by those they impact. Linstone (1999) suggested that complex problems exist within dynamic, socio-technical systems, and can be usefully viewed through three different *perceptual filters*: (a) technical perspective, (b) organizational perspective, and (c) personal perspective (abbreviated as *TOP approach*). Here, the term *perceptual filter* is used interchangeably with *perspective*, and defined as one lens, among many, that an individual uses to make sense of the world. Each perspective is unique, offering insights not possible with the other perspectives. Imagine the difference between seeing an object three-dimensionally (3D) versus two-dimensionally. A (single) photograph of Mt. Everest provides significantly less information compared to what would be available if one were physically in the presence of the world's highest mountain (particularly if in an aircraft). It is by integrating the three different perspectives that a clearer

understanding of lack of treatment staff support for addiction medications *emerges*, and Aristotle's famous words, "the whole is more than the sum of its parts; the part is more than a fraction of the whole" ring true. In using the TOP approach, a balance is sought among the perspectives so that one particular perceptual filter does not result in gross imbalances that impede the ability to see a problem, system, or solution as clearly as possible.

The *technical perspective* (T) represents the traditional way of viewing the world through the lens of rationality and the scientific method. The focus is on understanding through logic, quantification, mathematics, and by maintaining objectivity. What cannot be measured is assumed to be not important or to exist at all. It is a perspective that is reductionist, making the assumption that the sum of the parts is the whole, and that it is possible to split a system into subunits that can be studied individually to gain knowledge of the entire system. Decisions made through the T perspective often use cost-benefit analysis, statistics, and probability theory to arrive at the best solution to a problem. The T perspective is a dominant theme running throughout this study, following closely the scientific method.

The T perspective has received a great amount of attention in the addiction field as a result of recognizing that a significant gap exists between what is known from scientific research and the approaches used most often in clinical practice (Institute of Medicine, 1998, 2001). Studies have indicated that clinicians have for years avoided interventions with significant empirical support, choosing instead to employ treatments that often have little foundation in science (Institute of Medicine,

1998). Although the gap between research and practice has focused considerably on understanding why the treatment field has largely ignored evidence-based treatment interventions, it is clear that the behavior of clinicians cannot be solely understood by a T perspective and another perspective is necessary.

The *organizational perspective* (O) represents the social aspects of a system or problem, typically from the perspective of a group or organization. Behavior is understood through the actions of the group, and problems are most often solved to protect the stability of the group or organization. The O perspective examines the structure of an organization and how that structure operates to maintain stability and control of the people within it. Problems are often viewed as short-term and solved through interventions that maintain the best interests of those in power. Among the best illustrations of this perspective is the political arena, where decisions about complex problems are often based on doing what will result in reelection instead of what may benefit society in the long-term.

The O perspective plays a critical role in the present study, both in understanding the problem and in the development of interventions. A limited number of studies (Fuller et al., 2005; Roman & Johnson, 2002; Thomas et al., 2003), reviewed in detail in the next chapter, have shown that lack of clinician support for medications may in part be explained by organizational characteristics, including culture, size, and structure (i.e., in this case, services offered). Perhaps among the most predictive is the case where the organizational culture adheres strongly to a *12-step treatment orientation*, an approach rooted in the long-standing self-help group

Alcoholics Anonymous (AA). Historically, AA understands addiction to be a spiritual problem, thereby requiring a spiritual solution. Within this treatment approach, there is little need for medications, and in fact, medications may be viewed as distractions getting in the way of the spiritual transformation that is necessary for recovery. Thus, interventions to successfully increase support for medication use have to consider the many organizational factors that influence the use of medications in treatment, including: (a) organizational culture and climate, (b) costs associated with the delivery of medications, (c) patient populations, and (d) organizational risks inherent in using medications. Interestingly, despite the control, structure, and status quo behavior of organizations and groups, one individual can change everything, resulting in the need for the third perceptual filter.

The *personal perspective* (P) is represented through the eyes of the individual and his or her own thoughts, feelings, and behaviors. The goal of using this perceptual filter is to understand individuals' self-interests, intuition, and power within socio-technical systems. It also helps explain how and why decisions are made under a wide range of conditions including: (a) crisis situations, (b) development of policies where there is significant variability in individual beliefs, and (c) times when there exists an overload of information. History is rich with examples where understanding an event necessitates taking a P perspective. For example, the liberation of India from British rule would be ill understood if the actions of Mahatma Gandhi were not taken into account. Also, the avoidance of nuclear war during the Cuban Missile Crisis can only

be appreciated by examining the actions of President John F. Kennedy. Thus, the P perspective is a powerful filter that augments the other two perspectives.

Much of the current research devoted to understanding lack of support for use of addiction medications focuses on attitudes of individual treatment staff. Studies reviewed in the next chapter reveal that individual differences in education, clinical experience, and job role can indeed account for some of the variability in attitudes related to addiction medications. There is also evidence that when a treatment director supports use of medication it is more likely that staff counselors will follow suit. Later in this dissertation, diffusion of innovation theory is reviewed, which provides a framework for understanding how and why particular innovations spread through a social system. Within diffusion theory, there is evidence that influential individuals can come from any level of an organization. Such individuals are commonly referred to as *opinion* or *thought leaders*, and often they are among the early adopters of a new innovation. In the present study, the individual or P perspective is critical, but only when balanced with the other two perspectives.

Summarizing this section, the TOP approach offers a powerful set of lenses to investigate complex issues in socio-technical systems, and at the same time it offers useful insights when employing a systems methodology for problem solving. In the end, understanding lack of treatment staff support for addiction medications ideally emerges from the integration of the three perspectives.

This chapter provided an overview of the systems approach, and highlighted some of the limitations of prior studies. It also served as an introduction to many of the terms used in a systems approach, and suggested definitions that will be used throughout this dissertation. In the next chapter, the literature review serves to fill in many of the details regarding what is known about medications to treat substance abuse disorders within the framework outlined in Figure 1. That discussion begins by reviewing studies about the U.S. health care and substance abuse treatment systems, and then proceeds to explore the details of current addiction medicines and what is known about the barriers to their use.

Chapter 3: Literature Review

In keeping with a systems approach, this chapter begins by reviewing the literature that helps define the relevant environment or context in which the perceived problem (lack of treatment staff support for addiction medications) occurs. It first considers the role of the U.S. health care system, since addiction treatment programs are embedded in this larger system. Recent reports about the U.S. health care system indicate there are significant deficits in quality of care and several issues surrounding the use of medications in general. These findings help provide a frame for a more detailed discussion of quality related to substance abuse treatment. The second section of this chapter reviews medications specific to the treatment of substance abuse disorders, and concludes there is significant evidence that a number of medicines, when used in conjunction with psychosocial therapies, improve patient outcomes.

Despite the evidence of improved patient outcomes, medications to treat substance abuse disorders remain underutilized in practice, the topic of the third section in this review. Studies suggest multiple barriers, but as pointed out in the previous chapter, most have ignored the hierarchical nature of the data and have given little attention to the relationships between individual and organizational factors. Inherent in all these studies, however, is the theory behind why some technologies become widely adopted, while others fail to gain an audience. The fourth section tackles this topic by reviewing diffusion of innovation theory and how it pertains to addiction medications. Finally, the review concludes with a discussion of the National Drug Abuse Clinical Trials Network. The latter research, funded by NIDA is an

attempt to bridge the gap between practice and research in the addiction field. It is also the source of the data for the present study.

3.1 The Treatment System

3.1.1 Quality of Health Care in the United States

To better understand the present state of the substance abuse treatment system, it is first useful to recognize that it is but one component of a much larger health care system, one that in recent years has been under considerable scrutiny. A brief review of the quality of health care in the United States helps frame a more detailed discussion that follows on quality related to substance abuse treatment and medication.

In 1999, the Institute of Medicine published its first of three reports on the quality of health care delivered to Americans. *To Err Is Human: Building a Safer Health System*, focused specifically on patient safety. The report delivered a scathing critique of how patient safety is significantly jeopardized as a result of medical errors that on the whole are preventable. The authors concluded that "tens of thousands of Americans die each year from errors in their care, and hundreds of thousands suffer or barely escape from nonfatal injuries that a truly high-quality care system would largely prevent" (Institute of Medicine, 2001, p. 2).

Studies investigating the incidence and prevalence of errors fall into two categories: general studies of patients' experiencing adverse events that may include medication-related events, and studies related more specifically to errors in use of medication. Adverse events are those in which the patient injury is caused by an error in medical management rather than the underlying condition of the patient. Most

studies on adverse events focus on hospitalized patients, the most extensive being the Harvard Medical Practice Study conducted in 1984 (Brennan et al., 1991; Leape et al., 1991). In a review of over 30,000 randomly selected patient discharges from 51 randomly selected hospitals in New York State, adverse events occurred in 3.7% of hospitalizations. Adverse events included: drug complications (19%), wound infections (14%), and technical complications (13%). In 13.6% of the cases, the error resulted in death, and in 2.6% of the cases the error led to a permanent disabling injury. The errors were considered preventable in 58% of the cases.

Results from the above study were further corroborated in 1992 when a similar review process was applied to 14,732 randomly selected discharges from 28 hospitals in Colorado and Utah (Thomas et al., 1999). Adverse events occurred in 2.9% of hospitalizations, with one out of every five events occurring prior to admission in a non-hospital setting (e.g., physician's office, patient's home). The reviewers detected 459 adverse events costing in total, $661,889,000 (health care costs, lost wages, lost household production). Of this, $348,081,000 was attributable to health care costs. Of these adverse events, 256 were considered preventable (53%) and their prevention would have yielded a total cost savings of $308,382,000 ($159,245,000 from health care). Adverse events were classified into several categories including: operative (35%), drug related (32%), diagnostic or therapeutic (17%), procedure related (9%) and other (6%).

When the results from these two large studies are extrapolated to the 33 million hospital admissions in 1997, the national costs of adverse events exceeds $37 billion

and implies that as many as 98,000 patients die each year as a result of preventable medical errors (Institute of Medicine, 2000). Although medication errors were among the most common adverse events in the above two studies, the majority of these errors did not result in death or serious injury (Institute of Medicine, 2000). Successfully increasing use of addiction medications will necessitate balancing effectively the benefits and risks, and finding mechanisms to protect patients from adverse drug events (cf. Section 7.4).

Studies focused specifically on errors in use of medication are quite common in the U.S. due to the vast numbers of people affected by medications, the prevalence of medication errors, and the costs involved. A study that reviewed U.S. death certificates in 1983 and 1993 found that 7,391 people died as a result of medication errors in 1993, compared to 2,876 deaths in 1983 (Phillips, Christenfeld, & Glynn, 1998). This represents an 8.48-fold increase in outpatient deaths and a 2.37-fold increase in inpatient deaths during the 10-year period. In another study that analyzed 289,411 medication orders written at a teaching hospital during a one-year time period, the overall error rate was estimated to be 3.13 errors for every 1000 orders written (Lesar, Briceland, & Stein, 1997). In a meta-analysis of 39 prospective studies from U.S. hospitals investigating the incidence of adverse drug reactions (ADRs) between 1966 and 1996, the overall incidence of serious ADRs was 6.7% and the incident of fatal ADRs was .32%. The authors estimated that in 1994 about 106,000 hospital patients died due to ADRs and that fatal ADRs rank somewhere between the fourth and sixth leading cause of death in the U.S., a finding that has remained stable

for the last 30 years. In a more recent study of ADRs, Gurwitz et al. (2005) followed all residents in two long-term care facilities (i.e., nursing homes) from 2000 to 2001 and found that the rate of adverse drug events was 9.8 per 100 resident-months. The rate for preventable adverse drug events was 4.1 per 100 resident-months. If these findings are extrapolated to the 1.6 million residents in U.S. nursing homes, the authors concluded that about 1.9 million ADRs may occur each year, of which approximately 40% are preventable (Gurwitz et al., 2005).

Perhaps the most important finding from the IOM report *To Err Is Human: Building a Safer Health System* was that the results from the above studies on adverse events and medication errors were primarily a function of the *system* in which they occurred rather than the fault of any one person or group of people. In most cases, when errors occur, "it is due to multiple faults that occur together in an unanticipated interaction, creating a chain of events in which the faults grow and evolve (Institute of Medicine, 2000, p. 52)." Consequently, the report called for a national effort to improve patient safety and outlined several recommendations to accomplish this goal. But in a critique of the progress made in the five years since the report's publication, Leape and Berwick (2005) concluded that in spite of some improvements, the overall health care system is not demonstrably or measurably safer. The authors suggested that the primary barriers to progress include: (a) difficulties in changing complex medical systems; (b) professional fragmentation; (c) a culture of medicine that promotes individualistic, hierarchical authority structure, and diffuse accountability; (d) individual habits and belief systems; and (e) organizational leadership.

The second report published by the IOM, *Crossing the Quality Chasm: A New Health System for the 21st Century* (2001), provides an even broader framework for understanding the context of lack of use of medications in the addiction field. Unlike the first IOM report that focused narrowly on patient safety, this report examined the quality of health care using a much wider lens. Central to the report was a review of over 70 peer-reviewed journal articles published from 1987 to 1998 on studies specific to health care quality across a broad range of medical domains including the field of addiction. In summary:

> The dominant finding of our review is that there are large gaps between the care people should receive and the care they do receive. This is true for preventive, acute, and chronic care, whether one goes for a checkup, a sore throat, or diabetic care. It is true whether one looks at overuse, underuse, or misuse. It is true in different types of health care facilities and for different types of health insurance. It is true for all age groups, from children to the elderly. And it is true whether one is looking at the whole country or a single city (Institute of Medicine, 2001, p. 236).

Despite the increasing attention to the quality of the system, only one study examined issues related to addiction. Regier and colleagues (1993) reviewed prevalence rates of mental and addictive disorders and subsequent treatment utilization. The authors concluded that a huge gap exists between the number of people needing treatment and those actually receiving it. They found that less than one third of those identified with a mental or addictive disorder received any kind of treatment in the year prior to being interviewed, and less than a quarter of those with substance abuse disorders received any care (Regier et al., 1993). In fact, of the total population in need of substance abuse treatment, Epstein & Gfroerer (1998) found

that only about 20% received any kind of care in a given year, a trend that continued throughout the 1990s in spite of increased treatment needs.

Although underutilization of medications in substance abuse treatment was not mentioned specifically in the report (Institute of Medicine, 2001), other examples of both underuse and misuse of medications across a broad range of medical conditions were documented. The reasons behind these and other gaps in health care quality, came down to four key factors: (a) growing complexity of science and technology; (b) increases in the number of chronic conditions; (c) poorly organized delivery system; and (d) constraints on exploiting the revolution in information technology. These four factors do not operate independently, but are best understood from a *systems perspective*, where each factor may exacerbate the effects of the others.

Not surprisingly, the report called for a redesign of the health care system to address the identified problems, and it outlined several recommendations to improve quality of care. Among them was the need to incorporate systematically scientific knowledge into clinical practice (Institute of Medicine, 2001). The report pointed out that it takes an average of 17 years before new knowledge generated by randomized controlled trials is incorporated into practice, and even then adoption rates vary considerably among users (Balas & Boren, 2000). The gap between scientific evidence and clinical practice in large part reflects the failure of dissemination efforts to reach clinicians and patients.

Recognizing that health care for mental and substance use conditions have unique characteristics (e.g., coercion into treatment, inconsistent delivery systems and

infrastructure, and universal quality measures), the IOM published a third report titled *Improving the Quality of Health Care for Mental Health and Substance-Use Conditions: Quality of Chasm Series* (Institute of Medicine, 2006). The report offered a more comprehensive examination of the quality of services specific to mental health and substance abuse treatment compared to the previous IOM publications. The report documented that every year about 33 million Americans seek treatment for mental health and substance abuse problems, and that millions more report that they could benefit from treatment but do not receive it. Across the many diverse illnesses, diagnoses, and conditions for which people seek help, the report provides significant empirical evidence that effective treatments are available.

> The results of research to date have revealed our lifelong ability to influence the structure and functioning of our brains through manipulation of environmental and behavioral factors (our brains' "plasticity") and have enabled the development of improved psychotherapies ("talk" therapies), drug therapies, and psychosocial services. Effective mental health interventions range from the use of specific medications (such as clozapine) to treat schizophrenia better in some people to the application of specific models for treating depression in primary care and providing supported housing for homeless persons with mental illness. Those and other mental health interventions have been demonstrated to be cost-effective (Institute of Medicine, 2006, p. 4).

Further, the report documented the range of effective psychosocial and pharmacological interventions to treat substance abuse disorders. Medications including naltrexone, buprenorphine, and methadone – all of which are examined in the present study, are provided as examples of effective treatments that are underutilized in practice.

In a review of studies published from 1992 to 2000 assessing the quality of care for those suffering from a wide range of mental health or substance use disorders, it was found that about 75% of the treatment did not adhere to established clinical practice guidelines (Bauer, 2002). A number of other review studies outlined in the IOM report provided further evidence that, across the spectrum of mental health and addiction problems, more often than not, the care individuals receive is not consistent with the best known treatments available (Institute of Medicine, 2006). The report further details how such gaps in quality of care have significant consequences for the nation.

> Consequences are felt directly in the workplace; in the education, welfare, and justice systems; and in the nation's economy as a whole. Together, unipolar major depression and drug and alcohol use and dependence are the leading cause of death and disability among American women and the second highest among men (behind heart disease) (Institute of Medicine, 2006, p. 6).

The report concluded by providing evidence that the framework for improving quality across the general healthcare system, outlined in the previous two Quality of Chasm reports, can also be used to effectively improve care for mental and substance use disorders.

In summary, findings from the IOM reports on quality of health care in the U.S. suggest that: (a) adverse medical events and errors in medication use are quite common, often preventable, and in numerous cases lead to death; (b) despite initiatives to improve patient safety, little has been accomplished; (c) there exist significant gaps in health care quality across a broad range of medical domains including the field of addiction; (d) scientific knowledge is slow to be, or often not

incorporated into clinical practice; and (e) there is a need to redesign the health care system to improve patient safety and overall quality of health care. Taken together, these findings not only represent challenges for the entire U.S. health care system, but they also reflect many of the problems currently existing in the substance abuse treatment industry.

3.1.2 The Practice-to-Research Gap in Substance Abuse Treatment

In 1998, the Institute of Medicine published *Bridging the Gap Between Practice and Research: Forging Partnerships with Community-Based Drug and Alcohol Treatment,* a review focusing on the quality of care in substance abuse treatment. Although predating the IOM reports on health care quality, the findings were remarkably similar in many respects, highlighting significant deficiencies in quality, fragmentation of stakeholders, and the need for improvement in many areas of delivered care. The central message was that gaps in quality were in large part the result of a disconnect between scientific knowledge and clinical practice (Institute of Medicine, 1998). The IOM committee charged with investigating the gaps held numerous discussions with treatment providers, researchers, policy makers, and a host of other stakeholders. Among the first lessons learned was that each of these groups operate from a different mental model, or deeply held set of beliefs and assumptions about how the world, and specifically substance abuse treatment, work. Consequently, these groups made little use of each other's knowledge base, resulting in a community-based treatment system that has largely ignored scientific advancements in addiction treatment during the past 30 years (Rawson, Marinelli-Casey, & Ling,

2002). Evidence for the gaps between practice and research were outlined in the report and included five critical areas.

Different perspectives: Researchers value the scientific process and live in a world of data, statistics, and randomized clinical trials. Truth is based on *p*-values and the replication of results over time. They often become frustrated by clinicians' lack of support for EBPs and believe clinicians to be naïve and ignorant about the necessity for empirical principles in substance abuse treatment. Clinicians, on the other hand, place significant value on personal experiences, mentoring relationships, experiential processes, and ideological positions. They see researchers as mechanistic since they have never sat with a client in a therapy session and are unable to appreciate the real-world challenges of diverse patient populations (Rawson et al., 2002). Policy makers provide a third perspective. They complain that the information they need to make good decisions is often buried in volumes of journal articles and written in a language that does not provide clear guidance for practice. Further, they say that research findings are often published long after they could be of value. Finally, consumers of substance abuse treatment services come from a position that seeks knowledge about the most effective treatment interventions. Yet, unlike other chronic medical conditions for which there is a vast amount of popular literature, relatively few publications exist for the general public about substance abuse treatment incorporating current scientific knowledge.

Underutilized research findings in practice: The IOM report (Institute of Medicine, 1998) identified numerous examples where effective interventions

developed from research were generally not utilized or underutilized in practice. These EBPs included both psychosocial and pharmacological approaches to treatment. Among the most researched and supported of the psychosocial interventions is contingency management, an intervention that involves the use of positive reinforcements to increase desired behaviors such as abstinence from illicit substances (Higgins et al., 1994). Despite evidence of its effectiveness in both laboratory and clinical settings in multiple clinical trials, the IOM report documented that it has not been widely adopted in practice. Another example is the underuse of the *community reinforcement approach* (Hunt & Azrin, 1973; Smith, Meyers, & Miller, 2001). This intervention, now over 30 years old, has consistently been rated among the most effective psychosocial treatments for alcoholism in multiple meta-analytic reviews (Finney & Monahan, 1996; Holder, Longabaugh, & Miller, 1991; Miller et al., 1995), yet it remains practically unknown to most clinicians. Most significant to the present study was the lack of support by treatment staff for use of medications to treat opioid and alcohol dependence. Details of the medications and evidence for their underutilization are considered in detail in the sections that follow. Although the present study focuses on understanding attitudes related to the lack of support for use of addiction medications, the need to examine why other psychosocial EBPs are underutilized remain equally important. In the end, if substance abuse treatment outcomes are to be optimized, treatment providers will need to use a wide range of EBPs that will include *both* psychosocial and pharmacological interventions.

Service delivery approaches: Because many who struggle with substance abuse also suffer from physical, emotional, social, and economic hardships, programs recognize the necessity to offer supplementary services in their treatment approaches. Such services include case management, tailored interventions for women and children, and so called "wrap-around" services that include medical care, legal assistance, and career counseling. Although the benefits of such interventions have been documented (McLellan, Alterman, Metzger, Woody, & O'Brien, 1993), the IOM report called for increased research to assess more fully the role such services play in outcomes across a variety of treatment settings.

Treatment approaches understudied in research: Just as treatment providers have underutilized research findings, researchers have failed to investigate many current treatment practices. Underscoring this point is the abundance of *efficacy* research and the lack of *effectiveness* research (cf. Section 3.2) (Institute of Medicine, 1998). In a comprehensive review of the treatment outcome literature, the IOM report concluded that there is a significant lack of effectiveness research. Many studies have purposely excluded important classes of patients who are common in community-based treatment programs, often because such patients make it more difficult to study an intervention under controlled conditions. Researchers have also studied interventions requiring resources that are not realistic in the current treatment environment, assuming that if the interventions are successful the resources can be found.

Policies that impede treatment: A final gap involves the barriers created by state and federal legislation that hinder successful adoption of EBPs. For example, methadone is the most regulated medication in the nation, requiring patients and providers to adhere to a long list of federal requirements (discussed later in this chapter) and limiting its wide spread adoption by those who could benefit (Institute of Medicine, 1998). Another barrier is the need for states to amend individually their narcotic regulations to incorporate new medications, a time-consuming process that has significantly hindered the implementation of beneficial treatments. There are also financial, paperwork, and treatment policies that the IOM report suggested needs reexamination.

Taken together, these issues present significant challenges to the substance abuse treatment system. Similar to the IOM findings on quality of health care in the U.S. (2001; 2000), use of scientific knowledge is lacking throughout the substance abuse treatment industry, and efforts are needed to redesign the system to improve patient access and overall quality of care. However, such an undertaking will require addressing numerous barriers that hinder closing the gaps between practice and research. The IOM report (1998) identified six broad barriers to improve substance abuse treatment that may impede communication and cooperation among researchers, clinicians, and policy makers.

Structure: The typical treatment program is a small organization, employing fewer than 30 staff, and most often reliant upon state and federal funding to remain in business. Such programs face substantial challenges to find the resources necessary to

improve "wrap-around" services, hire medical staff to prescribe and dispense medications, or train clinicians on new EBPs.

Financing: Most treatment programs rely on a combination of public funds through block grants, Medicaid, and state funding sources. Each financial stream comes with a unique set of rules and policies that must be followed, often resulting in a paperwork overload for treatment providers. Further, many funding sources refuse to pay for new treatments, including medications.

Education and training: Staff working in substance abuse treatment programs are far from homogeneous. Differences in formal academic education, recovery status, and licensure and certifications, all lead to very different perspectives about treatment and the need to use EBPs. For example, clinicians in recovery from alcohol dependence who achieved sobriety by utilizing the 12-steps of AA may be less likely to embrace EBPs. They may feel there is little need for EBPs when the active ingredient of change from their perspective is the acceptance of a higher power.

Stigma: Ignorance and prejudice about addiction remain commonplace throughout society. These problems are in part related to deficits in addiction education in medical and graduate schools, citizens supporting treatment but not wanting the programs located in their communities, and decreased funding for treatment technologies.

Lack of knowledge about technology transfer: Despite the long history of diffusion research (Rogers, 1995, 2003), few studies have examined diffusion of substance abuse treatment technologies. Absent a clear, systematic approach to

implementing new technologies into practice, researchers and clinicians will likely remain frustrated with clinical outcomes. Recent diffusion models specific to addiction treatment offer hope and are reviewed later in this proposal (Simpson, 2002; Thomas et al., 2003).

Policy barriers: Local, state and federal policies can significantly impact who gets treatment and the quality of care. Treatment funding often is a function of the degree to which policy makers believe it is cheaper than putting substance abusers behind bars, rather than acknowledgement that addiction is a treatable condition (Institute of Medicine, 1998).

Perhaps the most significant contribution of the IOM report (1998) was that it provided solid recommendations for how to improve the substance abuse treatment system. Soon after publication, both NIDA and CSAT released funding initiatives aimed at bringing researchers and clinicians together to address collaboratively the "gaps." In January 1999, NIDA introduced the National Drug Abuse Clinical Trials Network (CTN) that partnered university-based research centers with community treatment programs. What started as five nodes has now grown to 17 nationwide, an indication that the CTN has shown it is possible to bridge the cultural divide between researchers and clinicians. In addition, the *NIDA Clinical Toolbox: Science-based Materials for Drug Abuse Treatment* was disseminated to nearly 12,000 programs nationwide (Rawson et al., 2002). At the same time, CSAT aggressively increased efforts to close the gaps through a number of initiatives that included: (a) publishing *The Change Book: A Blueprint for Technology Transfer* (Addiction Technology

Transfer Centers, 2000); (b) funding 14 Community-Based Practice Improvement Collaboratives (PICs) nationwide to foster knowledge exchange among key community stakeholders; and (c) publishing 38 Treatment Improvement Protocols (TIPs) designed to be best-practice guidelines for a wide range of topics related to substance abuse (free publications available to treatment providers).

In summary, many positive changes are occurring within the treatment field, but as one researcher put it, "It is clear that researchers and practitioners are beginning to dance together, but it is unclear if the dance will look like a waltz or like the funky chicken" (Rawson et al., 2002, p. 948). At the center of the dance is the need to bring EBPs, including the use of effective medications, to the forefront of treatment. Yet studies consistently indicate that when it comes to use of addiction medications, clinicians have not been overly supportive. Before delving into why this is so, it is first useful to understand a bit about the medications that have been approved for the treatment of substance use disorders, the topic of the next section.

3.2 Medications to Treat Substance Use Disorders

Significant advances in understanding the neurobiology of addictive disease have occurred during the past couple of decades, yet these discoveries have resulted in just a handful of medications that have successfully been brought to market (Institute of Medicine, 1998; Vocci, 2003a, 2003b). Currently, FDA approved drugs exist for the treatment of alcohol and opioid dependence, yet none have achieved widespread acceptance, a topic reviewed hereafter. Considering that 16 million Americans abuse alcohol and 19 million abuse illicit drugs (U.S. Department of Health and Human

Services, 2005), the stakes remain high for increasing use of currently approved drugs and developing new medications for the treatment of addiction. This section reviews FDA approved medications specific to the treatment of substance abuse disorders, and provides a brief overview of what the future holds. Attention is focused on naltrexone, methadone, and buprenorphine, the three medications involved in the present study.

Studies conducted to test medication effects generally fall into two categories. *Efficacy* research refers to those studies that test the impact of a medication under controlled experimental conditions. The primary advantage of such studies is that they demonstrate the degree to which an outcome can be attributed to the effect of the medication (i.e., they maximize internal validity). This in part is accomplished by selecting study participants that meet specific criteria aimed at screening out extraneous factors that may confound the treatment effects. For example, participants in a study to test a medication for alcohol dependence might be required to have no other mental health diagnoses and no recent history of any other substance abuse. Such restrictions improve the internal validity of the study, but decrease the external validity of the results since study populations are often not representative of the populations of people who seek treatment.

Studies conducted under more realistic, real-world treatment conditions are often referred to as *effectiveness* studies. Medications are tested in various treatment settings (e.g., residential, outpatient), during particular times of treatment (e.g., beginning, middle, or end of treatment), and often with patients that have multiple co-occurring disorders. When treatment effects are found, such studies indicate the degree

in which a medication can be generalized to other settings, times and conditions. The downside of such studies is that findings can often be hard to interpret when confounding variables are present. Where efficacy studies maximize internal validity at the expense of external validity, effectiveness studies have the opposite effect; they maximize external validity at the expense of internal validity. It is also worth noting that randomized controlled trials (RCTs) are often associated with efficacy research, but effectiveness studies can also be RCTs as well. Approved FDA medications to treat substance abuse disorders have all been subjected to both efficacy and effectiveness research to some degree, however efficacy studies are generally more common.

3.2.1 Medications to Treat Alcohol-Use Disorders

Currently, there exist three FDA approved medications to treat alcohol abuse disorders: disulfiram, naltrexone, and acamprostate. Disulfiram (Antabuse®) has been used for over 50 years and is available in both oral and implant forms. It impacts the metabolism of alcohol, resulting in unpleasant symptoms (e.g., nausea, vomiting, flushing) when even small amounts of alcohol are ingested. More than 135 studies have investigated its efficacy and effectiveness, yet only a handful of these have been RCTs (Garbutt, West, Carey, Lohr, & Crews, 1999). In spite of widely-held beliefs by counselors that disulfiram reduces drinking and deters relapse, the evidence suggests strongly that disulfiram has only moderate effects on alcohol consumption, and virtually no impact on abstinence rates (Garbutt et al., 1999).

Naltrexone (ReVia™), an opiate antagonist available since the 1980s to treat opioid dependence, was approved in 1994 as an adjunct to psychosocial treatments of alcoholism. Currently available in oral and injectable forms, naltrexone is believed to reduce drinking cravings by blocking the release of endogenous opioids associated with the rewarding effects of alcohol (Weinrieb & O'Brien, 1997). Initial RCTs showed naltrexone to be efficacious in reducing drinking frequency and the incidence of relapse (O'Malley et al., 1992; Volpicelli, Alterman, Hayashida, & O'Brien, 1992). Since that time, at least 20 published RCTs have provided additional support that naltrexone is an efficacious, safe, and useful adjunct to psychosocial interventions for reducing drinking behavior and the frequency of relapse (Carmen, Angeles, Munoz, & Jose Maria, 2004; Kranzler & Van Kirk, 2001). However, a few studies have challenged these finding by reporting that naltrexone was found to be no better than placebo (Chick et al., 2000; Krystal, Cramer, Krol, Kirk, & Rosenheck, 2001).

Although shown to be *efficacious* in well-controlled clinical trials, naltrexone's *effectiveness* in community-based treatment settings with heterogeneous populations has been mixed. In a recent study of alcohol dependent patients in a rural community treatment setting, Killeen et al. (2004) found support for use of naltrexone in patients continuing to drink in the early stages of treatment, but found no differences on drinking outcome measures at 12 week follow-up. This finding suggests that it may be more useful in the early stages of treatment to reduce drinking behavior or help patients gain initial abstinence, but not as useful in the long-term management of addiction. The authors suggest that marginal medication adherence, psychosocial

instability, and polysubstance abuse all contributed to the poor outcomes in this study, and further effectiveness research in community-based settings is needed.

In July of 2004 the FDA approved acamprosate (Campral®) as a third alternative for the treatment of alcoholism. Also available in oral form, acamprosate is believed to exert its effect by restoring normal activity of glutamatergic neurotransmission adversely affected by chronic alcohol exposure, but the specific mechanism of action is still not well understood (Mason, 2005). It has been used extensively for the past 15 years, primarily in Europe, and been subject to many RCTs that have found it to be a safe, effective, and efficacious medication for reducing alcohol consumption (Carmen et al., 2004; Kranzler & Van Kirk, 2001; Mason, 2005). Some evidence suggests that acamprosate may be more useful for patients targeting long-term abstinence, whereas naltrexone may be more beneficial in programs focused on reduced or controlled consumption (Carmen et al., 2004).

There is recent evidence that combining acamprosate with naltrexone is more effective than either medication alone when used with cognitive behavioral therapy (Feeney, Connor, Young, Tucker, & McPherson, 2006). The study matched 236 patients across gender, age group, and alcohol dependence severity, and allowed patients to self-select one of three treatment options: (a) naltrexone with therapy, (b) acamprosate with therapy, or (c) naltrexone and acamprosate with therapy. Three groups of 59 patients were assessed over a 12-week period, in addition to a group of patients that chose therapy without any medication. On all outcome measures (e.g., attendance, abstinence rate, and relapse rate) a trend favored the combined medication

and therapy approach, but the results never achieved statistical significance. As an effectiveness study, the authors point out the results are low on internal validity since patients were able to self-select their treatments. Further, issues related to medication compliance and differences between patients who take medications, and those who choose not to, need further investigation.

In summary, disulfiram, naltrexone and acamprosate provide three different pharmacological alternatives to the treatment of alcoholism. Efforts to increase support for use have primarily focused on naltrexone, but acamprosate will likely be a target of future efforts. Both have been subject to multiple RCTs and shown to be safe, efficacious, and beneficial when used concurrently with psychosocial interventions. Other medications have also been tested in the treatment of alcoholism (e.g., nalfemene, SSRIs, lithium, etc.), but results have yet to support their use (Garbutt et al., 1999). One recent innovation to enhance patient compliance is the development of a long-acting injectable naltrexone (Vivitrol™) that became available to patients in late 2006. A recent RCT found it to be well tolerated and effective at reducing drinking days, but its benefit over oral naltrexone has yet to be determined (Garbutt et al., 2005).

3.2.2 Medications to Treat Opioid Dependence

Currently, there are four FDA approved medications for the treatment of opioid dependence: methadone, buprenorphine, levo-alpha-acetymethadol (LAAM), and naltrexone. The most widely prescribed, methadone, was first introduced as a potential treatment against a backdrop of escalating heroin use in the 1960s. Dole and

Nyswander (1965; 1967) are credited with first using methadone as a legal opioid substitution therapy. By acting on the same receptor sites as heroin, methadone satiates addictive cravings, while suppressing withdrawal symptoms for up to 24 hours (i.e., once daily dosing). At the same time, it does not produce sedation or a dulling of consciousness, and is thus unattractive as a drug of abuse (National Institute of Health, 1997). It currently is available in tablet, wafer, and liquid form, and used in 1,105 methadone clinics in 44 states nationwide (American Association for the Treatment of Opioid Dependence, 2004). It is estimated that of the approximate 810,000 heroin addicts in the U.S., about 20% receive treatment in methadone maintenance programs (American Methadone Treatment Association, 1998). Since its introduction as a therapeutic agent for opiate dependence, numerous RCTs have shown a consistent, statistically significant relationship between use of methadone and reductions in illicit opiate use, mortality, crime, and HIV risk behaviors, as well as improved rates of treatment retention and quality of life (Amato et al., 2005; Gossop, Marsden, Stewart, & Treacy, 2001; Marsch, 1998; National Institute of Health, 1997).

Despite being among the most effective evidence-based treatments available (National Consensus Development Panel on Effective Treatment of Opiate Addiction, 1998), its use has historically been plagued by numerous barriers. Many working in substance abuse treatment and the criminal justice system are philosophically opposed to nonabstinence-based interventions, and believe that ongoing use of a prescribed narcotic is immoral and fundamentally opposed to the goals of rehabilitation (U.S. Department of Health and Human Services, 1994). Methadone is also the most

regulated pharmaceutical agent in the nation, requiring providers and patients to follow stringent guidelines that many consider aversive and unnecessary. The NIH consensus statement on methadone treatment went so far as to say "we know of no other area where the Federal government intrudes so deeply and coercively into the practice of medicine" (National Consensus Development Panel on Effective Treatment of Opiate Addiction, p 1940). Although diversion of methadone has been noted (e.g., street trade, theft, etc.), it frequently is the result of patients attempting to self-medicate outside of professional treatment (Cicero, Inciardi, & Munoz, 2005). Finally, lack of physicians trained in addiction interventions and limited funding have inhibited access to treatment (National Consensus Development Panel on Effective Treatment of Opiate Addiction, 1998).

Among the recommendations from the National Consensus Developmental Panel was the need for federal legislative change to improve substance abusing patients' access to opiate medications. Soon after, the *Drug Addiction Treatment Act of 2000* (DATA 2000) was passed, allowing qualified physicians to use Schedule III, IV, or V narcotics approved for treatment of opiate dependence. In 2002, buprenorphine became the first schedule III medication approved by the FDA to meet the criteria, heralding in a long awaited alternative to the often demeaning structure surrounding use of methadone. Patients could now receive treatment in a physician's office, although the Act limited physicians' prescribing to 30 patients at any given time. The limitation was enacted primarily to prevent physician practices from becoming too dependent on buprenorphine prescriptions, and did not apply to group

medical practices or treatment programs. Buprenorphine is a partial agonist, exerting a *ceiling effect* at higher doses that makes it particularly safe in the treatment of opioid dependence, but that limits its usefulness in patients requiring higher levels of full agonist activity for treatment success (U.S. Department of Health and Human Services, 2004). Further, its long duration of action, minimal withdrawal symptoms upon cessation, and low level of physical dependence add to its favorable profile (Ling & Smith, 2002). Currently it is available in two sublingual tablet forms (Subutex® and Suboxone®), but Suboxone® has become the preferred medication because is contains naloxone, an opioid antagonist that helps deter diversion and misuse. Multiple RCTs have shown buprenorphine to be an efficacious treatment for opioid dependence (Amass et al., 2004; Johnson et al., 2000; Ling et al., 2005; Ling et al., 1998; Pani, Maremmani, Pirastu, Tagliamonte, & Gessa, 2000). Similar support is found for the buprenorphine-naloxone combination (Amass, Kamien, & Mikulich, 2000, 2001). Similar to methadone, there is evidence of improved outcomes in combination with psychosocial services (Law & Nutt, 2003).

Two other medications for opiate dependence treatment deserve mention. LAAM was approved by the FDA in 1993 after numerous RCTs showed it to be a safe and efficacious treatment (Fudala, Vocci, Montgomery, & Trachtenberg, 1997; Judson & Goldstein, 1983; Ling, Klett, & Gillis, 1978). It was hailed to quickly overtake methadone as the treatment of choice for opiate dependence, but instead became a lesson in all that can go wrong when attempting to implement a new innovation into practice (Ling, Rawson, & Anglin, 2003). Almost eight years after its approval, fewer

than 2% of opiate dependent patients in the U.S. were using LAAM (Rawson, Hasson, Huber, McCann, & Ling, 1998). A combination of limited marketing, state and federal regulatory hurdles, and the lack of a powerful advocate championing its use all contributed to its failure. Currently, it remains an approved medication by the FDA, but it is not being manufactured by any pharmaceutical company for patient use and is unavailable in pharmacies.

Finally, naltrexone gained FDA approval in 1985 for the treatment of opiate dependence. It is a complete antagonist, blocking the mu opioid receptors and taking away the effect of opiate drugs. It has been primarily used to maintain abstinence following detoxification, but a recent review of RCTs found insufficient evidence to justify its use in maintenance treatment (Kirchmayer et al., 2002). There is some evidence that when naltrexone is used in combination with benzodiazepines, it may improve a patient's ability to maintain abstinence from opiates (Stella et al., 2005).

In summary, methadone has been used successfully for over 35 years as an effective therapeutic agent for the treatment of opioid dependence, and is considered by many to be among the most effective of all addiction treatment interventions. But as successful as it may be, it remains a controversial agent that is used by only 20% of those in need, and has yet to garner consistent support from the treatment community. As an alternative, buprenorphine shows great promise in overcoming many of the methadone hurdles; but as the next section on medication barriers reveals, it remains largely unknown to many in the treatment industry two years after approval. Those

pushing for its adoption need only look to the failure of LAAM to realize that bridging the gap between research and practice can be a daunting task.

3.2.3 Future Directions

The current arsenal of addiction medications may be limited, but significant effort is currently underway to discover new pharmacological agents. There are two primary approaches to the development of new medicines. The first, known as a *top-down* approach, occurs when researchers test whether a medication already on the market for a health issue other than addiction, may have some benefit for those struggling with addiction (Vocci, 2003a). One example is rimonabant, a drug that blocks cannabinoid-1 (CB1) receptors in the brain and used in the management of obesity. It is now being tested as a potential treatment for alcohol dependence since animals studies indicate that blocking CB1 receptors results in animals consuming less alcohol (National Institutes of Health Clinical Trials Center, 2006). Another example is baclofen, a decades-old medication approved for the treatment of muscle spasms and cramps in patients suffering from multiple sclerosis or spinal problems. A recent RCT demonstrated that baclofen may be effective in reducing cocaine use when used concurrently with psychosocial interventions (Shoptaw et al., 2003). At present, there is no approved medication for the treatment of cocaine dependence, but NIDA is currently using a top-down approach to test 21 medicines already on the market as possible options (Vocci, 2003b). Disulfiram (Antabuse) used for alcohol treatment was also recently shown to be an effective pharmacological agent for treating cocaine dependence when used with cognitive-behavioral therapy (Carroll et al., 2004). A

number of the SSRIs, including fluoxetine and venlafaxine, are also current candidates.

Development of new medications also occurs from what is known as a *bottom-up* approach, where new medicines result from scientific discoveries in the laboratory. Numerous drugs are now being assessed for possible treatments for cocaine (e.g., GBR 12909, NMDA modulators, CRF antagonists, etc.), and methamphetamine dependence (e.g. Loeline) (Vocci, 2003a). Taken together, significant resources are currently being devoted to pharmacological treatments for substance abuse disorders. Whether these investments will result in widespread benefit depends largely on their effectiveness, and on attitudes patients, providers, and the public have towards them.

The above review points to the important role medications can play in the treatment of substance abuse disorders. Naltrexone, buprenorphine, and methadone have all been used successfully to reduce addictive behavior and improve clinical outcomes, but none have become widely adopted in practice. Each medication has benefits and risks, and the best that can be said about their effectiveness is that they have all been shown to have moderate effect sizes in RCTs, a finding often used to justify their underuse. But as Orford (2001) points out, experts have searched long and hard for the best treatment for addiction, and in the process, have developed numerous psychosocial interventions that have all resulted in moderate effect sizes as well. In the absence of a gold standard, patients and providers benefit from a menu of options that include both psychosocial and pharmacological interventions, often used concurrently for the best outcomes.

3.3 Barriers to Use of Medication in Substance Abuse Treatment

Despite the empirical evidence that medications can significantly improve clinical outcomes for those struggling with substance abuse disorders, research consistently points to their underutilization in practice. Numerous studies have been done to learn more about this phenonenon, the majority of which have relied on survey methodologies of those who prescribe medication, or who are in a position to influence whether medications may be used (e.g., counselors, program administrators, etc.). These individual-level studies provide evidence that there are multiple barriers at work. Also, as mentioned in the previous chapter, a few studies have investigated barriers to medication use at the organizational level. This section reviews those studies, the majority of which have focused on barriers to adoption (or use) of naltrexone in alcohol dependent patients. The limitations of the studies are then summarized, and how these limitations can be overcome using a multilevel approach is explored.

Among the most recent studies was an investigation examining organizational-level influences on the adoption of naltrexone in six northeastern states (Fuller et al., 2005). Surveys were conducted in outpatient substance abuse treatment programs in 1997, 1999, and 2001, and structural equation modeling was used to assess the degree to which organizational variables, including size, type of clinic, medication services offered, funding streams, and staff characteristics impacted the adoption of naltrexone. During the five-year time span of the study, the percent of programs reporting that they use naltrexone went from 14% in 1997 to 25% in 2001. Most significant was the

finding that organizational variables did not directly influence the use of naltrexone during this time period, but rather their effects were mediated by whether a treatment program offered psychiatric medications for mental health disorders. The authors suggested that when a treatment program has already invested in the infrastructure necessary to prescribe psychiatric medications, then it is not such a leap to make available addiction medications. The study also found that larger organizations, with more diverse funding streams and more highly educated counselors, were more likely to adopt use of naltrexone. Programs that offered substance abuse treatment only were less likely to adopt naltrexone.

In a mail survey to 135 physicians with substance abuse specialization (63% response rate) and 1,116 certified addiction counselors (65% response rate) in Massachusetts, Tennessee, and Washington state, limited support for use of naltrexone was found (Thomas et al., 2003). As expected, physicians were more supportive of use than counselors, with 80% reporting current or past experience prescribing naltrexone. However, only 15% indicated prescribing it *often* or *for almost all clients*, while the majority (45%) said they used it *occasionally* and the remaining indicated *rare* (20.2%) or *no experience* (18.6%) (Thomas et al., 2003). In comparison, over half of all counselors said they never suggested using naltrexone to their patients, and less than 5% indicated recommending it often or almost all the time. To better understand these findings, the investigators utilized logistic regression to examine the barriers to adoption for both groups.

For physicians, being involved in an organization that supported use of medications for substance abuse disorders (odds ratio [ratio of the odds of an event occurring in the physician group to the odds of it occurring in the counselor group] = 11.6) and having some experience with research (odds ratio = 19.7) increased the likelihood that they would prescribe naltrexone. However, physicians in recovery (i.e., they were "in recovery" from their own addiction and were assumed to be abstinent) (odds ratio = .2) and with multiple academic degrees (odds ratio = .1) were found to be less likely to prescribe naltrexone. No explanation was given to explain these findings. The authors also noted adoption may be hindered by a physician's skepticism regarding the evidence of naltrexone's effectiveness. For counselors, programs that organizationally supported use of naltrexone (odds ratio = 7.9) and who received marketing information (odds ratio = 3.2) were more likely to recommend it to patients. Additionally, counselors were more likely to encourage use of naltrexone if patients had insurance coverage (Medicaid) (odds ratio = 2.0) or worked in the state of Washington, which promoted use of the medication (odds ratio = 1.5), but less likely to suggest its use if patients were self-pay or funded through block grants. In sum, there appear to be multiple factors influencing use of medication in substance abuse treatment programs, the strongest predictors being organizational support, financing mechanisms, and state policies.

Focus groups have been used to learn more about the barriers to the use of naltrexone. Mark, Kranzler, Poole et al. (2003) conducted two focus groups, one with 11 alcoholic patients and the other with 11 physicians who had treated alcohol

dependent patients. Both patients and physicians were asked to rank barriers to use. Patients' responses in order of most salient to least were: (1) lack of education about naltrexone, (2) side effects, (3) cost, (4) mode of administration, and (5) Alcoholics Anonymous philosophy. Physicians offered their responses but did not agree on any rank order: (1) insufficient research, (2) lack of perceived effectiveness on both the part of patient and the physician, (3) lack of marketing, and (4) cost. For both groups, the most significant barrier to use was lack of education about naltrexone. To examine this finding further, the investigators reviewed the degree to which information about the medication was being disseminated in research literature, at professional meetings, and through pharmaceutical marketing efforts. Their conclusion was that, compared to other psychotropic medications, there appeared to be less information disseminated about naltrexone. They noted however, that if use of naltrexone was to increase, both patients and physicians needed to be convinced that the benefits outweigh the side effect risks.

In another study about physicians' opinions about medications to treat alcoholism, Mark, Kranzler, and Song (2003) surveyed 1,388 physicians (65% response rate) from two specialty medical societies with expertise in addiction, the American Society of Addiction Medicine (ASAM) and the American Academy of Addiction Psychiatry (AAAP). Physicians belonging to both groups received only one survey. On average, physicians indicated prescribing naltrexone to only 13% of their alcohol dependent patients. Self-reported reasons for not prescribing naltrexone to more patients included: Failure to comply with treatment (23.2%), cost (21%), patients

not in a formal treatment program (14.8%), small effect on drinking relative to side effects (11.6%), and concerns about side effects (10.3%). Other noted reasons included lack of time to monitor use, naltrexone not being a medication paid for by insurance, and an effect size in the small to medium range. When asked what actions would lead to increased prescribing of medications for the treatment of alcohol dependence, physicians indicated a need for more research to develop new medications (33%), increased education about existing medications like naltrexone (17%), and greater involvement of physicians in the treatment of alcoholism (17%). Taken together, these findings suggest that physician attitudes, patient behavior, economic factors, and medication characteristics all contribute to the low rate of naltrexone prescribing.

In a study investigating organizational influences on the adoption of naltrexone, Roman and Johnson (2002) found that 44.1% of a national sample of 400 private substance abuse treatment programs reported use of naltrexone. However, actual usage in alcoholic patients was low (13.2% of the caseload), as was usage among opiate dependent patients (11.3%). Using logistic regression, the authors examined the degree to which treatment center structure, leadership, and caseload characteristics influenced the adoption and implementation of naltrexone. Increased probability of use was found in: older programs, led by administrators with longer tenure in the field, that employed a higher percentage of master's level counselors, and with caseloads having a higher percentage of HMO/PPO patients and relapsers (Roman & Johnson, 2002). With the exception of center age, no other structural

characteristics including size, placement in a hospital, or availability of physician time were significant predictors of naltrexone use. This finding suggests that an expanded resource base may not be necessary in the adoption of naltrexone, and that other variables play a more significant role in whether it is incorporated into routine practice. Specifically, administrative experience in the field, counselor education, and caseload characteristics appear to be the primary drivers.

In one of the first surveys to characterize attitudes about addiction treatment and medication use in community-based treatment programs in the U.S., Forman, Bovasso and Woody (2001) surveyed 317 substance abuse treatment staff members (57% response rate) from three northeastern states. Survey participants came from a broad cross-section of addiction treatment professionals working in a variety of treatment settings and funding structures. Although over 80% of the respondents supported increased research-based practice, only 39% supported the use of naltrexone, and only 34% favored methadone maintenance. Many were unsure about the use of naltrexone (46%) and over 40% disagreed that methadone maintenance should be used more. In regards to naltrexone, the authors noted that it is unclear whether the lack of support is due to a belief that it is not effective or the result of insufficient knowledge about the medication (Forman et al., 2001). Consistent with previous studies, support for medication use was highest for physicians and psychiatrists, as well as those with advanced education. It is also worth noting that support for psychiatric medications for mental health disorders ranked highest (52%)

among all respondents, but the authors did not investigate whether this finding predicted support for use of addiction medication as in the Fuller et al. (2005) study.

In a similar study in Ontario, Canada, 663 treatment staff (44% response rate) from 227 specialized addiction treatment programs were surveyed about their attitudes related to 53 different treatment processes including the use of medication (Ogborne, Wild, Braun, & Newton-Taylor, 1998). Factor analysis identified three interpretable dimensions of beliefs: (a) cognitive-behavioral, (b) disease, and (c) medication. The cognitive-behavioral factor had high loadings for items related to coping skills, identifying relapse triggers, and information on community resources frequently used by cognitive-behavioral therapists. The second factor, disease, had high loadings for items associated with 12-step programs and the disease concept of addiction. The final factor had the highest loadings for items related to use of medication in preventing relapse. Although there was overwhelming support for cognitive-behavioral interventions, processes related to the disease concept of addiction received mixed ratings. However, respondents overwhelmingly rated medications (antabuse, methadone, opiate antagonists, and medications to control alcohol craving), on average, as detrimental. The authors suggested this finding may reflect a general ideological opposition to the use of medications in addiction treatment. Support for medication use was only found for staff with masters or doctoral degrees, and those working in assessment/referral services.

In the first comprehensive survey assessing attitudes related to the use of buprenorphine in the treatment of opioid dependence, little support for use of the

medication was found (Knudsen et al., 2005). More than two-thirds of the substance abuse treatment counselors (N = 1972) selected a "don't know" response when asked about their perception of the effectiveness of buprenorphine based on their knowledge and experience with the medication. Among counselors who provided ratings of effectiveness (N = 660), the mean score was 4.0 on a seven-point scale (SD = 1.66), with no significant change in this outcome during the time of the study. Despite the low rate of adoption overall, in the two years of data collection (June 2002 – July 2004), there was some evidence of increased counselor knowledge about buprenorphine over time (note: different counselors surveyed during the study period). Variables that predicted increased knowledge about perceived effectiveness included: receiving buprenorphine specific training, increased education (at least a master's degree), and working in a treatment program that promoted use of the medication. The authors also noted that counselors in recovery were more likely to know about and accept use of buprenorphine, while those with a 12-step treatment orientation had the opposite response. This finding suggests that personal recovery is not synonymous with a 12-step orientation to treatment. Overall, these results show that lack of use of medication in addiction treatment is not limited to naltrexone.

3.3.1 Influence of the Above Findings on the Present Study

Summarizing the above, these studies collectively offer significant evidence of the consistent lack of support for medication use in addiction treatment. They also provide insight into the many barriers that play a role in why such medications are not used more frequently. Perhaps most telling is the replication of findings related to both

positive and negative influences on prescribing attitudes. Consistent positive predictors from multiple studies included:

- Increased education
- Working in a treatment program that supports use of medications
- Patients having access to insurance to pay for medications
- Having received training or marketing materials related to medications
- Being in a position to prescribe medications (physician, psychiatrist, etc.)
- Experience with psychiatric medications

Consistent negative predictors were:

- Having a 12-step orientation to treatment
- Beliefs about the characteristics of the medications such as:
    - Cost
    - Side effects
    - Low to moderate effect

Although other predictors such as clinician recovery status (i.e., whether a clinician is in recovery from his or her own addiction versus no personal experience with addiction), organizational size and age, and caseload characteristics showed less convergence among the study outcomes, they add to the complexity in understanding why medications are underutilized in substance abuse treatment. What becomes apparent when considering the above findings is that attitudes about medication are influenced by a host of factors. What is not clear from the previous studies is the specific role each of these factors plays in treatment staffs' lack of support for

medication use, as well as potential interactions among them. Also, as highlighted in the previous chapter, these studies suffer from a number of methodological limitations that include: 1) focusing on either individual or organizational level effects when both need to be considered simultaneously; and 2) using analytic techniques that assume independence of observations when the data have inherent dependencies.

In the above studies, some of the researchers chose to focus on individual-level effects (Forman et al., 2001; Knudsen et al., 2005; Mark, Kranzler, Poole et al., 2003; Mark, Kranzler, & Song, 2003; Mark, Kranzler, Song et al., 2003; Ogborne et al., 1998; Thomas et al., 2003), whereas others examined outcomes based primarily on organizational predictors (Fuller et al., 2005; Roman & Johnson, 2002). To date, investigators have not studied the impact of both individual and organizational-level factors simultaneously. The present study hypothesized there are a number of important relationships between these multilevel variables that should be examined. The specific relationships are detailed in Chapter 4, but they are based upon variables at both the individual and organizational levels that have already been shown to be significant predictors of medication attitudes. The key point is that when variables from different levels of analysis are examined simultaneously, it is hypothesized that important differences between treatment units will emerge, motivating the need for different types of interventions to increase support for appropriate use of addiction medications.

In addition to ignoring the relationships between variables at different levels of analysis, a significant shortcoming of the above studies summarized above is their

disregard of the dependencies that exist in the surveyed populations. This issue was introduced in the previous chapter, and with the exception of Knudsen et al. (2005) who corrected for the effects of clustered data, none of the other studies mention the complexities involved in analyzing hierarchical data sets. By not accounting for the dependencies that result from nested data (i.e., counselors nested in treatment programs nested in geographic locations), outcomes from the above studies may not be accurate. For example, in the Thomas et al. (2003) study, it was found that counselors working in the state of Washington were more likely to recommend use of naltrexone relative to counselors in Massachusetts and Tennessee as a result of state policy differences. As a result, treatment programs in the state of Washington shared a relationship that did not exist in the other states, illustrating how treatment programs in the total sample are not all truly independent.

In summary, to gain a greater understanding of the factors influencing attitudes towards use of medication in substance abuse treatment, it is necessary to consider both individual and organizational predictors simultaneously. Multilevel modeling can be used to examine such relationships, and offers a number of advantages including: (a) improved estimation of the individual effects since multilevel models take into consideration inherent dependencies in the data; (b) the ability to model cross-level effects (i.e., interactions between individual and organizational factors); and (c) the ability to partition the variance and covariance components among the levels, helping to assess which predictors are most important (Raudenbush & Bryk, 2002). It is also helpful to consider the theory behind why particular innovations become widely

adopted, and others like addiction medications, fail to diffuse. All the above studies provide pieces to the puzzle, but what connects the dots is *diffusion of innovation theory*, the focus of the next section.

3.4 Diffusion of Innovation

3.4.1 Theory and Models

Recent studies investigating barriers to medication use (Fuller et al., 2005; Knudsen et al., 2005; Roman & Johnson, 2002; Thomas & McCarty, 2004; Thomas et al., 2003) have all made reference to classical diffusion theory (Rogers, 1995, 2003). Pioneered by Everett Rogers, the field of diffusion theory provides a framework for understanding how and why particular innovations spread through a social system, while others languish or are minimally adopted if at all. The theory offers a generalizable model for piecing together findings from the previously reviewed studies, ultimately paving the way for diffusion models specific to the field of substance abuse treatment reviewed hereafter. The primary factors in the diffusion of new ideas are: (a) an *innovation* (b) that is *communicated* through certain *channels* (c) *over time* (d) among members of a *social system* (Rogers, 1995, 2003).

To a large degree, diffusion depends on *attributes of the innovation*, which help explain different rates of adoption (Meyer & Goes, 1988; Rogers, 2003). Among the most important attributes are: relative advantage, compatibility, complexity, trialability, and observabilty (Rogers, 2003). Taken together, these factors account for up to 87% of the variance in whether an innovation is likely to be adopted, and offer further insight into why medications used in substance abuse treatment have been

underutilized (Rogers, 1995, 2003). To further illustrate this point, consider the role these factors play in the diffusion of naltrexone.

Relative advantage refers to the degree to which an innovation is perceived as being better than what is currently available, or what essentially boils down to a cost-benefit analysis. Working against the diffusion of naltrexone is that it has not been shown to be superior to other pharmacological or psychosocial treatments for alcohol dependence. Further, naltrexone can be cost prohibitive for some patients, can produce adverse side effects, and requires physician time to monitor. However, since it does have a moderate effect, for some patients it is a useful intervention.

Compatibility refers to the degree in which the innovation is perceived as being consistent with the values, experiences, and needs of potential users. For clinicians and programs with a 12-step orientation to treatment, medications like naltrexone serve little purpose, because recovery from alcoholism is based on embracing a higher power (i.e., God or some other spiritual source of power). On the other hand, treatment programs that have prescribers on staff and administrative support for using addiction medications are more likely to adopt use of naltrexone.

Complexity is the degree to which the end user believes the innovation is hard to use. Increased education and training are associated with greater levels of support. This suggests that the more clinicians know about naltrexone (i.e., both about the medication and steps necessary to have it prescribed to a patient) its perceived complexity of use is reduced. However, physicians have noted that use can be complicated by noncompliance of patients and the need for increased monitoring

(e.g., more appointments to address intended drug effects, side effects, compliance issues). Other complexities may include dealing with insurance, finding referral sources, and patient selection.

Trialability refers to the degree to which an innovation can be tested on a limited basis without significant risk or commitment. All medications, including naltrexone, are essentially prescribed on a trial basis until there is evidence of the desired outcome without significant side effects. For this to happen, a patient must first have access to naltrexone, which can be hindered by barriers including cost, access to insurance, and prescriber availability. As a side note, free samples of naltrexone were never offered (Mark, Kranzler, Song et al., 2003).

Observability is the degree to which the results of an innovation are visible to others. For clinicians and their patients, observability most often translates into the clinical outcome of fewer drinking days since this is often a primary goal of treatment. But determining if this outcome is directly the result of naltrexone can be challenging when patients receive concurrent psychosocial interventions and may also attend self-help support groups.

In addition to the above factors, the diffusion process is influenced by the *communication channels* by which an innovation becomes known. Rogers (2003) proposes that *mass media channels* (e.g., radio, internet, television, newspaper) are the most rapid and efficient means of informing a population of potential adopters about a new innovation. Although such channels potentially can change weakly held attitudes, their primary role in the diffusion process is to inform individuals, who by their

influencing power, persuade others to adopt an innovation. Individuals with persuasive powers have been termed *opinion leaders.* During the persuasion stage, diffusion occurs primarily through *interpersonal channels* that involve face-to-face interactions, often with opinion leaders. These exchanges are more effective in forming and changing attitudes toward a new idea, because they usually involve the transfer of subjective information from a person who has tried the innovation to a potential new adopter (Klein & Sorra, 1996; Meyer & Goes, 1988; Rogers, 2003). Thus, scientific research may create awareness-knowledge of an innovation, but rarely does it persuade a person to adopt an innovation to the same degree as a recommendation from a trusted peer. Rogers (2003) also points out that although communication is more effective among homophilous peers (similar in certain attributes), some degree of heterophily (differences in attributes between individuals) is necessary for successful diffusion to occur. Whereas homophily accelerates the diffusion process among like individuals, heterophily communication links diverse groups of people, thus expanding the spread of diffusion.

Communication channels play an important role in the diffusion of addiction medications. Awareness-knowledge of medications like naltrexone and buprenorphine first becomes known through mass media channels including scientific literature, professional meetings, and trainings. Adoption decisions most often then occur through face-to-face interaction with colleagues, opinion leaders in the addiction field, and representatives from pharmaceutical manufacturers. However, marketing of addiction medications by drug companies has historically played a smaller role, as

manufacturers have spent little on promotion and have been cautious to avoid the perception of selling a "miracle pill" (Mark, Kranzler, Song et al., 2003; Thomas et al., 2003). Survey studies on the barriers to medication use have also revealed the heterophilous nature of the substance abuse treatment industry. Although there are characteristic differences between physicians, counselors, and treatment administrators, even wider gaps exist between researchers, clinicians, policy makers, and the general public (Institute of Medicine, 1998). Although it may be easier for addiction psychiatrists to convince other physicians of the effectiveness of addiction medications, for adoption to become wide spread, communication between the various heterophilous stakeholders is essential.

Diffusion of an innovation takes *time*. Diffusion research conceptualizes this process into five steps: (1) knowledge (2) persuasion (3) decision (4) implementation, and (5) confirmation (Rogers, 2003). From the time when a person first learns about an innovation to his or her confirmation that adopting was the right thing to do, there are inherent risks that an innovation may fail. Individuals will naturally seek information throughout the diffusion process in order to reduce uncertainty about an innovation's expected outcome. Because individuals differ in their degree of risk-taking, there is variability in adoption rates of an innovation across any given social system. Significant research has been devoted to *innovativeness*, or the degree to which an individual is relatively earlier at adopting an innovation over his or her peers. This has led to adopter categories based on the S-shaped growth curve of successful innovations. Since this growth curve approaches normality when plotted over time,

five adopter categories have been conveniently established using the mean and standard deviation as dividing lines: innovators (2.5%); early adopters (13.5%); early majority (34%); late majority (34%); and laggards (16%) (Rogers, 2003).

Most research on adopter categories has focused on the socioeconomic, personality, and communication traits of early adopters compared to the other groups. To summarize, early adopters tend to have: (a) more formal education, (b) higher social and economic status, (c) greater rationality and intelligence, (d) favorable attitudes toward science and research, (e) higher status occupations, (f) more socially outgoing personalities with larger interpersonal networks, (g) greater exposure to mass media and interpersonal channels, and (h) increased knowledge of innovations (Rogers, 2003). The ability to characterize differences between the groups has led to a variety of market segmentation strategies utilizing different communication channels to reach each subaudience.

Addiction treatment providers are not a homogeneous lot. Not only do functional differences exist between programs (e.g., outpatient, inpatient, hospital), but there is a range of attitudes toward medication use among treatment administrators and staff. In general, the traits of early adopters resemble the traits found in individuals who tend to support use of addiction medications. More favorable attitudes are associated with higher levels of formal education, higher status occupations (e.g., psychiatrists/physicians vs. counselors), and greater acceptance of scientific research (Fuller et al., 2005; Roman & Johnson, 2002; Thomas et al., 2003). The heterogeneity of the substance abuse treatment industry is one reason why addiction medications

have not been as quickly adopted as other pharmaceutical innovations. For example, new arthritis and gastrointestinal disease medications have been shown to be widely adopted within one year (Thomas & Ritter, 2000), whereas naltrexone has been available since 1994 and still has limited usage, primarily by early adopters. It becomes clear that if effective interventions are to be developed to increase support for use of medications in substance abuse treatment, it will be necessary to better understand the different groups or adopter categories within the addiction field.

Finally, diffusion of new ideas occurs within a social system, or group of interrelated units (e.g., individuals, groups, organizations) that come together to solve a common goal (Rogers, 2003). Although each unit may have its own individual attributes, it is the shared objective between the units that defines the system. As previously illustrated, underutilization of addiction medications is manifested within a multilevel social system. The *focal unit* for understanding lack of pharmaceutical diffusion in this study is the attitudes of staff, nested within substance abuse treatment units, further influenced by the treatment industry and the national health care system. Different factors from each level influence staff attitudes towards medication use, ultimately impacting the entire diffusion process. Also, within each level there is a defined structure that gives stability and regularity to how the units within that level operate. For instance, staff working in treatment programs are subject to the policies and working guidelines established by management. At the same time, every treatment program must follow specific state practice policies or risk closure.

Other important predictors of successful diffusion related to social systems include norms, opinion leaders, and change agents (Rogers, 2003). Norms are the established behavior patterns considered typical for a particular group. They define the range of tolerable behavior and serve as guides to what is expected of each member within a group. Norms can become a barrier to diffusion, particularly in the case of addiction medications. The majority of treatment programs in the country embrace a 12-step ideology that resists medication use (Roman & Blum, 1997), resulting in a norm among clinicians that significantly hinders adoption of new pharmacological agents. However, such barriers may become weakened due to the influence of opinion leaders and change agents.

Opinion leaders act as catalysts within an organization, using their influence in informal ways to convince others of the benefits of a new innovation. They tend to be at the center of interpersonal communication networks, and often are respected by others for their technical competence and adherence to the system's norms. In substance abuse treatment programs, opinion leaders are at the forefront of bridging the gap between practice and research. Whether functioning as a treating clinician or administrative supervisor, these individuals embrace scientific research and work to promote evidence-based practices within their organizations. They typically stay current with new treatment innovations, attend workshops specific to new treatment technologies, and network with others who maintain similar positions. Although opinion leaders maintain significant influence in the diffusion process, often

organizations will employ an external change agent with expertise in the diffusion process.

Within the substance abuse treatment industry, change agents are most often associated with academic research institutions (e.g., National Drug Abuse Treatment Clinical Trials Network), government agencies (e.g., SAMHSA, CSAT, NIDA), or private consulting firms. Change agents often make use of the influence of opinion leaders, as well as offer structured interventions to guide the diffusion process within an organization. As an example, change agents may utilize strategies from *The Change Book*, a resource published by the Addiction Technology Transfer Centers (2000) suggesting 10 steps that facilitate organizational change specific to the adoption of new treatment technologies.

Lastly, when considering the many factors within a social system influencing the diffusion of new innovations in substance abuse treatment organizations, it can be useful to view a treatment program as an *open system* (Katz & Kahn, 1978). Figure 2, illustrates the essential elements of a substance abuse treatment organization as an open system:

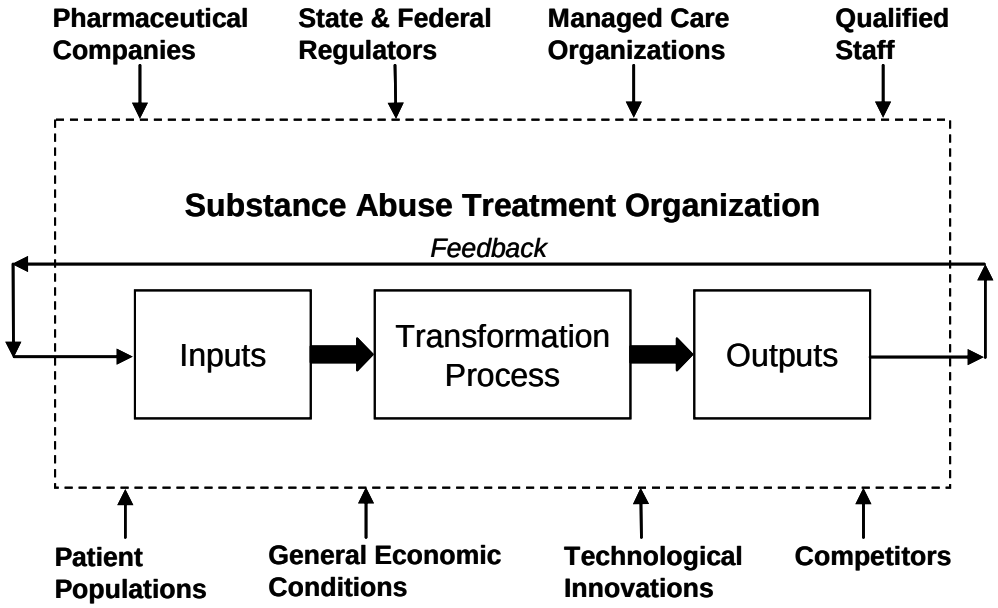

Figure 2. Substance abuse treatment organization as an open system.

To function, treatment programs require *inputs* from the external environment including: qualified staff, population of patients needing treatment, financial support from managed care organizations, and a location in which to offer services. These resources are then *transformed* within the organization into outputs that ideally consist of patients with improved functioning. Outputs may also include decreased crime within the local community, increased patient productivity, and reductions in aggregate health care expenses (McLellan, Lewis, O'Brien, & Kleber, 2000). *Feedback* in the system occurs in many forms, including patients returning to treatment who have relapsed (Hubbard, Flynn, Craddock, & Fletcher, 2001), counselors who are former patients, and changes in service delivery due to economic or patient population conditions. Further, the dynamics between a treatment program

and the external environment are often changing, making it more difficult to sort out the many factors influencing diffusion of new technologies.

3.4.2 Diffusion Models in Substance Abuse Treatment

Recently, diffusion theory has played a role in the development of conceptual models of technology adoption specific to substance abuse treatment. Simpson (2002) has proposed a process model of program change built around major stages of organizational change and factors that promote or hinder successful adoption of an innovation (Figure 3):

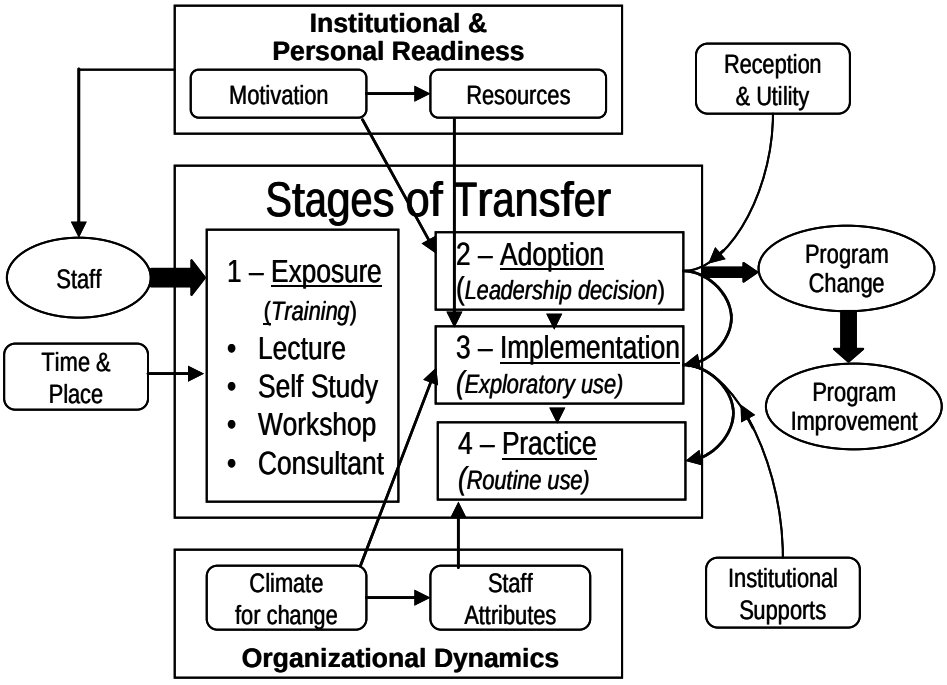

Figure 3. Texas Christian University Program Change Model (Simpson, 2002).

At the core of the model are four steps that parallel closely those in general diffusion theory: exposure, adoption, implementation and practice.

Exposure to a new technology occurs through both mass media (lecture, workshop) and interpersonal (consultant) communication channels. For exposure to have an impact, treatment staff and administrative leaders need motivation to change the status quo or a reason to consider a new innovation. Additionally, resources must be available to support learning about the new technology such as training time and educational materials.

Adoption combines Rogers' (1995; 2003) persuasion and decision steps and can be initiated on either an individual or group level. After attending a workshop, a clinician or group of counselors may wish to adopt a new treatment intervention. Likewise, a treatment director may decide to incorporate a new technology on behalf of the organization. In these cases, the diffusion process is influenced by *reception* and *perceived utility* of the innovation by counselors and treatment administrators, which depend largely on the innovation attributes discussed previously (e.g., relative advantage, compatibility), whether staff are properly trained, and the degree to which the new innovation fits into the organizational culture (Morgenstern, Morgan, McCrady, Keller, & Carroll, 2001).

Implementation involves the activities required to gain the targeted organizational members' appropriate and committed use of an innovation (Klein & Sorra, 1996). In large part, this depends on the innovation's fit with the current *climate for change* within the organization, and the *institutional supports* (e.g., staffing, facilities, training, and equipment) necessary to initiate and sustain use of the new technology. During this stage, users are likely to experience uncertainty and have

questions related to putting a new innovation into practice (Rogers, 1995, 2003). Andrzejewski, Kirby, Morral, and Iguchi (2001) have shown that monitoring, feedback, and positive reinforcement all can influence successful implementation.

Practice is the stage at which an innovation evolves into routine use. Simpson (2002) stresses the importance of staff attributes (e.g., professional growth, efficacy, influence, and adaptability) on successful adoption, while Rogers (1995, 2003) provides evidence that it largely depends on a confirmation process. Even after a new innovation is in use, adopters and decision makers may continue to seek reinforcement for the adoption-decision and may reverse it if there is sufficient evidence that the new technology is not working as expected (although this feedback mechanism is not illustrated in Simpson's model).

In summary, this 4-stage process model offered by Simpson (2002) provides a tool for better understanding the variables influencing successful diffusion of new technologies specific to substance abuse treatment programs. Further, it identifies targets for treatment program interventions that could occur at any of the four stages and has been used as a framework for developing numerous organizational questionnaires and surveys to support the diffusion process (Simpson, 2002) . Most useful is the *TCU Organizational Readiness for Change* (ORC) assessment used to collect data from both staff and program directors on four domains related to the process model: motivation for change, adequacy of resources, staff attributes, and organizational climate (Lehman, Greener, & Simpson, 2002).

Thomas et al. (2003) proposed an alternative model of technology diffusion (Figure 4).

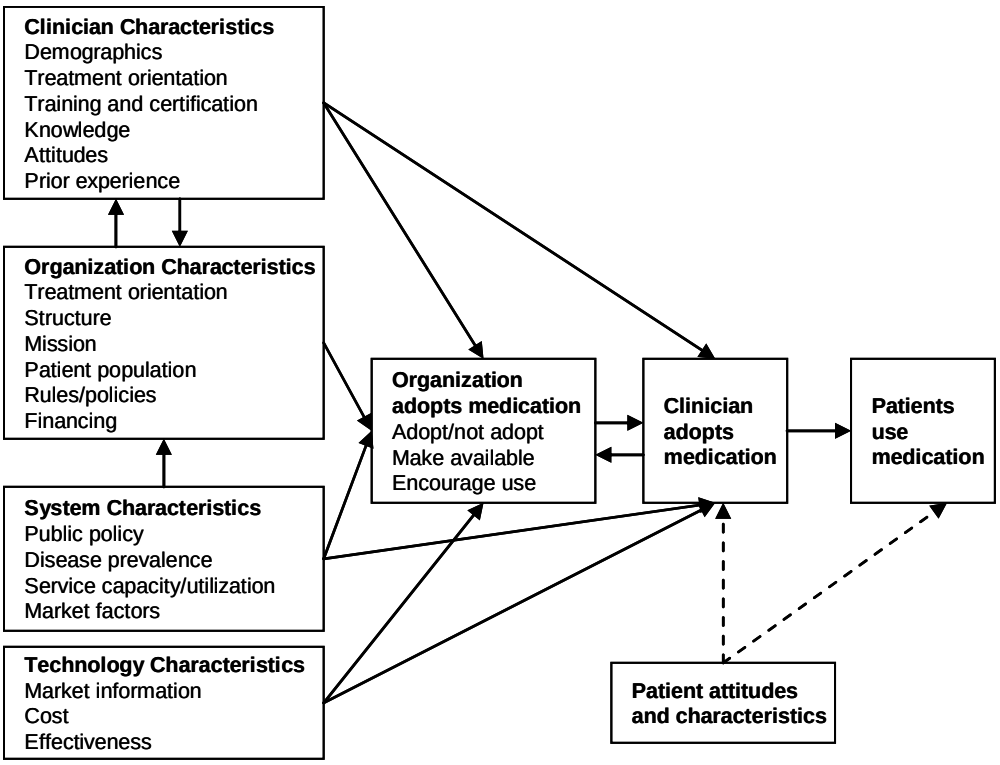

Figure 4. Conceptual model for adoption of new substance abuse pharmaceutical technologies (Thomas & McCarty, 2004)

First developed specifically to illustrate the factors affecting adoption of naltrexone, it was later refined into a general model for adoption of new substance abuse pharmaceutical technologies (Thomas & McCarty, 2004). As with the Simpson model, this model incorporates many of the elements of standard diffusion theory including: an innovation (*Technology Characteristics*), that is adopted by an individual (*Clinician Characteristics*), in a social system (*Organizational and System*

Characteristics). Unlike the Simpson model, which focused specifically on change within a substance treatment program, Thomas et al. (2003) incorporate factors from multiple levels (clinician, organization, larger treatment system) that interact to influence adoption and implementation of a new pharmaceutical innovation. Further, routine use of a new medication is dependent on patient acceptance, which is influenced by patient attitudes and characteristics. The model is particularly useful for identifying potential barriers to adoption of addiction medications, but it falls short of illustrating the *degree* to which different variables contribute to the end goal.

Both models offer a framework for understanding the role treatment staff attitudes play in use of medications in substance abuse treatment. In particular, Simpson (2002) stresses the need for clinicians to have some degree of motivation for considering use of medications, such as a caseload of high-relapsing alcoholics or the need to manage opiate dependent patients without the use of methadone. In addition, clinicians' attitudes are influenced by the degree to which they are exposed to new innovations, often a function of the training opportunities provided by treatment administrators. Further, staff attitudes are influenced by the organizational climate, resource availability, and personal attributes (e.g., education, recovery status, theoretical orientation). The Thomas et al. (2003) model also illustrates that clinician attitudes can be influenced by factors outside the treatment organization, including financing of treatment, public policy, service capacity, and market factors. Finally, in the case of adoption of addiction medications, there is the need for organizational acceptance prior to provider/patient acceptance. In sum, clinician attitudes about

medication use are best understood from *multiple perspectives* as discussed in the previous chapter.

Although these models offer insight into the diffusion of addiction technologies, if they are to be widely used in practice, they will ultimately need to articulate more clearly the relationships that exist between variables. The present study does not attempt to provide all the answers, but it moves research in the right direction by beginning to examine how some of the variables are related and to what degree. To accomplish this goal, individual and organizational factors specific to attitudes about addiction medications are studied using a hierarchical data set. The next section reviews the history behind the National Drug Abuse Clinical Trials Network, the source of the data used in the present study.

3.5 National Drug Abuse Clinical Trials Network

As identified in the IOM report *Bridging the Gap Between Practice and Research* (1998), many evidence-based treatments developed by researchers for substance abuse disorders, including the use of medication, have been significantly underutilized in practice. The efficacy of these treatments, although demonstrated in specialized research settings with homogeneous populations, generally have not been tested in heterogeneous groups under contemporary treatment conditions. To address this issue, the IOM report recommended that NIDA and CSAT develop a national infrastructure of practitioners, investigators, and policymakers to facilitate research within community-based treatment programs, similar to the National Cancer Institute's Community Clinical Oncology Program networks (Institute of Medicine,

1998). The result was the *National Drug Abuse Treatment Clinical Trials Network (CTN).*

In 1999 NIDA funded five *nodes,* each consisting of a regional research and training center and 5-10 community treatment programs (CTPs). Since that time, the CTN has evolved to a network that includes 17 nodes and more than 120 CTP partners. The core mission of the CTN is twofold:

> (1) Conduct studies of behavioral, pharmacological, and integrated behavioral and pharmacological treatment interventions of therapeutic effect in rigorous, multisite clinical trials to determine effectiveness across a broad range of community-based treatment settings and diversified patient populations; and (2) Transfer the research results to physicians, providers, and their patients to improve the quality of drug abuse treatment throughout the country using science as a vehicle (NIDA, 2002, p. 2).

Key to the success of the CTN has been the active participation of CTPs in the research design, implementation, and analysis of data from clinical trials. Their involvement also assures that researchers are appropriately informed about the complexities involved in treating diverse patient populations with limited funding and a diversely educated workforce.

The initial clinical trials tested buprenorphine detoxification, motivational interviewing (MI) and motivational enhancement therapy, and low cost incentives for methadone and outpatient programs. Results from the studies have only recently been published. Two studies investigated buprenorphine-naloxone for short-term opioid detoxification in both outpatient and residential settings (Amass et al., 2004; Ling et al., 2005). Findings across twelve diverse CTPs revealed the medication to be safe, efficacious, and effective, even for those patients receiving services from a CTP with

minimal experience providing medical detoxification for opioid dependence. Integrating motivational interviewing (MI) into the initial assessment in five CTPs found that participants randomized to MI had significantly better retention rates through the 28-day follow-up than those receiving the standard evaluation (Carroll et al., 2005). However, no differences were found in use patterns at either the 28-day or 84-day follow-up, suggesting that MI is most useful in promoting patient retention early in treatment. Lastly, the efficacy of an abstinence-based contingency management intervention was tested across multiple methadone and outpatient CTPs (Peirce et al., 2005; Petry et al., 2005). Patients in the treatment condition received prizes for submitting substance-free urine samples, with the chances of winning increasing with continuous abstinence. The intervention led to significantly more stimulant and alcohol free drug samples, better retention rates, and statistically significant abstinence outcomes over standard treatment.

These initial results suggest that researchers and clinicians can collaboratively work together to test new treatment technologies and develop mechanisms for successful adoption into practice. But diffusion theory, and the previously reviewed diffusion models specific to substance abuse treatment, revealed that bridging the gap between practice and research requires more than clinical trials in CTPs. Successful adoption of evidence-based practices hinges on multiple factors including clinician and organizational characteristics. Although a number of substance abuse treatment workforce surveys have investigated these two critical factors (Brown, 1997; Forman et al., 2001; Gallon, Gabriel, & Knudsen, 2003; Mulligan, McCarty, Potter, &

Krakow, 1989; The Lewin Group, 2001), the CTN recognized the need to further characterize attributes of participants in the CTPs to guide further clinical trials and gain a better understanding of factors influencing study outcomes. The Oregon Node coordinated data collection, analysis, and dissemination of results of the CTP, treatment unit, and clinical workforce surveys.

Results from the surveys were summarized in two studies; one focusing on the *individual* staff attributes (Level-1 in the present study), the other on the *organizational* attributes (Levels 2 in the present study). Data from the Level-1 Workforce Survey (N = 3,786) focused on individual demographics, education, certification and licensure, and attitudes towards use of specific EBPs including use of medications to treat substance abuse disorders (McCarty et al., 2007). Results from the Level-2 Treatment Unit Survey (N = 348) revealed: types of care offered, ancillary services, patient demographics, patient drug use, and prevalence of co-occurring disorders (i.e., patients having both a substance abuse and mental health disorder) (McCarty et al., under review). When compared to the 2003 National Survey of Substance Abuse Treatment Services, the findings suggested CTPs reflect the national treatment system but tend to be more often located in medical settings and less likely to offer mental health services (Substance Abuse and Mental Health Services Administration, 2002).

As in the previously reviewed studies on barriers to medication use, the Level-1 individual Workforce Survey (focus on individuals) found that across all job categories, support for addiction medications was modest. About 35% of respondents

supported increased use of methadone for heroin dependence, 29% supported increased use of naltrexone for alcohol dependence, and 28% indicated buprenorphine is an effective treatment for opiate dependence (McCarty et al., 2007). Not surprisingly (based on the previously cited results), higher levels of education and ability to prescribe were associated with greater levels of support for medication use.

3.5.1 CTN Data as Basis for Present Study

The present study expands on these initial descriptive results and prior studies cited above by investigating the degree to which *individual* and *organizational* variables jointly help predict staff attitudes towards addiction medications. The CTN surveys provide an ideal data set for this study for a number of reasons.

The first, and potentially most important, reason is that the surveys involved data collection at three nested levels of analysis: 1) Individual, 2) Treatment Unit, and 3) Program. Data for the Individual level included attitudes towards the most commonly used addiction medications (e.g., naltrexone, methadone, and buprenorphine), and in addition, many individual-level factors previously shown to be significant predictors of attitudes, including primary job function, highest educational degree, and whether staff members received addiction-specific education and training. Data collection for levels 2 and 3 (Treatment Unit and Program) was motivated by the fact that treatment *programs* often operate multiple treatment *units*, where each unit specializes in a particular aspect of treatment (e.g., detoxification, residential, outpatient). As such, treatment units within one program may vary significantly in terms of staff characteristics, models of treatment utilized, and patient populations

(Roman & Blum, 1997). Program-level surveys focused more on the corporate structure of the organization, its primary service setting (e.g., free-standing substance abuse clinic, part of a hospital or medical facility), and funding sources. For the present study, only *service setting* (from Level-3) was included in the analysis, and for reasons to be described in Chapter 5, it was included as a Level-2 predictor. In this way, program-level data, per se, were not employed in the present study.

The second attribute of the CTN survey data important to the present study is that it allows a number of relationships to be examined within a multilevel framework. Because differences exist between treatment units, the present study hypothesized that these differences will impact the significance of individual-level factors on attitudes about use of addiction medications in some predictable ways. For example, staff working in treatment units whose service setting is connected to a hospital or medical clinic, have a medication provider on staff, and already use pharmacotherapy to treat psychiatric disorders, will be more likely to support of use of addiction medications, regardless of their level of education or personal recovery status.

A third attribute of the CTN survey data important for the present study is its form and format, which allows analysis using multilevel modeling that accounts for the natural dependencies existing in such hierarchical data sets. Prior studies have used similar multilevel data sets, but have analyzed the data using traditional regression techniques, where the latter methods fail to account for the dependencies (cf. Section 2.1). The main thrust of the present study was to employ *multilevel modeling tools* to analyze the CTN data. This allowed development of more precise and nonbiased

estimates of the predictors of attitudes towards addiction medications (i.e., technical advantage over prior studies). Also, since the multilevel modeling methodology is designed to examine individual and organizational variables simultaneously, it provides a more real-world understanding of the predictors of medication attitudes (i.e., conceptual advantage over prior studies).

Finally, the CTN survey data involved a large enough sample to meet the requirements of a multilevel analysis that is focused on cross-level interactions and exploration of variance across levels. Hox (2002) suggests that these analyses need to meet the 100/10 rule, which means that the sample includes a minimum of 100 groups with about 10 individuals per group. In the final sample following listwise deletion, 1,421 treatment staff are nested within 237 treatment units (cf. Section 6.1). In addition, the CTN workforce survey is based on a national sample of community-based treatment programs that generally reflects the national substance abuse treatment system, strengthening the external validity of the study (Roman & Blum, 1997).

Chapter 4: Problem Statement, Study Aims, and Research Hypotheses

Motivation for the present study was presented in the previous chapter, and is summarized here:

1. There exist several FDA approved medications for the treatment of substance abuse disorders, yet support for use of these medicines by treatment staff remains moderate at best (cf. Sections 3.2 and 3.3).
2. Understanding of attitudes related to use of addiction medications has traditionally been gained via research methodologies that have not taken into consideration the systemic nature of the variables, nor the hierarchical nested structure inherent in treatment settings. This has resulted in outcomes that may not only be inaccurate, but add little understanding of how variables at different levels of analysis interact with each other (cf. Sections 2.1 and 3.3).
3. Diffusion models of technology adoption specific to the field of substance abuse treatment have been proposed to help identify variables central to the diffusion process. These models provide an underlying structure upon which interventions can be developed. However, these models, by themselves, articulate little about the dynamic relationships between variables, or the degree in which specific variables play a role (cf. Section 3.4.1).

With the above as backdrop, the aims of the present study may be stated as follows:

Aim 1: Examine the relationship between individual-level (Level-1) variables and attitudes about use of addiction medications, while controlling for other Level-1

variables and organizational-level (Level-2) factors. The importance of this aim is to assess whether individual-level variables that have been shown in prior studies to be predictive of medication attitudes remain significant when higher level variables are included in the model. There are four hypotheses specific to Aim 1:

Hypothesis 1*. Treatment staff members with a professional license to prescribe addiction medications will be more supportive of use of addiction medications than staff without a license to prescribe addiction medications, when controlling for other individual and organizational factors.* Prior research suggests that treatment staff who are licensed to prescribe medications (e.g., physicians, psychiatrists, nurse practitioners) are more supportive of use of addiction medications than staff who have no authority to prescribe medications (Forman et al., 2001; Knudsen et al., 2005; Thomas et al., 2003). Although a consistent finding, what has not been examined is the degree to which being a prescriber versus a nonprescriber influences medication attitudes when controlling for other multilevel variables.

Hypothesis 2. *Higher levels of education will be associated with greater levels of support for use of addiction medications when controlling for other individual and organizational-level factors.* A consistent finding across several studies is that higher levels of formal academic education are associated with greater levels of support for use of addiction medications (Forman et al., 2001; Fuller et al., 2005; Roman & Johnson, 2002). With increased education, the assumption is that treatment staff are exposed to new ways of thinking about problems, become more open to various treatment options, and are more apt to be exposed to research findings that support use

of addiction medications. In the U.S., 98% of mental health treatment programs require incoming treatment staff to have a minimum of a master's degree, while only 10% of substance abuse treatment programs have the same requirement (Kerwin, Walker-Smith, & Kirby, 2006). If education remains a significant predictor within a multilevel framework as hypothesized, the challenge will be how to increase support for use of addiction medications by less educated treatment staff.

Prior reviewed studies have also found that addiction-specific education (e.g., continuing education, pharmaceutical marketing materials, addiction-specific trainings and workshops) is positively associated with increased support for use of addiction medications (Knudsen et al., 2005; Thomas et al., 2003). Independent of academic education, there is evidence that if treatment staff receive some kind of training specific to the use of addiction medications, their level of support for the medications increases. Because both academic and addiction-specific education are included in the same model and tested under hypothesis 2, it is possible to assess the degree to which each of these types of education are predictive of medication attitudes.

Hypothesis 3. *Primary job category will predict attitudes about use of addiction medication, when controlling for other individual and organizational-level factors, such that medical staff will be more supportive of addiction medications than managers/supervisors, counselors, and support staff.* Whereas hypothesis 1 categorized treatment staff into two groups by professional licensure (i.e., those who can prescribe versus those who cannot), this hypothesis assesses the degree to which job category (e.g., counselors, medical staff, managers/supervisors, support staff)

differentiates support for use of addiction medications. In essence, it provides another test of hypothesis 1, where medical staff are assumed to be more supportive than all other treatment staff. But it also examines the degree to which managers/supervisors and support staff contribute to medication attitude outcomes within a multilevel framework. Initial analyses of the CTN workforce surveys indicated that managers/supervisors tended to be most supportive of evidence-based practices (McCarty et al., 2007). Therefore, it is hypothesized that managers/supervisors will be positively associated with use of addiction medications even more than counselors because their job position likely involves staying current on EBPs. Support staff are included in the analysis because they very often have direct patient contact and may influence in subtle, or not so subtle, ways the use of addiction medications. For example, a patient who is ambivalent about taking naltrexone for alcohol dependence and shares this with a receptionist may hear something like "you probably don't really need it, most clients here just go to a few extra AA meetings." To what degree this factor plays a role when compared to other individual-level variables and organizational predictors has not been previously investigated.

Hypothesis 4. *Treatment staff indicating greater levels of support for use of psychiatric medications will be more likely to support use of addiction medications when controlling for other individual and organizational-level factors.* Although prior studies have not examined this relationship directly, Fuller et al. (2005) found that use of psychiatric medications in substance abuse treatment programs mediated the relationship between other organizational variables (e.g., size, services offered,

funding streams) and adoption of naltrexone. Further, Forman et al. (2001) found high levels of support for use of psychiatric medications among a survey of substance abuse treatment staff. Taken together, these studies suggest that the association between psychiatric and addiction medications may depend on both individual and organizational factors.

Aim 2: Examine to what degree treatment unit variables (Level-2) explain variance at Level-1 that is not explained by Level-1 predictor variables, and explore how significant Level-2 variables moderate relationships between Level-1 variables and attitudes about use of addiction medications. Although previous studies have shown that Level-2 predictor variables can significantly influence attitudes about addiction medications, their relationship to Level-1 variables has not been investigated. Therefore, this study tests four additional hypotheses specific to the relationships that exist between individual and organizational factors.

Hypothesis 5. *Treatment unit predictor variables (Level-2), taken together, will account for a significant amount of the variance in individual treatment staff attitudes about the use of addiction medications.* This hypothesis, in large part, addresses the major underlying motivation of the present study, because it says that an accurate understanding of individual staff attitudes towards use of addiction medications depends on both individual and organizational factors. Whereas the Aim-1 hypotheses focus on testing Level-1 predictor variables in a multilevel framework, this hypothesis tests whether Level-2 variables taken together represent a significant

amount of variance that is not explained at the individual-level, while controlling for Level-1 variables.

Five Level-2 variables that have been shown in prior research to be significantly associated with medication attitudes are used to test this hypothesis. The first is based on several studies that have shown organizational *treatment models* are likely to explain some of the variance in individual staff attitudes (Knudsen et al., 2005; Mark, Kranzler, Poole et al., 2003; Ogborne et al., 1998). Kaskutas et al. (1998) has suggested that treatment units or programs can be classified as adhering either to a social or medical model of treatment. Staff working in programs supportive of the social model tend to utilize the philosophy promoted in the 12-step approach of AA and believe that a higher power is the most significant ingredient associated with behavior change. In essence, if recovery is the result of turning an addiction over to God, then medications serve little purpose. Alternatively, those working in programs supportive of a medical model (i.e., conceptualize addiction as a brain disease) are far more likely to be supportive of use of medications that work to reverse or prevent further brain changes resulting from continued substance abuse. The second selected Level-2 variable is *staff recovery status*. This variable represents the estimated percent of treatment staff that are in personal recovery within a given treatment unit. Prior studies suggest a mixed relationship between this variable and support for addiction medications (Knudsen et al., 2005; Thomas et al., 2003). By including this variable in the multilevel models, the goal is to show that it plays a significant role in medication attitudes, and to clarify its relationship with Level-1 variables and the DVs. The third

selected Level-2 variable assesses whether a treatment unit's primary intervention is use of *methadone*. The assumption tested is that if a treatment unit already uses an addiction medication, it should have a positive influence on individual staff attitudes. The fourth selected Level-2 variable measures whether a treatment unit offers *primary medical care*. Treatment units that are integrated in some way with primary care medicine are assumed to be more supportive of addiction medications. The final selected Level-2 variable, *primary treatment setting*, is a disaggregated Level-3 variable that is being tested in this study in a manner to determine whether it warrants consideration in a full three-level model. If predictive in the two-level model, it would suggest significant variability may exit between programs, and a more complex three-level model would be indicated. This variable essentially measures whether a program is a free-standing substance abuse clinic, or part of a larger healthcare service setting (e.g., hospital, mental health center). The assumption is that programs attached to any healthcare setting already routinely using medications would likely have a positive influence on staff attitudes towards addiction medications. Taken together, these five organizational variables are hypothesized to significantly explain variability in treatment staff attitudes towards use of addiction medications.

Hypothesis 6. *The relationship between staff education and attitudes towards use of addiction medications will be moderated by treatment model such that education will play less of a role when organizations adhere more to a social model of care.* As previously reviewed studies have shown, higher levels of both academic and addiction-specific education are associated with greater levels of support for addiction

medications. However, it is hypothesized here that this relationship is not independent of organizational effects, and that the treatment model used within a treatment unit significantly influences the impact of education on individual medication attitudes. The mechanism by which this occurs is in large part explained by organizational culture. Schein (1992) has stated that organizational culture is:

> A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems (p. 12).

Although treatment staff may have differing levels of education, the group-level effect of organizational culture powerfully shapes the assumptions and attitudes about how best to treat substance abuse disorders. This is particularly true when newer staff members interact with staff that have worked in the field for many years and have strong opinions about the "right way to work with clients." As reviewed in Section 3.1.2, a significant challenge in the substance abuse treatment field is that many treatment programs have long-adhered to a specific culture that has resisted use of evidence-based practices including medications in favor of more social models of care (i.e., 12-step philosophy of treatment). Therefore, when treatment model is allowed to vary across treatment units, this study hypothesizes that this variation will significantly explain Level-1 variability in the relationship between education and attitudes about addiction medications.

Hypothesis 7. *The relationship between support for psychiatric medications and attitudes towards use of addiction medications will be moderated by whether a treatment unit has on-site primary medical care, such that support for psychiatric medications will be greater for treatment units offering medical care on-site.* Prior studies suggest there is reason to believe that a positive association exists between attitudes about psychiatric medications and support for use of addiction medicines (Forman et al., 2001; Fuller et al., 2005). Treatment staff that support medications for mental health disorders and witness clients benefiting from psychiatric medications are likely to be more supportive of addiction medications than staff that have no experience with medications at all. But to a large extent, use of psychiatric medications in substance abuse treatment programs depends on access to prescribers. Therefore, it is hypothesized that the strength of the relationship between support of psychiatric medications and attitudes about addiction medications will be depend on whether a treatment unit has the necessary infrastructure to prescribe medications (i.e., on-site medical care). Staff working in treatment units that do have prescribers should show greater levels of support for addiction medicines.

Hypothesis 8. *The relationship between primary job and attitudes towards use of addiction medications will be moderated by whether a treatment unit is licensed to dispense methadone, such that across all job categories, support of addiction medications will be higher in treatment units that currently use methadone.* The mechanism that best explains this moderating effect is Bem's (1972) self-perception theory that attitudes are often inferred from our behavior and the context in which the

behavior occurs (i.e., it is behavior that causes attitudes). Therefore, regardless of job position, if a treatment unit dispenses methadone it is hypothesized that staff behaviors associated with this service will, over time, result in more positive attitudes towards use of addiction medications. Further, as reviewed in Section 3.2.2, methadone treatment for opioid dependence is among the most effective substance abuse interventions currently available. Staff that are unsure or ambivalent in their attitudes towards addiction medications are likely to develop more positive attitudes towards these medicines if they witness positive outcomes for clients on methadone. It is also the case that the organizational culture supporting methadone as a treatment intervention positively influences attitudes about addiction medications in similar ways as psychiatric medications.

Aim 3: Explore how results from the multilevel analyses might refine the present diffusion models specific to substance abuse treatment, and motivate interventions to increase support of appropriate use of addiction medications.

As a summary, Figure 5 illustrates: (a) the two levels of the study; (b) the selected predictor variables at each level; (c) the hypothesized relationships each variable has with attitudes about use of addiction medications; and (d) the three dependent variables representative of attitudes about use of addiction medicines (i.e., naltrexone, methadone, and buprenorphine).

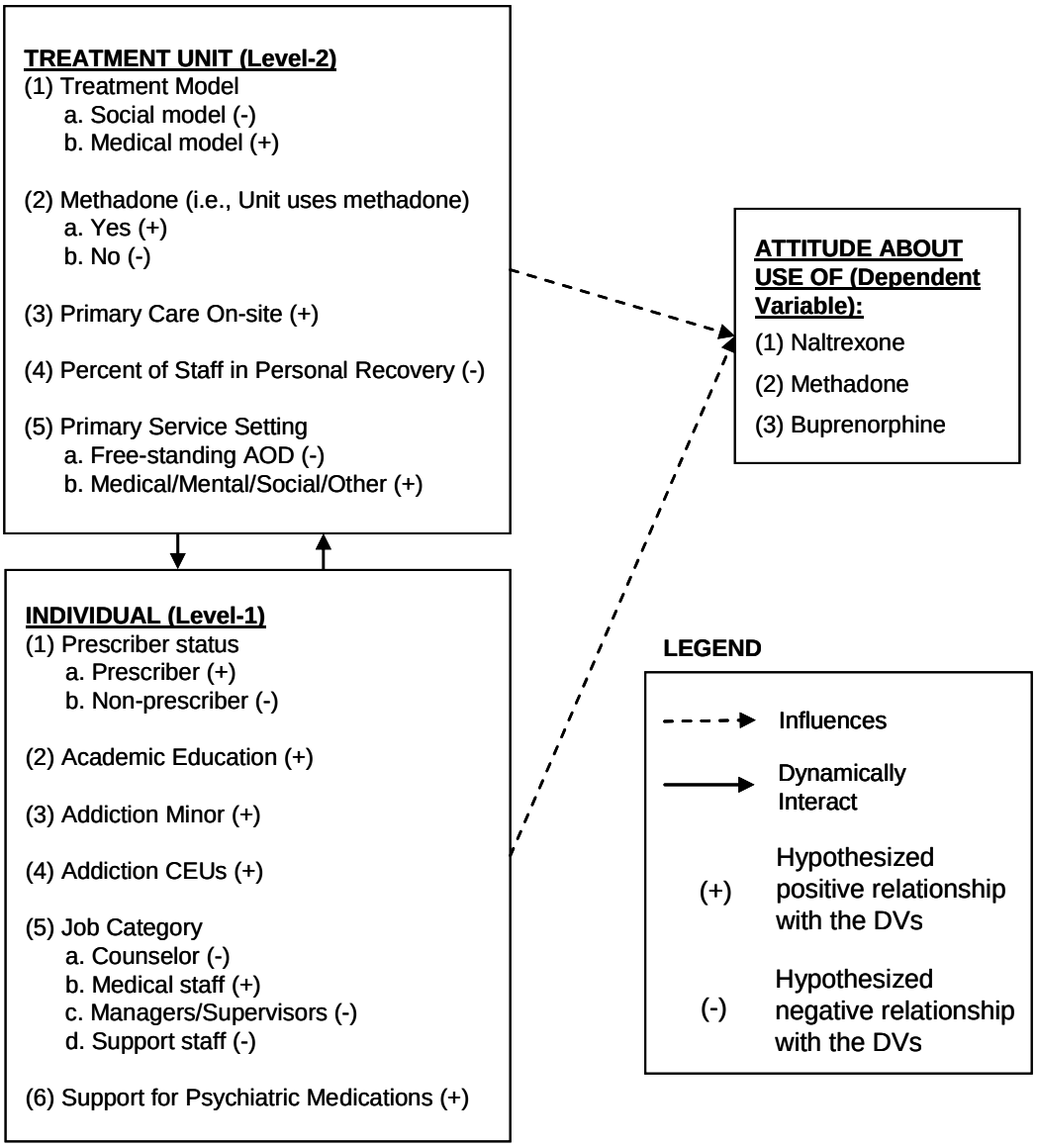

Figure 5. Multilevel predictors influencing attitudes about appropriate use of addiction medications

Chapter 5: Method (Approach)

5.1 Study Participants and Procedure

This study analyzed existing data from the National Drug Abuse Treatment Clinical Trials Network Workforce Surveys discussed in section 3.5. The data were collected by the Oregon Node of the CTN between March 25, 2002 and August 24, 2004. Community-based treatment programs participating in the CTN were invited to participate in the workforce study by completing three surveys: (1) Organizational, (2) Treatment Unit, and (3) Staff. Of the 112 eligible community treatment programs in the CTN, 106 completed the Organizational Survey (95% response rate). Treatment Unit Surveys were obtained from 348 out of a possible 384 treatment units (91% response rate), and Staff Surveys were collected from 3,786 workforce members (71% response rate).

The workforce sample included 1,757 counselors, 522 managers/supervisors, 511 medical personnel, and 908 support staff. Missing data on job category from 88 respondents resulted in a total *N* of 3,698. Sixty-six percent of the workforce staff were female, with the majority occupying support (74%) and medical (71%) positions, rather than counselor (62%) and manager/supervisor (61%) roles (McCarty et al., 2007). The workforce was ethnically diverse: 24% African-American, 11% Latino/Hispanic, 3% multi-racial, 1% Asian/Pacific Islander and 1% American Indian (60% were Caucasian). Most survey participants were full-time workers (i.e., 35 or more hours per week) (84%), with the exception of medical staff (67%), who were more likely to work part-time. Professional licensure was most common among

medical staff (93%), and less so among managers (57%) and counselors (42%). Seventy-two percent of the workforce had a college degree (associates degree or higher), while managers (58%) and counselors (42%) were more likely to hold advanced degrees (masters or doctoral degree).

To help facilitate data collection, the Oregon Node enlisted the help of a *protocol coordinator* for each of the 17 CTN nodes. The coordinator distributed surveys to their (respective) local CTPs, monitored response rates, and encouraged participation in the study. All data by protocol coordinators were submitted to the Oregon Node, which served as the data management center. Organizational and Treatment Unit Surveys were primarily administered through a secure website and completed online by Executive Directors and Treatment Unit Managers. In some cases, paper and pencil versions were used when web access was hindered. The Treatment Unit Survey also requested a listing of all staff employees; individual workforce surveys were then provided to each person on the list through local CTN protocol coordinators.

Because programs within the CTN varied in their opinions about participant compensation, each node made its own participation compensation decisions. Confidentiality for both the web-based and paper version surveys was maintained using passwords and sealed envelopes. Quality assurance for the web-based forms included checks for range, logic, and skip patterns, thus minimizing entry error. Summaries of data for the Organizational and Treatment Unit Surveys were sent to Executive Directors who made corrections for missing or incorrect values. The

Oregon Health Science University (OHSU) Institutional Review Board (IRB) reviewed and approved the study procedures. Because the survey was evaluated as low risk, the OHSU IRB authorized use of an information sheet rather than a formal consent process. Some nodes had their own IRB reviews with a few requiring a signed consent form.

5.2 Measures

The three surveys described above were all developed by the Oregon Node of the CTN for the purpose of collecting information on the attributes of participating treatment organizations, treatment units, and workforce staff providing care. Items for the surveys were constructed from the National Survey of Substance Abuse Treatment Services (Substance Abuse and Mental Health Services Administration, 2002), prior literature (Kaskutas et al., 1998; Simpson, 2002), or were developed specifically for the surveys to assess beliefs and opinions about practices and treatment technologies being tested or potentially being tested in the CTN. The Staff Survey included a 115-item Organizational Readiness to Change Scale (Simpson, 2002), but no data from the scale was used in the present study.

The Treatment Unit Survey included a 33-item Social Model Philosophy Scale (SMPS) that was filled out by one supervisor for each treatment unit. The SMPS classifies the extent to which treatment units follow a social model approach to treatment (Kaskutas et al., 1998). Programs adhering to a social model approach rely heavily on the principles of AA and often utilize staff who are in personal recovery (Borkman, 1990). The scale is based on six domains (physical environment, staff role,

authority base, view of substance abuse problems, governance, and community orientation), where higher scores reflect greater use of the social model. Overall, internal reliability of the SMPS was high ($\alpha = .92$), with alphas for each of the six subscales ranging from .57 to .79. Additionally, correlations between an overall scale score and individual subscales ranged from .61 to .84, suggesting a moderate to strong relationship between subscales and the scale's total score. Validity testing was also done by having three experienced substance abuse program administrators rank order 15 known programs in terms of the degree to which they felt the programs adhered to a social model of treatment. Rankings were then compared to results from the SMPS with an overall correlation of .66. The authors concluded that the SMPS accurately measures a treatment unit's adherence to the social model approach to treatment across time, administrators, and respondents. The scale has also been shown to reliably differentiate social model programs from those that adhere more to a medical model of treatment (Kaskutas et al., 1998), and is used as an organizational predictor in the present study.

Three dependent variables (DVs) were used in the study. All were from the Staff Survey and based on answers given when CTN workforce members were asked to assess the degree to which they disagree or agree (1-5 Likert scale, where higher numbers reflect greater agreement) with the following statements: (a) Methadone maintenance should be used more to treat heroin dependence; (b) Naltrexone should be used more in the treatment of alcohol dependence; and (c) Buprenorphine is an effective treatment for opiate dependence. Selection of the independent variables (IVs)

was based on: (a) findings from previously reviewed studies; (b) key variables identified by diffusion theory; and (c) their perceived (or face-value) usefulness in explaining staff attitudes towards addiction medications within a multilevel framework (cf. Section 4.1).

Six IVs from the Staff Survey were used to predict staff attitudes toward addiction medication. *Prescriber* is a dichotomous variable where treatment staff have been categorized by professional license into those with an ability to prescribe medications (e.g., physicians, psychiatrists, nurse practitioners) and those clinicians who are not licensed to prescribe medicines (e.g., counselors, social workers, clergy). *Academic Education* is a dichotomous variable comparing staff members with a graduate-level education (e.g., masters degree, doctoral degree, medical degree) to those with less than a graduate education (e.g., no high school diploma, high school diploma, associates degree, bachelors degree). *Addiction Minor* is a dichotomous variable indicating whether a staff member has a minor degree in an addiction related field. *Addiction CEUs* is measured by the number of substance abuse related continuing education units (CEUs) taken during the last year. The variable *Job Category* is a dummy-coded variable, where medical staff are the reference category, compared against counselors, managers, and support staff. The final individual-level variable, *Psychiatric Medications*, was measured by the question "Psychiatric medications should be used more in addiction treatment" and scored on a 5-point scale that ranged from 1 (strongly disagree) to 5 (strongly agree).

Five IVs from the Treatment Unit Survey were used as Level-2 predictor variables. *Treatment Model* were measured by the SMPS, where a total possible score of 100 represents the ideal type of a pure social program. Lower scores reflect treatment units more accepting of a medical treatment model. *Methadone* is a dichotomous predictor variable indicating whether a treatment unit provides methadone maintenance therapy as a primary component of treatment. The variable was operationalized as units treating 10 or more patients with methadone. The variable, *Primary Care On-site,* is also dichotomous and indicates whether a treatment unit offers primary medical care on-site. *Staff in Recovery* is the percent of staff estimated to be in personal recovery from substance abuse disorders. Finally, *Service Setting* is a dichotomous variable and indicates whether a treatment unit is a free-standing substance abuse treatment program, or associated with a larger healthcare or social service organization.

5.3 Analysis Strategy

The research questions examined in this study are hierarchical, in that their goal was to help understand how individual-level and organizational-level characteristics influence individual staff attitudes towards appropriate use of addiction medications. Therefore, the associated hypotheses were analyzed using *random coefficient modeling* (RCM) that allows for the investigation of both within and between group effects on individual-level dependent variables (Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). Currently, there exist a number of software packages that can analyze multilevel models. For this study, Hierarchical Linear Modeling

(HLM 6.0) software (Bryk et al., 2005) was used to estimate the random coefficient models. The analyses followed the outline suggested by Hox (2002) that involves specifying the simplest possible model, and then adding parameters step by step to improve the overall model fit.

Before reviewing the steps that were used to develop the models in the study, it is important to know how the models were estimated and compared, and the criteria that were used to assess the significance of parameter estimates. The method most commonly used to estimate regression coefficients and variance components in random coefficient models is the *Maximum Likelihood* (ML) method (Raudenbush & Bryk, 2002). ML essentially is an iterative process accomplished by multilevel software that first generates estimates for all parameters. It then uses a computational procedure to improve on the parameter estimates until the program *converges*, or reaches a point where the estimates cannot be improved any further. A full discussion of the estimation procedure is beyond the scope of this dissertation; the reader is referred to Snijders & Bosker (1999) for a more detailed discussion.

With large samples such as those used in this study, ML estimates are generally robust and protective against minor violations of the assumptions, including non-normal errors (Hox, 2002). The HLM program produces *p*-values (normally set to .05 significance level) and confidence intervals that guide the selection of which variables to keep in a model. An advantage of using the ML method is that a *deviance* statistic can be computed to determine how well a particular model fits the data, and

how it compares to other models. In general, lower deviance scores reflect better fitting models. Hox (2002) explains:

> The deviance is defined as -2xLN(*Likelihood*), where *Likelihood* is the value of the Likelihood function at convergence, and LN is the natural logarithm…the difference of the deviances for two nested models has a chi-square distribution, with degrees of freedom equal to the difference in the number of parameters estimated in the two models. This can be used to perform a formal chi-square test to test whether the more general model fits significantly better than the simpler model (pp. 43-44).

Because all models tested in this study are nested models (i.e., two models are equivalent with the exception that one model contains a subset of parameters not shared by the other model), they can be compared statistically using their deviances. If a significant difference is found between two models, it means that the model estimating more parameters has a better fit to the data than the more parsimonious model. However, if the chi-square test is not significant, estimating the additional parameters has no benefit over the more parsimonious model and the simpler model is retained.

The first step in model development is to analyze the simplest model, known as the intercept-only model (i.e., also known as the empty model, constant-only model, or null model) in which there are no explanatory variables. The model is represented by the equation:

$$Y_{ij} = \gamma_{00} + U_{0j} + R_{ij}$$

The model contains only random groups (treatment units) and random variation within groups. Y represents one of the DVs and is the sum of: (a) a general mean, γ_{00}; (b) a random effect at the group level, U_{0j}; and (c) a random effect at the individual level,

R_{ij}. The subscript *i* is for individual treatment staff within each treatment unit (i = 1 [first individual within a particular treatment unit j]…i [last individual in treatment unit j]) and the subscript *j* is for the treatment units (j = 1 [first treatment unit in sample]…j [last treatment unit in sample]). In the above case, γ_{00} represents the mean of all treatment unit means, and U_{0j} and R_{ij} represent the unexplained variance at the treatment unit and individual treatment staff levels. The intercept-only model is useful because it provides an estimate of the *intraclass correlation*, or the proportion of variance explained by having treatment staff grouped into treatment units. By definition, the intraclass correlation is the proportion of variance at the group level compared to the total variance (Snijders & Bosker, 1999). It is the expected correlation of any two randomly chosen treatment staff members from the same treatment unit. The intercept-only model is also useful because it provides a baseline measure of the *deviance* that will be used to determine how much better models with added parameters fit the data.

The second step involves analyzing a model that contains all the Level-1 explanatory variables hypothesized to explain (or reduce) variance at the individual level (i.e., R_{ij}). The following equation represents an initial Level-1 model predicting medication attitude for one of the three DVs:

$$\text{medication attitude}_{ij} = \gamma_{00}$$

$$+ X_{1ij}\,(\text{prescriber})$$
$$+ X_{2ij}\,(\text{education})$$
$$+ X_{3ij}\,(\text{education})$$
$$+ X_{4ij}\,(\text{addiction CEUs})$$
$$+ X_{5ij}\,(\text{job category})$$
$$+ X_{6ij}\,(\text{psychiatric medications})$$
$$+ R_{ij}$$
$$+ U_{0j}$$

Where: (a) γ_{00} is the intercept; (b) $X_{1ij} \ldots X_{6ij}$ represent Level-1 predictors; (c) R_{ij} is the usual Level-1 residual error term; and (d) U_{0j} is the remaining variance explained by Level-2 variables. Note that for every Level-1 predictor variable there is a corresponding overall regression coefficient for the relationship (slope) between a Level-1 predictor and the DV (i.e., $\gamma_{10} - \gamma_{50}$). Hox (2002) suggests that this model include random intercepts and only fixed Level-1 variables (i.e., slopes not allowed to vary across treatment units and fixed at zero) to allow for a direct comparison with the intercept-only model.

The third step involves adding the Level-2 variables to the model, and determining whether they help explain differences between treatment units in the DVs. Again, explanatory variables at Level-2 are fixed, intercepts are allowed to vary, but slopes are not allowed to vary in this model. The equation for the Level-2 model is:

$$\text{medication attitude}_{ij} = \gamma_{00} + (\text{Level-1 explanatory variables})$$

$$+ Z_{01}(\text{treatment model})$$
$$+ Z_{02}(\text{methadone})$$
$$+ Z_{03}(\text{primary care on-site})$$
$$+ Z_{04}(\text{staff in recovery})$$
$$+ Z_{05}(\text{service setting})$$
$$+ R_{ij}$$
$$+ U_{0j}$$

Where $Z_{01}\ldots Z_{04}$ represent Level-2 predictor variables. Note that for every Level-2 predictor variable there is a corresponding overall regression coefficient for the relationship (slope) between a Level-2 predictor and the DV (i.e., $\gamma_{01} - \gamma_{05}$). This equation predicts the DV for the average treatment unit (the intercept γ_{00}) from the five Level-2 IVs. Notice that the intercept and each of the Level-2 variables do not include a subscript *j*, meaning that these parameter estimates are all fixed across treatment units (i.e., slopes are not allowed to vary). Both of the previous two models are considered *variance component* models because they decompose the intercept variance into different variance components for each level of analysis (Hox, 2002). In such models, regression slopes for the predictor variables are fixed across treatment units, but the regression intercepts are assumed to vary across the units. Although such models have been used widely in research involving hierarchical data, they assume that the group structure is represented in the explanatory variables (Snijders & Bosker, 1999). When groups vary in size, this is not the case, and random coefficient models are necessary to account for group differences. Once a model with fixed regression coefficients at both levels is shown to be superior to the intercept-only model using the

deviance statistic to test differences, it is then appropriate to investigate and test the random components of the model.

This step involves development of the random coefficient model by allowing both the intercepts and the slopes of the Level-2 regression coefficients to vary across treatment units. The purpose is to assess whether there is significant variance in the Level-2 predictors between treatment units. Each Level-2 predictor is individually assessed, and only those that vary significantly between groups are included in the model. One reason for testing each parameter separately is that when slopes for all Level-2 predictor variables are allowed to vary, it is possible that the model may not converge or have serious estimation problems (Hox, 2002). It is also necessary to consider reassessing any Level-2 variables in the previous step that did not have a significant average slope across treatment units because such variables could be significant when slopes are allowed to be random. The general equation may be written:

$$\text{medication attitude}_{ij} = \gamma_{00}$$

$$+ \text{(level-1 predictor variables)}$$
$$+ \text{(level-2 predictor variables)}$$
$$+ u_{pj}\,\text{(level-1 predictor variables)}$$
$$+ U_{0j}$$
$$+ R_{ij}$$

Where u_{pj} represent the treatment unit or group level residuals of the slopes of the Level-1 predictor variables.

The final step is to add the hypothesized cross-level interactions to the model. The purpose is to assess whether relationships between Level-1 predictors and the

DVs depend upon the moderating effects of the Level-2 variables. The included interactions are between the Level-2 variables and those Level-1 variables that had significant slope variation from the previous step (Hox, 2002). This results in the full (or final) random coefficient model given in the following equation:

$$\text{medication attitude}_{ij} = \gamma_{00}$$

$$+ \text{(level-1 predictor variables)}$$
$$+ \text{(level-2 predictor variables)}$$
$$+ \text{(level-1 x level-2 variables)}$$
$$+ u_{pj}\,\text{(level-1 predictor variables)}$$
$$+ U_{0j}$$
$$+ R_{ij}$$

Where the interaction terms are represented by: "level-1 x level-2" as shown in the above equation. The overall fit of this final model is again assessed using the deviance statistic and compared to the previously developed models.

In summary, use of multilevel modeling has a number of advantages over approaches employed in prior studies, and is most appropriate for the data set used in the present study. Even though both of these issues were outlined in previous sections they are summarized here again:

1. Multilevel models are based on assumptions that are more realistic in that they account for clustering of individuals within higher-level units, such as treatment units or programs. They do this by not requiring the assumption of independence necessary for traditional ordinary least squares (OLS) regression analysis. Also, they are more realistic in that they allow for the

examination of variables that *interact simultaneously* at different levels of analysis, such as in the present study.

2. Because multilevel models are based on more realistic assumptions, they utilize more accurate estimated standard errors of parameter estimates and thus decrease the probability of a Type I error in hypothesis testing.
3. Multilevel models allow for the investigation of cross-level effects by examining how individual staff attitudes about addiction medication (Level -1 in the multilevel models) are influenced by contextual factors existing at the Treatment Unit level (Level-2).
4. Multilevel models partition the variance both within and between groups, statistically separating the "true" variance of the predictors from the sampling variance. This improves our ability to understand the degree to which particular predictors influence individual staff attitudes about addiction medication.
5. Multilevel models improve estimation of effects in situations with high *intraclass correlation.* Such situations occur when there is homogeneity of observations within groups, relative to between groups (Raudenbush & Bryk, 2002). This is the case in the current data set, as individual staff in particular treatment units are assumed to be more alike than staff in other treatment units. If there were no differences between staff across treatment units, the intraclass correlation would be zero and use of multilevel modeling would have no advantages over OLS regression.

6. Multilevel models conceptually are an improvement over traditional regression techniques because they encourage thinking about complex phenomena systemically.

For all of these advantages, multilevel models are not without their drawbacks. Perhaps the most significant limitation is that interpretation of the models can be extremely challenging, particularly when models include multiple predictors at different levels, and involve cross-level interactions. It is worth noting that of all published studies that have utilized multilevel models, the majority (perhaps 90%) have been two-level designs (Newsom, 2006). Although interpretation of fixed effects is generally straightforward, interpretation of random effects can become more difficult, particularly in models with multiple variables having moderating effects.

In addition, Kreft and Boon (1996), in an attempt to demystify multilevel modeling techniques, concluded that no model by itself can advance a field. Multilevel models may result in increased accuracy of parameter estimates, and allow for the exploration of complex hierarchical data structures, but in the end, the techniques do not generate knowledge; that is a function of the researcher. Therefore, model building is somewhat of an art, and how models are constructed and tested should be driven by theory and the field in which the models are used. Few studies in the substance abuse field have utilized multilevel models, but it is hoped that this study will motivate others to begin using multilevel models when analyzing data appropriate for such analyses.

Chapter 6: Results

6.1 Data Preparation and Evaluation of Assumptions

The original data set contained 3,786 treatment staff nested in 348 treatment units. A limitation of multilevel modeling is the need for no missing data on predictor or dependent variables. Although a number of sophisticated programs have been developed to estimate missing data in multilevel data sets, at present, listwise deletion is considered an acceptable option for handling missing data (Newsom, 2006). Table 1 provides a summary of missing data with no discernable patterns identified by examining the data and frequency distributions. Two variables, *Addiction Minor* and

Table 1. Missing data prior to listwise deletion

Variable	**Missing**
Dependent Variables	
Naltrexone	221
Methadone	90
Buprenorphine	284
Individual Level-1	
Prescriber	0
Education	137
Addiction minor	1177
Addiction CEUs	1357
Jobdum1 – counselor	0
Jobdum2 – manager	0
Jobdum3 – support staff	0
Psychiatric med support	126
Treatment unit Level-2	
Treatment model	17
Methadone unit	5
Primary care on-site	7
Staff in recovery (percent)	67
Free-standing clinic	0

Addiction CEUs, were responsible for significantly more missing data than other variables, but because they produced statistically significant results on two medications they were maintained in the models.

Application of the listwise deletion procedure on the missing data resulted in a data set containing 1,435 treatment staff nested in 239 treatment units. However, after final models for each dependent variable were established, all were checked for distributional assumptions and two multivariate outliers were discovered for naltrexone.

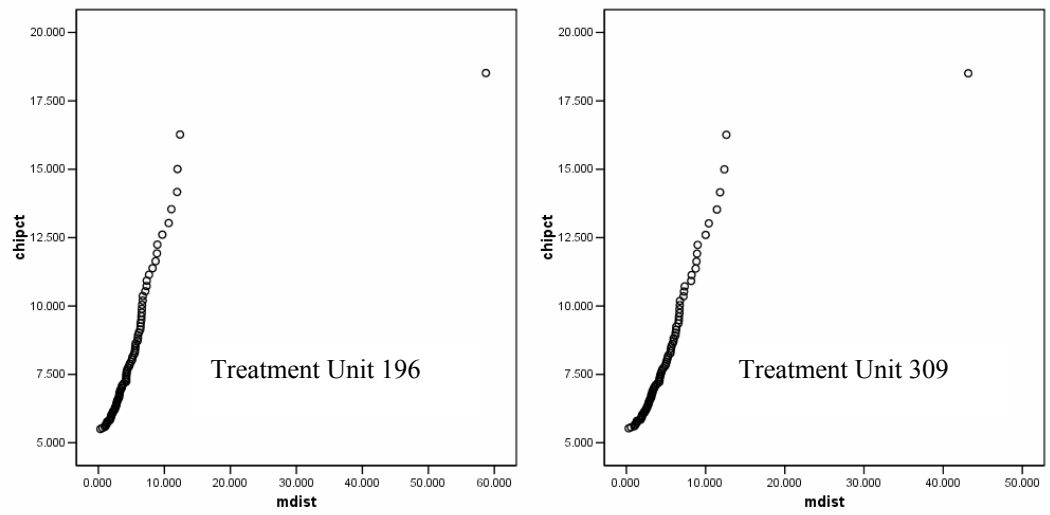

Figure 6. Outliers for treatment units 196 and 309 for dependent variable naltrexone

In Figure 6, *chipct* (expected values on the chi-square distribution) is plotted again *mdist* (Mahalanobis Distance of the Empirical Bayes coefficients from the fitted value) to check the normality assumption for Level-2 residuals. Treatment units 196 and 309 were both identified as multivariate outliers. A comparison of means across predictors showed no obvious reasons why these treatment units were outliers.

Subsequently, both were deleted from the data set, resulting in a final sample of 1,421 treatment staff nested in 237 treatment units. Descriptive statistics are provided in Table 2, showing the means and standard deviations for the three dependent variables, individual Level-1 independent variables, and treatment unit Level-2 independent variables. Correlations among Level-1 predictors and the dependent variables, and Level-2 predictors, are shown in Tables 3 and 4 (see next page).

Table 2. Descriptive statistics for dependent, Level-1, and Level-2 variables

Variable	**M**	**SD**
Dependent Variables		
Naltrexone	3.17	.86
Methadone	3.03	1.17
Buprenorphine	3.29	.81
Individual Level-1		
Prescriber	.05	.21
Education	.53	.50
Addiction minor	.40	.49
Addiction CEUs	22.12	22.12
Jobdum1 – counselor	.54	.50
Jobdum2 – manager	.21	.41
Jobdum3 – support staff	.11	.32
Psychiatric med support	3.40	1.01
Treatment unit Level-2		
Treatment model	34.23	13.77
Methadone unit	.22	.41
Primary care on-site	.30	.46
Staff in recovery (percent)	34.83	27.01
Free-standing clinic	.63	.48

Table 3. Correlations among Level-1 predictors and dependent variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Prescriber	---										
2. Education	.215	---									
3. AOD minor	-.015	-.026	---								
4. AOD CEUs	.031	.015	.216	---							
5. Medical vs. Counselor	-.241	.044	.156	.076	---						
6. Medical vs. Manager	-.038	.171	.010	.081	-.538	---					
7. Medical vs. Support	-.061	-.210	-.104	-.165	-.400	-.183	---				
8. Psychiatric med. support	.096	.136	.016	.018	-.057	.052	-.053	---			
9. Naltrexone	.101	.122	.008	.048	-.074	.064	-.053	.236	---		
10. Methadone	.142	.128	-.030	.014	-.061	.078	-.049	.270	.365	---	
11. Buprenorphine	.191	.139	.040	.096	-.176	.137	-.058	.252	.361	.291	---

Table 4. Correlations among Level-2 predictor variables

Variable	1	2	3	4	5
1. Treatment model	---				
2. Methadone Used	-.225	---			
3. Primary care on-site	.230	.101	---		
4. Staff in recovery	.464	-.280	.004	---	
5. Freestanding AOD	.177	-.136	-.088	.292	---

Mean levels of support for all addiction medications, measured on a 1 to 5 scale (1 = low support and 5 = high support), were moderate. Treatment staff indicated the highest mean levels of support for buprenorphine (3.29), followed by naltrexone (3.17), and methadone (3.03). It is worth noting that medications with higher levels of support were more recently approved by the FDA for the treatment of addictive disorders (i.e., buprenorphine was approved in 2002, naltrexone was approved in 1997, and methadone 1960s).

At Level-1, *Prescriber* is a dichotomous variable where a mean of .05 indicates there are very few prescribers in the total sample of treatment staff. *Academic Education* is also a dichotomous variable where a mean of .53 indicates an almost even split between graduate-trained counselors and those with a bachelors degree or less education. In regards to addiction specific education, about 40% of treatment staff had a minor degree in an addiction related field, and on average treatment staff had 22.12 CEUs (note: most clinical licenses and certifications require 20 CEUs per year). For the dummy-coded variable *Job category*, where medical staff are the reference category, the largest mean difference was between counselors (.54), followed by managers (.21) and support staff (.11). These numbers represent the mean difference between medical staff and each job category on a 1 to 5 scale. Mean treatment staff support for psychiatric medications, measured on a 1 to 5 scale, was 3.40. Note that there was more support for psychiatric medications than for any of the addiction medications.

At Level-2, treatment model, measured by the SMPS, on average was 34.23 (1 to 100 scale where lower scores equate to a medical model and higher scores indicate a social model of treatment). There were 22% of treatment units that indicated 10 or more patients utilized methadone in treatment, and 30% of treatment units that said primary care was available on-site. About 35% of staff working in treatment units were in recovery, and 63% of all substance abuse treatment units were free-standing clinics (i.e., not part of a hospital or other larger behavioral health treatment organization).

In the results that follow, a linear relationship is assumed for all pairs of variables. Distributional assumptions for all models were checked in HLM by creating residual files for the Level-1 and Level-2 models. The files were written in SPSS and the assumption of normal distribution of Level-1 and Level-2 residuals were assessed in Q-Q plots. Graphs for all models indicated no serious deviations from normality or extreme outliers. The assumption of homogeneity of Level-1 variances (i.e., variance of the residual errors is the same for all treatment units) for all models was assessed in HLM utilizing a chi-square test where a significant *p*-value indicates a violation of the assumption. Results for all models found no assumption violations. The three dependent variables were assessed for normality and produced skewness and kurtosis statistics that were within the acceptable range (West, Finch, & Curran, 1995).

6.2 Model Specification

6.2.1 Naltrexone Results

Total variance in staff attitudes towards naltrexone was partitioned into its within-treatment and between-treatment unit components (random effects). In this fully unconditional model, there are no predictor variables from any level, and the analysis is equivalent to conducting a one-way random-effects ANOVA in which treatment unit is a random factor with varying number of staff members per treatment unit. Staff attitudes toward naltrexone were measured on a scale from 1 to 5, where higher values represent greater support for use of naltrexone.

The results indicated that the variance in attitudes toward naltrexone between staff within treatment units (sigma squared) was .68, and the variance between treatment units (tau) was .06. The chi-square test statistic of between-treatment unit variability revealed statistically significant variability existed between treatment units in staffs' average naltrexone attitude scores, χ^2 (236) = 363.56, $p < .001$. The mean naltrexone attitude score was significantly greater than zero ($\gamma_{00} = 3.16$, $t = 108.44$, $p < .001$). The intraclass correlation (i.e., the percentage of variance between treatment units) was .086, indicating that 8.6% of the variability in staffs' attitudes about naltrexone can be accounted for by differences in treatment units.

Next, a series of multilevel models were analyzed to examine the relationship between attitudes towards naltrexone and the Level-1 and Level-2 predictors. Following the steps outlined by Hox (2002) and detailed in Chapter 5, explanatory variables were first added to the model with fixed slopes, decomposing the intercept

variance into different variance components at the individual and treatment unit levels. Predictors with a *p*-value of greater than .05 were then deleted from the model, resulting in the best possible model for the fixed part. Slopes were then allowed to vary across treatment units, resulting in the final estimated random coefficient model shown in Table 5. Final model fit was confirmed by examining the reduction in the deviance statistic across models as discussed in Chapter 5. The initial deviance statistic for the intercept-only model was 3591.89. After establishing the best possible fixed model, the deviance dropped to 3504.91. The model fit was further improved by allowing slopes to vary, resulting in a final deviance statistic of 3480.81.

Table 5. Final HLM model showing Level-1 and Level-2 predictors of attitudes towards use of naltrexone

Effect	**Coefficient**	**Variance**
Fixed		
Naltrexone attitude mean, γ_{00}	3.150 ***	
Methadone used, γ_{01}	.256 ***	
Primary care on-site, γ_{02}	-.144 **	
Education, γ_{10}	.180 ***	
AOD CEUs, γ_{20}	.003 *	
Medical versus Counselor, γ_{30}	-.148 **	
Support for psych med, γ_{40}	.157 ***	
Random		
Variance of adjusted intercepts across treatment units, U_{0j} (τ_0^2)		.037 *
Education, U_{1j} (τ_1^2)		.074 *
AOD CEUs, U_{2j} (τ_2^2)		.000
Medical versus Counselor, U_{3j} (τ_3^2)		.005
Support for psych med, U_{4j} (τ_4^2)		.029 *

*** p < .05, ** p < .01, *** p < .001**

Results indicated that the mean naltrexone attitude score was 3.15 at the grand-mean of all Level-1 variables and when Level-2 predictors are zero ($t = 89.602$, $p <$

.001). The fixed effects indicated that variability in naltrexone attitudes is significantly predicted by education, AOD CEUs, job category (medical versus counselor), and support for psychiatric medication at Level-1, and use of methadone and primary care on-site at Level-2.

Considering more specifically the Level-1 predictors, having a graduate degree (masters degree or higher) was associated with a .180 increase in attitude towards naltrexone when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma_{10} = .180$, $t = 3.744$, $p < .001$). This suggests that a graduate education is one important factor associated with greater levels of support for use of naltrexone. AOD CEUs was marginally significant ($\gamma_{20} = .003$, $t = 2.411$, $p = .02$), suggesting that clinicians who attend continuing education trainings are more likely to have greater support for use of naltrexone. For every additional AOD CEU there was a .003 increase in attitude toward naltrexone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model. Job category was dummy coded to reflect differences between medical staff and the other three job categories (counselor, management, and support staff). In the present model, the only significant relationship was the comparison between counselors and medical staff. Specifically, counselors were -.148 less supportive of naltrexone than medical staff when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma_{30} = -.148$, $t = -3.637$, $p = .001$). Of all Level-1 predictors, support for psychiatric medications was most significant ($\gamma_{40} = .157$, $t = 6.157$, $p < .001$). Results indicated that a one-unit increase in support for psychiatric medication (e.g., from a 3

to a 4 on a 1 to 5 scale) was associated with a .157 increase in attitude toward use of naltrexone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model.

At Level-2, use of methadone in a treatment unit significantly predicted increased support for use of naltrexone (γ_{01} = .256, t = 4.758, p < .001). Use of methadone in a treatment unit was associated with a .256 increase in attitude toward use of naltrexone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model. On-site primary care in treatment units was also a significant predictor of attitudes toward naltrexone (γ_{02} = -.144, t = -2.658, p = .009). Having on-site primary care was associated with a .144 decrease in attitude toward use of naltrexone when controlling for the other grand-mean centered Level-1 and uncentered level-2 predictors in the model.

The test of random effects indicated that attitudes towards naltrexone, adjusted for grand-mean centered Level-1 variables and uncentered Level-2 variables varied significantly across treatment units (τ_0^2 = .037, χ^2 (86) = 117.105, p = .014). Of the Level-1 predictors, the slope for education varied significantly across treatment units (τ_1^2 = .074, χ^2 (88) = 115.144, p = .027), as did the slope for psychiatric medications(τ_4^2 = .029, χ^2 (88) = 116.001, p = .024). Further investigation of interactions between education and support for psychiatric medications, and other Level-2 predictors, yielded no significant relationships.

In summary, results for naltrexone provide support for: (a) *Hypothesis 2* – higher levels of education, specifically a graduate-level education and higher number

of CEUs, were associated with greater levels of support for naltrexone; (b) *Hypothesis 3* – medical staff were more supportive of use of naltrexone than counseling staff, but other job category comparisons did not produce significant differences; (c) *Hypothesis 4* – treatment staff indicating greater levels of support for use of psychiatric medications were more supportive of naltrexone; and (d) *Hypothesis 5* – treatment unit predictor variables, specifically use of methadone in a treatment unit and having primary care on-site, both significantly contributed to explaining individual medication attitudes. No support was found for *Hypotheses 1, 6, 7* or *8* (see Section 7.1 for a more complete recapitulation of research questions and conclusions).

6.2.2 Methadone Results

Total variance in staff attitudes towards methadone was partitioned into its within-treatment and between-treatment unit components (random effects). In this fully unconditional model, there are no predictor variables from any level and the analysis is equivalent to conducting a one-way random-effects ANOVA in which treatment unit is a random factor with varying number of staff members per treatment unit. Staff attitudes toward methadone were measured on a scale from 1 to 5, where higher values represent greater support for use of methadone.

The results indicated that the variance in attitudes toward methadone between staff within treatment units (sigma squared) was .88, and the variance between treatment units (tau) was .47. The chi-square test statistic of between-treatment unit variability revealed that statistically significant variability existed between treatment units in staffs' average naltrexone attitude scores, χ^2 (236) = 1017.87, $p < .001$. The

mean methadone attitude score was significantly greater than zero ($\gamma_{00} = 3.03$, $t = 56.208$, $p < .001$). The intraclass correlation (i.e., the percentage of variance between treatment units) was .345, indicating that 34.5% of the variability in staffs' attitudes about methadone can be accounted for by differences in treatment units.

Next, a series of multilevel models were run to examine the relationship between attitudes towards methadone and the Level-1 and Level-2 predictors. Following the steps outlined by Hox (2002) and detailed in Chapter 5, explanatory variables were first added to the model with fixed slopes, decomposing the intercept variance into different variance components at the individual and treatment unit levels. Predictors with a *p*-value of greater than .05 were then deleted from the model, resulting in the best possible model for the fixed part. Slopes were then allowed to vary across treatment units, resulting in the final estimated random coefficient model shown in Table 6. Final model fit was confirmed by examining the reduction in the deviance statistic across models. The initial deviance statistic for the intercept-only model was 4160.80. After establishing the best possible fixed model, the deviance dropped to 3995.20. The model fit was further improved by allowing slopes to vary, resulting in a final deviance statistic of 3972.38.

Table 6. Final HLM model showing Level-1 and Level-2 predictors of attitudes towards use of methadone

Effect	**Coefficient**	**Variance**
Fixed		
Methadone attitude mean, γ_{00}	2.997 ***	
Methadone used, γ_{01}	1.063 ***	
Primary care on-site, γ_{02}	-.179 *	
Staff in recovery (percent), γ_{03}	-.005 **	
Prescriber, γ_{10}	.484 **	
Education, γ_{20}	.136 *	
Medical versus Manager, γ_{30}	.209 **	
Support for psych med, γ_{40}	.147 ***	
Random		
Variance of adjusted intercepts across treatment units, U_{0j} (τ_0^2)		.181 ***
Prescriber, U_{1j} (τ_1^2)		.114
Education, U_{2j} (τ_2^2)		.031
Medical versus Manager, U_{3j} (τ_3^2)		.006
Support for psych med, U_{4j} (τ_4^2)		.051 **

*** p < .05, ** p < .01, *** p < .001**

Results indicated that the mean methadone attitude score was 2.997 at the grand-mean of all Level-1 variables and when Level-2 predictors are zero (t = 36.237, p < .001). The fixed effects indicated that variability in methadone attitudes is significantly predicted by professional licensure (prescriber), education, job category (medical versus managers), and support for psychiatric medication at Level-1, and use of methadone, primary care on-site, and percent of staff in recovery at Level-2.

More specifically, at Level-1, professional licensure (i.e., the ability to prescribe medications) significantly predicted attitudes towards methadone (γ_{10} = .484, t = 3.646, p = .001). The ability to prescribe medications was associated with a .484 increase in attitude toward methadone when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors. Further, having a graduate degree (masters

degree or higher) was associated with a .136 increase in attitude towards methadone when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors (γ_{20} = .136, t = 2.412, p = .017). This suggests that a graduate education is one important factor associated with greater levels of support for use of methadone. Job category was dummy coded to reflect differences between medical staff and the other three job categories (counselor, management, and support staff). In the present model, the only significant relationship was the comparison between counselors and management. Specifically, management was .209 more supportive of methadone than medical staff when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors (γ_{30} = .209, t = 3.563, p = .001). Support for psychiatric medications was also a significant predictor of attitude toward methadone (γ_{40} = .147, t = 4.696, p < .001). Results indicated that a one-unit increase in support for psychiatric medication was associated with a .147 increase in attitude toward use of methadone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model.

At Level-2, use of methadone in a treatment unit significantly predicted increased support for use of methadone as would be expected (γ_{01} = 1.063, t = 9.943, p < .001). Use of methadone in a treatment unit was associated with a 1.063 increase in attitude toward use of methadone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model. On-site primary care in treatment units was also a significant predictor of attitudes toward methadone (γ_{02} = -.179, t = -2.003, p = .046). Having on-site primary care was associated with a .179

decrease in attitude toward use of methadone when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model. Lastly, the percent of staff in recovery significantly predicted attitude toward methadone (γ_{03} = -.005, t = -2.710, p = .008). A one-percent increase in the number of treatment staff in recovery was associated with a .005 decrease in attitude toward methadone.

The test of random effects indicated that attitudes towards methadone, adjusted for grand-mean centered Level-1 variables and uncentered Level-2 variables varied significantly across treatment units (τ_0^2 = .181, χ^2 (18) = 70.139, p < .001). Of the Level-1 predictors, only the slope for support of psychiatric medications varied significantly across treatment units (τ_4^2 = .051, χ^2 (21) = 39.50, p = .009). Further investigation of interactions between support for psychiatric medications and other Level-1 predictors yielded no significant relationships.

In summary, results for methadone provide support for: (a) *Hypothesis 1* – the ability to prescribe methadone was associated with greater levels of support for use of methadone; (b) *Hypothesis 2* – higher levels of education, specifically a graduate-level education, was associated with greater levels of support for methadone; (c) *Hypothesis 4* – treatment staff indicating greater levels of support for use of psychiatric medications were more supportive of methadone; and (d) *Hypothesis 5* – treatment unit predictor variables, specifically use of methadone in a treatment unit, having primary care on-site, and the percentage of staff in recovery all significantly contributed to explaining individual medication attitudes. Opposite to what was hypothesized about job categories (*Hypothesis 3*), medical staff were significantly less

supportive of methadone than management. No other job category comparisons produced significant differences, and no support was found for *Hypotheses 6, 7* or *8* (see Section 7.1 for a more complete recapitulation of research questions and conclusions).

6.2.3 Buprenorphine Results

Total variance in staff attitudes towards buprenorphine was partitioned into its within-treatment and between-treatment unit components (random effects). In this fully unconditional model, there are no predictor variables from any level and the analysis is equivalent to conducting a one-way random-effects ANOVA in which treatment unit is a random factor with varying number of staff members per treatment unit. Staff attitudes toward buprenorphine were measured on a scale from 1 to 5, where higher values represent greater support for use of buprenorphine.

The results indicated that the variance in attitudes toward buprenorphine between staff within treatment units (sigma squared) was .51, and the variance between treatment units (tau) was .14. The chi-square test statistic of between-treatment unit variability revealed that statistically significant variability existed between treatment units in staffs' average buprenorphine attitude scores, χ^2 (236) = 614.143, $p < .001$. The mean buprenorphine attitude score was significantly greater than zero ($\gamma_{00} = 3.30$, $t = 99.908$, $p < .001$). The intraclass correlation (i.e., the percentage of variance between treatment units) was .215, indicating that 21.5% of the variability in staffs' attitudes about buprenorphine can be accounted for by differences in treatment units.

Next, a series of multilevel models were run to examine the relationship between attitudes towards buprenorphine and the Level-1 and Level-2 predictors. Following the steps outlined by Hox (2002) and detailed in Chapter 5, explanatory variables were first added to the model with fixed slopes, decomposing the intercept variance into different variance components at the individual and treatment unit levels. Predictors with a *p*-value of greater than .05 were then deleted from the model, resulting in the best possible model for the fixed part. Slopes were then allowed to vary across treatment units, resulting in the final estimated random coefficient model shown in Table 7. Final model fit was confirmed by examining the reduction in the deviance statistic across models. The initial deviance statistic for the intercept-only model was 3295.72. After establishing the best possible fixed model, the deviance dropped to 3144.77. The model fit was further improved by allowing slopes to vary, resulting in a final deviance statistic of 3116.06.

Table 7. Final HLM model showing Level-1 and Level-2 predictors of attitudes towards use of buprenorphine

Effect	**Coefficient**	**Variance**
Fixed		
Buprenorphine attitude mean, γ_{00}	3.528 ***	
Treatment model, γ_{01}	-.006 **	
Prescriber, γ_{10}	.463 ***	
Education, γ_{20}	.162 ***	
AOD Minor, γ_{30}	.090 *	
AOD CEUs, γ_{40}	.004 ***	
Medical versus Counselor, γ_{50}	-.257 ***	
Support for psych med, γ_{60}	.155 ***	
Random		
Variance of adjusted intercepts across treatment units, U_{0j} (τ_0^2)		.102 **
Prescriber, U_{1j} (τ_1^2)		.095
Education, U_{2j} (τ_2^2)		.029
AOD Minor, U_{3j} (τ_3^2)		.046
AOD CEUs, U_{4j} (τ_4^2)		.000
Medical versus Counselor, U_{5j} (τ_5^2)		.016
Support for psych med, U_{6j} (τ_6^2)		.029

*** p < .05, ** p < .01, *** p < .001**

Results indicated that the mean buprenorphine attitude score was 3.528 at the grand-mean of all Level-1 variables and when Level-2 predictors are zero ($t = 46.093$, $p < .001$). The fixed effects indicated that variability in buprenorphine attitudes is significantly predicted by professional licensure (prescriber), education, AOD minor, AOD CEUs, job category (medical versus counselor), and support for psychiatric medication at Level-1, and treatment model at Level-2.

More specifically, at Level-1, professional licensure (i.e., the ability to prescribe medications) significantly predicted attitudes towards buprenorphine ($\gamma_{10} = .463$, $t = 4.907$, $p < .001$). The ability to prescribe medications was associated with a

.463 increase in attitude toward buprenorphine when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors. Further, having a graduate degree (masters degree or higher) was associated with a .162 increase in attitude towards buprenorphine when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma_{20} = .162$, $t = 3.876$, $p < .001$). This suggests that a graduate education is one important factor associated with greater levels of support for use of buprenorphine. Having a minor degree related to addiction was also significant ($\gamma_{30} = .090$, $t = 2.078$, $p = .038$) and associated with a .090 increase in attitude toward buprenorphine when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors. Also significantly predictive of attitudes toward buprenorphine is the number of AOD CEUs ($\gamma_{40} = .004$, $t = 3.861$, $p < .001$). For every additional AOD CEU there was a .004 increase in attitude toward buprenorphine when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model. Job category was dummy coded to reflect differences between medical staff and the other three job categories (counselor, management, and support staff). In the present model, the only significant relationship was the comparison between counselors and medical staff. Specifically, counselors were -.257 less supportive of buprenorphine than medical staff when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma_{50} = -.257$, $t = -6.178$, $p < .001$). Finally, support for psychiatric medications was also significant ($\gamma_{60} = .155$, $t = 7.329$, $p < .001$). Results indicated that a one-unit increase in support for psychiatric medication (e.g., from a 3 to a 4 on a 1 to 5 scale) was associated with a .155 increase

in attitude toward use of buprenorphine when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model.

At the treatment unit level, only treatment model significantly predicted attitudes towards use of buprenorphine (γ_{01} = -.006, t = -3.137, p = .002). A one-unit increase in the model of treatment (i.e., Kaskutas Scale from 1 to 100) was associated with a .006 decrease in attitude toward use of buprenorphine when controlling for the other grand-mean centered Level-1 and uncentered Level-2 predictors in the model.

The test of random effects indicated that attitudes towards buprenorphine, adjusted for grand-mean centered Level-1 variables and uncentered Level-2 variables varied significantly across treatment units (τ_0^2 = .102, χ^2 (22) = 42.693, p = .005). However, none of the Level-1 slopes were significant and helped to explain this treatment unit variance.

In summary, results for buprenorphine provide support for: (a) *Hypothesis 1* – the ability to prescribe buprenorphine was associated with greater levels of support for use of buprenorphine; (b) *Hypothesis 2* – higher levels of education, both graduate as well as CEUs, and having a minor degree in an addiction-related field, was associated with greater levels of support for buprenorphine; (c) *Hypothesis 3* – medical staff were more supportive of use of buprenorphine than counseling staff, but other job category comparisons did not produce significant differences; (d) *Hypothesis 4* – treatment staff indicating greater levels of support for use of psychiatric medications were more supportive of buprenorphine; and (e) *Hypothesis 5* – treatment unit predictor variables, specifically treatment model, contributed to explaining individual medication

attitudes. No support was found for *Hypotheses 6, 7* or *8* (see Section 7.1 for a more complete recapitulation of research questions and conclusions).

6.3 Summary Across Medication Models

Table 8 (see next page) provides a summary of the significant predictors in the final random coefficient models across all three addiction medications. It is worth noting that *education* and *psychiatric medication support* were significant predictors across all medications. However, the variable, *free-standing* (i.e., free-standing versus part of a larger healthcare organization), and the dummy coded variable comparing medical staff to support staff, were not significant predictors for any of the medications.

The table also indicates that across all medications, there was significant variance between treatment units (i.e., random intercept variance). A comparison of the intraclass correlations revealed that more variability exits at the organizational-level for methadone (34.5%) and buprenorphine (21.5%) than for naltrexone (8.6%). Further, although not shown in the table, the random intercept variance was partially explained by differences in support for psychiatric medications for naltrexone and methadone, and for differences in education for naltrexone. Additional investigation of interaction effects with these variables and other Level-2 variables revealed no significant interactions.

Table 8. Summary of significant coefficients in final multilevel models across medications

	Naltrexone	Methadone	Buprenorphine
Level-2			
Treatment model			-.006 ***
Methadone unit	.26 ***	1.063 ***	
Primary care on-site	-.144 **	-.179 *	
Staff in recovery		-.005 *	
Free-standing			
Level-1			
Prescriber vs. Non-prescriber		.484 **	.463 ***
Education	.180 ***	.136 *	.162 ***
AOD minor			.090 *
AOD CEUs	.003 *		.004 ***
Medical vs. Counselor	-.148 **		-.257 ***
Medical vs. Management		.209 **	
Medical vs. Support Staff			
Psychiatric medication support	.157 ***	.147 ***	.155 ***
Random intercept variance	Yes	Yes	Yes
Intraclass Correlation	8.6%	34.5%	21.5%

*** p < .05, ** p < .01, *** p < .001**

An important consideration when evaluating the usefulness of the above findings is the distinction between *statistical* and *practical* significance. Abelson has said:

> A major difficulty with simply using the significance level is that the *p* value depends not only on the degree of departure from the null hypothesis, but also on the sample size. Thus with very large samples, small effects can readily achieve extreme significance levels (Abelson, 1995, p. 40).

In the present study, a robust sample size contributed to producing some significant findings that have questionable practical significance. For example, *AOD CEUs* significantly predicted medication attitudes towards naltrexone and buprenorphine. However, the coefficient values, .003 for naltrexone and .004 for buprenorphine, are

so small that a counselor would have to obtain over a hundred CEUs in one year to raise an attitude score by even half a point (i.e., score of 3 to 3.5). Since most professional licensing boards require only 20 CEUs per year, there is little chance that any counselor would obtain enough CEUs in a given year to significantly influence medication attitudes.

Although there are additional variables that have questionable practical significance (treatment model, AOD Minor, staff in recovery), a decision was made to not eliminate them from the models because: (a) they were statistically significant; (b) they did influence medication attitudes, although not to the same degree as other variables in the model; and (c) there is usefulness in understanding the magnitude of their effects when analyzed within a multilevel design, since they have been shown to be important predictors in previous research. However, future studies would likely benefit from examining more parsimonious models.

Chapter 7: Discussion

There is strong evidence that pharmacotherapy specific to addictive disorders, when combined with psychosocial interventions, can contribute to positive treatment outcomes. Yet in spite of this evidence, studies consistently indicate a general lack of support for use of addiction medications by those working in the addiction treatment field. The purpose of this study was to extend previous research on treatment-staff attitudes towards addiction medications by examining the influence of individual and organizational factors within a multilevel framework. Although all of the variables selected for the analysis had been significant predictors in prior studies, none had been tested within a multilevel design that considers individual and organizational factors simultaneously.

In the first part of this chapter, findings addressing each of the specific research questions (hypotheses) are summarized (Aim 1 and Aim 2 from Chapter 5). The results are then discussed in a more general framework that explores their unique contribution to the field. The discussion then examines the practical implications for how support for appropriate use of addiction medications can be increased, utilizing the systems methodology outlined in Chapter 2 (Aim 3). This chapter also addresses the possible unintended consequences of promoting and increasing the appropriate use of addiction medications. Lastly, the limitations of the study and directions for future research are explored.

7.1 Recapitulation of Research Questions and Conclusions

Hypothesis 1*. Treatment staff members with a professional license to prescribe addiction medications will be more supportive of use of addiction medications than staff without a license to prescribe addiction medications, when controlling for other individual and organizational factors.*

The results indicated that the ability to prescribe addiction medications is a significant predictor of medication attitudes when controlling for other individual and organizational factors, but not across all medications. Contrary to studies suggesting prescriber status is an important predictor of attitudes towards naltrexone (Forman et al., 2001; Thomas et al., 2003), this study found that it was only predictive for methadone and buprenorphine. One explanation is that prescribers may view medications for opiate dependence differently than a medication for alcohol dependence. Methadone has long been the gold standard for effectively treating opiate dependence, and has also been used for years as an effective pain analgesic. As a result, prescribers are likely to be more familiar with methadone, its historical use in treatment programs (i.e., methadone maintenance programs), and may know that there are no well-established self-help or psychosocial interventions for opiate dependence as there are for alcoholism.

To prescribe buprenorphine (also for opiate dependence), physicians are required to meet specific qualifications outlined in the Drug Addiction Treatment Act of 2000 aimed at ensuring proper use of the medication. No such requirements exist for naltrexone, so it is possible that physicians may be less versed in naltrexone's use

for alcoholism. But this argument is weak because the physicians surveyed were working in substance abuse treatment programs and likely were aware of how to appropriately use it. Perhaps most revealing is that unlike treatment for opiate dependence, alcoholism has been traditionally treated by programs that emphasize use of the 12-steps of AA. Such self-help programs have historically not been supportive of addiction medications. In my own experience as a clinician, I have known at least three medical directors of alcohol treatment programs that were in recovery themselves, champions of 12-step ideology, and believed that change was ultimately related to a spiritual experience and not because of the use of a medication. Although this study included the percent of staff in recovery as an organizational variable, the original data did not differentiate recovery status by job category; thus further exploring its significance for prescribers was not possible. Whether or not personal recovery status and 12-step ideology help differentiate the effects between different medications needs to be further explored.

It is also interesting to note that support for psychiatric medications was a significant individual-level predictor across all medications, but only significantly explained treatment unit variance for methadone. Thus, prescribers, even in programs that treat alcohol dependence, are not adverse to supporting use of psychiatric medications.

Hypothesis 2. *Higher levels of education will be associated with greater levels of support for use of addiction medications when controlling for other individual and organizational-level factors.*

Similar to prior research (Forman et al., 2001; Fuller et al., 2005; Knudsen et al., 2005; Roman & Johnson, 2002), this study found that across all medications, higher levels of academic education significantly predicted attitudes towards appropriate use of addiction medications when controlling for other individual and organizational factors. The only other variable at either the individual or organizational-level that was significantly predictive across all medications was support for psychiatric medications. Thus, this study offers further evidence that academic education is among the most important of all predictors of addiction medication attitudes.

Unfortunately, this study did not investigate what specific educational factors were responsible for increased support for addiction medications. However, an interesting finding was that having a minor degree related to addiction was only predictive of attitudes towards buprenorphine, and only at the $p < .05$ significance level. This may indicate that the benefits of a graduate-level education may have more to do with learning how to think about a broad range of issues from multiple perspectives, critically evaluate research, and become aware of the role of personal bias, rather than an increased knowledge of addiction-specific content. It is also possible that those who teach addiction-specific content may have personal biases towards addiction medications and inadvertently pass on their opinions to students. Future studies are needed to better understand the role of academic education, and learn what factors most influence attitudes towards addiction medications.

As mentioned in Chapter 5, 98% of mental health treatment programs require incoming clinical staff to have a minimum of a master's degree, while only 10% of addiction treatment programs have the same requirement (Kerwin et al., 2006). This has led to a clinical workforce in the substance abuse treatment field that is much more academically diverse than in the field of mental health. In the present study, about 60% of workforce staff had a bachelor's degree or less, 30% had a master's degree, and about 5.5% had a medical or doctoral degree (4.5% missing data). Other workforce surveys have found similar academic diversity (Kaplin, 2005). In the absence of knowing what specific educational factors influence medication attitudes, one obvious implication is that support for appropriate use of addiction medications can be increased if program managers hire clinicians with a minimum of a master's degree.

Alternatively, the present study found that CEUs related to the treatment of addictive disorders positively influenced attitudes towards naltrexone and buprenorphine, but not methadone. This finding is similar to those of other studies (Knudsen et al., 2005; Thomas et al., 2003), and suggests that addiction-specific education (e.g., trainings, workshops) can influence medication attitudes independent of formal academic education. It is also very likely that current CEU trainings and programs would have a greater emphasis on relatively newer FDA approved medications like naltrexone and buprenorphine rather than methadone. For program managers who are limited financially in their ability to hire master's level counselors,

increased focus on CEU programs specific to addiction medications may be a cost-effective alternative.

Hypothesis 3. *Primary job category will predict attitudes about use of addiction medication when controlling for other individual and organizational-level factors, such that medical staff will be more supportive of addiction medications than managers/supervisors, counselors, and support staff.*

Primary job category was not a strong predictor of attitudes towards addiction medications. This study found only three significant differences between medical staff and other job categories. As hypothesized, medical staff had more favorable attitudes towards naltrexone and buprenorphine than counselors, but did not differ significantly in their attitudes towards methadone. This finding provides further evidence that prescribers have greater levels of support for use of naltrexone and buprenorphine than clinical treatment staff, but it also reveals that prescribers are not significantly different from managers and other support staff on these two medications. For methadone, contrary to what was hypothesized, managers were significantly more supportive of methadone than prescribers. It is very likely that program managers of methadone maintenance programs are more supportive of use of methadone than prescribers because the success of their business relies on the appropriate use of methadone. It also makes sense that prescribers and counselors would not differ significantly on their attitudes towards methadone because use of the medication is ubiquitous within programs.

Collectively, the findings suggest that within substance abuse treatment programs, medical staff, managers/supervisors and support staff are not so different in their attitudes towards addiction medications. But counselors, who have the most patient contact, are the least supportive of use of medications. Findings for hypotheses 1 and 2 suggest that higher levels of education help explain this difference, but support staff have the least amount of formal academic experience. Thus it appears that the most significant divide in attitudes within treatment programs is between *treatment* staff, and more specifically between counselors and prescribers. In the latest survey on substance abuse treatment services in the United States (SAMHSA, 2005), only 28% of the programs said they offered pharmacotherapy, delivered mostly by part-time prescribers who have little contact with counseling staff (McLellan & Meyers, 2004). Further, it is worth noting that a large number of program directors worked as clinicians before moving into managerial positions (McLellan & Meyers, 2004). Therefore, interventions to increase support for appropriate use of addiction medications across the entire treatment system must recognize that general counseling staff should be a primary target population. Even in programs that do not offer pharmacotherapy, if counselors support the appropriate use of addiction medications, then they are in a strong position to lobby management to find a way to add this service. At the very least, programs can develop a system where patients can be referred to prescribers outside of an agency.

Hypothesis 4. *Treatment staff indicating greater levels of support for use of psychiatric medications will be more likely to support use of addiction medications when controlling for other individual and organizational-level factors.*

This study contributes further evidence to previous findings that staff who support use of psychiatric medications are more likely to be supportive of addiction medications (Forman et al., 2001; Fuller et al., 2005). As mentioned in hypothesis 2, support for psychiatric medications and academic education were the only two predictors at both the individual and organizational level that significantly predicted attitudes towards all three medications. In addition, support for psychiatric medications significantly explained variance between treatment units, but only for naltrexone and methadone. Unfortunately, further examination of this random effect with other Level-2 variables suggested no significant interactions. One possible explanation for the random effect is that the differences in treatment units are directly related to which treatment units actively treat psychiatric problems. Additional research is needed to better understand the role of psychiatric medications in substance abuse treatment clinics.

Over half of all patients who seek treatment for substance abuse problems have a significant co-occurring mental health disorder, and that after the severity of the substance abuse problem, the variable most predictive of successful treatment outcomes is severity of psychiatric symptoms (Institute of Medicine, 1998; Kessler et al., 1997; Kessler et al., 1994). Unfortunately, only about 40% of substance abuse treatment programs in the country conduct any type of psychiatric evaluation, with

even fewer offering comprehensive treatment services for mental health problems (McLellan et al., 1993; SAMHSA, 2005). Thus, it appears that one broad challenge of the current substance abuse treatment system is how best to accommodate individuals with co-occurring disorders. Although there are a variety of effective psychosocial interventions for many mental health problems, there is clear evidence that use of medications (e.g., antidepressants, antipsychotics) can significantly enhance treatment outcomes for many patients (Institute of Medicine, 2006). Therefore, it appears there is a dual challenge of how best to go about increasing support for both psychiatric and addiction medications. It is likely that efforts to increase one will likely have a positive spillover effect on the other.

Hypothesis 5. *Treatment unit predictor variables (Level-2), taken together, will account for a significant amount of the variance in individual treatment staff attitudes about the use of addiction medications.*

A primary objective of the present study was to test known predictors of addiction medication attitudes – both individual and organizational – within a multilevel framework. Findings suggest that attitudes towards addiction medications are a function of *both* individual and organizational factors, but to varying degrees across the three medications. The intraclass correlation provides an estimate of the percentage of variance in individual attitudes that is explained at the organizational (treatment unit) level. Across the three medications, naltrexone had the least amount of variance at the organizational-level (8.6%), followed by buprenorphine (21.5%), and methadone (34.5%). Unlike at the individual-level where academic education and

support for psychiatric medications were predictive across all medications, no organizational predictors showed the same consistent outcome. This suggests that attitudes towards each medication are a unique blend of individual and organizational factors.

Naltrexone showed the least amount of variability at the organizational-level, but that variability in part was explained by two factors. Staff working in treatment units that routinely used methadone (i.e., methadone maintenance programs) were significantly more supportive of naltrexone for the treatment of alcohol dependence. This suggests that once staff become comfortable using one addiction medication they are likely to be supportive of others. Among the most puzzling findings and opposite to what was hypothesized, was that staff working in treatment units providing on-site primary care were less likely to be supportive of naltrexone. Although only about a third of all treatment units offered such services, this finding suggests that primary care professionals may represent a culture at odds with substance abuse treatment. Differences in individual characteristics, training, experience, and philosophies of treatment likely explain such cultural gaps (Thomas & McCarty, 2004). Further, it may also be that primary care staff working in substance abuse treatment programs are more likely to be in personal recovery, resulting in less favorable attitudes towards addiction medications (Thomas et al., 2003).

Organizational factors were most predictive of attitudes towards methadone. As expected, a significant and positive relationship was found between methadone maintenance treatment units and attitudes towards use of methadone. Similar to

naltrexone, staff working in treatment units providing on-site primary care were less supportive of methadone for likely the same reasons suggested above. It is worth noting that on-site primary care was not predictive of attitudes towards buprenorphine, a medication strongly being marketed for use in primary care clinics external to substance abuse treatment. This suggests even more that primary care staff working in substance abuse treatment programs may hold unique beliefs and attitudes towards addiction medications separate from primary care staff not associated with addiction treatment. Attitudes towards methadone were also significantly predicted by the percentage of staff in personal recovery. The greater the percentage within a treatment unit the less supportive staff attitudes were towards methadone. Because this study did not investigate which personal recovery characteristics most related to medication attitudes, this finding needs further investigation in light of Knudsen et al. (2005) suggesting that personal recovery is not synonymous with a 12-step orientation to treatment.

The only organizational-level factor that significantly predicted attitudes towards buprenorphine was the model used in treatment (i.e., medical versus social). Staff adhering more to a social model of care were significantly less supportive of buprenorphine. This is not surprising since the essence of a social model of care is based on healing relationships and not use of a medication (Kaskutas et al., 1998). Although prior studies indicated this factor was important across medications (Knudsen et al., 2005; Mark, Kranzler, Poole et al., 2003; Ogborne et al., 1998), when

tested within a multilevel framework, the results suggest that treatment model may play a less significant role across addiction medications.

In summary, results from this study suggest that organizational factors play a more significant role in predicting attitudes towards medications to treat opioid dependence than alcohol dependence. It is worth noting that methadone, which had the highest degree of organizational variability, also was the only medication for which management (at the individual-level) were more supportive of its use than prescribers. Further, when comparing the overall profiles of predictors at both the individual and organizational levels, attitudes towards buprenorphine were explained by the most individual-level predictors (six compared to four for naltrexone and methadone) and the least organizational factors (one compared to two for naltrexone and three for methadone). Thus when tested in a multilevel framework, attitudes towards each addiction medication appear to be a unique blend of individual and organizational factors, suggesting that efforts to increase support for addiction medications would benefit from medication-specific interventions.

Hypothesis 6. *The relationship between staff education and attitudes towards use of addiction medications will be moderated by treatment model such that education will play less of a role when organizations adhere more to a social model of care.*

No evidence was found to support treatment model as a moderator of the relationship between staff education and medication attitudes. Only attitudes towards buprenorphine were predicted by both education and treatment model, but the test for random effects indicated that treatment unit variance was not related to staff

education. This provides further evidence that education may be among the most important predictors of medication attitudes, and be independent of the model used in treatment. As a result, interventions to increase the support for addiction medications may not have to be as concerned about the organizational culture of treatment units so much as the degree of education of staff working in those units.

Hypothesis 7. *The relationship between support for psychiatric medications and attitudes towards use of addiction medications will be moderated by whether a treatment unit has on-site primary medical care, such that support for psychiatric medications will be greater for treatment units offering medical care on-site.*

No evidence was found to support on-site primary medical care being a moderating effect of the relationship between psychiatric medications and addiction medication attitudes. As previously noted, support for psychiatric medications was among the most significant individual-level predictors across all medications, and a significant random effect for naltrexone and methadone. Yet further investigation of interaction effects for naltrexone and methadone with on-site primary care revealed no significant relationships. This may suggest that primary care is not synonymous with use of all medications, and that medications used for psychiatric and addictive disorders may represent a class of drugs less known to staff delivering primary care services. This gap between behavioral health and primary care has been noted by others (Institute of Medicine, 2006; Thomas & McCarty, 2004), and provides another opportunity for the development of interventions to increase support for addiction medications.

Hypothesis 8. *The relationship between primary job and attitudes towards use of addiction medications will be moderated by whether a treatment unit is licensed to dispense methadone, such that across all job categories, support of addiction medications will be higher in treatment units that currently use methadone.*

Findings suggest that the relationship between primary job category and medication attitudes is not moderated by the use of methadone in treatment units. Although some significant differences in attitudes between prescribers and other staff members across medications was found, none of these produced significant random effects, suggesting that the differences in attitudes are fairly consistent across treatment units. This implies that interventions to increase support for addiction medications specific to job category, may not have to be as concerned about whether a treatment unit uses methadone or not. However, it is worth noting that only about a fifth of all treatment units in the present study were considered regular dispensers of methadone, and that additional multilevel research is needed to more fully characterize the relationships between treatment staff, use of methadone, and attitudes towards addiction medications in general.

7.2 Contribution of the Findings

The primary objective of this dissertation was to develop a better understanding of why those who deliver substance abuse treatment services are not more supportive of addiction medications, given the vast evidence that such medications can significantly contribute to positive treatment outcomes. This is important because medications have the potential to improve the lives of many who

struggle with addiction, but only to the extent that such medications are supported by the treatment community and known to patients. Although numerous studies have examined the determinants of attitudes towards addiction medications and found that individual and organizational factors are involved, the present study was the first to investigate such factors within a multilevel framework. As a result, the findings advance the current research literature by providing evidence for the following:

1. ***Individual and organizational factors simultaneously influence attitudes towards addiction medications.*** Although prior studies have indicated that attitudes towards addiction medications involve both individual and organizational determinants, this study provided the first empirical support that both are involved simultaneously. Further, it showed that attitudes towards addiction medications are determined primarily by individual characteristics, but that for some medications, organizational factors are quite important. For example, attitudes towards naltrexone were least influenced by organizational determinants (8.6%), while more than a third of the variance of attitudes towards methadone were explained at the organizational-level (34.5%), with buprenorphine in the middle (21.5%).
2. ***Determinants of medication attitudes are not consistent across medications.*** The findings suggest that the determinants of medication attitudes are not homogeneous across medications. Unlike many of the prior studies that focused exclusively on one medication, a strength of this study is that it examined the determinants of attitudes across three different medications. As a

result, the outcomes provide evidence that a unique blend of individual and organizational factors exist for each medication, although specific factors are robust predictors of attitudes across all medications. This suggests that efforts to increase support for each medication should ideally take into consideration the unique profile of each medicine.

3. ***Education and support for psychiatric medications are among the most important factors influencing attitudes towards addiction medications.*** This study provides further and convincing evidence that higher levels of academic education (i.e., graduate-level education) and support for use of psychiatric medications are among the most important determinants of positive attitudes towards addiction medications. Interestingly, both of these factors are also critical to substance abuse treatment outcomes in general. As discussed in Chapter 3, there has been a gap between research and practice that is now beginning to close as evidence-based practices become more and more implemented in treatment programs across the country. One of the ways this is occurring is by recognizing the benefit of hiring professionally trained staff (i.e., graduate-level education) that have the ability to deliver EBPs, including those that address mental health disorders. Many payees of addiction treatment services (e.g., county contracts, HMOs, private health insurance plans) now require that treatment be delivered by professional counselors, knowing that their expenditures will be optimized (i.e., best clinical outcomes for the least expense). Thus, results from this study further support the general shift taking

place in the field to hire graduate trained clinicians, and integrate substance abuse treatment with mental health services.

4. ***Staff attitudes towards addiction medications vary between treatment units.*** An advantage of examining the determinants of medication attitudes within a multilevel framework is that it is possible to explore variance both within and between treatment units. As a result, this study found that there were significant differences between treatment units across all medications. Further, findings pointed to some of the variability between treatment units for naltrexone and methadone being explained by differences in academic education and attitudes towards psychiatric medications. Unfortunately, no significant relationships were found between these predictor variables and the organizational factors included in the models. This suggests that there are additional variables influencing attitudes towards addiction medication that need further investigation.

5. ***Existing models illustrating the factors and processes involved in the adoption of addiction medications (Figure 3 and 4), could be improved by incorporating factors and processes that more carefully operationalize the relationships between variables, and take into consideration the unique attributes of each medication.*** The determinants of attitudes towards addiction medications are a complex blend of individual and organizational factors that vary across medications. Although the general models of technology diffusion put forth in the literature go beyond the determinants of attitudes (Simpson,

2002; Thomas & McCarty, 2004), such models could be refined by considering: (a) the multilevel nature of the variables (i.e., how do they fit within a levels framework with emerging properties such as in Figure 1?); (b) the different roles variables play across medications (i.e., why is treatment model important for one medication and less important for another?); (c) the causal relationships between variables (i.e. how are variables specifically related to each other – what causes what?); (d) the variable of time (i.e., how do the variables interact and change over time?); and (e) unintended consequences of the adoption of medication use (i.e., what might be the negative effects of increased used of addiction medications?).

6. ***A systems approach offers the best framework for examining the complex nature of attitudes towards addiction medications, and for the development of interventions to increase the support for use of addiction medications.*** A significant contribution of this study has been the use of a systems approach that extends prior research in a number of important ways. First, a system was explicitly defined that included the relevant environment and context in which appropriate use of addiction medications occur (Figure 1). Although prior studies have developed conceptual models related to the adoption of medications in practice (Figure 3 and 4), the levels approach taken in this study offers a broader framework for thinking about the system in which use of addiction medication occurs. This is important because knowledge of a system is a critical precursor to the development of effective interventions aimed at

changing attributes of the system. In addition, significant attention was given to the importance of dynamic complexity, and the potential unintended effects of increasing medication use when feedback within a complex system is not well understood.

7.3 Increasing Support for Appropriate Use of Addiction Medications

> The substance abuse treatment infrastructure in this country is not capable of delivering these emerging "evidence-based practices." This situation is particularly worrisome within the addiction field because, unlike other areas of health care, there is no primary care for substance use disorders. Only the specialty sector programs provide any care for addiction. The number of these programs is inadequate and many are on the brink of closing. The clinical workforce is turning over at the same rate as that in the fast-food industry. Though very serious in the adult treatment sector, the situation is even worse within the adolescent treatment sector (McLellan, 2006, p. 290).

It is against the backdrop of a national substance abuse treatment system in dire need of change that the topic of how best to increase support for appropriate use of addiction medications must be examined. Although progress has been made in recognizing the gap between research and practice (Institute of Medicine, 1998, 2006), and closing the gap through a number of government sponsored initiatives (e.g., CTN, PICs, TIPs), there remain many questions as to how to address pervasive systems problems that threaten to stand in the way of a truly effective treatment enterprise. The most significant systems problems include:

> 1) inability of social and health systems to identify and address potential substance abuse cases; 2) inadequate and difficult access to any type of substance abuse care for those who are identified; 3) a deteriorating infrastructure, including the leadership, workforce, and information systems with the treatment programs. These factors combine to produce inadequate types, amounts, and quality of substance abuse treatment services for those who need it (McLellan & Meyers, 2004, p. 764).

This section does not attempt to offer solutions to the very complex problem of how to rescue the ailing addiction treatment system, but instead focuses on practical ways to increase support for appropriate use of addiction medications based on what was learned from the present study. But clearly, this discussion cannot realistically be separated from the larger systems problems, because increased use of addiction medications ultimately requires a treatment system capable of delivering evidence-based practices.

Throughout this dissertation it has been argued that a systems approach is necessary not only to understand the problem of limited support for addiction medications, but also as a methodology for exploring how to improve this situation. Here it is helpful to return to the steps outlined in section 2.3 that provide a useful framework for exploring how best to increase support for appropriate use of addiction medications, while at the same time recognizing that such interventions occur within a challenged treatment system in need of significant changes (Hall, 1989). As previously noted, the following steps involve taking the knowledge learned from the present study and utilizing it to explore improved intervention strategies.

(1) Problem definition: Where are we now?

This study has focused primarily on the problem definition, and further advancing the research literature regarding the limited support for addiction medications across substance abuse treatment programs. Although prior research has examined this issue from a number of perspectives, this study utilized a systems approach to uniquely describe the system in which the problem occurs, its relative

environment and context, and the specific individual and organizational factors that simultaneously influence medication attitudes. Thus one answer to *where are we now* is found throughout this dissertation, with specific empirical outcomes summarized in the previous sections.

Another important aspect of this step relates to how a particular treatment program develops an understanding of its particular intervention needs. Discussed in section 3.4.2, the *TCU Organizational Readiness for Change* (ORC) assessment, is an ideal tool for exploring a programs' needs specific to staff attributes, available resources, motivation for change, and organizational climate (Lehman et al., 2002). In addition, *The Change Book: A Blueprint for Technology Transfer*, provides guidance on how programs should go about clarifying the problem definition (Addiction Technology Transfer Centers, 2000).

(2) Value system design: Where do we want to be, what values will guide us in the process of getting there, and how do we measure attainment of the objective(s)?

A blueprint of the value system design has been meticulously outlined in the IOM reports briefly reviewed in this dissertation (Institute of Medicine, 1998, 2000, 2001, 2005). Although many of the recommendations are aimed at improving the overall healthcare and substance abuse treatment system, they also provide a clear framework for answering the above questions specific to addiction medications. Thus, the six aims of high-quality health care can be adopted for addiction medications as follows (Institute of Medicine, 2006):

- Safe: All necessary precautions should be taken to avoid causing harm to patients as a result of appropriate use of addiction medications aimed at helping them. Among the best approaches for effectively addressing this issue is considering the unintended consequences of using addiction medications, detailed in the next section of this chapter.
- Effective: Appropriate use of addiction medications should be based on solid empirical evidence that they provide improved clinical outcomes, meet FDA approval, and not be under or over-utilized in practice.
- Patient-Centered: Appropriate use of addiction medications should be guided by individual patient preferences, needs, and values. All decisions related to use of addiction medications should reside with the patient.
- Timely: Wait times and delays related to patient access to addiction medications should be minimized. This also suggests that if patients are unaware of addiction medications (as is frequently the case), they should be educated about appropriate medication options in a timely matter (i.e., preferably at the time of treatment planning).
- Efficient: Barriers to efficient use of addiction medications should be identified and minimized, such as those outlined in the discussion about methadone (3.2.2).
- Equitable: Appropriate use of addiction medications should not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, or socioeconomic status.

Further details specific to determining the optimal settings for delivery of addiction medications, the necessary structural changes needed to dispense medications in treatment programs, and how best to measure whether use of addiction medications meets the quality standards set forth in the IOM reports are beyond the scope of this section. However, many of the answers are well outlined in the IOM reports specific to substance abuse treatment services (Institute of Medicine, 1998, 2006).

(3) Systems synthesis: What are the possible options for solving the problem?

Considering the challenges present in the addiction treatment system, and the results from the present study, there are a number of practical options for increasing support for appropriate use of addiction medications that would likely prove useful.

- Hire graduate trained clinicians: Findings suggest that graduate trained clinicians have more favorable attitudes towards use of addiction medications, and have the necessary skills to appropriately treat mental health disorders common in substance abuse populations. Although most often there are increased costs associated with hiring professional counselors, payees of addiction treatment services now recognize that clinical outcomes are optimized, and costs ultimately reduced, when programs utilize professionally trained clinicians. This creates an obvious challenge for financially constrained programs, and will likely be a key determinant in restructuring the future addiction treatment system.
- Treat mental health disorders present in substance abuse populations: Substance abuse programs that do not treat co-occurring mental health

disorders will likely not remain in business in the future. Payees of addiction treatment services now recognize the necessity of addressing mental health problems in optimizing clinical outcomes. Because this study found that support for psychiatric medications was among the most robust predictors of attitudes towards addiction medications, efforts by programs to offer psychiatric services will likely have a positive influence on the appropriate use of addiction medications.

- Develop a referral network: In lieu of treatment programs having prescribers on staff (due to expense), program administrators should establish an outside network of prescribers that counseling staff can trust and rely upon to prescribe both psychiatric and addiction medications. Although this may appear a simple proposition, in all likelihood, developing such a network may require significant time and energy (although not necessarily money). Optimal referral networks are based upon relationships between prescribers and treatment staff that ideally involve face-to-face interactions, regular contact, and mutual respect for each other's work. Among the most viable options are linkages with primary care medicine. A seminar sponsored by NIDA titled *Primary care and drug abuse: A research-setting round table seminar* provided evidence for the need for more collaboration between primary care medicine and substance abuse treatment, but also delineated some very specific steps that will likely encourage more linkages in the future (NIDA, 2003).

- Require staff to attend CEU trainings specific to learning evidence-based interventions that utilize, as one component, addiction medications: This study found evidence that independent of academic education, CEU trainings and workshops can play an important role in increasing support for appropriate use of addiction medications. Because CEUs are required for many treatment staff, program administrators can encourage and pay for trainings that focus on evidence-based interventions that combine psychosocial approaches with addiction medications (Volpicelli, Pettinati, McLellan, & O'Brien, 2001). Further, research related to attitude-behavior consistency suggests that the more staff are exposed to information about addiction medications, and are in a position to effect positive change with patients, the greater the likelihood addiction medications will be used more in practice (Fazio, 1990).
- Provide information about addiction medications to clinical staff and patients: Treatment programs should make available to patients and clinicians information about addiction medications, their appropriate use in practice, and possible unintended effects (see next section). Information can be in the form of popular articles, summary reviews from newsletters like the *Harvard Mental Health Letter*, or in some cases, marketing materials from pharmaceutical companies (bearing in mind the likely bias). Information can be made available in waiting rooms, counseling offices, group therapy rooms, and in other areas frequented by patients and/or clinical staff.

- Provide in-house medication services as a routine component of treatment: This option provides patients with a seamless ability to receive both counselor and medication services under one roof, further optimizing clinical outcomes. However, it also requires treatment programs to invest in the infrastructure necessary to support prescribers, resulting in more significant programmatic changes that necessitate careful planning and implementation (see Step 7). As illustrated in Section 2.1, rash policy decisions to implement evidence-based practices that do not take into consideration the views of all stakeholders in a change are likely to fail.

(4) Systems analysis: What are the best alternatives or options for solving the problem based on where we want to be?

Every substance abuse treatment program has a unique set of challenges that must be overcome to successfully achieve the envisioned value system design, and deliver high-quality care specific to addiction medications. Such challenges are most often identified and studied during the problem definition phase, so that during this step, optimal solutions can be matched with specific program needs using the criteria outlined in Step 2.

During this phase, the *TOP approach* outlined in Section 2.4 can be useful for exploring various options from multiple perspectives (Linstone, 1999). For example, the effects of hiring graduate-trained clinicians can be examined through the lens of the *technical perspective* by considering costs and benefits (i.e., higher cost but able to meet contractual requirements), and the impact on quantitative clinical outcomes

based on increased ability to deliver evidence-based practices. Alternatively, the decision to hire professional clinicians can be examined through the *organizational perspective* that considers how such an intervention would impact other treatment staff and the social dynamics existing within a program. Finally, the *personal perspective* could be used to examine how hiring one influential clinician supportive of addiction medications might lead others to follow suit. Final decisions about any particular interventions would likely benefit from consideration of all three perspectives.

(5) Optimization: How can we optimize the alternative solutions so that each is the best it can be?

Similar to the previous step, fine-tuning viable intervention options is a process unique to each treatment program. This step ideally involves administrators, treatment staff, and expert change agents carefully considering all the possible effects of each option, and determining which interventions will most likely increase use of addiction medications while minimizing risks and costs. Key to this step is assessing the possible unintended consequences that may result from particular interventions (see next section).

(6) Decision making: What is the ideal solution to the problem?

Optimal interventions to increase support and appropriate use of addiction medications will vary across treatment programs and service settings. Final decisions about specific interventions are ideally guided by the criteria established in the value systems design (Step 2), and result from the collaborative efforts of all stakeholders involved in the decision-making process.

(7) Planning for action: How best can we implement the solution?

In Section 3.2, the distinction between *efficacy* and *effectiveness* research was introduced to make the point that evidence-based practices developed under carefully controlled conditions may likely prove challenging to implement in typical substance abuse treatment programs where diverse patient populations, treatment staff, and limited resources can all impact clinical outcomes. It has been noted that the government spends approximately 95 billion dollars a year on research to develop new treatments across all healthcare related fields, about 1.8 trillion dollars a year on supports for services to people, and less than 1 billion dollars a year on implementation research (Fixen, 2006). As a result, there is a tremendous deficit in knowledge about how best to implement solutions, including interventions to increase support and appropriate use of addiction medications, into clinical practice. Thus implementation is the missing link between research and practice.

Fixen (2006) has suggested that there is considerable empirical evidence for what does not work in terms of implementation, including: (a) dissemination of information by itself, including practice guidelines, research literature, and mailings; (b) training alone without additional follow-up and support; (c) implementation without changing supporting roles and functions; and (d) implementation by edict. As a result, the options suggested in Step 3 will likely fail as stand-alone interventions, and must be implemented within a larger framework that considers the stages of implementation and how best to accomplish the goals and objectives of each stage. Following a seminal review of the implementation literature, Fixen et al. (2005) put

forth a conceptual framework for implementation of well-defined programs and practices, that can be used as a guide for how best to implement interventions specific to addiction medications. Although the framework initially overlaps with the steps outlined here, it primarily concerns itself with answering the question: *how can we implement the solution?* Although the details of the framework are beyond this section to review, it is interesting to note that a critical aspect of implementation involves considering the simultaneous and multilevel nature of the variables involved in a particular intervention, within a levels paradigm similar to that suggested in Chapter 2.

7.4 Unintended Consequences

This study was motivated by a desire to improve treatment outcomes for patients with substance abuse disorders, particularly those who consistently relapse and have relied solely on psychosocial interventions. There is significant evidence that the majority of patients fall into this category (Hubbard et al., 2001; Institute of Medicine, 1998; McLellan et al., 2000), and that long-term outcomes may be improved in many of these patients by combining psychosocial treatment with addiction medications (Institute of Medicine, 1998, 2006; Volpicelli et al., 2001). But despite this evidence, few researchers have thought much about how increasing support for addiction medications might have unintended consequences.

Central to the systems approach is recognizing that any time a change is made to one part of a system, quite often there are unanticipated effects for the entire system. Chapter 2 introduced the idea of *dynamic complexity*, and discussed how the best intentions to improve a situation can often backfire as a result of not fully

understanding the role of feedback in a system. When many variables are changing simultaneously, studies have shown that the ability of humans to make reasonable inferences about the behavior of a system over time are significantly limited, even when given complete and perfect knowledge of a system (Sterman, 2000). Given that most working in the substance abuse treatment field are stressed for time and operate with limited financial resources, it is not surprising that most change-related decisions are often based on incomplete information, habits, rote procedures, and simple mental models that quite often lead to outcomes that are less than desirable.

The previous section (and 3.1) highlighted the dire state of the current substance abuse treatment system, illustrating that the challenge is not to just increase support for addiction medications, but to enact entire systems changes that improve overall levels of addiction care on many fronts. As a result, there are inherent dangers in going about fixing the current system without significant thought as to how best to approach such a complex undertaking. The purpose of this section is not to discuss all the possible outcomes from such system-wide changes, but to highlight the most probable unintended effects of increasing use of addiction medications, and offer suggestions on how they may be appropriately addressed.

Over-reliance on use of addiction medications. A quick-fix mentality pervades society, fueled by advertising media suggesting that there are simple and fast solutions to losing weight, quitting smoking, and ending addictions. Even more, many of these solutions are based solely on the use of a medication. In the forward to the

book *Combining Medication and Psychosocial Treatments for Addiction*, Distinguished Professor of Psychology and Psychiatry, William R. Miller states:

> I fear that the dispensing of medications for addictions could be thought of much as the prescription for antibiotics for infections. There are common features, of course, such as problems with medication adherence, but addictions center not on an invasive organism, but on a pervasive behavior. A busy schedule and a mind-set to treating acute illnesses can easily combine to produce a 'Just do it!' approach that frustrates both patient and practitioner, and becomes a self-perpetuating cycle (Volpicelli et al., 2001, p. xii).

It is not hard to see how counselors and prescribers, given time constraints and limited resources, might inadvertently scale back psychosocial interventions in lieu of medications appearing to have a positive effect. Patients may report significant behavioral change after beginning a medication, unaware they are overstating the pharmacological benefit and underestimating the need to maintain concurrent psychosocial recovery activities. Over time, both patient and clinician may fall into the trap described above, where relapse becomes inevitable.

For clinicians, the solution to a quick-fix mentality is maintaining awareness that addictive disorders are long-term, chronic medical conditions that require attention to multiple factors over long periods of time (McLellan et al., 2000; McLellan, McKay, Forman, Cacciola, & Kemp, 2005). Although addiction medications can be useful in preventing relapse, they are not panaceas for many of the problems that co-occur with substance abuse, such as developmental deficits and constrictions (e.g., self-regulation problems, inability identify and use emotions), relationship problems, legal issues, and mental health disorders (McLellan et al., 1993). Thus formal academic education, continuing education trainings, and clinical

supervision all provide valuable opportunities for educating counselors and prescribers about the nature of addiction, the appropriate use of medications, and the most effective methods for obtaining optimal outcomes.

Policy decisions that lead to adverse outcomes due to lack of buy-in from impacted stakeholders. At a time when there is a significant push to incorporate evidence-based practices into substance abuse treatment, there is also the risk that rash efforts to do so may have unintended outcomes. An example of how this might happen was offered in Section 2.1, where a well-meaning program director quickly implements a policy to increase use of addiction medications, and then scratches his head months later when counselor turnover doubles and patient dropout rates increase. As discussed in the previous section of this chapter, there is significant evidence that implementing evidence-based practices, including appropriate use of addiction medications, is a complex undertaking that requires a significant amount of time and effort (Addiction Technology Transfer Centers, 2000; Fixen et al., 2005). Attempts by program administrators to short-change the implementation process will very likely lead to a host of unintended consequences that ultimately undermines the use of medications as an evidence-based treatment. Therefore, efforts to increase appropriate use of addiction medications in substance abuse treatment programs should include strong caveats to all counseling staff, administrators and prescribers, that findings from implementation research should guide programmatic changes.

Unbalanced consideration of the benefits, risks, and costs. Use of addiction medications is not without risks and costs. Although the benefits of these medications

have been reviewed in Section 3.2, little has been said about the potential hazards they pose to patients and the economic impact of increasing their usage within the substance abuse treatment system. Although studies reviewed in section 3.2 provided evidence of the safety of FDA approved addiction medications, there are numerous examples of drugs that were long thought to be safe, but later confirmed to actually cause more harm than good (i.e., Prempro®, Vioxx®, Redux®) (Avorn, 2004). Although it is not likely that naltrexone, methadone, or buprenorphine will suffer the same fate, each of these medications can produce adverse side effects that vary between patients, and at times, necessitate that a patient stop taking a particular medication.

Prescribers and patients must always recognize that even mild side effects, including drowsiness, nausea, and headaches, can influence daily activities like driving and walking, resulting in consequences beyond the initial side effects of the drug (e.g., car accident, fall). Also, patients in treatment for substance abuse commonly have medical issues that require pharmacotherapy. Although patients, prescribers and pharmacists are jointly responsible for assessing risks associated with drug interactions, there is always a chance that such interactions get overlooked. There is also the issue about how to appropriately address medication risks clinically.

> The most commonly consulted source for risk information is the ponderous Physicians' Desk Reference, where its depiction may be both overwhelming and useless. The PDR uses an odd format for describing side effects. Its 3,500 pages of tightly packed small type comprise the FDA sanctioned listings that each manufacturer provides for its drugs; most descriptions are thousands of words long. Confusingly, risks can appear under one or more of several headings: Warnings, Contraindications, Precautions, and Adverse Reactions (Avorn, 2004, p. 163).

If addiction medications are to be used more frequently in substance abuse treatment, counselors and prescribers ideally need tools beyond the PDR that accurately and concisely characterize side effects as well as benefits, and help patients make informed decisions about their care. Such tools may include web-based applications that review benefits and risks, brief publications that can be shared with patients, and in some cases, marketing materials from pharmaceutical manufacturers. In a recent edition of the *Addiction Professional* (2007), the official magazine of the National Association of Alcohol and Drug Abuse Counselors, an article titled *Pharmacotherapy: Integrating new tools into practice* provides an example of where counselors can gain knowledge of how best to utilize addiction medications in practice.

In addition to balancing benefits and risks, the equation must also include the economic impact of addiction medications for patients, as well as programs that offer medication services. Numerous studies have cited cost as a significant barrier to adoption (Mark, Kranzler, Poole et al., 2003; Mark, Kranzler, & Song, 2003; Thomas et al., 2003), and for newer medications without generics (e.g., Subutex®, Suboxone®, Vivitrol®), this is legitimate issue with unintended consequences. One concern regarding the treatment of opiate addiction is that a two-tier system will develop, where patients with insurance will receive office-based treatment using buprenorphine, and those without insurance will have no alternative but to seek help from methadone maintenance clinics. In a similar manner, I recently had a conversation (2006) with a sales manager for the company marketing Vivitrol® - the newly FDA approved, extended-release, injectable naltrexone. Because the medication

requires a monthly injection, he said patients ideally would have the cost covered by insurance not under their medication formularies, but as a surgery. Without insurance he estimated the cost around $600 per month. With a significant population of substance abusing patients having no insurance, or means for paying for addiction medications, the issue of cost has no simple solutions.

Another concern related to increasing use of addiction medications in substance abuse treatment programs is the ability of program administrators to effectively manage the costs associated with having prescribers on staff. As McLellan and Meyers (2004) have pointed out, most program administrators have minimal graduate business education, have commonly worked as counselors before taking on administrative roles, and often work second jobs as a way of improving their salaries. As a result, the development of an infrastructure to support medications services, given that many programs are already financially unstable, may present challenges beyond the capabilities of many administrators. For many programs, the best solution is to invest resources into a referral network of prescribers that are willing to work closely with counseling staff.

In summary, efforts to increase appropriate use of addiction medications should also include the development of a framework that patients, prescribers, and counseling staff can use to appropriately balance the benefits, risks and costs. Although there is no simple formula that can be followed in all cases, such a framework would optimally provide guidelines as to when addiction medications are a realistic treatment option for a particular patient. Such a framework would likely

consider a patient's substance abuse history, treatment experiences, relapse rate, insurance coverage, motivation for pharmacotherapy, and any contraindications. Learning how to assess such factors and determine the best course of action in regards to medication, ideally should begin during graduate training, and then be reinforced in continuing education programs and clinical supervision. Substance abuse treatment programs should also provide information to patients about the benefits, risks, and costs of medication in literature describing treatment services and options.

Abuse and diversion of opioid medications. An unintended consequence of efforts to increase the use of medications to treat opioid dependence is a likely increase in abuse and diversion of these medications. As reviewed in Section 3.2.2, when used appropriately, methadone and buprenorphine can be effective treatments for those struggling with addiction. But studies indicate that these medications are not immune to problems of abuse and diversion (Cicero & Inciardi, 2005a, 2005b; Cicero et al., 2005). Although much of this research has focused on the abuse and diversion liability of these medications in pain patients, there is evidence that some abuse and diversion may also occur among patients in substance abuse treatment. In one of the only reported studies on the abuse potential of buprenorphine in office-based treatment of opioid dependence, Cicero and Inciardi (2005) reported that a year after the launch of Subutex® and Suboxone®, very little abuse was found, and much less than that for methadone. Nevertheless, there is some indication that when methadone and buprenorphine are diverted or abused, such behaviors are related to patients attempting

to self-treat addiction symptoms outside the scope of formal treatment, particularly in situations where there is limited treatment available.

With reports indicating a significant and growing problem with abuse of opioid analgesics in general (SAMHSA, 2004), mechanisms to better understand the prevalence, scope, and problem of abuse and diversion specifically in patients using methadone and buprenorphine for addiction treatment purposes is needed. Joranson and Gilson (2006) have argued that a public health approach provides the best mechanism to collect such information. There is a significant need for better data sources that investigate the motivations of abusers, the sources and ways in which diversion occurs and the ethnographic variability in abuse and diversion across different geographic locales.

Complex dosing may lead to non-adherence and increased likelihood of relapse. Although medications to treat substance abuse disorders can improve clinical outcomes, prescribers and counselors may take for granted that patients take the medications exactly as prescribed. Because addiction medications are commonly used for many months or years, and can involve multiple or complicated dosing schedules, patient adherence to treatment can suffer over time, particularly if the effects of the medication are not obvious. Thus far, no specific studies have examined addiction medication compliance, but there is evidence that for other chronic medical conditions, patients' ability to adhere to a specific pharmacotherapy regimen is limited.

> Hypertension, diabetes, and asthma are also chronic disorders, requiring continuing care throughout a patient's life. Treatments for these illnesses are effective but heavily dependent on adherence to the medical regimen for that effectiveness. Unfortunately, studies have shown that less than 60% of adult patients with type 1 diabetes mellitus fully adhere to their medication schedule, and less than 40% of patients with hypertension or asthma adhere fully to their medication regimens (McLellan et al., 2000, p. 1693).

The authors of the previous statement also make the point that low adherence to medication regimens is associated with low socioeconomic status, lack of social support, and significant psychiatric comorbidity - the same issues that plague patients in substance abuse treatment. This suggests that when addiction medications are utilized in such patient populations, both prescribers and counselors should become acutely aware of adherence issues, and develop strategies to improve medication compliance.

In summary, addiction medications can play an important role in improving treatment outcomes for many patients, but also can be responsible for a number of unintended consequences. Hopefully by now, this dissertation has illustrated that the addiction treatment enterprise is dynamically complex, involving many different stakeholders, technologies, and treatments. Efforts to successfully incorporate appropriate use of addiction medications into such a complex system will likely fail if the above factors are not taken into consideration. Perhaps the best mechanism for addressing such issues is that outlined throughout this study: a systems approach.

7.5 Limitations and Directions for Future Research

There are several limitations with regard to findings presented in this dissertation. First, the study was based on a secondary analysis of workforce surveys

designed to gain general knowledge of workforce characteristics within the CTN, and not on a random sample of substance abuse treatment programs throughout the country. Participants in the CTN were selected because of their capacity and willingness to become involved in research, and likely represent programs and staff with a greater interest in research, medicine, and the incorporation of evidence-based practices. Thus, generalizing findings from the present study to the entire treatment industry should be done with caution, as programs outside of the CTN are likely to have even greater resistance to use of addiction medications. Future research should investigate workforce attitudes about addiction medications in such treatment settings, particularly those that would most likely be resistant to pharmacotherapy.

A second limitation of this study is that only one independent variable (*Treatment Model*) was measured using a standardized and validated assessment measure (i.e., the Social Model Philosophy Scale). As discussed in Section 5.1, items in the surveys were primarily constructed from the National Survey of Substance Abuse Treatment Services, prior literature, or developed specifically for the surveys to assess beliefs and opinions about practices and treatment interventions being tested or potentially tested in the CTN. Future research on medication attitudes could benefit from the inclusion of additional standardized measures.

A third limitation is the reduction in sample size from the original data set due to missing data. The initial sample included more than 3,700 workforce staff nested in 348 treatment units, but dropped to 1,421 staff working in 237 treatment units following listwise deletion. A limitation of multilevel modeling is that there can be no

missing data on any of the predictors or dependent variables. Although a number of software programs exist for estimating missing values in multilevel data sets, at present, the reliability and validity of such imputation options is questionable; therefore, listwise deletion is presently considered the safest option for addressing missing data. However, it should be noted that despite the reduction in sample size, the analyzed data set met sample size requirements for a multilevel analysis, and provided robust estimates of predictors without any convergence problems. Although it would have been useful to investigate whether significant differences existed between staff members included in the present study and those with missing data, in practice this is extremely hard to do because data are missing on multiple variables and at different levels, often in complex ways that makes detection of relationships very difficult.

A fourth limitation of this study is that the results are based on measuring treatment staff attitudes towards addiction medications, and not directly behavior. Although there is significant evidence in the research literature that attitudes play a crucial role in determining behavior, attitudes and behavior are not synonymous, and there are likely to be discrepancies between what treatment staff say about addiction medications and what they actually would do in practice. Such discrepancies should be the focus of future research. Studies should also investigate how the determinants of behavior differ from those found in the present study.

The findings are also limited by a number of constraints imposed on the multilevel models. Because this was the first study to investigate both individual and organizational factors within a multilevel framework, a decision was made to include

only those factors that had been shown in prior studies to consistently explain medication attitudes. This provided a useful way to pare down the many possible predictor choices and establish useful baseline multilevel models upon which future studies could build. At the same time, this approach limited the explanatory power of the models by the selected variables. Because models for methadone and buprenorphine both produced significant random effects, and tests of interactions to explain these effects proved non-significant, there is a clear need for additional research to investigate other individual and organizational factors within a multilevel framework.

Another factor that limits the findings is the lack of any interaction variables in the models. Such variables are commonly used in multilevel analyses to account for complex real-world relationships between multilevel predictors. But the downside of interaction variables is that their inclusion can quickly result in models that become extremely challenging to interpret. Because no prior studies provided clear evidence for particular interactions among the chosen predictors, none were modeled in this study. As a result, a strength of the findings is that they are based on the simplest of multilevel models, and can be understood by a wide audience. However, even results from this study indicate that attitudes towards addiction medications are a complex blend of factors. Future studies based on more sophisticated multilevel models will likely show that the determinants of attitudes are even more complex.

References

Abelson, R. P. (1995). *Statistics as Principled Argument*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Addiction Technology Transfer Centers. (2000). *The change book: A blueprint for technology transfer*. Kansas City, MO: Addiction Technology Transfer Center National Office.

Amass, L., Kamien, J. B., & Mikulich, S. K. (2000). Efficacy of daily and alternate-day dosing regimens with the combination buprenorphine-naloxone tablet. *Drug and Alcohol Dependence, 58*, 143-152.

Amass, L., Kamien, J. B., & Mikulich, S. K. (2001). Thrice-weekly supervised dosing with the combination buprenorphine-naloxone tablet is preferred to daily supervised dosing by opioid dependent humans. *Drug and Alcohol Dependence, 61*, 173-181.

Amass, L., Ling, W., Freese, T. E., Reiber, C., Annon, J. J., Cohen, A. J., et al. (2004). Bringing buprenorphine-naloxone detoxification to community treatment programs: The NIDA Clinical Trials Network field experience. *The American Journal of Addictions, 13, Supplement 1*, S42-S66.

Amato, L., Davoli, M., Perucci, C. A., Ferri, M., Faggiano, F., & Mattick, R. P. (2005). An overview of systematic reveiws of the effectiveness of opiate maintenance therapies: available evidence to inform clinical practice and research. *Journal of Substance Abuse Treatment, 28*, 321-329.

American Association for the Treatment of Opioid Dependence. (2004). *Q & A: Count of active OTPs*. Retrieved November 3, 2005, from http://www.aatod.org/qa_otp.html

American Methadone Treatment Association. (1998). *News Report*. pp. 1-14.

Andrzejewski, M. E., Kirby, K. C., Morral, A. R., & Iguchi, M. Y. (2001). Technology transfer through performance management: the effects of graphical feedback and positive reinforcement on drug treatment counselors' behavior. *Drug and Alcohol Dependence, 63*, 179-186.

Avorn, J. (2004). *Powerful medicines: The benefits, risks, and costs of prescription drugs*. New York, NY: Random House, Inc..

Balas, A. E., & Boren, S. A. (2000). *Managing clinical knowledge for health care improvement. Yearbook of Medical Informatics*. Bethesda, MD: National Library of Medicine.

Bauer, M. S. (2002). A review of quantitative studies of adherence to mental health clinical practice guidelines. *Hardvard Review of Psychiatry, 10*(3), 138-153.

Bem, D. J. (1972). Self-perception theory. In L. Berkowith (Ed.), *Advances in experimental social psychology* (Vol. 6). New York: Academic Press.

Borkman, T. J. (1990). A comparison of social model and clinical model services. In S. Shaw & T. Borkman (Eds.), *Social model recovery: An environmental approach* (pp. 45-52). Burbank, CA: Bridge Focus, Inc.

Brennan, T. A., Leape, L. L., Laird, N. M., Hebert, L., Localio, A. R., Lawthers, A. G., et al. (1991). Incidence of adverse events and negligence in hospitalized patients. *The New England Journal of Medicine, 324*(6), 370-376.

Brown, B. S. (1997). Staffing pattern and services for the war on drugs. In J. A. Egertson, D. M. Fox & A. I. Leshner (Eds.), *Treating drug abusers effectively* (pp. 99-124). Malden, MA: Blackwell Publishers and the Milbank Memorial Fund.

Bryk, A. S., Raudenbush, S. W., & Congdon, R. T. (2005). HLM 6.01. Hierarchical linear and nonlinear modeling. Chicago: Scientific Software International.

Carmen, B., Angeles, M., Munoz, A., & Jose Maria, A. (2004). Efficacy and safety of naltrexone and acamprosate in the treatment of alcohol dependence: a systamatic review. *Addiction, 99*, 811-828.

Carroll, K. M., Ball, S. A., Nich, C., Martino, S., Frankforter, T. L., Farentinos, C., et al. (2005). Motivational interviewing to improve treatment engagement and outcome in individuals seeking treatment for substance abuse: A multisite effectiveness study. *Drug and Alcohol Dependence*, in press.

Carroll, K. M., Fenton, L. R., Ball, S. A., Nich, C., Frankforter, T. L., Shi, J., et al. (2004). Efficacy of disulfiram and cognitive behavior therapy in cocaine-dependent outpatients. *Archives of General Psychiatry, 61*(3), 264-272.

Chick, J., Anton, R., Checinski, K., Croop, R., Drummond, D. C., Farmer, R., et al. (2000). A multicentre, randomized, double-blind, placebo-controlled trial of naltrexone in the treatment of alcohol dependence or abuse. *Alcohol, 35*, 587-593.

Cicero, T. J., & Inciardi, J. A. (2005a). Diversion and abuse of methadone prescribed for pain management. *JAMA, 2005*, 293-297.

Cicero, T. J., & Inciardi, J. A. (2005b). Potential for abuse of buprenorphine in office-based treatment of opioid dependence. *New England Journal of Medicine, 353*(17), 1863-1864.

Cicero, T. J., Inciardi, J. A., & Munoz, A. (2005). Trends in abuse of OxyContin and other opioid analgesics in the United States: 2002-2004. *The Journal of Pain, 6*(10), 662-672.

Dole, V. P., & Nyswander, M. (1965). Medical treatment for diacetylmorphine (heroin) addiction. *JAMA, 193*, 80-84.

Dole, V. P., & Nyswander, M. (1967). Heroin addiction: a metabolic disease. *Archives of Internal Medicine, 120*, 19-24.

Epstein, J., & Gfroerer, J. (1998). *Changes affecting NHSDA estimates of treatment need for 1994-1996: OAS working paper*. Rockville, MD: Office of Applied Studies, Substance Abuse and Mental Health Services Administration.

Fazio, R. (1990). Multiple processes by which attitudes guide behavior: The MODE model as an integrative framework. In M. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 23, pp. 75-109). San Diego, CA: Academic Press.

Feeney, G. F. X., Connor, J. P., Young, R., Tucker, J., & McPherson, A. (2006). Combined acamprosate and naltrexone, with cognitive behavioural therapy is

superior to either medication alone for alcohol abstience: A single centres' experience with pharmacotherapy. *Alcohol & Alcoholism, 41*(3), 321-327.

Finney, J. W., & Monahan, S. C. (1996). The cost-effectiveness of treatment for alcoholism: a second approximation. *Journal of studies on alcoholism, 57*, 229-243.

Fixen, D. L. (2006, October 16-17). *Implementing evidence-based programs.* Paper presented at the Blending addiction science and practice: Bridges to the future, Seattle, WA.

Fixen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M., & Wallace, F. (2005). *Implementation research: a synthesis of the literature*. Tampa: University of South Florida.

Forman, R., Bovasso, G., & Woody, G. (2001). Staff beliefs about addiction treatment. *Journal of Substance Abuse Treatment, 21*, 1-9.

Fudala, P. J., Vocci, F., Montgomery, A., & Trachtenberg, A. I. (1997). Levomethadyl acetate (LAAM) for the treatment of opioid dependence: A multisite, open-label study of LAAM safety and an evaluation of the product labeling and treatment regulations. *Journal of Maintenance in the Addictions, 1*(2), 9-39.

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.

Gallon, S. L., Gabriel, R. M., & Knudsen, J. (2003). The toughtest job you'll ever love: A Pacific Northwest Treatment Workforce Survey. *Journal of Substance Abuse Treatment, 24*, 183-196.

Gambrill, E. (1999). Evidence-based practice: An alternative to authority-based practice. *Familes in society: The Journal of Contemporary Human Services, 80*(4), 341-350.

Garbutt, J. C., Kranzler, H. R., O'Malley, S. S., Gastfriend, D. R., Pettinati, H. M., Silverman, B. L., et al. (2005). Efficacy and tolerability of long-acting injectable naltrexone for alcohol dependence. *JAMA, 293*, 1617-1625.

Garbutt, J. C., West, S. L., Carey, T. S., Lohr, K. N., & Crews, F. T. (1999). Pharmacological treatment of alcohol dependence: A review of the evidence. *JAMA, 281*(14), 1318-1325.

Gossop, M., Marsden, J., Stewart, D., & Treacy, S. (2001). Outcomes after methadone maintenance and methadone reduction treatments: two-year follow-up results from the National Treatment Outcome Research Study. *Drug and Alcohol Dependence, 62*, 255-264.

Griffin, M. A., & Hofmann, D. A. (1997). *Hierarchical linear models in organizational research: Cross-level interactions*. Retrieved 2/16/06, from http://aom.pace.edu/rmd/1997_forum_hlm_models.html

Gurwitz, J. H., Field, T. S., Judge, J., Rochon, P., Harrold, L. R., Cadoret, C., et al. (2005). The incidence of adverse drug events in two large academic long-term care facilities. *The American Journal of Medicine, 118*, 251-258.

Hall, A. D. (1989). *Metasystems methodology: A new synthesis and unification.* Oxford, England: Pergamon Press.

Higgins, S. T., Budney, A. J., Bickel, W. K., Foerg, F. E., Donham, R., & Badger, G. J. (1994). Incentives improve outcome in patient behavioral treatment of cocaine dependence. *Archives of General Psychiatry, 51*(7), 568-576.

Holder, H., Longabaugh, R., & Miller, W. R. (1991). The cost effectiveness of treatment for alcoholism: a first approximation. *Journal of studies on alcoholism, 52*, 517-540.

Howell, D. C. (2002). *Statistical Methods for Psychology* (5th ed.). Pacific Grove, CA: Thomas Learning, Inc.

Hox, J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Erbaum.

Hubbard, R. L., Flynn, P. M., Craddock, S. G., & Fletcher, B. W. (2001). Relapse after drug abuse treatment. In F. M. Tims, C. G. Leukefeld & J. J. Platt (Eds.), *Relapse + Recovery in Addictions*. New Haven, CT: Yale University Press.

Hunt, G. M., & Azrin, N. H. (1973). A community-reinforcement approach to alcoholism. *Behavior research and therapy, 11*, 91-104.

Institute of Medicine. (1998). *Bridging the gap between practice and research: Forging partnerships with community-based drug and alcohol treatment.* Committee on Community-Based Drug Treatment. S. Lamb, M.R. Greenlick, and D. McCarty (Eds.). Washington, DC: National Academy Press.

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century*. Washington, D.C.: National Academy Press.

Institute of Medicine. (2006). *Improving the quality of health care for mental and substance-use conditions: Quality of chasm series*. Washington, D.C.: National Academy Press.

Institute of Medicine (Ed.). (2000). *To err is human: Building a safer health system*. Washington, D.C.: National Academy Press.

Johnson, R. E., Chutuape, M. A., Strain, E. C., Walsh, S. L., Stitzer, M. L., & Bigelow, G. E. (2000). A comparison of levomethadyl acetate, buprenorphine, and methadone for opiate dependence. *New England Journal of Medicine, 343*, 1290-1297.

Joranson, D. E., & Gilson, A. M. (2006). *Wanted: a public health approach to prescription opioid abuse and diversion*. Retrieved February 8, 2007, from http://www.medsch.wisc.edu/painpolicy/commentary.htm

Judson, B. A., & Goldstein, A. (1983). Episodes of heroin use during maintenance treatment with stable dosage of levo-alpha-acetylmethadol. *Drug and Alcohol Dependence, 11*, 271-278.

Kaplin, L. (2005). *Addiction Treatment Workforce*. Retrieved February 2, 2007, from http://www.ncsl.org/programs/health/addictionib.htm

Kaskutas, L. A., Greenfield, T. K., Borkman, T. J., & Room, J. A. (1998). Measuring treatment philosophy: A scale for substance abuse recovery programs. *Journal of Substance Abuse Treatment, 15*(1), 27-36.

Katz, D., & Kahn, R. L. (1978). *The social psychology of organizations* (2nd ed.). New Yok: Wiley.

Kerwin, M. E., Walker-Smith, K., & Kirby, K. C. (2006). Comparative analysis of state requirements for the training of substance abuse and mental health counselors. *Journal of Substance Abuse Treatment, 30*, 173-181.

Kessler, R. C., Crum, R. M., Warner, L. A., Nelson, C. B., Schulenbern, J., & Anthony, J. C. (1997). Lifetime co-occurrence of DSM-III-R alcohol abuse and dependence with other psychiatric disorders in the National Comorbidity Survey. *Archives of General Psychiatry, 54*, 313-321.

Kessler, R. C., McGonalge, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshleman, S., et al. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. *Archives of General Psychiatry, 51*, 8-19.

Killeen, T. K., Brady, K. T., Gold, P. B., Simpson, K. N., Faldowski, R. A., Tyson, C., et al. (2004). Effectiveness of naltrexone in a community treatment program. *Alcoholism: Clinical and Experimental Research, 28*(11), 1710-1717.

Kirchmayer, U., Davoli, M., Verster, A. D., Amato, L., Ferri, M., & Perucci, C. A. (2002). A systematic review on the efficacy of naltrexone maintenance treatment in opioid dependence. *Addiction, 97*(10), 1241-1249.

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review, 21*(4), 1055-1080.

Knudsen, H. K., Ducharme, L. J., Roman, P. M., & Link, T. (2005). Buprenorphine diffusion: the attitudes of substance abuse treatment counselors. *Journal of Substance Abuse Treatment, 29*, 95-106.

Kozlowski, S. W. J., & Klein, K. J. (2000). A multilevel approach to theory and research in organizations: Contextual, temporal, and emergent processes. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions*. San Francisco, CA: Jossey Bass, Inc..

Kranzler, H. R., & Van Kirk, J. (2001). Efficacy of naltrexone and acamprosate for alcoholism treatment: A meta-analysis. *Alcoholism: Clinical and Experimental Research, 25*(9), 1335-1341.

Kreft, I. G. G., & Yoon, B. (1996). *Are multilevel techniques necessary? An overview, including simulation studies*. Retrieved March 15, 2006, from http://www.calstatela.edu/faculty/ikreft/quarterly/quarterly.html

Krystal, J. H., Cramer, J. A., Krol, W. F., Kirk, G. F., & Rosenheck, R. A. (2001). Naltrexone in the treatment of alcohol dependence. *New England Journal of Medicine, 25*, 1734-1739.

Law, F. D., & Nutt, D. J. (2003). Maintenance buprenorphine for opioid users. *The Lancet, 361*, 634-635.

Leape, L. L., & Berwick, D. M. (2005). Five years after To Err Is Human: What have we learned? *JAMA, 293*(19), 2384-2390.

Leape, L. L., Brennan, T. A., Laird, N. M., Lawthers, A. G., Localio, A. R., Barnes, B. A., et al. (1991). The nature of adverse events in hospitalized patients. *The New England Journal of Medicine, 324*(6), 377-384.

Lehman, W. E. K., Greener, J. M., & Simpson, D. D. (2002). Assessing organizational readiness for change. *Journal of Substance Abuse Treatment, 22*, 197-209.

Lendaris, G. G. (1986). On systemness and the problem solver: Tutorial comments. *Systems, Man, and Cybernetics, SMC-16*(4), 604-610.

Lesar, T. S., Briceland, L., & Stein, D. S. (1997). Factors related to errors in medication prescribing. *JAMA, 277*(4), 312-317.

Ling, W., Amass, L., Shoptow, M., Annon, J. J., Hillhouse, M., Babcock, D., et al. (2005). A multi-center randomized trial of buprenorphine-naloxone versus clonidine for opioid detoxification: Findings from the National Institute on Drug Abuse's Clinical Trials Network. *Addiction, 100*, 1090-1100.

Ling, W., Charuvastra, C., Collins, J. F., Batki, S., Brown, L. S., Kintaudi, P., et al. (1998). Buprenorphine maintenance treatment of opiate dependence: A multicenter, randomized clinical trial. *Addiction, 93*(4), 475-486.

Ling, W., Klett, C. J., & Gillis, R. D. (1978). A cooperative clinical study of methadyl acetate: II. Friday-only regimen. *Archives of General Psychiatry, 35*, 345-353.

Ling, W., Rawson, R. A., & Anglin, M. D. (2003). Pharmacology, practice, and politics: A tale of two opiate pharmacotherapies. In J. L. Sorensen, R. A. Rawson, J. Guydish & J. E. Zweben (Eds.), *Drug abuse treatment through collaboration: practice and research that work*. Washington, DC: American Psychological Association.

Ling, W., & Smith, D. (2002). Buprenorphine: blending practice and research. *Journal of Substance Abuse Treatment, 23*, 87-92.

Linstone, H. A. (1999). *Decision making for technology executives: Using multiple perspectives to improve performance*. Boston, MA: Artech House.

Mark, T. L., Kranzler, H. R., Poole, V. H., Hagen, C. A., McLeod, C., & Crosse, S. (2003). Barriers to the use of medications to treat alcoholism. *The American Journal on Addictions, 12*, 281-294.

Mark, T. L., Kranzler, H. R., & Song, X. (2003). 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. (2003). Physicians' opinions about medications to treat alcoholism. *Addiction, 98*, 617-626.

Marsch, L. A. (1998). The efficacy of methadone maintenance interventions in reducing illict opiate use, HIV risk behavior and criminality: a meta-analysis. *Addiction, 93*(4), 515-532.

Mason, B., J. (2005). Acamprosate in the treatment of alcohol dependence. *Expert Opinion on Pharmacotherapy, 12*, 2103-2115.

McCarty, D., Fuller, B. E., Arfken, C., Miller, M., Nunes, E. V., Edmundson, E., et al. (2007). Direct care workers in the national drug abuse treatment clinical trials network: Characteristics, opinions, and beliefs. *Psychiatric Services, 58*(2), 181-190.

McLellan, A. T. (2006). What we need is a system: Creating a responsive and effective substance abuse treatment system. In W. R. Miller & K. M. Carroll (Eds.), *Rethinking substance abuse: What the science shows, and what we should do about it* (pp. 275-292). New York: The Guilford Press.

McLellan, A. T., Alterman, A. I., Metzger, D. S., Woody, G., & O'Brien, C. P. (1993). The effects of psychosocial services in substance abuse treatment. *JAMA, 269*(15), 1953-1959.

McLellan, A. T., Lewis, D. C., O'Brien, C. P., & Kleber, H. D. (2000). Drug dependence, a chronic medical illness: Implications for treatment, insurance, and outcomes evaluation. *JAMA, 284*(13), 1689-1695.

McLellan, A. T., McKay, J. R., Forman, R., Cacciola, J., & Kemp, J. (2005). Reconsidering the evaluation of addiction treatment: from retrospective follow-up to concurrent recovery monitoring. *Addiction, 100*(4), 447-458.

McLellan, A. T., & Meyers, K. (2004). Contemporary addiction treatment: A review of systems problems for adults and adolescents. *Biological Psychiatry, 56*(10), 764-770.

Meyer, A. D., & Goes, J. B. (1988). Organizational assimilation of innovations: A multilevel contextual analysis. *Academy of Management Journal, 31*(4), 897-923.

Miller, W. R., Brown, J. M., Simpson, T. L., & et al. (1995). What works? A methodological analysis of the alcohol treatment outcome literature. In R. K. Hester & W. R. Miller (Eds.), *Handbook of alcoholism treatment approaches: effective alternatives (2nd ed.)*. Needham, MA: Allyn & Bacon.

Miller, W. R., & Wilbourne, P. L. (2002). Mesa Grande: A methodological analysis of clinical trials of treatments for alcohol use disorders. *Addiction, 97*, 265-277.

Morgenstern, J., Morgan, T. J., McCrady, B. S., Keller, D. S., & Carroll, K. M. (2001). Manual-guided cognitive-behavioral therapy training: a promising method for disseminating empirically supported substance abuse treatments to the practice community. *Psychology of Addictive Behavior, 15*(2), 83-88.

Mulligan, D. H., McCarty, D., Potter, D., & Krakow, M. (1989). Counselors in public and private alcoholism and drug abuse treatment programs. *Alcohlism Treatment Quarterly, 6*(3/4), 75-89.

National Consensus Development Panel on Effective Treatment of Opiate Addiction. (1998). Effective medical treatment of opiate addiction. *JAMA, 280*, 1936-1943.

National Institute of Health. (1997). *NIH Consensus Development Statement: Effective Medical Treatment of Heroin Addiction*. Retrieved November 3, 2005, from http://consensus.nih.gov/1997/1998TreatOpiateAddiction108html.htm

National Institutes of Health Clinical Trials Center. (2006). *Rimonabant to reduce alcohol consumption*. Retrieved June 14, 2006, from http://www.clinicaltrials.gov/show/NCT00075205

Newsom, J. (2006). Advanced Statistics: Multilevel Regression. Portland State University.

NIDA. (2002). National drug abuse clinical trials network: Forging partnerships to improve the quality of drug abuse treatment throughout the nation: National Institute of Health: U.S. Department of Health and Human Services.

NIDA. (2003). *Primary care and drug abuse: A research-setting round table*. Retrieved February 11, 2007, from www.drugabuse.gov/whatsnew/meetings/primarycare.html

Ogborne, A. C., Wild, T. C., Braun, K., & Newton-Taylor, B. (1998). Measuring treatment process beliefs among staff of specialized addiction treatment services. *Journal of Substance Abuse Treatment, 15*(4), 301-312.

O'Malley, S. S., Jaffe, A. J., Chang, G., Shottenfeld, R. S., Meyer, R. E., & Rounsaville, B. (1992). Naltrexone and coping skills therapy for alcohol dependence: a controlled study. *Archives of General Psychiatry, 49*, 881-887.

Orford, J. (2001). *Excessive appetites: a psychological view of addictions* (2nd ed.). New York, NY: Wiley.

Pani, P. P., Maremmani, I., Pirastu, R., Tagliamonte, A., & Gessa, G. L. (2000). Buprenorphine: A controlled clinical trial in the treatment of opioid dependence. *Drug and Alcohol Dependence, 60*, 39-50.

Peirce, J. M., Petry, N. M., Stitzer, M. L., Blaine, J., Kellogg, S., Besteman, K. J., et al. (2005). Lower-cost incentives increase stimulant abstinence in methadone maintenance community treatment. *Archives of General Psychiatry*, in press.

Petry, N. M., Peirce, J. M., Stitzer, M. L., Blaine, J., Roll, J. D., Cohen, A. J., et al. (2005). Prize-based incentives increase retention in outpatient psychosocial treatment programs: Results of the National Drug Abuse Treatment Clinicial Trials Network Study. *Archives of General Psychiatry*, in press.

Phillips, D. P., Christenfeld, N., & Glynn, L. M. (1998). Increase in US medication-error deaths between 1983 and 1993. *Lancet, 351*, 643-644.

Power, E. J., Nishimi, R. Y., & Kizer, K. W. (2005). *Evidence-based treatment practices for substance use disorders - workshop proceedings*. Washington, D.C.: National Quality Forum.

Raudenbush, S., & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Rawson, R. A., Hasson, A. L., Huber, A. M., McCann, M. J., & Ling, W. (1998). A 3-year progress report on the implementation of LAAM in the United States. *Addiction, 93*, 533-540.

Rawson, R. A., Marinelli-Casey, P., & Ling, W. (2002). Dancing with strangers: Will U.S. substance abuse practice and research organizations build mutually productive relationships? *Addictive Behaviors, 27*, 941-949.

Regier, D. A., Narrow, W. E., Rae, D. S., Manderscheid, R. W., Locke, B. Z., & Goodwin, F. K. (1993). The de facto US mental and addictive disorders service system: Epidemiologic catchment area prospective 1-year prevalence rates and disorders and services. *Archives of General Psychiatry, 50*(February), 85-94.

Richmond, B. (2001). *An Introduction to Systems Thinking*. Lebanon, NH: High Performance Systems, Inc.

Rogers, E. M. (1995). *Diffusion of Innovations* (4th ed.). New York: Free Press.

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.

Roman, P. M., & Blum, T. (1997). *National treatment center study summary report*. Athens, GA: Institute for Behavioral Research.

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.

Sackett, D. L., Richardson, W. S., Rosenberg, W., & Haynes, R. B. (1997). *Evidence-based medicine: How to practice and teach EMB*. New York: Churchill Livingstone.

SAMHSA. (2004). *Results from the 2003 national survey on drug use and health: national findings (Office of Applied Studies, NSDUH Series H-25, DHHS Publication No. SMA 04-3964)*. Rockville, MD.

SAMHSA. (2005). *National Survey of Substance Abuse Treatment Services*. Retrieved February 2, 2007, from http://wwwdasis.samhsa.gov/webt/state_data/US05.pdf

Schein, E. H. (1992). *Organizational culture and leadership* (2nd ed.). New York: Jossey-Bass.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Currency Doubleday.

Shoptaw, S., Yang, X., Rotheram-Fuller, E. J., Hsieh, Y. M., Kintaudi, P., Charuvastra, C., et al. (2003). Randomized placebo-controlled trial of baclofen for cocaine dependence: preliminary effects for individuals with chronic patterns of cocaine use. *Journal of Clinical Psychiatry, 64*, 1440-1448.

Simpson, D. D. (2002). A conceptual framework for transferring research to practice. *Journal of Substance Abuse Treatment, 22*, 171-182.

Smith, J. E., Meyers, R. J., & Miller, W. R. (2001). The community reinforcement approach to the treatment of substance use disorders. *The American Journal on Addictions, 58*, 7-29.

Snijders, T., & Bosker, R. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage.

Stella, L., D'Ambra, C., Mazzeo, F., Capuano, A., Del Franco, F., Aviolio, A., et al. (2005). Naltrexone plus benzodiazepine aids abstinence in opioid-dependent patients. *Life Sciences, 77*, 2717-2722.

Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. New York: Irwin McGraw-Hill.

Substance Abuse and Mental Health Services Administration. (2002). *National survey of substance abuse treatment services (N-SSATS): 2000. Data on substance abuse treatment facilities*. Rockville, MD: author.

Substance Abuse and Mental Health Services Administration. (2005). *Results from the 2005 National Survey on Drug Use & Health*. Rockville, MD: SAMHSA.

The Lewin Group. (2001). The Clinical Workforce in the Substance Abuse Treatment System.

Thomas, & McCarty, D. (2004). Adoption of drug abuse treatment technology in specialty and primary care settings. In H. J. Harwood & T. G. Myers (Eds.), *New treatments for addiction: Behavioral, ethicial, legal, and social questions* (pp. 140-172). Washington, D.C.: The National Academic Press.

Thomas, & Ritter, G. A. (2000). *Drug utilization trends by therapeutic class*. Retrieved October 24, 2005, from http://aspe.hhs.gov/health/reports/drug-papers/thomas/thomas-final.htm

Thomas, 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, E. J., Studdert, D. M., Newhouse, J. P., Zbar, B. I., Howard, K. M., Williams, E. J., et al. (1999). Costs of medical injuries in Utah and Colorado. *Inquiry, 36*, 255-264.

Thomas, L. (1974). *The lives of a cell: Notes of a biology watcher*. New York: Viking Press.

U.S. Department of Health and Human Services. (1994). *Treatment of opiate addiction with methadone: A counselor manual*. Rockville, MD: author.

U.S. Department of Health and Human Services. (2004). *Clinical guidelines for the use of buprenorphine in the treatment of opioid dependence: A treatment improvement protocal TIP 40*. Rockville, MD: author.

U.S. Department of Health and Human Services. (2005). *Drug abuse statistics (Chapter 5)*. Retrieved August 23, 2005, from http://www.drugabusestatistics.samhsa.gov/Highlights.htm

Vocci, F. (2003a). *Bringing new medications to the treatment of addiction*. Retrieved November 6, 2005, from http://www.psychiatrictimes.com/p030541.html

Vocci, F. (2003b). *Medications Update*. Retrieved November 6, 2005, from www.drugabuse.gov/about/organization/nacda/powerpoint/Vocci503.ppt

Volpicelli, J. R., Alterman, A. I., Hayashida, M., & O'Brien, C. P. (1992). Naltrexone in the treatment of alcohol dependence. *Archives of General Psychiatry, 49*, 876-880.

Volpicelli, J. R., Pettinati, H. M., McLellan, A. T., & O'Brien, C. P. (2001). *Combining medication and pscyhosocial treatments for addictions*. New York: The Guilford Press.

Weinrieb, R. M., & O'Brien, C. P. (1997). Naltrexone in the treatment of alcoholism. *Annual Review of Medicine, 48*, 477-487.

West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation modeling with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed.), *Structural Equation Modeling: Concepts, Issues and Applications* (pp. 56-75). Thousand Oaks: Sage Publications.