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Understanding Attitudes Toward Use of Medication in Substance Abuse Treatment: A Multilevel Approach

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Individual and organizational variables influence attitudes toward use of naltrexone, methadone, and buprenorphine for the treatment of alcohol and drug disorders. Previous research has not considered both sets of influences simultaneously. Hierarchical linear modeling tested the contribution of individual and organizational variables with data from the National Drug Abuse Treatment Clinical Trials Network treatment unit and workforce surveys ($n = 2,269$ staff nested within 247 treatment units). Individual-level variables consistently had more influence on attitudes, but a unique blend of variables existed for each medication. One predictor, support for psychiatric medications, influenced attitudes across all medications. Staff attitudes toward addiction medications varied significantly between treatment units. Implications for increasing the appropriate use of addiction medications are discussed.

Keywords: addiction medications, substance abuse treatment, evidence-based practices

Use of medication (e.g., naltrexone, methadone, buprenorphine) in conjunction with psychosocial therapy consistently ranks among the most effective substance abuse treatment interventions (Amass et al., 2004; Miller & Wilbourne, 2002; National Consensus Development Panel on Effective Treatment of Opiate Addiction, 1998; Power, Nishimi, & Kizer, 2005). However, pharmacotherapy remains underutilized and presents one of the greatest implementation challenges for community-based treatment programs (Institute of Medicine, 1998, 2006).

Research on barriers to the use of medication in treatment for alcohol and drug use disorders explores staff characteristics and organizational attributes (Forman, Bovasso, & Woody, 2001; Fuller, Rieckmann, McCarty, Smith, & Levine, 2005; Knudsen, Ducharme, Roman, & Link, 2005; Mark, Kranzler, Poole, et

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al., 2003; Mark, Kranzler, & Song, 2003; Mark, Kranzler, Song, et al., 2003; Ogborne, Wild, Braun, & Newton-Taylor, 1998; Roman & Johnson, 2002; Thomas, Wallack, Lee, McCarty, & Swift, 2003). Previous studies, however, have investigated either the individual or organizational variables and have ignored relationships between individual and organizational attributes. Individual and organizational-level factors should be tested simultaneously using hierarchical linear modeling to assess support for the use of different medications.

Medications To Treat Substance Abuse Disorders

The Food and Drug Administration (FDA) in the United States has approved three medications to treat alcohol use disorders: disulfiram (Antabuse, Duramed Pharmaceutical Inc., Montvale, NJ), naltrexone (ReVia, Duramed Pharmaceutical Inc., Montvale, NJ; Vivitrol, Cephalon, Inc., Frazer, PA), and acamprosate (Campral, Merck Sante s.a.s., Darmstadt, Germany). Disulfiram has been used for over 50 years, and many clinicians believe that it reduces alcohol use and inhibits relapse; evidence suggests, however, that disulfiram has only moderate effects on alcohol consumption and virtually no impact on abstinence rates (Garbutt, West, Carey, Lohr, & Crews, 1999). Naltrexone, an opiate antagonist, was approved in 1994 as an adjunct to psychosocial treatments for alcohol dependence (O'Malley et al., 1992; Volpicelli, Alterman, Hayashida, & O'Brien, 1992). Randomized clinical trials support naltrexone as an efficacious, safe, and useful adjunct to psychosocial interventions (Carmen, Angeles, Munoz, & Jose Maria, 2004; Kranzler & Van Kirk, 2001). A long-acting injectable version of naltrexone (Vivitrol) also has FDA approval for use in the treatment of alcohol abuse. In July of 2004, the FDA approved acamprosate as a third medication for alcohol use disorders. Used extensively for the past 15 years, primarily in Europe, acamprosate has been found in trials to be a safe, effective, and efficacious medication for reducing alcohol consumption (Carmen et al., 2004; Kranzler & Van Kirk, 2001; Mason, 2005).

The FDA has approved four medications for the treatment of opioid dependence: methadone, buprenorphine (Subutex, Suboxone, both by Reckitt Benckiser Pharmaceuticals, Inc., Richmond, VA), levo-alpha-acetymethadol (LAAM), and naltrexone. Methadone, has been used as an opioid replacement therapy since the 1960s, and research consistently finds reductions in illicit opiate use, mortality, crime, and HIV risk behaviors after initiation of methadone maintenance (Amato et al., 2005; Gossop, Marsden, Stewart, & Treacy, 2001; Marsch, 1998; National Institutes of Health, 1997). In 2002, the FDA approved two formulations of buprenorphine hydrochloride (Subutex and Suboxone). Available from qualified prescribers, buprenorphine is an efficacious treatment for opioid dependence (Amass, Kamien, & Mikulich, 2000, 2001; Amass et al., 2004; Johnson et al., 2000; Ling et al., 2005, 1998; Pani, Maremmani, Pirastu, Tagliamonte, & Gessa, 2000). Although LAAM was approved by the FDA in 1993 for the treatment of opioid dependence, it became a lesson in all that can go wrong when attempting to implement a new innovation into practice (Ling, Rawson, & Anglin, 2003). Almost 8 years after its approval, fewer than 2% of opiate-dependent patients in the United States were using LAAM (Rawson, Hasson, Huber, McCann, & Ling, 1998). Low adoption and increased safety concerns, including increased risk of cardiotoxicity, ended use of the medication; it is no longer available (Longshore, Annon, Anglin, & Rawson, 2003). Naltrexone gained FDA approval in 1985 for the treatment of opiate dependence. A review of research trials found insufficient evidence to justify its use in maintenance treatment (Kirchmayer et al., 2002). The injectable extended-release formulation of naltrexone (Vivitrol) has not been approved for the treatment of opioid dependence but is generating research interest.

Utilization of Addiction Medications in Substance Abuse Treatment

Despite the empirical evidence that medications can significantly improve clinical outcomes for those struggling with substance abuse disorders, relatively few patients receive medication as part of treatment. A mail survey of 135 physicians with substance abuse specialization and 1,116 certified addiction counselors in Massachusetts, Tennessee, and Washington State found limited use of naltrexone (Thomas et al., 2003). Few physicians (15%) prescribed naltrexone "often" or "for almost all clients"; the majority (45%) said that they used it "occasionally," and the remaining indicated "rare"

(20%) or "no experience" (19%) (Thomas et al., 2003). A survey of 1,388 physicians from the American Society of Addiction Medicine and the American Academy of Addiction Psychiatry found physicians prescribing to only 13% of their alcohol-dependent patients (Mark, Kranzler, & Song, 2003).

Forman et al. (2001) surveyed 317 substance abuse treatment staff members from three northeastern states. 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. A survey assessing attitudes related to the use of buprenorphine in the treatment of opioid dependence found little support for use of the medication; more than two thirds of the substance abuse treatment counselors ($n = 1{,}972$) selected a "don't know" response when asked about their perception of the effectiveness of buprenorphine (Knudsen et al., 2005).

Over a 5-year period (1997 to 2001), naltrexone use rates in outpatient treatment programs in the New England states increased from 14% to 25% (Fuller et al., 2005). Organizational variables (e.g., size, type of clinic, services offered, funding streams, staff characteristics) did not directly influence the use of naltrexone; effects were mediated by whether a treatment program offered psychiatric medications for mental health disorders (Fuller et al., 2005). Roman and Johnson (2002) found that 44% of a national sample of 400 private substance abuse treatment programs reported use of naltrexone; usage with alcohol-dependent patients, however, was low (13% of the caseload). Probability of use increased in treatment centers that were older, that were 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).

Study Overview

The study examined variables that influence attitudes toward addiction medications using a multilevel framework and assessing variations across medications. A secondary analysis of data from the National Drug Abuse Treatment Clinical Trials Network's (CTN's) Organizational, Treatment Unit, and Workforce Surveys (McCarty et al., 2007, 2008) used hierarchical linear modeling to assess the influence of treatment staff variables (Level 1) and organizational variables (Level 2) to disentangle the influence of treatment staff and organizational attributes on treatment staff opinions toward the use of medications.

Method

Participants and Procedure

Community-based treatment programs participating in the CTN were invited to complete three surveys: (a) Organizational, (b) Treatment Unit, and (c) Staff. The workforce sample included 1,757 counselors, 522 managers/supervisors, 511 medical personnel, and 908 support staff. Missing data on job category ($n = 88$) resulted in a total sample of 3,698. Because this study used a multilevel approach (i.e., nested design), the final sample included 3,418 workforce staff nested within 321 treatment units. 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. The workforce was ethnically diverse: 24% were African American, 11% were Latino/Hispanic, 3% were multiracial, 1% was Asian/Pacific Islander, and 1% was American Indian (60% were White). Eighty-four percent of the survey participants were full-time workers (i.e., 35 or more hours per week), with the exception of medical staff (67%), who were more likely to work part time (McCarty et al., 2007). See McCarty et al. (2008) for details on participating treatment units.

Measures

The surveys elicited information on the attributes of participating treatment organizations, treatment units, and workforce staff providing care. Items for the surveys were extracted from the National Survey of Substance Abuse Treatment Services (Substance

Abuse and Mental Health Services Administration, 2002), extracted from previous literature (Kaskutas, Greenfield, Borkman, & Room, 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.

Treatment unit directors completed the Treatment Unit Survey and a 33-item Social Model Philosophy Scale (SMPS). The SMPS classifies the extent to which treatment units follow a social model approach to treatment (Kaskutas et al., 1998). Individuals with direct care responsibilities completed the Workforce Survey. Respondents used a 5-point Likert-type scale (1 = *strongly disagree*; 5 = *strongly agree*) to record their support for three statements on the use of medications: (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. Predictor variables used in the models are listed in Table 1.

Two variables—addiction minor and addiction continuing education units (CEUs)—were excluded from the primary models because they primarily pertained to staff delivering treatment services and significantly reduced the overall sample size. However, to examine their effect on medication attitudes, a subanalysis was conducted on clinical staff (n = 960 staff nested in 220 treatment units) in which addiction minor was a dichotomous variable indicating whether a staff clinician had a minor degree in an addiction-related field. Addiction CEUs was measured by the number of substance abuse-related CEUs taken during the last year.

Table 1
Level-1 and Level-2 Predictor Variables Used in the Random Coefficient Models

Variable	Description of variable
Level 2	
Treatment model	Measured by the SMPS, on which 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 unit	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
Primary care on-site	Dichotomous variable indicating whether a treatment unit offers primary medical care on-site
Staff in recovery	Percentage of staff estimated to be in personal recovery from substance abuse disorders
Service setting	Dichotomous variable indicating whether a treatment unit is a freestanding substance abuse treatment program or associated with a larger health care or social service organization
Level 1	
Prescriber	Dichotomous variable for which 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	Dichotomous variable comparing staff members with a graduate-level education (e.g., master's degree, doctoral degree, medical degree) with those with less than a graduate education (e.g., no high school diploma, high school diploma, associate's degree, bachelor's degree)
Job category	Dummy-coded variable for which medical staff (i.e., prescribers) are the reference category, compared against counselors, managers, and support staff
Psychiatric medication support	Measured by the question "Psychiatric medications should be used more in addiction treatment" and scored on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*)

Note. SMPS = Social Model Philosophy Scale.

Analysis Strategy

Random coefficient modeling allowed for the investigation of both within- and between-group effects on individual-level dependent variables (Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). Hierarchical linear modeling (HLM 6.0) software (Bryk, Raudenbush, & Congdon, 2005) estimated the random coefficient models. The analyses followed the work of Hox (2002) and specified the simplest possible model (i.e., intercept-only model); parameters were added step by step until the best possible random coefficient model was achieved. The HLM program produces p values ($p < .05$) and confidence intervals that guided the selection of which variables to retain. The deviance statistic determined how well a particular model fit the data and how it compared with other models. A limitation of multilevel modeling is the need for no missing data on individual predictor or dependent variables. Application of listwise deletion procedure resulted in a final data set of 2,269 treatment staff nested in 247 treatment units.

Results

Mean levels of support for all medications, measured on a scale ranging from 1 (*low support*) to 5 (*high support*), were moderate. Treatment staff indicated the highest mean levels of support for buprenorphine ($M = 3.23$, $SD = 0.78$), followed by naltrexone ($M = 3.11$, $SD = 0.86$), and methadone ($M = 2.99$, $SD = 1.16$).

Variance in staff attitudes was first partitioned into within-treatment and between-treatment unit components (random effects). In these unconditional models (i.e., intercept only), there are no predictor variables from any level, and the analysis is equivalent to conducting a one-way random-effects analysis of variance (ANOVA) in which treatment unit is a random factor with varying number of staff members per treatment unit.

Influence of Treatment Units

The variance in attitudes toward naltrexone between staff within treatment units (Σ^2) was 0.68, and the variance between treatment units (τ) was 0.06. 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, $\chi^2(246) = 450.46$, $p < .001$. The intraclass correlation suggested that treatment units accounted for 8.4% of the variability in staffs' attitudes about naltrexone. Conversely, the variance in attitudes toward methadone between staff within-treatment units was 0.93, and the variance between treatment units was 0.41. The chi-square test statistic of between-treatment unit variability revealed that statistically significant variability existed between treatment units in staffs' average methadone attitude scores, $\chi^2(246) = 1{,}256.59$, $p < .001$. The intraclass correlation suggested that treatment units accounted for 30.4% of the variability in staffs' attitudes about methadone. Similarly, the variance in attitudes toward buprenorphine between staff within-treatment units was 0.49, and the variance between treatment units was 0.12. 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, $\chi^2(246) = 786.401$, $p < .001$. The intraclass correlation indicated that treatment units accounted for about 20% of the variability in staffs' attitudes about buprenorphine. See Table 2 for details on the analysis of naltrexone, methadone, and buprenorphine. Relationships between attitudes toward each medication and the Level-1 and Level-2 predictors were explored with multilevel models for each medication.

Naltrexone

The fixed effects indicated that two Level-1 variables (academic education and support for psychiatric medications) and two Level-2 variables (employment in a methadone treatment unit and the treatment units SMPS score) influenced staff opinions toward the use of naltrexone for treatment of alcohol disorders. A graduate degree (master's degree or higher) was associated with an increase in attitude toward naltrexone when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma = 0.162$, $t = 4.117$, $p < .001$). Support for psychiatric medications was also significant ($\gamma = 0.158$, $t = 7.564$, $p < .001$). At Level 2, the score on the SMPS was significantly related to attitudes toward naltrexone ($\gamma = -0.006$, $t = -4.239$, $p < .001$). Staff in programs with stronger social model scores

Table 2
Descriptive Statistics for Dependent, Level-1, and Level-2 Variables and Summary of Significant Coefficients in Final Multilevel Models Across Medications

Variable	*M*	*SD*	Naltrexone	Methadone	Buprenorphine
Level 2					
Treatment model	34.21	13.74	−.006***		−.006***
Methadone unit	.21	.41	.182***	.943***	
Primary care on-site	.30	.46			
Staff in recovery	34.96	26.92		−.005**	
Service setting	.63	.48			−.129*
Level 1					
Prescriber	.03	.18		.575***	.564***
Academic education	.38	.49	.162***		.083*
Medical vs. counselor	.50	.50			
Medical vs. management	.17	.37		.229***	.248***
Medical vs. support staff	.22	.41			
Psychiatric medication support	3.31	1.02	.158***	.161***	.130***
Random intercept variance			Yes	Yes	Yes
Intraclass correlation			8.4%	30.4%	19.7%

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

were less supportive of the use of naltrexone. Use of methadone in a treatment unit, conversely, increased support for use of naltrexone ($\gamma = 0.182$, $t = 3.784$, $p < .001$).

Methadone

Prescriber status, job category (medical vs. management), and support for psychiatric medications were Level-1 influences on opinions about the use of methadone. Level-2 influences included use of methadone in the treatment unit and percentage of staff in recovery. The ability to prescribe medications was associated with more positive attitudes toward methadone ($\gamma = 0.575$, $t = 4.855$, $p < .001$). Individuals in management and supervision positions were more supportive of methadone than medical staff when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors ($\gamma = 0.229$, $t = 4.362$, $p < .001$). Support for psychiatric medications also had a positive influence on attitude toward methadone ($\gamma = 0.161$, $t = 6.519$, $p < .001$). Use of methadone in the treatment unit was associated with increased support for use of methadone ($\gamma = 0.943$, $t = 10.305$, $p < .001$). Programs with proportionately more staff in recovery, however, were less supportive of methadone ($\gamma = -0.005$, $t = -3.214$, $p = .002$).

Buprenorphine

For buprenorphine, Level-1 influences included prescriber status, academic education, job category (medical vs. management), and support for psychiatric medications. SMPS scores and service setting were Level-2 influences. Prescribers ($\gamma = 0.564$, $t = 7.295$, $p < .001$) and individuals with graduate-level education ($\gamma = 0.083$, $t = 2.291$, $p = .023$) had more positive attitudes toward buprenorphine when controlling for other grand-mean centered Level-1 and uncentered Level-2 predictors. Managers and supervisors ($\gamma = 0.248$, $t = 6.523$, $p < .001$) were also more supportive of buprenorphine. Stronger support for the use of psychiatric medications was also associated with more positive opinions toward buprenorphine ($\gamma = 0.130$, $t = 7.866$, $p < .001$).

Random Effect Outcomes

Random effect models suggested significant variation between treatment units when adjusted for grand-mean centered Level-1 and uncentered Level-2 variables. The significant variability between treatment units for naltrexone ($\tau_0^2 = 0.029$), $\chi^2(172) = 242.819$, $p < .001$, was in part explained by slope variation in academic education ($\tau_1^2 = 0.032$), $\chi^2(174) = 212.942$, $p = .023$), and support for psychiatric medica-

tions ($\tau_2^2 = 0.024$), $\chi^2(174) = 251.184$, $p < .001$. Further investigation of interactions between education and support for psychiatric medications, as well as other Level-2 predictors, yielded no significant relationships. For methadone, significant variability between treatment units ($\tau_0^2 = 0.162$), $\chi^2(38) = 173.878$, $p < .001$, was in part explained by slope variation in support for psychiatric medications ($\tau_3^2 = 0.035$), $\chi^2(40) = 63.657$, $p = .010$. Similar to naltrexone, none of the cross-level interactions produced any significant relationships. Last, although there was significant variation between treatment units for buprenorphine ($\tau_0^2 = 0.087$), $\chi^2(32) = 110.586$, $p < .001$, adjusted for grand-mean centered Level-1 and uncentered Level-2 variables, none of the individual-level slopes were significant.

Subanalysis of Licensed Clinicians

The effect of a minor degree in an addiction-related field and the influence of CEUs on attitudes toward addiction medications were examined with a subanalysis of licensed clinicians delivering treatment services (i.e., prescribers and counselors, excluding management and support staff; $n = 960$ staff nested in 220 treatment units). A minor degree in an addiction-related field was not a significant influence for any of the medications. Addiction CEUs were only a significant factor for buprenorphine ($\gamma = 0.003$, $t = 2.941$, $p = .004$). Note that, although statistically significant, the practical significance of this finding is limited; a half-point increase in attitude score (i.e., score of 3 to 3.5) would require over 150 CEUs—an unrealistic number considering that most licensing boards only require 20 CEUs in a given year.

Discussion

Individual and organizational variables appear to influence staff attitudes toward the use of addiction medications. Within a multilevel framework, medication attitudes were modestly influenced by organizational variables, with naltrexone being least influenced by organizational characteristics (8%), followed by buprenorphine (20%) and methadone (30%). Individual characteristics appear to play a more important role in medication attitudes. Medical staff, including prescribers, had more positive opinions toward methadone and buprenorphine than toward naltrexone. More education was also associated with higher levels of support for use of naltrexone and methadone. Support for psychiatric medication was the only variable associated with positive support for all medications.

Organizational variables, including on-site primary care, percentage of staff in personal recovery, and whether a clinic is freestanding or attached to a larger health care organization, have been important predictors in previous studies but showed fewer associations when controlling for individual-level influences. Offering primary care services on-site was unrelated to attitudes toward any of the addiction medications, further illuminating the gap between primary care medicine and addiction treatment. Perhaps primary care staff working in substance abuse treatment programs are more likely to be in personal recovery, resulting in less favorable attitudes toward addiction medications (Thomas et al., 2003).

Use of psychiatric medications may influence both organizational contexts and personal opinions. Programs that used psychiatric medications were more likely to use naltrexone (Fuller et al., 2005). Forman et al. (2001) found high levels of support for use of psychiatric medications among a survey of substance abuse treatment staff. Furthermore, psychiatric medications may be a key to the development of a technology cluster and facilitate the use of other medications (Knudsen, Ducharme, & Roman, 2007). The current analysis extends support for psychiatric medications being among the most important determinants of medication attitudes.

Study results also indicate that the ability to prescribe addiction medications is an important influence on medication attitudes when controlling for other individual and organizational factors but not across all medications. Contrary to studies suggesting that prescriber status is a significant predictor of attitudes toward 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. Prescribers may be more likely to be familiar with methadone and its historical use in treatment programs, and they may know that there are no well-established self-help or psychosocial interventions

for opiate dependence as there are for alcoholism. In addition, to prescribe buprenorphine for opioid 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.

It is interesting to note that, in the comparison of medical staff versus other job categories, there were relatively few differences. Counselors providing direct service and support staff who have significant patient contact, therefore, are target populations for interventions aimed at increasing support for use of addiction medications. Recently, a private substance abuse treatment organization reported that a key factor in increasing the usage of addiction medications within their traditional 12-step treatment structure was training for support staff; many were in recovery themselves, opposed to use of medications, and influenced patients (Lind, 2007).

Increasing Support for Use of Addiction Medications

If the benefits of addiction medications are to reach patients, then knowledge of their underutilization in practice ultimately needs to motivate the development of interventions to increase their use. This study suggests practical strategies for increasing the appropriate use of addiction medications in substance abuse treatment programs, including (a) hiring graduate-level trained clinicians; (b) treating mental health disorders present in substance-abusing populations utilizing psychosocial and pharmacological interventions; (c) developing referral networks with appropriate prescribers; (d) providing information about addiction medications to clinical staff, patients, and other treatment stakeholders; (e) recognizing the need to train all staff members within a treatment program about addiction medications, including support staff (e.g., receptionists, bus drivers, janitors); and (f) offering in-house medication services as a routine component of treatment. Each of these strategies present numerous implementation challenges that would optimally be matched with specific treatment programs and settings.

For practicing clinicians, there are a number of steps that can be immediately implemented to optimize use of addiction medications, including the following: (a) learning about the benefits, risks, and costs and how best to combine them with psychosocial interventions; (b) educating patients and the various stakeholders (e.g., family, legal, medical, social) involved in treatment about how addiction medications may improve outcomes; (c) linking psychological services with primary care medicine by working in collaboration with health care providers; and (d) attending periodic trainings to stay current about new pharmacological advancements in the field. Such actions will help prepare clinicians for dealing appropriately with the predictable resistance from some patients and other community stakeholders.

Limitations

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; generalizability, therefore, may be limited. Participants in the CTN were selected because of their capacity and willingness to become involved in research, and they likely represent programs and staff with a greater interest in research, medicine, and the incorporation of evidence-based practices.

A second limitation is the reduction in sample size from the original data set because of missing data. The initial sample included more than 3,700 workforce staff nested in 348 treatment units but dropped to 2,269 staff working in 247 treatment units after listwise deletion. A limitation of multilevel modeling is that there can be no missing data on any of the predictors or Level-1 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 uncertain; therefore, listwise deletion is considered the safest option for addressing missing data. Despite the reduction in sample size, however, the 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 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.

Study results are based on treatment staff attitudes toward addiction medications rather than 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.

Because this was the first study to investigate both individual and organizational factors within a multilevel framework, the analysis was limited to variables shown in previous studies to consistently explain medication attitudes. This was a useful way to pare down 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 all models produced significant random effects, and because tests of interactions to explain these effects proved nonsignificant, there is a clear need for additional research to investigate other individual and organizational factors within a multilevel framework.

Relationships between organizational and staff variables are complex. The analysis suggests that both sets of variables have simultaneous influence on staff attitudes toward the use of medications for the treatment of alcohol and drug use disorders. Future analyses can build on this foundation and provide a more detailed description of the interrelationships.

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