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Medication-assisted treatment for alcohol-dependent adults with serious mental illness and criminal justice involvement: effects on treatment utilization and outcomes

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Abstract

Objective—Adults with serious mental illness and co-morbid alcohol dependence are at high risk for both high utilization of crisis-driven healthcare services and criminal justice involvement. Evidence-based medication-assisted treatment (MAT) for alcohol dependence may reduce both crisis service utilization and criminal recidivism. We estimated the effect of MAT on behavioral health treatment utilization and criminal justice outcomes for this population.

Method—Relevant administrative data were merged from several public agencies in Connecticut for 5,743 adults 18 years of age or older with schizophrenia spectrum disorder, bipolar disorder, or major depression; co-morbid with moderate to severe alcohol dependence; who had at least one night in jail during the study window during 2002–2009. Longitudinal multivariable regression models estimated the effect of MAT versus other outpatient substance abuse treatment on inpatient mental health or substance abuse hospitalizations, emergency department visits, criminal convictions, and incarcerations.

Results—MAT was associated with significant improvements in clinical outcomes in the 12 months following initiation versus the non-MAT comparison group, including larger reductions in mental health hospitalization and emergency department visits, and larger improvements in psychotropic medication adherence. No benefits of MAT were found for most criminal justice outcomes, except for significant reductions in felony convictions among adults with bipolar disorder.

Conclusions—MAT is under-used for treating alcohol dependence, especially among adults with serious mental illness. These results suggest MAT can have important benefits for clinical outcomes in this population. More research is needed to improve its use for this population, and to address barriers to its use.

Introduction

Eleven million people in the U.S. suffer from serious psychiatric disorders including schizophrenia, bipolar disorder, and major depression and are at risk for a range of bad outcomes, including poor social functioning, frequent psychiatric hospitalizations,

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homelessness, and incarceration. For the nearly 25% who also suffer from co-occurring substance use disorders, those risks are markedly exacerbated.[1–6] Alcohol dependence, the predominating substance problem in this population, undermines individuals' stability and recovery, and puts them at higher risk for costly hospitalizations and incarceration. Medication-assisted treatment holds significant promise for ameliorating alcohol dependence among adults with serious mental illnesses.

Alcohol use disorders affect 20 – 50% of adults with psychotic disorders like schizophrenia and bipolar disorder.[6–8] Alcohol misuse can worsen psychiatric symptoms, reduce treatment adherence to psychotropic medications and psychosocial treatment, and complicate co-morbid medical conditions.[1–6] Furthermore, substance use disorders—including alcohol dependence—are strongly associated with risk for entering the criminal justice system. At least 75% of adults with serious mental illness who have had some justice system involvement have co-occurring substance use disorders.[7–10]

Many adults with SMI do not get adequate, well-integrated treatment for co-occurring disorders, and many get none at all.[11–13] However, Medicaid expansion under the Affordable Care Act, Mental Health Parity and Addiction Equity Act, and recent increases in federal funding for substance use disorder treatment such as the 21st Century Cures Act hold promise for increasing availability and access to substance use disorder treatment.

Medication-assisted treatment (MAT)—pharmacotherapies used for treating substance dependence in conjunction with psychosocial treatment—is an evidence-based practice for treating substance use disorders. The literature examining the use of MAT in people with co-occurring disorders demonstrates that MAT is generally well tolerated in people with serious mental illness, with little evidence of complicating interactions with psychotropic medications or unique adverse side effects. A recent randomized, controlled pilot study demonstrated significant reductions in alcohol craving and drinking days associated with use of naltrexone in patients with bipolar disorder and alcohol dependence.[14] Other studies demonstrated promising results for use of naltrexone and disulfiram for treating alcohol dependence in patients with serious mental illness,[15] specifically schizophrenia[16–18] or major depression,[19] indicating good tolerability and significant reductions in drinking. Patient and provider attitudes regarding use of monitored naltrexone for alcohol dependence in patients with schizophrenia have also been positive, with a majority of patients reporting improvements in mental health and reduced drinking.[20]

Less is known about the extent to which MAT is adopted as part of routine care, but it is clear that it is drastically under-utilized.[21–23] Moreover, current focus lies heavily on the role for MAT in addressing the opioid epidemic, with far less attention given to its value in treating alcohol dependence, the most common substance use disorder among adults with serious mental illness. More effective treatment of alcohol dependence in this population could contribute to better mental health outcomes as well, with corresponding gains in quality of life and diminished burden of disease, and reductions in criminal justice involvement. This study estimated the effect of MAT on clinical and justice-related outcomes in a sample of adults with serious mental illness, co-occurring alcohol dependence, and criminal justice involvement.

Methods

Administrative data on treatment utilization and criminal justice events for 5,743 adults with serious mental illness, co-occurring alcohol dependence, and criminal justice involvement were merged from several public agencies in Connecticut. Our study population was adults 18 years of age or older, with a recorded diagnosis of schizophrenia spectrum disorder, bipolar disorder, or major depression, a recorded diagnosis of moderate to severe alcohol dependence, and some period of Medicaid enrollment during the study window. All had been in a Connecticut jail or prison for at least one night during 2002–2009, and began community-based treatment for alcohol dependence during 2003–2008, allowing for 12 months of observation before and after treatment initiation.

The Connecticut Department of Mental Health and Addiction Services provided demographic characteristics and clinical diagnoses for the sample, along with outpatient treatment utilization, and state psychiatric and substance abuse hospitalizations. The Department of Social Services provided Medicaid service claims for MAT prescription fills, psychotropic medications for mental illness, outpatient service utilization, emergency department and crisis center visits, and psychiatric and substance abuse hospitalizations in community hospitals. The Department of Correction (in Connecticut, a unified system that produces administrative data for both jail and prison stays) provided data on days incarcerated, the Department of Public Safety on arrest records, and the Judicial Branch on probation days. Data from these sources were matched, merged, and de-identified. Institutional Review Boards at Duke University School of Medicine and Connecticut Department of Mental Health and Addiction Services approved this study.

MAT utilization was identified from Medicaid-covered pharmacy claims for acamprosate, disulfiram, or naltrexone (oral or extended release, the latter approved for treatment of alcohol dependence in 2006). For the MAT group (n=896), the index treatment episode was defined as the first observed outpatient MAT maintenance episode. Treatment episodes were defined as periods of continuous treatment with no gaps longer than 14 days. For MAT pharmacy claims, the maintenance episode was defined to begin on the 8th day, assuming that up to the first seven days were spent in detoxification or titration of the treatment regimen.

For the comparison group (n=4,847), the index treatment episode was defined as the first observed episode of outpatient substance abuse treatment, or outpatient mental health treatment if accompanied by an alcohol dependence diagnosis. Comparison treatment episodes were also defined by sequential outpatient treatment visits not separated by more than 14 days. Except for use of MAT, individuals in both study groups received a range of treatment services, including outpatient mental health treatment, outpatient substance abuse treatment, residential care, ACT services, or case management. While no requirement was imposed that treatment service utilization be uniform across study groups, all outcome models were adjusted for use of each type.

Measures

Outcomes

Dependent variables were dichotomous indicators of any crisis-driven healthcare and criminal reoffending during each month of observation. Crisis-driven healthcare was measured in three ways: any inpatient hospitalization for mental health, any inpatient hospitalization for substance use, and any receipt of crisis care at an emergency department or other crisis care provider. We also estimated the effect of MAT on adherence to psychotropic medications for mental illness, calculating the monthly medication possession ratio as the proportion of days in a month in which an individual had a supply of psychotropic medication appropriate for his or her primary psychiatric diagnosis, and with a dichotomous indicator for whether the medication possession ratio was at least 80% within a given month. This approach is consistent with existing research using medication possession ratio as a validated proxy for medication adherence.[24–28] Criminal offending was measured three ways: any days in jail or prison, any arrest convictions (e.g., trespassing, disturbing the peace, drug charges, violent crimes, motor vehicle, and property crimes), and only felony arrest convictions for offenses that typically carry prison sentences of 2 or more years.

Explanatory variables

To compare change over time for the two study groups (MAT versus other outpatient treatment), we included dichotomous main effects variables to indicate: time-period, the 12-month post-period following initiation of index treatment episode (reference: pre-period); study group membership, MAT treatment group (reference: comparison treatment group); and an interaction term of time X study group.

Covariates

Multivariate models adjusted for the effects of fixed and time-varying characteristics. Fixed characteristics were age at index treatment (missing n = 28, 0.49% of sample, imputed with sample mean age); educational need, measured by Department of Correction on a scale of 1 (lowest) to 5 (highest) (missing n=150, 2.61% of sample, imputed with sample mean value); gender; primary psychiatric diagnosis (schizophrenia spectrum disorder, bipolar disorder, or major depressive disorder); and race/ethnicity (white non-Hispanic, African-American non-Hispanic, Hispanic/Latino, and other).

The models included several important time-varying covariates during the observation period: any probation days, enrollment in Medicaid (≥15 days), any Supplemental Security Income, any outpatient service utilization (mental health, substance abuse, Assertive Community Treatment, residential care), a dichotomous indicator of psychiatric medication possession ratio (included in all models except medication possession ratio outcome model, and lagged by one month to avoid temporal uncertainty between medication possession ratio and outcomes of interest in a given month), and secular time (measured as 24 30-day periods numbered consecutively). We also adjusted for differential time in the community at risk (i.e., not institutionalized) by including as covariates the number of jail days (for inpatient outcome models), inpatient days (for jail outcome model), and total community days (for arrest and emergency department/crisis outcome models).

An underlying assumption of medication possession ratio as a proxy measure for medication adherence is that the patient should remain on psychotropic medication for the reference psychiatric disorder indefinitely. Duration of medication for treating alcohol dependence, however, is much more variable; and while evidence suggests six months to one year should be the minimum, the optimal duration is not known.[29–30] Discontinuation is determined by the patient's ability to maintain abstinence, readiness to discontinue, and engagement in other recovery activities such as mutual-help groups.[29] Thus, it was not appropriate to calculate a medication possession ratio for MAT medications given the treatment course and discontinuation decisions for any given individual in the study sample were unknown.

Analysis

A longitudinal dataset was constructed with repeated person-month observations, where each individual had 24 observations centered on the start of the index treatment episode, with 12 months of observations before and after initiation of the index treatment event. Generalized estimating equations[31] were used to fit the multivariate repeated measures logistic regression models and estimate the differential changes in odds of crisis-driven healthcare utilization and criminal reoffending between study groups before and after the intervention.

We also conducted sub-group analyses stratified by primary psychiatric diagnosis, based on an expectation that MAT could have differential effectiveness across psychiatric disorders with varying average levels of severity, symptoms, and disability; and given the possibility that many of the individuals with major depression diagnoses may have had less serious mental illness that was largely secondary to their substance use disorder. Finally, to determine whether adherence to their medication regimen for the major psychiatric disorder was a necessary condition for MAT to exert its beneficial effects, we examined the moderating effect of medication adherence in the sub-samples of individuals with schizophrenia and bipolar disorder, stratifying each diagnostic sub-sample by high versus low medication possession ratio for psychiatric medications.

All analyses were carried out using SAS 9.4 PROC GENMOD procedure.

Results

Table 1 presents demographic and clinical characteristics in both study groups. The MAT group (n=896) was slightly older; more likely to be White, and less likely to be Black, suggesting a racial/ethnic disparity in MAT use in this sample; and more likely to have a psychotic disorder (schizophrenia or bipolar disorder) than the comparison group (n=4,847). In both groups, over 2/3 were men. Table 2 presents the distributions for treatment utilization and criminal justice involvement in the 12 months leading up to the index treatment episode. The MAT group had significantly more intensive utilization of both outpatient and inpatient mental health and substance abuse treatment than the comparison group in the pre-index period. They also had lower psychiatric medication adherence than the comparison group. The MAT group had a significantly lower prevalence of any jail time in the pre-treatment period, but was more likely than the comparison group to be on probation.

Among the MAT group, the majority used acamprosate for treating their alcohol dependence during both the index treatment episode (52.46%) and also during the full 12-month follow-up period, which accounted for both the index treatment episode and any subsequent MAT episodes (56.14%) (Table 3). Naltrexone was the second most common medication for alcohol dependence for the MAT group, with 39.29% using it for their index treatment episode and 43.53% at some time during full 12-month follow-up period. Fewer than 10 percent of the sample were treated with disulfiram.

MAT was not, on average, associated with reduced recidivism relative to the non-MAT group. For arrest, there was no statistically significant difference in change in odds of arrest between pre- and post-treatment periods across the two study groups (odds ratio=0.99, 95% CI=0.86–1.15). The repeated measures regression models demonstrated modestly higher relative odds of incarceration from the pre-to the post-treatment period for the MAT group versus the comparison group (Table 4) (odds ratio=1.50, 95% CI=1.28–1.77); this was driven by the comparison group having a significant reduction in incarceration in the post-treatment period (mean number of days in pre-period 53.63 (SD =90.42) to mean number of days in post-period 39.63 (SD=76.59), while the incarceration rate for the MAT group remained stable 30.32 mean days in pre-period (SD=63.50) to 32.34 mean days in post-period (SD=69.11). Because jail time can be a function of sanctions for probation violations or old charges, these differences may reflect baseline differences in the samples.

MAT was, however, associated with strong beneficial changes in treatment utilization. The odds of mental health hospitalizations were significantly decreased for the MAT group versus the comparison group (odds ratio=0.72, 95% CI=0.57–0.92) (Table 5); and the odds of emergency department/crisis visits after initiating the index treatment episode also decreased for the MAT group (odds ratio=0.86, 95% CI=0.75–0.98). The mean number of jail days during months without hospitalizations was relatively stable for the MAT group (pre-period mean days=2.78, SD=8.20; post-period mean days=2.84, SD=8.37), and decreased for the comparison group (pre-period mean days=4.61, SD=10.30; post-period mean days=3.40, SD=9.05), indicating that reductions in mental health hospitalizations were not a function of trans-institutionalization to incarceration. MAT also appeared to be associated with improved adherence to psychotropic medication: the odds of having a good medication possession ratio in the post-period were increased for the MAT group than for the comparison group (odds ratio=1.57, 95% CI=1.28–1.93).

Model results were consistent among the stratified sub-sample of adults with schizophrenia, where the MAT group had no differences in arrests (including felony arrests), somewhat worse outcomes for jail time (odds ratio=1.38, 95% CI=1.04–1.83), but significantly better service-related outcomes, including lower odds of mental health hospitalization (odds ratio=0.69, 95% CI=0.48–0.98) and ED/crisis visits (odds ratio=0.80, 95% CI=0.65–0.98), as well as increased odds of having good adherence to psychiatric medications during the post-period (odds ratio=1.46, 95% CI=1.10–1.95). (See online supplemental data.) For the sub-group of adults with bipolar disorder, however, MAT was associated with reduced odds of felony arrest after initiating treatment (odds ratio =0.50, 95% CI=0.29–0.86) and also improvements in odds of having good psychiatric medication adherence (odds ratio =1.65, 95% CI=1.21–2.24). (See online supplemental data.)

We also examined the moderating effect of psychiatric medication adherence, with the expectation that individuals with good medication adherence would be more likely to fully benefit from the therapeutic effects of MAT. The unfavorable jail outcomes for the MAT group among those with schizophrenia were only evident for those with poor medication adherence (odds ratio=1.64, 95% CI=1.13–2.37). (See online supplemental data.) Among the sub-group with bipolar disorder, those who had good medication adherence benefited from MAT in much the same way as the full sample and the schizophrenia sub-group – having lower odds of mental health hospitalization (odds ratio=0.43, 95% CI=0.24–0.78) and emergency department/crisis visits odds ratio=0.60, 95% CI=0.39–0.91) in the follow-up period. Likewise, the association of MAT with decreased odds of felony arrest for individuals with bipolar disorder held only for those with good psychiatric medication adherence (odds ratio=0.18, 95% CI=0.05–0.64). (Data not shown; results available in online supplemental data.)

To explore the influence of changing prescribing patterns over time, we conducted a set of sensitivity analyses, including the year of index treatment episode as a covariate in the model. All model outcomes were statistically consistent with our original set of models that do not include index-year as a covariate, indicating that evolving prescribing patterns did not, themselves, drive the observed treatment effect.

Discussion

These study results indicate that MAT had strong clinical benefits for adults with serious mental illnesses and co-occurring alcohol dependence, including reductions in psychiatric hospitalizations, emergency department visits, and improved adherence to psychiatric medications. To the extent that crisis-driven treatment utilization is a proxy for the incidence of mental health or substance abuse crises, reductions in that type of treatment use directly benefit the patients who are spared the experience, and may also translate to considerable public behavioral healthcare savings given the high costs of hospitalization and emergency department care. The beneficial effect observed in the MAT group may, to some extent, be more broadly attributable to engagement in other treatment services at the time of MAT initiation; though the analytic models do control for use of other treatment services, which helps distinguish the MAT-specific effect.

MAT was not associated with reduced recidivism in the full study sample, which may have been related to the MAT group's greater representation on probation during the follow-up period. Community supervision places individuals under greater legal scrutiny, and, especially those with co-occurring disorders, at higher risk of incarceration due to probation violations.[32] These are not circumstances that we can explore in the administrative records, but they may at least partly explain the MAT group's lack of decrease in incarceration risk. Also, because the incarceration data are not directly linked to the arrest data, we cannot distinguish the seriousness of the offenses that led to the incarceration, nor the extent to which psychiatric and/or alcohol were influencing factors.

The criminal justice outcomes associated with MAT may also reflect the complex, multi-determined causes of criminal offending in this population. There are many examples in the

literature of only partial effectiveness of interventions for mentally ill adults who are at risk for criminal justice involvement, where the intervention is associated with improved clinical engagement and functioning, but not reductions in offending risk.[33–36] The lack of treatment effect on criminal offending risk may be due to adverse characteristics of the social environment that increase this population's risk[37] or limited attention to independent criminogenic risk factors that propel offending behavior. For the sub-set whose offending is tied exclusively to intoxication, treating the underlying alcohol dependence could resolve that offending behavior almost entirely; where for others with longstanding antisocial behavior patterns, treating their alcohol dependence would not, alone, successfully address their offending risk. A challenge, however, in attributing criminal offenses to substance use is knowing that many offenses themselves are not substance related in their nature (e.g., assault), but that alcohol may have been an important contributing factor. It is also possible, though, that the comparison group having higher baseline rates of incarceration, including possibly due to exacerbation of psychiatric or alcohol use disorders, had more room for improvement in their incarceration risk once they initiated community-based treatment.

One sub-group in our study population, however, did appear to uniquely benefit from MAT via reduced offending risk: in those diagnosed with bipolar disorder, odds of felony arrest conviction were reduced by half, and for those with good psychiatric medication adherence, odds of felony arrest conviction were reduced by 80%. Adults with bipolar disorder are more likely than those with schizophrenia to engage in criminal behavior, especially if they suffer from co-occurring substance use disorders.[13,38–40] So, for this particular diagnostic group, treating alcohol dependence with MAT was associated with a reduced risk for serious offending, including via a demonstrated moderating benefit of good adherence to their psychiatric medications—and without special attention to criminogenic risk factors.

Furthermore, for those with bipolar disorder, it appeared that the clinical benefits of MAT were actualized for those with good psychiatric medication adherence in the 12 months after initiating MAT. For that sub-group with good medication adherence, MAT was associated with substantial reductions in mental health hospitalizations and emergency department visits. By contrast, the bipolar sub-group with poor psychiatric medication adherence experienced no benefit from MAT for either clinical or offending outcomes. These findings suggest that, for the adults with bipolar disorder, the potential benefits of MAT are realized only when individuals are adherent to their other psychotropic medications. One limitation of these findings is that a high medication possession ratio could be a proxy for good adherence with MAT as well, or treatment in general, or other unidentified selection effects. It is also possible that initiation of MAT was a proxy for willingness to take medications, and potentially a stronger marker of medication adherence and associated improvements in crisis service utilization than were individuals' level adherence to psychiatric medications. As a result, these interpretations should be regarded with some caution.

There are other important limitations to consider when interpreting the study findings. The administrative data for psychiatric diagnoses are not as reliable as they would have been if directly assessed with structured diagnostic interviews. The Department of Mental Health and Addiction Services, however, assesses and records psychiatric diagnoses at inpatient and outpatient admissions, and reviews diagnoses at least once every six months to increase

accuracy. The medication possession ratio serves as a validated near proxy for medication adherence, but is not equivalent to evidence of actually taking the medication. Also, while crisis-driven service utilization is an important part of one's functional status, the administrative data lack measures on alcohol consumption or other functional status measures. With that, we cannot determine the extent to which potentially greater disease severity (and, thereby, greater potential for improvement) in the MAT group contributed to the observed MAT effect on outcomes. Given the severity of co-morbid disease in this population with chronic, relapsing disorders, however, it is unlikely that differential severity by study group would account for the full treatment effect as it might in a more diverse sample.

The quasi-experimental design yields less definitive findings than would a randomized controlled trial. Also, our study groups were non-equivalent on several dimensions, with the MAT group having more clinically severe symptoms, as indicated by higher rates of both outpatient and inpatient service use and emergency department visits than the comparison group. The groups' differences at baseline yielded poorly matched samples when a propensity analysis approach was attempted; so, rather than use the unstable propensity sample and violate the assumption that the groups were similar at baseline, we opted to use all 24 months of observed data in the analyses for both groups, and instead measure the difference in rate of change for outcomes of interest in both study groups with study period X study group interaction terms.

Many adults with serious mental illness and co-occurring alcohol dependence have relatively good access to MAT as compared to others without SMI who could benefit from these medications but face treatment barriers. Seriously mentally ill adults are more likely to be engaged in psychiatric treatment than someone with alcohol dependence but no mental illness, most of whom do not receive any behavioral health care. That active treatment engagement facilitates the addition of MAT to their treatment regimen, especially the medications used for treating alcohol dependence, which do not require any special licensure. Also, adults with SMI are more likely to have Medicaid coverage than those with only substance use disorders (that do not qualify for Medicaid-eligible disability status), thereby reducing their out-of-pocket medication costs. Most states' Medicaid formularies include the current evidence-based medications for treating alcohol dependence, including extended-release naltrexone.

MAT may need to be paired with other interventions that directly address criminogenic risk to reduce offending rates in this population of alcohol-dependent adults with serious mental illness; but the demonstrated clinical benefits of MAT, alone, are compelling and should inform practice. Important next steps would be to identify opportunities to increase MAT prescribing for this population, and identify and reduce racial and ethnic disparities. Significant reductions in psychiatric hospitalizations and emergency department visits, along with improvements in psychiatric medication adherence associated with MAT, suggest that evidence-based medications for treating alcohol dependence among adults with serious mental illness can significantly improve their clinical functioning and should be considered more systematically during assessments of their treatment needs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Negrete JC. Clinical aspects of substance abuse in persons with schizophrenia. Can J Psychiatry. 2003; 48:14–21. [PubMed: 12635559]
2. Margolese HC, Malchy L, Negrete JC, et al. Drug and alcohol use among patients with schizophrenia and related psychoses: levels and consequences. Schizophr Res. 2004; 67:157–166. [PubMed: 14984874]
3. Turkington A, Mulholland CC, Rushe TM, et al. Impact of persistent substance misuse on 1-year outcome in first-episode psychosis. Br J Psychiatry. 2009; 195:242–248. [PubMed: 19721115]
4. Opsal A, Clausen T, Kristensen O, et al. Involuntary hospitalization of first-episode psychosis with substance abuse during a 2-year follow-up. Acta Psychiatr Scand. 2011; 124:198–204. [PubMed: 21418161]
5. Kavanagh DJ, McGrath J, Saunders JB, et al. Substance misuse in patients with schizophrenia: epidemiology and management. Drugs. 2002; 62:743–755. [PubMed: 11929329]
6. Lagerberg TV, Andreassen OA, Ringen PA, et al. Excessive substance use in bipolar disorder is associated with impaired functioning rather than clinical characteristics, a descriptive study. BMC Psychiatry. 2010; 10:9. [PubMed: 20105311]
7. Abram KM, Teplin LA. Co-occurring disorders among mentally ill jail detainees: implications for public policy. Am Psychol. 1991; 46:1036–1045. [PubMed: 1746771]
8. Abram KM, Teplin LA, McClelland GM. Comorbidity of Severe Psychiatric Disorders and Substance Use Disorders Among Women in Jail. Am J Psychiatry. 2003; 160:1007–1010. [PubMed: 12727711]
9. Teplin L. Psychiatric and substance abuse disorders among urban jail detainees. Am J Public Health. 1994; 84(2):290–293. [PubMed: 8296957]
10. Swanson J, Frisman L, Robertson AG, et al. Costs of Criminal Justice Involvement among Persons with Severe Mental Illness in Connecticut. Psychiatr Serv. 2013; 64(7):630–637. [PubMed: 23494058]
11. Substance Abuse and Mental Health Services Administration. Mental Health, United States, 2010. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2012. HHS Publication No. (SMA) 12-4681
12. Epstein, J., Barker, P., Vorburger, M., et al. Serious mental illness and its co-occurrence with substance use disorders, 2002. Rockville, MD: Substance Abuse and Mental Health Services Administration, Office of Applied Studies; 2004. (DHHS Publication No. SMA 04-3905, Analytic Series A-24)
13. Kessler RC, Demler O, Frank RG, et al. Prevalence and treatment of mental disorders, 1990 to 2003. N Engl J Med. 2005; 352(24):2515–23. [PubMed: 15958807]
14. Brown ES, Carmody TJ, Schmitz JM, et al. A randomized, double-blind, placebo-controlled pilot study of naltrexone in outpatients with bipolar disorder and alcohol dependence. Alcohol Clin Exp Res. 2009; 33(11):1863–1869. [PubMed: 19673746]
15. Mueser, Noordsy DL, Fox L, et al. Disulfiram Treatment for Alcoholism in Severe Mental Illness. Am J Addict. 2003; 12:242–252. [PubMed: 12851020]

16. Batki SL, Dimmock JA, Wade M, et al. Monitored naltrexone without counseling for alcohol abuse/dependence in schizophrenia-spectrum disorders. Am J Addict. 2007; 16(4):253–9. [PubMed: 17661192]
17. Petrakis IL, Nich C, Ralevski E. Psychotic spectrum disorders and alcohol abuse: A review of pharmacotherapeutic strategies and a report on the effectiveness of naltrexone and disulfiram. Schizophr Bull. 2006; 32:644–654. [PubMed: 16887890]
18. Petrakis IL, O'Malley S, Rounsaville B, et al. Naltrexone augmentation of neuroleptic treatment in alcohol abusing patients with schizophrenia. Psychopharmacology(Berl). 2004; 172:291–297. [PubMed: 14634716]
19. Pettinati HM, Oslin DW, Kampman KM, et al. A double-blind, placebo-controlled trial combining sertraline and naltrexone for treating co-occurring depression and alcohol dependence. Am J Psychiatry. 2010; 167:668–675. [PubMed: 20231324]
20. Leontieva L, Dimmock J, Cavallerano M, et al. Patient and provider attitudes towards monitored naltrexone treatment of alcohol dependence in schizophrenia. Am J Drug Alcohol Abuse. 2009; 35(5):273–8. [PubMed: 19591067]
21. Knudsen HK, Abraham AJ, Roman PM. Adoption and implementation of medications in addiction treatment programs. J Addict Med. 2011; 5(1):21–27. [PubMed: 21359109]
22. Schmidt LA, Rieckmann T, Abraham A, et al. Advancing recovery: Implementing evidence-based treatment for substance use disorders at the systems level. J Stud Alcohol Drugs. 2012; 73:413–422. [PubMed: 22456246]
23. Volkow ND, Frieden TR, Hyde PS, et al. Medication-assisted therapies--tackling the opioid-overdose epidemic. N Engl J Med. 2014; 370(22):2063–6. [PubMed: 24758595]
24. Gilmer TP, Dolder CR, Lacro JP, et al. Adherence to treatment with antipsychotic medication and health care costs among Medicaid beneficiaries with schizophrenia. Am J Psychiatry. 2004; 161:692–699. [PubMed: 15056516]
25. Karve S, Cleves MA, Helm M, et al. Prospective validation of eight different adherence measures for use with administrative claims data among patients with schizophrenia. Value Health. 2009; 12(6):989–95. [PubMed: 19402852]
26. Svarstad BL, Shireman TI, Sweeney JK. Using drug claims data to assess the relationship of medication adherence with hospitalization and costs. Psychiatr Serv. 2001; 52:805–811. [PubMed: 11376229]
27. Valenstein M, Copeland LA, Blow FC, et al. Pharmacy data identify poorly adherent patients with schizophrenia at increased risk for admission. Medical Care. 2002; 40:630–639. [PubMed: 12187177]
28. Swartz MS, Wilder CM, Swanson JW, et al. Assessing outcomes for consumers in New York's assisted outpatient treatment program. Psychiatr Serv. 2010; 61:976–981. [PubMed: 20889634]
29. Center for Substance Abuse Treatment. Treatment Improvement Protocol 49. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2009. Incorporating alcohol pharmacotherapies into medical practice. (HHS Publication No. [SMA] 12-4389.)
30. Fishman, MJ.Mee-Lee, D.Shulman, GD., et al., editors. ASAM Patient Placement Criteria: Supplement on Pharmacotherapies for Alcohol Use Disorders. Philadelphia, PA: Lippincott, Williams & Wilkins; 2010.
31. Liang, Kung-Yee, Zeger, Scott L. Longitudinal Data Analysis Using Generalized Linear Models. Biometrika. 1986; 73(1):13–22.
32. Skeem J, Eno Louden J, Manchak S, et al. Social networks and social control of probationers with co-occurring mental and substance abuse problems. Law Hum Behav. 2008; 33:122–135. [PubMed: 18581220]
33. Martin MS, Dorken SK, Wamboldt AD, et al. Stopping the revolving door: A meta-analysis on the effectiveness of interventions for criminally involved individuals with major mental disorders. Law Hum Behav. 2011; 36:1–12.
34. Skeem JL, Manchak S, Peterson JK. Correctional policy for offenders with mental illness: Creating a new paradigm for recidivism reduction. Law Hum Behav. 2011; 35:110–126. [PubMed: 20390443]

35. Robertson AG, Lin H, Frisman L, et al. The effects of brief incarcerations before jail diversion on program participants' health and reoffending outcomes. Psychiatr Serv. 2014; 65(9):1113–1119. [PubMed: 24828832]

36. Robertson AG, Swanson JS, Van Dorn RA, et al. Effects of early and consistent treatment participation and medication adherence on arrest and incarceration costs for persons with serious mental illness. Psychiatr Serv. 2014; 65(10):1189–91. [PubMed: 25270494]

37. Barrenger SL, Draine J, Angell B, et al. Reincarceration risk among men with mental illnesses leaving prison: a risk environment analysis. Community Ment Health J. 2017; doi: 10.1007/s10597-017-0113-z

38. Robertson AG, Swanson JW, Frisman LK, et al. Patterns of justice involvement among adults with schizophrenia and bipolar disorder: key risk factors. Psychiatr Serv. 2014; 65(7):931–8. [PubMed: 24633645]

39. Baillargeon J, Binswanger IA, Penn JV, et al. Psychiatric disorders and repeat incarcerations: the revolving prison door. Am J Psychiatry. 2009; 166:103–109. [PubMed: 19047321]

40. Fazel S, Lichtenstein P, Grann M, et al. Bipolar disorder and violent crime: new evidence from population-based longitudinal studies and systematic review. Archives of General Psychiatry. 2010; 67:931–938. [PubMed: 20819987]

Table 1

Characteristics of alcohol-dependent adults with severe mental illness in Connecticut public behavioral health system during 2002 – 2009, by study group

	MAT group (n=896)		Comparison group (n=4,847)		
	N	%	N	%	
Age (Mean, SD)	41.95	(8.83)	38.00	(9.87)	***
Gender					
Female	273	30.47 %	1,543	31.83 %	
Male	623	69.53 %	3,304	68.17 %	
Race/ethnicity					***
White	698	77.9 %	2,593	53.5 %	
Black/African-American	130	14.51 %	1,560	32.18 %	
Hispanic/Latino	60	6.7 %	676	13.95 %	
Other	8	0.89 %	18	0.37 %	
Psychiatric diagnosis					***
Schizophrenia spectrum disorder	249	27.79 %	1,305	26.92 %	
Bipolar disorder	278	31.03 %	1,273	26.26 %	
Major depressive disorder	369	41.18 %	2,269	46.81 %	

* p<.05;

** p<.01;

*** p<.001

Effect sizes were computed and they ranged from small to medium for Cramer's V (.01–.18), and medium for Cohen's d (0.4).

Table 2

Service utilization and justice involvement among alcohol-dependent adults with severe mental illness in Connecticut public behavioral health system during 12 months before index treatment episode, by study group

	MAT group (n=896)		Comparison group (n=4,847)		
	N	%	N	%	
Treatment service utilization					
Mental health outpatient visits (mean number, SD)	20.59	(41.84)	12.58	(39.34)	***
Substance abuse outpatient visits (mean number, SD)	19.58	(34.73)	4.20	(18.08)	***
Any psychiatric inpatient days	249	27.79 %	772	15.93 %	***
Any substance abuse inpatient days	347	38.73 %	696	14.36 %	***
Any Emergency department/crisis visits	494	55.13 %	1,510	31.15 %	***
Pre-index Medication Possession Ratio average† (mean, SD)	0.55	(0.35)	0.62	(0.41)	**
Criminal justice involvement					
Any jail	322	35.94 %	2,349	48.46 %	***
Pre-index jail (days) (mean number, SD)	30.32	(63.50)	53.63	(90.42)	***
Any probation	227	25.33 %	766	15.8 %	***
Any arrest	381	42.52 %	2,192	45.22 %	
Charges for convicted arrests included:					
Violent crimes	48	5.36	406	8.38	**
Other crimes against a person	62	6.92	368	7.59	
Weapons sales/possession	2	0.22	32	0.66	
Property crimes	52	5.80	422	8.71	**
Drug crimes	34	3.79	370	7.63	***
Driving while intoxicated	100	11.16	301	6.21	***
Miscellaneous felonies	8	0.89	27	0.56	
Minor misdemeanors	270	30.13	1,636	33.75	*
Insurance					
Supplemental Security Income (SSI or SSDI)	287	32.03 %	1,304	26.90 %	**

*
p<.05;

**
p<.01;

***p<.001

†Calculated for subset with diagnosis of schizophrenia or bipolar disorder and records of medication during 24-month observation period (MAT n=381; Comparison n=2,192)

Effect sizes were computed and they range from small to large for Cohen's d (.16–.71) and small to medium for Cramer's V (.01–.23).

Table 3

Types of MAT medications among alcohol-dependent adults with severe mental illness in Connecticut public behavioral health system (n=896)

	MAT sample by SMI diagnosis							
	Schizophrenia spectrum (n=249)		Bipolar disorder (n=278)		Major depression (n=369)		Full MAT Sample (n=896)	
	N	%	N	%	N	%	N	%
Index treatment episode								
Naltrexone	106	42.57 %	123	44.24 %	123	33.33 %	352	39.29 %
Number of days, if any (Mean, SD)	61.47	(66.39)	52.09	(60.33)	46.15	(55.52)	52.84	(60.77)
Acamprosate	121	48.59 %	133	47.84 %	216	58.54 %	470	52.46 %
Number of days, if any (Mean, SD)	47.69	(54.36)	50.03	(61.54)	38.05	(37.74)	43.92	(50.05)
Disulfiram	22	8.84 %	22	7.91 %	30	8.13 %	74	8.26 %
Number of days, if any (Mean, SD)	80.73	(115.94)	41.64	(41.65)	48.57	(65.79)	56.07	(79.72)
Full 12-month follow-up (includes index and any subsequent episodes) *								
Naltrexone	113	45.38 %	136	48.92 %	141	38.21 %	390	43.53 %
Number of days, if any (Mean, SD)	104.09	(97.24)	85.30	(82.72)	62.62	(70.86)	82.55	(84.77)
Acamprosate	129	51.81 %	149	53.60 %	225	60.98 %	503	56.14 %
Number of days, if any (Mean, SD)	71.29	(76.50)	77.62	(76.00)	63.22	(62.91)	69.55	(70.71)
Disulfiram	25	10.04 %	26	9.35 %	37	10.03 %	88	9.82 %
Number of days, if any (Mean, SD)	109.48	(121.35)	73.04	(67.26)	58.68	(70.98)	77.35	(88.87)

* Total percentages exceed 100% because 85 individuals received more than one type of MAT over 12 months post-index treatment initiation.

Table 4

Change in odds of incarceration and arrest after MAT initiation versus other outpatient substance abuse treatment, full sample (n=5,743)[≠]

	Jail			Any arrest			Any felony arrest		
	O.R.	**95% C.I.**	**p**	**O.R.**	**95% C.I.**	**p**	**O.R.**	**95% C.I.**	**p**
Study group X time-period interaction	1.50	(1.28–1.77)	<.0001	0.99	(0.86–1.15)	0.942	0.85	(0.62–1.17)	0.317
Main effects									
Study group[¥]	0.61	(0.52–0.70)	<.0001	0.90	(0.81–1.01)	0.068	0.86	(0.68–1.09)	0.216
Time period[¥]	0.50	(0.46–0.55)	<.0001	0.80	(0.71–0.90)	0.000	1.26	(1.00–1.58)	0.054

[≠]Models control for age, educational need, gender, primary psychiatric diagnosis, race/ethnicity, insurance (SSI, Medicaid), probation, service participation (residential, Assertive Community Treatment, outpatient mental health treatment, outpatient substance abuse treatment), medication possession ratio (prior month medication possession ratio of 80% or higher), time, and community tenure.

[¥]MAT group = 1, Comparison group = 0; Post-index-treatment period = 1, pre-index-treatment period = 0

Table 5

Change in odds of crisis-driven service utilization and high Medication Possession Ratio after MAT initiation versus other outpatient substance abuse treatment, full sample (n=5,743)[≠]

	Substance abuse hospitalization			Psychiatric hospitalization			Emergency department/Crisis			Psychiatric Medication Possession Ratio		
	O.R.	**95% C.I.**	**p**	**O.R.**	**95% C.I.**	**p**	**O.R.**	**95% C.I.**	**p**	**O.R.**	**95% C.I.**	**p**
Study group X time-period interaction	1.00	(0.82–1.22)	0.972	0.72	(0.57–0.92)	0.008	0.86	(0.75–0.98)	0.023	1.57	(1.28–1.93)	<.0001
Main effects												
Study group[¥]	2.34	(2.02–2.70)	<.0001	1.69	(1.40–2.04)	<.0001	1.76	(1.56–1.98)	<.0001	0.72	(0.59–0.87)	0.001
Time period[¥]	0.12	(0.09–0.15)	<.0001	0.32	(0.26–0.39)	<.0001	0.48	(0.42–0.55)	<.0001	0.87	(0.74–1.02)	0.084

[≠]Models control for age, educational need, gender, primary psychiatric diagnosis, race/ethnicity, insurance (SSI, Medicaid), probation, service participation (residential, Assertive Community Treatment, outpatient mental health treatment, outpatient substance abuse treatment), medication possession ratio (prior month medication possession ratio of 80% or higher), time, and community tenure. Medication possession ratio outcome model excludes medication possession ratio covariate, includes only person-months when individuals were enrolled in Medicaid, and is restricted to individuals with any record of medication who were diagnosed with schizophrenia spectrum or bipolar disorder (n=2,043).

[¥]MAT group = 1, COMP group = 0; Post-index-treatment period = 1, pre-index-treatment period = 0