Medications for alcohol use disorders during alcohol-related encounters in a Colorado regional healthcare system

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Abstract

RATIONALE: Investigations show medications for alcohol use disorders (MAUD) reduce heavy-drinking and relapses. However, only 1.6% of individuals with alcohol use disorders (AUD) receive MAUD across care settings. The epidemiology of MAUD prescribing in the acute care setting is incompletely described. We hypothesized that MAUD would be under-prescribed in inpatient acute care hospital settings compared to the outpatient, emergency department (ED), and inpatient substance use treatment settings.

METHODS: We evaluated electronic health record (EHR) data from adult patients with an International Classification of Diseases 10th revision (ICD-10) alcohol-related diagnosis in the University of Colorado Health (UCHealth) system between 1/1/2016 – 12/31/2019. Data from patients with an ICD-10 diagnosis code for opioid use disorder and those receiving MAUD prior to their first alcohol-related episode were excluded. The primary outcome was prescribing of MAUD, defined by prescription of naltrexone, acamprosate, and/or disulfiram. We performed bivariate and multivariate analysis to identify independent predictors of MAUD prescribing at UCHealth.

RESULTS: We identified 48,421 unique patients with 136,205 alcohol-related encounters at UCHealth. Encounters occurred in the ED (42%), inpatient acute care (17%), inpatient substance use treatment (18%), or outpatient primary care (12%) settings. Only 2270 (5%) patients received MAUD across all settings. Female sex and addiction medicine consults positively predicted MAUD prescribing. In contrast, encounters outside inpatient substance use treatment, Hispanic ethnicity, and black or non-white race were negative predictors of MAUD prescribing. Compared to inpatient substance use treatment, inpatient acute care hospitalizations for AUD was associated with a 93% reduction in the odds of receiving MAUD.

CONCLUSIONS: AUD-related ED and inpatient acute care hospital encounters in our healthcare system were common. Nevertheless, prescriptions for MAUD were infrequent in this population, particularly in inpatient settings. Our findings suggest that initiation of MAUD for patients with alcohol-related diagnoses in the acute care settings deserves additional evaluation.

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Introduction

Alcohol use is ubiquitous in society with 16 million individuals in the United States meeting criteria for an alcohol use disorder (AUD) (Jonas *et al.*, 2014). Presence of an AUD increases the risk of chronic disease, disability, and death (Schuckit, 2009). Between 2006 and 2010, the annual number of alcohol-associated deaths in the US was 9.8% of all US deaths or 88,000 deaths (Jonas *et al.*, 2014). Furthermore, AUDs contribute billions annually to healthcare expenditures, and total societal costs in the US in 2010 were estimated at 249 billion (Sacks *et al.* 2015, Sacks *et al.* 2010).

Although effective pharmacologic treatments for AUD exist, they remain under-utilized. Three FDA-approved medications for treatment of AUDs, namely disulfiram, acamprosate and naltrexone, reduce heavy drinking and prolong abstinence (Jonas *et al.*, 2014). Naltrexone has been associated with both reduced risk of relapsed drinking and reductions in binge drinking (O'Malley *et al.*, 2007; Litten *et al.*, 2016; Busch *et al.*, 2017). Similarly, a meta-analysis of acamprosate reported reduced risk of relapse in abstinent patients (Jonas *et al.*, 2014). Despite guidelines from the American Psychiatric Association suggesting consideration of pharmacotherapy to reduce misuse for all patients with moderate to severe AUD, only 3% of patients with AUDs are currently undergoing targeted treatment, and less than 15% of providers report prescribing AUD-specific pharmacotherapies (Mark *et al.*, 2003, Reus *et al.*, 2018; Williams *et al.*, 2018).

Patients with an AUD may be predisposed to receive medical care in inpatient or acute settings, rather than outpatient care, given their increased risk of more severe clinical presentations, traumatic injuries, infection and co-morbid disease (Spies *et al.*, 1996; Gupta *et al.*, 2019; Vartan *et al.*, 2020). In 2006, healthcare expenditures and hospitalizations for health conditions that were sequelae of alcohol use accounted for 20.8% of the 24.6 billion healthcare dollars spent (Bouchery *et al.*, 2006). Trends from 1998 to 2016 indicate that the number of alcohol-related hospitalizations may be increasing (Singh and Cleveland, 2020). A recent study utilizing universal screening of hospitalized patients found that of 21,519 screened hospitalized patients, 11% showed moderate to high risk alcohol use (Wakeman *et al.,* 2020). Studies suggest that an inpatient acute care hospital stay may represent a "teachable moment" acting as a trigger for behavioral change, including alcohol cessation, in survivors of critical illness (Clark and Moss, 2011; Clark *et al.*, 2013a). The 2019 National Survey on Drug Use and Health showed that of the 14.1 million adults with AUD, only 1.6% received MAUD (Han *et. al.,* 2021). Importantly, a single center study of a discharge planning protocol with MAUD prescribing guidance for patients with AUD demonstrated an increase in naltrexone prescribing on discharge along with a decrease in 30-day inpatient hospital readmissions and all-cause emergency department visits (Wei *et al.*, 2015), suggesting that MAUD provision in the inpatient acute care setting is feasible and associated with decreased re-admission and decreased ER visits.

Despite both the high prevalence of AUD in hospitalized patients and the effectiveness of AUD therapy in outpatients with an AUD, few studies have reported MAUD prescribing habits in hospitalized patients (Stewart and Connors, 2007; Wei *et al.*, 2015; Englander *et al.*, 2019; Kirchoff *et al.*, 2021). Therefore, we sought to define the epidemiology of MAUD prescribing in the acute care setting compared to the ED and outpatient care settings within our University of Colorado Healthcare (UCHealth) System, and to identify patient- and encounter- level factors associated with MAUD prescribing. We hypothesized that while MAUD is likely under-prescribed in all care settings, it is more likely under-prescribed in inpatient acute care hospital and Intensive Care Unit (ICU) settings compared to the outpatient, ED, and inpatient substance use treatment settings.

Materials and Methods:

Population Enrolled:

We conducted a retrospective cohort study using administrative data collected from the Health Data Compass (Compass) database from the UCHealth system, a health system that cares for communities throughout Colorado, southern Wyoming and western Nebraska. The UCHealth system incorporates acute care hospitals, stand-alone Emergency Departments, outpatient sub-specialty clinics, primary care clinics, inpatient substance use facilities, and urgent care centers. Compass is a multi-institutional data warehouse affiliated with UCHealth that contains inpatient and outpatient electronic medical data including patient, encounter, diagnosis, procedures, medications, laboratory results from two electronic medical record systems, state-level all-payers claims data, and the Colorado death registry.

For these investigations, patients who were age 18 years of age with an ICD-10 diagnosis of an alcohol-related disorder (F10, F10.2, F10.23) were included (ICD-10, 2019). Patients could have had an encounter in any UCHealth-affiliated facility between January 1, 2016 and December 31, 2019. A time period prior to the Covid-19 pandemic was chosen, as Covid-19 disrupted alcohol treatment protocols and influenced healthcare utilization by persons with AUD. Patients who had an ICD-10 diagnosis code for opioid use disorder (F11) and those who had evidence of a MAUD prescription in their pharmacy records at any point in the study period prior to their first alcohol-related encounter were excluded (ICD-10, 2019).

Outcome Variable

Prescription information was obtained by review of pharmacy records from the patients' EHR (Harris *et al.*, 2010; Robertson *et al.*, 2018; Kelly *et al.*, 2019). We defined MAUD prescribing for patients who had at least one prescribing instance for oral or intramuscular (IM) naltrexone, oral acamprosate, and/or oral disulfiram. The prescribing could have occurred in any encounter setting.

Predictor Variables

Information regarding patient age, race, ethnicity, sex, date of birth, socioeconomic status as measured by the average income in a patient's zip code, percentage of high school graduates in a patient's zip code and percentage of college graduates in a patient's zip code were

collected. The number of encounters per individual in the database over the study period was calculated and used as a patient level predictor variable. Encounter-level variables included encounter location, admission department, receipt of addiction consultation, and primary diagnosis. Using admission department and hospital of record information, patients were classified as being cared for in either primary care clinic, other outpatient clinic, emergency department, urgent care, inpatient acute care hospital, inpatient substance use treatment or ICU settings. Other outpatient clinics often included sub-specialty clinics, such as cardiology or nephrology care. Emergency departments included both hospital-affiliated and stand-alone emergency departments within the UCHealth system, while urgent care settings were classified separately. Emergency departments and urgent care facilities both provide same-day care to patients without prior appointment; however, emergency departments provide higher acuity care for more complex or critical medical situations. If an individual both presented to the ED and was subsequently admitted to the hospital this was classified as an acute care inpatient hospital encounter. Additionally, if a patient was admitted to the ICU it would be classified as an ICU encounter. Inpatient substance use treatment centers are encounters where patients received treatment for their substance use disorder. Encounters were classified as alcohol related if the word 'alcohol' was found in the primary ICD-10 diagnosis code for the encounter (Touquet and Harris, 2010).

Statistical Analysis

Descriptive statistics were used to describe individual- and encounter-level factors, as well as the types of MAUD prescribed for the whole population during the study period. MAUD recipients were compared to non-recipients using two independent sample t-tests and Pearson's chi-square test of independence. We performed a multivariate analysis using logistic regression with a dichotomous primary outcome of MAUD prescribing (yes/no) to identify predictors of MAUD prescribing in our healthcare system, with separate analyses performed for patient-level and encounter-level variables to better understand patient versus healthcare system effects. Each encounter was treated uniquely, so if an individual presented for care five times, and received a MAUD prescription three times, each time would count as a unique instance of prescribing for the multivariable model. In the individual level multivariable model, the above person would be considered to have five encounters. If they were ever prescribed MAUD they were counted as a yes for the prescription level variable. Variables that were initially significant in the bivariable analysis were included in the multivariable model. Odds ratios and 95% confidence intervals were calculated for every association. We explored the missingness in our variables to determine whether there was differential missingness by any of our key variables. Statistical analysis was performed using SAS OnDemand for Academics software (SAS, 2021) with a p-value of <0.05 considered statistically significant.

Human Subjects protection

All data for this investigation was stored on a secure server with limited access, with identifying information removed prior to analysis. This study was approved by the Colorado Multiple Institutional Review Board.

Results:

We identified 53,115 individuals who met inclusion criteria. A total of 3,797 individuals met exclusion criteria and were omitted from the analysis. A total of 136,205 encounters for these 49,318 individuals occurred during the study's time frame. Encounter level variables were missing data in 1764 encounters (1.3%) and were thus omitted from the planned analyses. Therefore, we analyzed data from 134,441 encounters, representing 48,421 unique patients. Figure 1 shows a breakdown of individuals and encounters included in the final analysis.

Patient characteristics

Data were analyzed from a total of 48,421 patients with likely AUD (Table 1). Compared to non-recipients, MAUD recipients were more often women, white, Non-Hispanic, slightly younger, had on average more encounters per recipient, had higher average income for their zip code, a higher percentage of their zip code had graduated from high school, but a lower percentage of residents of their zip code had graduated from college.

Encounter level variables

Alcohol-related diagnoses were coded in 136,205 encounters amongst our study population (Table 2). Encounters for these diagnoses occurred most often in the ED (42%). Importantly, the percentage of encounters during inpatient substance use treatment (18%) occurred at a similar frequency to those in the inpatient acute care (17%) and primary care settings (12%). Encounters where MAUD was prescribed were more likely to include an addiction medicine consult and more often associated with a primary alcohol-related diagnosis.

Frequency of MAUD prescriptions

Amongst patients with alcohol-related diagnoses, only 2270 unique individuals (5%) received MAUD in any care setting. Of the 5,964 prescriptions for MAUD, naltrexone PO was the most common (71.2%), followed by disulfiram (12.9%), acamprosate (8.8%), and naltrexone IM (5.4%) (Figure 2). On average individuals were prescribed 1.18 different kinds of prescriptions, and were prescribed the same prescription 2.22 times (Table 1).

Bivariable Models

In bivariable models (Table 3) female sex, having a primary alcohol related diagnosis, having an addiction medicine consult, having more alcohol-related encounters, and being older were associated with increased odds of receiving MAUD. Receiving treatment in the ED, inpatient acute care, or ICU settings compared to inpatient-alcohol treatment, as well as Hispanic ethnicity, and black race or multiple/other/unknown race were associated with decreased odds of receiving MAUD.

Multivariable Models

In multivariable models (Tables 4–5) positive predictors of MAUD prescribing included female sex, having more alcohol related encounters, having a primary alcohol related diagnosis, and having an addiction medicine consult. Notably, women were 20% more likely

to receive MAUD than men. Negative predictors included receiving treatment in the ED, inpatient acute care, or ICU settings compared to inpatient-alcohol treatment, as well as Hispanic ethnicity, and black race or multiple/other/unknown race. Hispanic ethnicity was associated with 23% decreased odds of receiving MAUD, compared to patients who did not identify as Hispanic, and patients of black race were nearly 50% less likely to receive MAUD compared to Caucasians. Compared to inpatient substance use treatment, patients with an alcohol related disorder admitted to an inpatient acute care setting were 95% less likely to receive MAUD, while patients with ICU admission were 93% less likely to receive MAUD.

Discussion:

Although AUD-related encounters were common in our Colorado healthcare system, few patients (5%) seen for an alcohol-related encounter across the system received a MAUD prescription in conjunction with their acute care encounter. The rate of MAUD prescriptions was associated with race, gender, ethnicity, and care setting. In certain healthcare settings, the rate of MAUD prescription was much lower than 5%. Our findings are consistent with a prior Veterans Health Administration (VHA) study from 2006–2007 describing a 3% MAUD initiation rate amongst a quarter million VHA patients with alcohol use disorder (Harris *et al.*, 2010). Although not all patients will necessarily be clinically appropriate for or want pharmacological therapy, current prescribing practices seem inadequate, given that the American Psychiatric Association states that in the absence of contraindications, naltrexone or acamprosate should be offered to all persons with moderate to severe AUD seeking treatment who are interested in MAUD or who have failed non-pharmacologic treatment (Reus *et al.*, 2018). Given the prevalence of alcohol-related diagnoses, the acute care setting may provide a 'teachable moment' for patients who be motivated to make health-related changes due to their acute illness. As such, incorporating MAUD prescribing into the acute care setting would be expected to improve this important metric.

Our cross-sectional data cannot fully delineate why individuals with AUD are infrequently prescribed MAUD, but it does suggest certain patient-level and provider-level contributing factors. On the provider level, there may be a lack of knowledge about indications, relative vs. absolute contraindications, or the efficacy and safety of MAUD (Mark *et al.*, 2003). In the busy inpatient setting, there may also be a lack of time to discuss MAUD and perceptions about addiction as a moral failing (Mark *et al.*, 2003). It is additionally possible that inpatient providers believe that prescribing MAUD may be the purview of outpatient providers, and do not want to prescribe a new medication to a patient with an unknown follow-up plan. Primary care engagement is associated with higher rates of MAUD prescribing, and efforts should be made to improve primary care utilization amongst those with alcohol use disorders (Joudry *et al.*, 2019). Attempts should be made to ensure follow-up when starting MAUD in the inpatient setting. Borg et al found that patients who had alcohol misuse followed up with outpatient care less frequently than patients without alcohol misuse (Borg *et al.*, 2018). However, the risks to a patient of continued AUD, including severe illness and readmission likely overshadow the risks to a patient of receiving a month-long prescription of naltrexone and missing outpatient follow up (Clark *et al.*, 2013b). Notably, pharmacist-led interventions have been associated with improved

follow-up and medication retention of MAUD and medications for opioid use disorder (MOUD) post discharge (Smith *et al.*, 2021). One study of ED-initiated buprenorphine therapy paired with referrals to primary care resulted in high levels of 30-day retention in addiction treatment (D'onofrio *et al.,* 2015). These examples demonstrate practical ways to support treatment retention following MAUD initiation in the acute care setting.

One way to improve MAUD prescribing rates would be systematic involvement of addiction medicine or inpatient substance use expertise to improve care delivery. In our data, patients that received an addiction medicine consult or were seen in inpatient substance use facilities were more likely to receive MAUD than patients admitted to an ICU or inpatient acute care hospital ward without addiction medicine consults. In our data, addiction consultation was only provided on 839 (0.6%) encounters, despite its efficacy in improving MAUD prescribing. Given that patients in the inpatient setting and ICU often have several acute issues being managed by their primary team, a multi-disciplinary approach to their addiction medicine care might be a more sustainable way to improve MAUD prescribing. Addiction medicine consultation services have been shown to increase engagement with post-discharge addiction medicine care for hospitalized patients with alcohol or opioid use disorder who may have many other acute issues during their hospitalization and may be lost to follow-up after their acute encounter (Wakeman *et al.*, 2017; Englander *et al.*, 2020a). Addiction medicine providers may serve as a bridge between the acute care and outpatient setting enhancing retention in treatment. A structural method to increase MAUD prescribing as well as other addiction related outcomes could be to standardize addiction consultations for all patients with moderate to severe alcohol use disorders, and especially for those with a primary alcohol related encounter (O'Toole *et al.*, 2007; Wakeman *et al.*, 2017; Englander *et al.*, 2020a; Englander *et al.*, 2020b). Although addiction medicine consults do increase MAUD prescribing, it is a resource intensive way to do so that may not be appropriate in all settings.

Given the limited number of addiction medicine specialists nationwide, especially outside of the academic medical setting, primary teams and inpatient social work teams will often be responsible for addiction treatment and linkage to post-discharge care. Given our low rate of inpatient acute care prescribing, education of hospitalists and intensivists may increase their familiarity with MAUD prescribing, and therefore increase naltrexone prescribing. Two trials looking at education of hospitalists found an increase in MAUD prescribing post-intervention, and both trials found a reduction in 30-day all-cause ED visits (Wei *et al.*, 2015; Stephens *et al.*, 2018). It is possible that more in depth training on use of MAUD in high-risk populations could increase MAUD prescribing amongst generalists to be close to the frequency with which addiction medicine consultants prescribe MAUD.

Patient-level factors can also contribute to MAUD prescribing practices. Our data highlighted a potential disparity in MAUD prescription for black and Hispanic patients. The relationship between diminished prescribing of MAUD for ethnic and racial minority patients has been reported in prior studies (Williams *et al.*, 2017; Oldfield *et al.*, 2019). Although we cannot assess the underlying reasons from in our retrospective study, they are likely complex and exist at both patient, provider, and structural levels. At the patient level, lack of trust in health-care systems, patient preferences, language barriers, and health

beliefs could play a role. At the provider level pre-existing attitudes about addiction as a moral disease that would not benefit from MAUD treatment may play a role (Williams *et al.*, 2018). Structural barriers to care such as insurance status, poor access to follow-up, high medication costs, and structural racism could all be contributing as well (Jackson *et al.*, 2021). These issues should be an area for further research.

Patients who received MAUD had on average seven additional encounters compared to those who did not receive MAUD. This suggests that AUD, like other addictive diseases, are stage-based in nature and may take multiple interactions with the healthcare system before individuals are motivated to change behavior (DiClemente *et al.*, 2004). Research in tobacco cessation field has shown that successful tobacco cessation can take anywhere between six and thirty attempts (Borland *et al.*, 2010; Chaiton *et al.*, 2016). The number of quit attempts required for successful cessation is less well studied amongst those with AUD. Prior research has placed the mean number of quit attempts at 5.4, however with a large standard deviation at 13.5 suggesting a large amount of variability within subgroups (Kelly *et al.*, 2019). Our data also shows that individuals on average were prescribed a single type of medication, and received two unique prescriptions of each kind of MAUD. This suggests that a gap may exist in diversifying the type of MAUD that is prescribed for people with AUD. If each individual is only getting one type of prescription, it is unlikely that providers are trialing different kinds of MAUD for someone who has failed treatment previously. Finally, the low number of repeat prescriptions for each type of MAUD suggests that individuals were getting initiated on treatment but were not continuing it in the long-term, further showing the necessity of linkage to outpatient care. This data can inform messaging to providers and patients alike about the challenging nature of treating addiction, and the importance in continued efforts despite prior difficulties.

Limitations of this trial include being a retrospective analysis within a single healthcare system. However, healthcare settings with the UCH healthcare system include community hospitals, academic hospitals, various clinics, and standalone emergency departments that serve areas in Colorado, Wyoming, and Nebraska. Furthermore, our rates of prescribing correlate with nationwide estimates (Harris *et al.*, 2010; Mark *et al.*, 2003). Individuals were included in this cohort if they had AUD-related encounters, which may have included some individuals who did not have true alcohol use disorder and therefore would not have been good candidates for MAUD. Individuals with opioid use disorders were excluded, which is a prevalent co-morbidity amongst those with alcohol use disorder. The conclusions of this study therefore may not be relevant to those with polysubstance use disorders. Our population was overwhelmingly white or Caucasian, limiting the conclusions we can draw about minority race groups. Our data was from electronic medical records, which only contains zip-code level information about socioeconomic status, which may not correlate to an individual's socioeconomic status. This limits our ability to draw conclusions on the relationship between MAUD prescribing and socioeconomic status. Additionally, our EHR data was only able to provide prescribing rates without information about how often prescriptions were filled by recipients. The data we do have still demonstrates a significant gap at the prescribing level that needs to be addressed. Our primary outcome excluded off-label prescriptions for MAUD, such as topiramate or gabapentin. This may mean our

prescribing rates would be higher if these medications were included; however, off-label prescribing is unlikely to be more common than on-label MAUD usage.

In conclusion, AUD-related encounters in our healthcare system were common, including the inpatient acute care hospital setting and the emergency department. Nevertheless, prescriptions for MAUD were infrequent in this population. Data also highlighted differences in MAUD prescribing associated with gender and race/ethnicity. Our findings suggest that acute care settings deserve additional consideration as a potential feasible venue for the initiation of MAUD in patients with alcohol-related diagnoses. Further studies will be necessary to evaluate the most feasible methods to provide MAUD for hospitalized patients with alcohol-related encounters in an equitable way.

Acknowledgments

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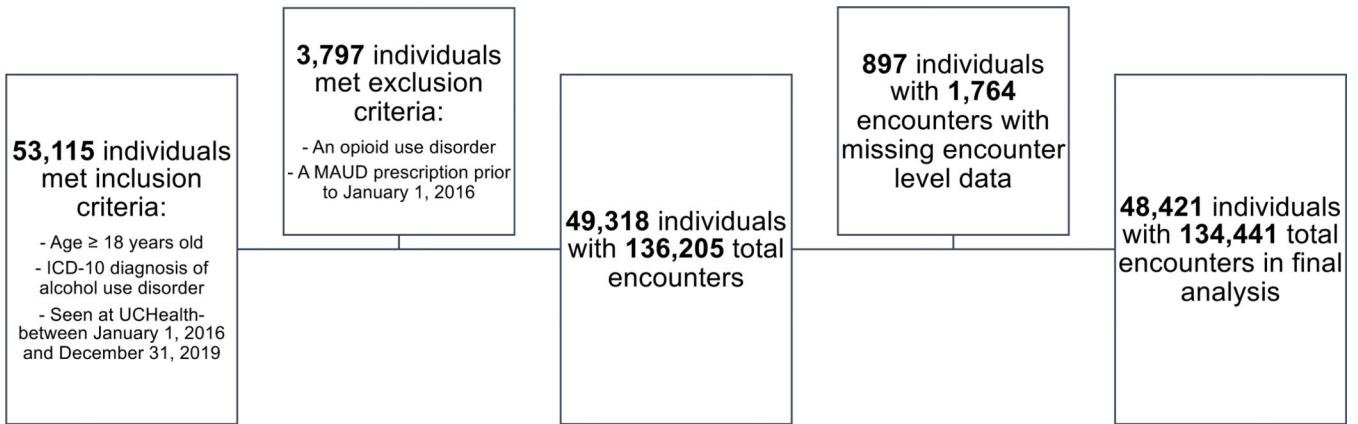
Figure 1:
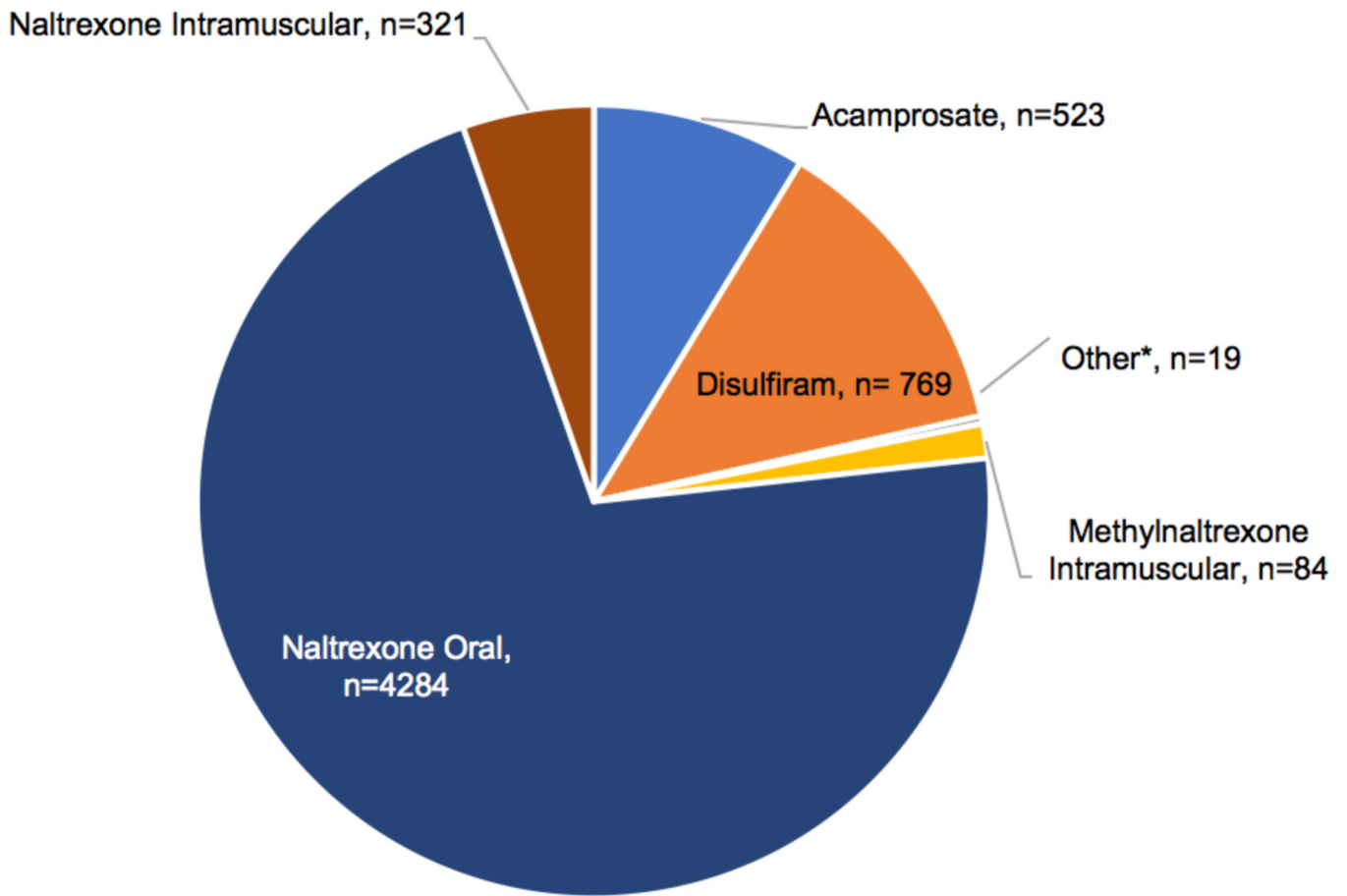Consort Diagram of participants initially eligible for analysis, and their disposition

Figure 2:
Types of MAUD prescribed; n=5,964
*Other: Naltrexone+buproprion n=13; Methylnaltrexone oral n=2; Morphine + naltrexone N=4

Table 1:

Description of population n = 48,421

Patient Characteristic	MAUD prescribed (n=2270)	MAUD not prescribed (n=46151)	P value
Age in years; Median (Std Dev)	43.8 (15.9)	44.8 (13.1)	0.002
Gender, Percent of population, (Number)			0.0002
Female	37.75 (857)	33.60 (15509)	
Male	62.25 (1413)	66.37 (30631)	
Unknown	0 (0)	0.02 (11)	
Race, Percent of population, (Number)			<0.0001
American Indian and Alaska Native	0.97 (22)	0.91 (422)	
Asian	0.40 (9)	0.83 (381)	
Black or African American	5.20 (118)	9.14 (4220)	
Multiple Race/Other/Unknown	9.16 (208)	18.19 (8395)	
Native Hawaiian and Other Pacific Islander	0.18 (4)	0.18 (84)	
White or Caucasian	84.10 (1909)	70.74 (32649)	
Ethnicity, Percent of population, (Number)			<0.0001
Unspecified/Patient Refused/Unknown	1.89 (43)	3.44 (1589)	
Hispanic	8.81 (200)	16.38 (7562)	
Non-Hispanic	89.30 (2027)	80.17 (37000)	
Average number of encounters per person (Std Dev)	10.0 (15.6)	2.46 (5.8)	<0.0001
Average number of distinct types of prescriptions per person (Std Dev)	1.18 (0.46)	--	--
Average number of repeat prescriptions per person (Std Dev)	2.22 (1.87)	--	--
Average Income for Patient's Zip Code; Mean in US Dollars (Std Dev)	69,316.62 (21155.81)	62,889.83 (20460.01)	<0.0001
Percent above High School Education in Patient's Zip Code; Mean (Std Dev)	91.8 (7.9)	89.9 (8.6)	<0.0001
Percent above College Education in Patient's Zip Code; Median (Std Dev)	36.6 (17.2)	42.7 (17.2)	<0.0001

[*]Classes within variables are italicized

Table 2:

Characteristics of alcohol-related encounters, n =130,241

Encounter Characteristic	MAUD prescribed (n=5964)	MAUD not prescribed (n=130,241)	P value
Addiction medicine consults, Percent of encounters, (Number)	1.01 (60)	0.60 (779)	<0.0001
Primary diagnosis is alcohol related diagnosis, Percent of encounters, (Number)	47.40 (2827)	46.13 (60079)	<0.0001
Treatment setting [**], Percent of encounters, (Number)			<0.0001
Inpatient	2.36 (141)	17.53 (22890)	
Intensive Care Unit	0.15 (9)	0.99 (1286)	
Emergency	11.47 (684)	43.12 (56158)	
Inpatient Substance Use Treatment	33.82 (2017)	16.85 (21941)	
Urgent Care	0.07 (4)	0.45 (592)	
Primary Care Provider	19.58 (1168)	11.68 (15214)	
Other Outpatient	6.56 (391)	9.19 (11973)	

[*] Classes within variables are italicized

[**] Encounter level data was missing from approximately 25% of encounters associated with MAUD prescribing, so treatment setting data is unavailable for these encounters

Table 3:

Bivariable model of predictors

Predictor	Odds Ratio, 95% CI	P-value
Age	1.00	<.0001
Gender (Ref is male)	1.20 (1.10–1.31)	<.0001
Race (Ref is caucasion)		
American Indian and Alaska Native	0.89 (0.58–1.34)	0.09
Asian	0.40 (0.21–0.78)	0.14
Black or African American	0.48 (0.40–0.58)	0.05
Multiple Race/Other/Unknown	0.42 (0.37–0.49)	0.001
Native Hawaiian and Other Pacific Islander	0.81 (0.29–0.22)	0.54
Ethnicity (Ref isnon-hispanic)	0.48 (0.42–0.56)	<.0001
Number of visits per person	1.09 (1.08–1.09)	<.0001
Percent above High school	1.03 (1.03–1.04)	<.0001
Percent above bachelors	1.02 (1.02–1.02)	<.0001
Average Income per zip	1 (1–1)	<.0001
Visit Type (Ref is inpatient substance use treatment)		
Other outpatient	0.36 (0.32–0.40)	<.0001
Inpatient	0.07 (0.06–0.08)	<.0001
Emergency	0.13 (0.12–0.15)	<.0001
ICU	0.08 (0.04–0.15)	<.0001
Urgent Care	0.07 (0.03–0.20)	0.0009
PCP	0.84 (0.78–0.90)	<.0001
Addiction medicine consult (Ref is Yes)	0.44 (0.34–0.57)	<.0001
Primary Alcohol Related Diagnosis (Ref is Yes)	0.48 (0.45–0.51)	<.0001

[*]
Classes within variables are italicized

Table 4:

Multivariable Model of Individual Level Predictors

Predictor	Odds Ratio, 95% CI	P-value
Gender (Ref is Male)	1.19 (1.08–1.31)	.0003
Race (Ref is Caucasian)		
American Indian and Alaska Native	1.07 (0.64–1.78)	0.15
Asian	0.44 (0.22–0.90)	0.09
Black or African American	0.51 (0.42–0.63)	0.0064
Multiple Race/Other/Unknown	0.60 (0.47–0.75)	0.13
Native Hawaiian and Other Pacific Islander	1.25 (0.45–3.45)	0.25
Number of visits per person	1.08 (1.07–1.08)	<.0001
Hispanic Ethnicity	0.78 (0.63–0.96)	<.0001
Percent above High school	0.98 (0.97–0.99)	<.0001
Percent above bachelors	1.02 (1.01–1.02)	<.0001

*
Age was not statistically significant in the adjusted model (p>0.05)

**
Classes within variables are italicized

Table 5:

Multivariable Model of Encounter Level Predictors

Predictor	Odds Ratio, 95% CI	P-value
Treatment Setting (Ref is inpatient substance use treatment)		
Other outpatient	0.35 (0.31–0.39)	<.0001
Inpatient	0.05 (0.041–0.060)	<.0001
Emergency	0.13 (0.12–0.15)	.0001
ICU	0.07 (0.03–0.13)	.0003
Urgent Care	0.07 (0.03–0.20)	0.028
PCP	0.8 (0.77–0.90)	<.0001
Addiction medicine consult (Ref is yes)	0.08 (0.06–0.11)	<.0001

*
Classes within variables are italicized