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Factors Associated with Healthcare Effectiveness Data and Information Set (HEDIS) Alcohol and Other Drug (AOD) Measure Performance in 2014-2015

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Abstract

Background: Only 10% of patients with alcohol and other drug (AOD) disorders receive treatment. The AOD Initiation and Engagement in Treatment (AOD-IET) measure was added to the national Healthcare Effectiveness Data and Information Set (HEDIS) to improve access to care. This study identifies factors related to improving AOD-IET rates.

Methods: We include data from seven health systems with differing geographic, patient demographic, and organizational characteristics; all used a common Virtual Data Warehouse containing electronic health records and insurance claims data. Multilevel logistic regression models examined AOD-IET among adults (18+).

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Results: 86,565 patients had an AOD diagnosis qualifying for the HEDIS denominator. Initiation rates varied from 26% to 46%; engagement rates varied from 14% to 29%. Women versus men (odds ratio [OR]=0.81, 95% confidence interval [CI]=0.76-0.86), Hispanics (OR=0.85, 95%CI=0.79-0.91), Black/African Americans (OR=0.82, 95%CI=0.75-0.90), and Asian Americans (OR=0.83, 95%CI=0.72-0.95) versus whites, and patients aged 65+ versus 18-29 (OR=0.82, 95%CI=0.74-0.90) had lower odds of initiation. Patients aged 30-49 versus 18-29 (OR=1.11, 95%CI=1.04-1.19), those with prior psychiatric (OR=1.26, 95%CI=1.18-1.35) and medical conditions (OR=1.18, 95%CI=1.10-1.26) had higher odds of engagement. Identification in primary care versus other departments was related to lower odds of initiation (ED: OR=1.55, 95%CI=1.45-1.66; psychiatry/AOD treatment: OR=3.58, 95%CI=3.33-3.84; other outpatient: OR=1.19, 95%CI=1.06-1.32). Patients aged 30-49 versus 18-29 had higher odds of engagement (OR=1.26, 95%CI=1.10-1.43). Patients 65+ versus 18-29 (OR=0.51, 95%CI=0.43-0.62) and Black/African Americans versus Whites (OR=0.64, 95%CI=0.53-0.77) had lower odds. Those initiating treatment in psychiatry/AOD treatment versus primary care (OR=7.02, 95%CI=5.93-8.31) had higher odds of engagement; those in inpatient (OR=0.40, 95%CI=0.32-0.50) or other outpatient settings (OR=0.73, 95%CI=0.59-0.91) had lower odds.

Discussion: Initiation and engagement varied, but were low. Findings identified age, race/ethnicity, co-occurring conditions and department of identification as key factors associated with AOD-IET. Focusing on these could help programs develop interventions that facilitate AOD-IET for those less likely to receive care.

Introduction

Alcohol and other drug (AOD) use disorders affect more than 20 million people throughout the United States and have a significant impact on the health of individuals, families and society as a whole. The Centers for Disease Control reports more than 2,200 alcohol overdose deaths in the United States each year—an average of six deaths every day. In 2014, 47,055 drug overdose deaths occurred, and 61 percent of these deaths were the result of opioid use, including prescription opioids and heroin.[1] These disorders cost $452 billion annually.[2] However, access to treatment is low; only 10% of those needing care receive it.[3-5]

Barriers to treatment have been identified in both treatment initiation and engagement.[6, 7] A welcome development in addressing access was the addition of AOD Initiation and Engagement of Treatment (IET) performance measures to the Healthcare Effectiveness Data and Information Set (HEDIS). HEDIS is a set of nationally adopted quality indicators created in 2002 as part of National Voluntary Consensus Standards for Ambulatory Care-Part 1.[8] They became mandatory in 2014, yet health systems and the AOD field in general know little about which factors are related to better performance on HEDIS measures. As shown by a review of studies on these measures, the field needs research on the variation across health systems and clinical departments[9] to better identify gaps in care and to inform new approaches to improving treatment access.[10] For example, the particular clinical settings where diagnoses are identified may impact initiation.[11] Co-location of primary care

and AOD treatment, internal versus external AOD treatment, and availability of medication assisted treatment may be other clinical factors that improve treatment initiation and engagement.

Understanding how success in meeting HEDIS standards varies by patient-level factors, can help identify disparities and subgroups that could benefit from enhanced referral and engagement strategies. In previous studies, patient-level factors associated with poorer AOD treatment initiation and engagement included female gender, lower AOD problem severity, drug (versus alcohol) dependence, perceived AOD treatment stigma, low motivation, and belief that treatment is ineffective.[6, 12-16] The studies showed mixed findings on effects of race/ethnicity: some found non-White individuals more likely to initiate and engage in treatment; others found the opposite.[17-22] Also, past studies have focused on data from Medicaid or the Department of Veterans Affairs rather than from private health systems.

The advent of mandatory HEDIS measures and the increased focus on AOD disorders due to the Affordable Care Act's inclusion of AOD treatment as an essential benefit[23] may have changed the organizational and patient level predictors of performance. In this study, we examined both patient and health system factors associated with HEDIS measures of treatment initiation and engagement across seven diverse health systems. Using the Anderson health care utilization framework, the study focused on key utilization predictors based on performance measures[24, 25] available in electronic health records (EHRs), As conceptualized here, the model included predisposing characteristics (demographic factors); need (severity, prior year medical and psychiatric comorbidities) and enabling factors (type of health care settings). Our goal was to identify opportunities to develop patient- and system-level interventions that facilitate initiation and engagement in AOD services, particularly among those who may be less likely to receive care.

Methods

Study Participants and Data Sources

This multisite study examined HEDIS AOD IET rates between October 1, 2014 to August 15, 2015 among patients (age 18) who qualified for the HEDIS measure denominator with an AOD diagnosis.[26, 27] Seven health systems in the Health Care System Research Network (HCSRN)[28] of the National Institute on Drug Abuse's Clinical Trials Network participated in this study. These systems are located throughout nearly all regions of the United States and represent different geographic, patient demographic, and organizational characteristics. They include diverse types of health insurance, including commercial, individual, Medicaid and Medicare plans. They also share a common Virtual Data Warehouse model which uses a common data structure comprised of harmonized data elements from the EHRs and insurance claims data for all health system members. This facilitates multisite research by allowing programming code written at one health system to be distributed and efficiently run at other health systems with minimal site-specific customization.

The analyst at the lead health system prepared the data extraction programs, which were code-reviewed by another health system's analyst before dissemination to the remaining systems for implementation. The limited datasets were transferred back to the lead health

system and reviewed for quality assurance and then combined into the final composite analytic dataset (N=86,565 patients). It included healthcare utilization data for adult patients with at least one HEDIS-qualifying AOD use disorder diagnosis. This research was reviewed and approved by the Kaiser Permanente Northern California Institutional Review Board. It met requirements for a waiver of informed consent.

Measures

HEDIS Performance Measure Outcomes: Treatment Initiation and Engagement.

—Following the National Committee for Quality Assurance (NCQA) Measure Technical Specifications,[29] the following data were extracted to identify all patients with an index diagnosis of AOD abuse or dependence: Diagnosis-Related Group (DRG) categories, International Classification of Diseases (ICD)-9 diagnosis codes, Current Procedural Terminology (CPT) codes, Uniform/Universal Billing form (UB) 92 Revenue codes, Centers for Medicare and Medicaid Services (CMS) 1500 site of service codes, department, and date of services.[26, 27] Per HEDIS definitions, adult patients with a "new" AOD abuse or dependence index diagnosis, defined as having no AOD diagnoses in the 60 days before the index diagnosis, who were continuously enrolled in the health system 2 months prior to the index date through 44 days post the index date were included in the denominator. For each patient, the index date (date of first qualifying AOD diagnosis during the study period), type of diagnosis (alcohol, cannabis, opioid, other drugs), and setting were extracted from the EHR. Settings included inpatient, emergency department (ED), psychiatry/AOD treatment, primary care (e.g., internal medicine, family practice, primary care, OBGYN, urgent care), and other outpatient.

Initiation and engagement rates were calculated consistent with HEDIS definitions. If the index diagnosis was made at an inpatient encounter, excluding detoxification, the inpatient stay was considered initiation of treatment, consistent with the HEDIS initiation definition.[29] If the index episode was an ED or outpatient claim/encounter, the patient must have had a subsequent AOD service (not including ED visits or detoxification) within 14 days of the index date to be considered "initiated." Patients who had two or more AOD-related services within 30 days after initiating treatment were considered "engaged."[29]

Patient-Level Characteristics.

—Patient characteristics included demographics (age, sex, race/ethnicity), length of health system membership in the year prior to the index date (allowing for a 30-day gap), insurance type (commercial/private pay, Medicare, state subsidized, unknown), type of AOD diagnoses in the year prior to index diagnosis visit (alcohol, opioid, cannabis and other drug) and location of the initiation visit, when applicable.

Co-occurring ICD-9 medical and psychiatric conditions in the year prior to the index visit were extracted from the EHR. The 18 main categories from the Healthcare Cost and Utilization Project (HCUP) clinical classifications were included.[30] Additional codes related to 21 Substance Abuse-Related Medical Conditions (SAMC) identified by a consensus of researchers with expertise in addiction medicine based on conditions related to drug and alcohol abuse in the literature were also included (see Appendix 1).[16, 31-35] Indicators of any

medical and psychiatric SAMCs were created based on these conditions. Patients living with HIV were identified by an ICD-9 code of 042. Charlson comorbidity index scores were calculated based on diagnosis codes made in the year prior to the index date.[36]

Counts of primary care, ED, and psychiatry/AOD treatment visits made in the 45 days after the index date were extracted.

Organization-Level Characteristics.—Data on organization-level characteristics were provided by site investigators based on their working knowledge of the health system and publicly available information. Variables were created to determine the following: if all clinics, at least one clinic, or no clinics within each health system had the following characteristics: 1) co-location of primary care and AOD treatment in the same building/ campus; 2) AOD treatment only available external to the health system (i.e., contracted out); 3) medication treatment available in AOD specialty treatment (e.g., buprenorphine, naltrexone, acamprosate); 4) medication treatment available in primary care (e.g., buprenorphine, naltrexone, acamprosate); 5) behavioral medicine specialist co-located with primary care in same building/campus; 6) use of EHR referral system to AOD treatment.

Analysis

Frequencies of the index AOD diagnosis type and department, patient characteristics, prior year medical and psychiatric SAMC conditions, prior-year Charlson comorbidity index, organizational factors and utilization patterns within 45 days after the index episode (i.e., visits to primary care, ED, and psychiatry/AOD specialty treatment) were examined across sites and by each performance measure using Chi-square tests and ANOVA models, for categorical and continuous predictors respectively. Because patients were nested within health systems, generalized linear models (GLM), with a logit link, clustered on health system, were used to model patient factors associated with initiation and engagement. These models examined a subset of key variables including patient characteristics, SAMC medical and psychiatric conditions, and index or initiation setting. Index setting was used to model treatment initiation, and initiation setting was included in the engagement model to examine the role of treatment initiation in engagement. Based on the HEDIS definition, inpatient index encounters qualified as treatment initiation, therefore only ED and outpatient (primary care psychiatry/AOD specialty treatment, and other outpatient) index encounters were examined in the treatment initiation models. Engagement rates were examined among all those who initiated treatment, including inpatient encounters. Measures potentially associated with initiation but not engagement were not examined in this study; therefore, a two-part model to account for the propensity for initiation among those engaged[32] was not used.

Using the methodology described above, associations between organizational-level characteristics and performance measures were examined. Models were run separately due to correlation between the organizational-level characteristics; all models adjusted for patient age, sex, race/ethnicity and Charlson comorbidity index score.

Results

Sample characteristics

Across the health systems, 86,565 adult patients had at least one HEDIS-qualifying AOD diagnosis during the study period. Among these patients, demographics and prevalence of prior medical and psychiatric conditions differed across health systems (all p<.001; Table 1). Overall, the majority of patients were men, aged 50-64, White, and had a high prevalence of medical conditions. Commercial/private pay was the most common insurance type. Type of index diagnosis differed, although alcohol was the most prevalent across all health systems. The majority of AOD diagnoses occurred during primary care visits, followed by ED and inpatient. Utilization of primary care, ED and psychiatry/AOD specialty treatment within 45 days post index also differed across health systems (Table 1).

Treatment initiation

Of patients identified with an index diagnosis, 27.9% (24,188/86,565; unadjusted) initiated treatment (Table 2). As index encounters in an inpatient setting (excluding detox) qualified as initiation per HEDIS definitions, treatment initiation was calculated only among patients with an index encounter in an outpatient or ED setting (n=70,079). Among these patients, 11.4% (7,995/70,079) initiated treatment. Rates ranged from 5.2% to 13.6% across health systems. More patients who initiated treatment were men, aged 30-49, and White, and fewer were Hispanic. Patients who initiated had lower average Charlson comorbidity scores and more SAMC medical and psychiatric conditions. More patients with an alcohol, opioid, or other drug index diagnosis initiated treatment, while fewer with a cannabis diagnosis initiated. Patients were more likely to initiate treatment with an index diagnosis in the ED or psychiatry/AOD specialty treatment. On average, patients who initiated treatment had greater primary care, ED, and psychiatry/AOD treatment utilization in the 45 days post the index encounter (Table 2).

In adjusted generalized linear models (Table 3), the same predictors emerged. Women had lower odds of initiation than men (Odds Ratio [OR]=0.81, 95% Confidence Interval [CI]=0.76-0.86); Hispanic (OR=0.85, 95% CI=0.79-0.91), Black/African American (OR=0.82, 95% CI=0.75-0.90) and Asian patients (OR=0.83, 95% CI=0.72-0.95) had lower odds of treatment initiation than white patients. Patients aged 30-49 had higher odds of initiation (OR=1.11, 95% CI=1.04, 1.19) while those 65+ had lower odds (OR=0.82, 95%CI=0.74-0.90) compared with patients aged 18-29. Both prior SAMC psychiatric (OR=1.26, 95% CI=1.18-1.35) and medical (OR=1.18, 95% CI=1.10-1.26) conditions were associated with higher odds of initiation. All index settings had higher odds of initiation compared with identification in primary care (ED: OR=1.55, 95% CI=1.45-1.66; psychiatry/AOD treatment: OR=3.58, 95% CI=3.33-3.84; other outpatient: OR=1.19, 95% CI-1.06-1.32).

Treatment Engagement

Of patients who initiated AOD treatment in any department, including patients with an index inpatient encounter, 11.5% (2,782/24,188) engaged in treatment (Table 2). Engagement rates ranged from 4.5% to 17.9%. More patients who engaged in treatment were men and White

and fewer were Black/African American. Those meeting engagement criteria had lower Charlson comorbidity scores and fewer had SAMC medical conditions than those who did not engage; psychiatric conditions did not differ. Engagement was more common among patients with an index diagnosis of alcohol, opioid, or other drug, and less likely with a cannabis diagnosis. Engagement occurred more frequently among patients with initiation in psychiatry/AOD treatment, and less frequently in inpatient or other outpatient settings. On average, those who engaged in treatment had more ED and psychiatry/AOD treatment visits in the 45 days post index than others; primary care visits did not differ.

In the generalized linear models, patients aged 30-49 had higher odds of engagement (OR=1.26, 95%CI=1.10-1.43) while patients aged 65 and older had lower odds (OR=0.51, 95%CI=0.43-0.62) compared with patients aged 18-29. Blacks/African Americans (OR=0.64, 95% CI=0.53-0.77) had lower odds of treatment engagement compared with Whites. Patients who initiated in psychiatry/AOD treatment had higher odds of engagement (OR=7.02, 95%CI=5.93, 8.31), while those who initiated in an inpatient (OR=0.40, 95%CI=0.32-0.50) or other outpatient setting (OR=0.73, 95% CI=0.59-0.91) had lower odds of engagement compared with patients initiating in primary care (Table 3).

Organization-Level Characteristics

All but one health system had at least one clinic where primary care and specialty treatment were co-located. Five of seven had specialty treatment only available internally (excluding methadone). Three systems did not have AOD medications available in primary care, but all had at least one clinic where they were available in specialty treatment. Behavioral medicine specialists were available in at least one primary clinic for all health systems except one. The EHR was used as the referral system to AOD treatment for five of the seven health systems; of the remaining two systems, one had at least one clinic using EHR referrals, the other did not.

In the generalized linear models, patients in health systems with co-located primary care and specialty AOD treatment had higher odds of treatment initiation (OR=2.77, 95% CI=1.89, 4.05) and engagement (OR=3.55, 95% CI=1.50, 8.43). Patients had higher odds of engagement when specialty treatment was available internally rather than contracted out (OR=2.27, 95% CI=1.07, 4.83). Patients at health systems where at least one clinic used the EHR for referrals to specialty treatment had lower odds of initiation (OR=0.35, 95% CI=0.21, 0.58) and engagement (OR=0.17, 95% CI=0.08, 0.36) than health systems that did not; patients also had lower odds of engagement when all clinics used EHR referrals (OR=0.54, 95% CI=0.33, 0.88) (Table 4).

Discussion

This study used HEDIS measures to investigate use of AOD treatment services in a diverse sample of seven health systems across the United States. We found that overall initiation and engagement rates were low relative to the need for AOD services. Age, race/ethnicity, co-occurring conditions and department of identification were identified as key factors associated with AOD-IET. Specifically, Black/African Americans, Hispanics and Asians were less likely to *initiate* treatment, as were women, patients aged 65+, and those identified

in a primary care versus other health care settings. Black/African Americans and patients aged 65+ were also less likely to *engage* in treatment, as were those who initiated in an inpatient or other outpatient setting versus primary care. Middle aged patients age 30-49 (compared to the youngest group 18-29) had better initiation and engagement rates; patients with co-occurring conditions had better initiation rates; those who initiated in psychiatry/AOD treatment had higher engagement rates. These findings support national survey results. Replicating these findings in healthcare settings rather than in a population survey is critical as it makes the evidence of disparities in access to services more robust.

Low initiation rates among patients identified in primary care is an important finding as primary care is where most people interact with health care. Primary care could play a major role in facilitating initial AOD treatment visits; however, it often does not. Additional support and training for primary care providers, including training in motivational enhancement skills, inclusion of behavioral health staff, and strategies to improve referrals, could greatly improve treatment initiation rates.

A history of medical and/or psychiatric co-occurring conditions were related to initiation, but not engagement. These patients may feel more urgency to start treatment but not necessarily to sustain engagement. Patients who initiated treatment in specialty psychiatry/AOD departments had higher odds of engagement than those initiating in primary care. However, these rates also need improvement.

Overall, organizational characteristics were less related to initiation and engagement than expected. Co-location of primary care and AOD treatment and having AOD treatment available internally were positively related as expected but having EHR capacity for providing referrals was negatively associated with initiation and engagement. While automated referrals may be more efficient, other referral processes such as warm-handoffs may provide more successful transitions though these types of referrals may occur less frequently when clinicians have easy access to EHRs. Other organizational characteristics, such as availability of AOD medications, were not significant. Given the heterogeneity of these characteristics across clinics within health systems, this finding may be due to the fact that these variables were measured at the health systems level rather than the clinic level.

Our most important findings were the overall low initiation and engagement rates in AOD treatment among patients with relatively good treatment access in these health systems. In the first study of these measures across health maintenance organizations, preferred provider organizations, and point of service plans,[37] initiation rates varied from 26% to 46% (our overall rate was 27%, also with wide variation), and engagement rates varied from 14% to 29% (our overall rate was 11.5%, ranging from 4.5% to 17.9%). Thus, rates have improved little over time, and some have even dropped.[37]

Recent years have seen many health policies implemented that were expected to improve treatment initiation and engagement. These include the Paul Wellstone and Pete Domenici Mental Health Parity and Addiction Equity Act (MHPAEA) of 2008,[38] which required health plans to cover mental health and AOD treatment services and the Affordable HealthCare Act,[23] which increased health care coverage and made AOD treatment services

"essential benefits."[39] Other policy changes, such as Meaningful Use,[39] which has increased the use of EHRs, should better facilitate referrals, as should the focus on integration by the Centers for Medicare and Medicaid, Institute of Medicine Reports[6] and the Surgeon General's Report.[5] More recent changes in healthcare policy, including reversal of the ACA individual mandate, may also have an impact. It is important to continue measuring HEDIS-based outcomes moving forward, as we have far to go to improve AOD treatment access. Developing a deeper understanding of the patient, provider, and health system characteristics related to initiating and engaging in treatment should provide some needed answers for improvement.

This study based on EHR data from multiple health systems had several limitations common to observational studies. Many individuals possibly eligible for an AOD diagnosis may go unrecognized or undocumented; thus, our analyses did not include them. Without this omission, the true denominator would be larger and the gap even wider than this paper documents. For HEDIS measures (not specific to this study), quality and specificity of care are unknown. It is also challenging to compare inpatient settings to other settings that require more documentation. Department coding varied somewhat across health systems. Three health systems included AOD treatment within psychiatry; thus, our analyses combined them. One health system used a utilization-based enrollment definition, a conservative capture of patients using the healthcare system, but this is unlikely to impact study results. Insurance information was not available for one health system.

The study timeframe (October 1, 2014 to August 15, 2015) was selected to allow use of the most recent data before the ICD-9/ICD-10 transition. The transition to ICD-10 coding could affect performance measures; future studies should evaluate the new coding scheme to determine whether actual changes in the HEDIS measures occur rather than artificial changes.

Conclusion

Despite recent measures to increase access to treatment, this study of seven heterogeneous health systems found that initiation and engagement rates in AOD treatment remain low. Systems should focus most on those with the worst rates, specifically, women, minorities and patients aged 65+, but rates were low for all patients needing services. The biggest improvements are needed in primary care, where most AOD disorders are identified, and patients can be helped to initiate treatment. Both structural changes and motivational interventions are called for to improve rates of AOD patient initiation and engagement in treatment, and to provide a benchmark for future study outcomes.

Acknowledgements:

Appendix 1:: ICD9 Medical and Psychiatric Codes for Substance Abuse-Related Medical Conditions (SAMCs) Diagnoses

Substance Abuse-Related Medical Conditions (SAMCs)[1-6]

Depression	296.2, 296.3, 296.82, 298.0, 300.4, 301.12, 309.0, 309.1, 309.28, 311
Injury and poisonings	800-999
Anxiety and nervous disorders	300.00, 300.01, 300.02, 300.2, 300.3, 309.21, 309.24, 309.81, 308.3
Hypertension	362.11, 401, 403, 402.00, 404.10, 402.90, 404.0, 405
Asthma	493
Psychoses	295, 297, 298.1, 298.2, 298.3, 298.4, 298.8, 298.9, 296.0, 296.1, 296.4, 296.5, 296.6, 296.7, 296.80, 296.81, 296.89, 296.9
Acid-related disorders	530.1, 531, 532, 533, 535, 536.8
Ischemic heart disease	410, 411, 412, 413, 414
Pneumonia	480, 481, 482, 483, 484, 485, 486, 487
Chronic obstructive pulmonary disease	490, 491, 492, 494, 496
Liver cirrhosis	571
Hepatitis C	070.41, 070.44, 070.51, 070.54
Diseases of the pancreas	577
Alcoholic gastritis	535.3
Toxic effects of alcohol (ethyl and unspecified)	980.0, 980.9
Alcohol neuropathy	357.5
Drug neuropathy	357.6
Alcoholic cardiomyopathy	425.5
Excess blood alcohol level	790.3
Poisoning by alcohol	E86.0
Drug dependence in mother-childbirth	648.3

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Table 1.

Characteristics of Patients with an Index Alcohol or Drug Abuse/Dependence Encounter in Seven Health Systems by Site, October 1, 2014 and August 15, 2015 (n=86,565)

	Health System							p-value
	A	B	C	D	E	F	G	
Gender, %								
Female	40.8	37.6	40.8	36.5	44.6	41.5	44.2	
Male	59.2	62.4	59.2	63.5	55.4	58.4	55.8	<.001
Age, %								
18-29	22.2	16.9	24.3	21.6	19.8	22.1	17.1	
30-49	31.3	17.9	29.0	28.1	27.6	30.8	37.8	
50-64	29.0	37.9	28.1	29.2	33.2	29.4	30.2	
65+	17.5	27.3	18.6	21.2	19.5	17.8	14.9	<.001
Race/ethnicity, %								
American Indian/Alaska Native	1.3	0.7	1.2	0.7	2.2	1.5	8.1	
Asian	0.9	0.6	5.6	3.3	2.4	1.5	0.1	
Native Hawaiian/Other Pacific Islander	0.3	0.0	0.8	0.5	0.8	0.7	0.1	
Black/African American	4.7	39.3	12.4	11.1	4.1	4.5	2.3	
Hispanic	14.2	1.7	17.3	30.4	3.4	4.4	0.7	
White	64.4	50.7	60.5	50.9	66.9	83.7	88.3	
Other/Unknown	14.2	7.0	2.2	3.0	20.2	3.6	0.4	<.001
Substance abuse related psychiatric conditions in the year prior, %	42.9	45.1	43.2	43.7	45.6	47.0	56.0	<.001
Substance abuse related medical conditions in the year prior, %	58.4	74.4	66.0	60.6	61.4	63.7	66.7	<.001
Charlson Comorbidity Index, mean (SD)	0.90 (1.72)	1.34 (1.96)	1.12 (1.93)	0.91 (1.68)	0.97 (1.77)	1.06 (1.86)	0.77 (1.36)	<.001
Insurance Type, %								
Commercial/Private Pay	65.0	67.5	61.4	67.0	64.8	57.7	0.0	
Medicare	22.7	32.5	26.8	23.9	26.9	15.3	0.0	
State Subsidized	12.3	0.0	11.9	9.1	2.7	27.0	0.0	
Unknown	0.0	0.0	0.0	0.0	5.6	0.0	100.0	<.001
Type of index diagnosis, %								
Alcohol	59.8	53.4	50.8	51.9	51.5	52.7	50.5	

				Health System					
	A	B	C	D	E	F	G	p-value
Cannabis	14.5	12.9	15.8	14.9	16.6	16.0	9.0	
Opioids	9.0	13.3	9.9	16.3	15.8	13.7	11.8	
Other drug	16.8	2.0	23.5	16.9	16.1	17.6	28.8	<.001
Index encounter type, %								
Primary care, %	20.3	48.1	21.8	16.5	14.5	21.6	19.8	
Emergency department, %	29.3	16.8	14.9	50.7	53.9	31.2	57.2	
Inpatient, %	29.6	15.0	47.6	13.1	16.1	24.9	3.6	
Psychiatry/AOD treatment, %	9.5	6.6	9.9	14.2	7.8	14.3	9.9	
Other outpatient, %	11.4	13.5	5.8	5.5	7.7	8.0	9.4	<.001
Treatment utilization 45 days post index encounter, mean(SD)								
Primary care	0.58(0.99)	0.61(0.98)	1.08(1.82)	0.71(1.16)	1.29(2.96)	0.76(1.12)	3.20(3.62)	<.001
Emergency department	0.03(0.27)	0.14(0.45)	0.31(0.83)	0.12(0.47)	0.23(0.80)	0.28(0.77)	0.07(0.34)	<.001
Psychiatry/AOD treatment	0.65(1.98)	0.98(3.35)	3.45(14.90)	1.70(7.91)	0.70(2.74)	0.51(2.68)	0.25(1.16)	<.001

Table 2.

Characteristics of Patients with an Index Alcohol or Drug Abuse/Dependence Encounter by Treatment Initiation [*] and Engagement [**]

	Initiated Treatment (n=7,995)		Did not Initiate Treatment (n=62,084)		p-value	Engaged in treatment (n=2,782)		Did not engage in treatment (n=21,406)		p-value
	n	%	n	%		n	%	n	%	
Gender										
Female	3,000	37.5	24,439	39.4	0.002	1,063	38.2	8,659	40.5	0.023
Male	4,995	62.5	37,645	60.6		1,719	61.8	12,747	59.6	
Age										
18-29	1,902	23.8	14,466	23.3	<.001	645	23.2	3,988	18.6	<.001
30-49	2,744	34.3	18,885	30.4		1,086	39.0	5,084	23.8	
50-64	2,351	29.4	17,802	28.7		814	29.3	6,690	31.3	
65+	998	12.5	10,931	17.6		237	8.5	5,644	26.4	
Race/ethnicity										
American Indian/Alaska Native	98	1.2	861	1.4	<.001	35	1.3	317	1.5	<.001
Asian	257	3.2	2,246	3.6		87	3.1	719	3.4	
Native Hawaiian/Other Pacific Islander	45	0.6	384	0.6		16	0.6	127	0.6	
Black/African American	669	8.4	5,988	9.6		181	6.5	2,429	11.4	
Hispanic	1,397	17.5	12,656	20.4		494	17.8	3,635	17.0	
White	5,074	63.5	36,589	58.9		1,785	64.2	13,301	62.1	
Other/Unknown	455	5.7	3,360	5.4		184	6.6	878	4.1	
Substance abuse related psychiatric conditions in the year prior	4,138	51.8	25,484	41.1	<.001	1,504	54.1	11,240	52.5	0.123
Substance abuse related medical conditions in the year prior	4,858	60.8	35,728	57.6	<.001	1,697	61.0	16,766	78.3	<.001
Type of index diagnosis										
Alcohol	4,318	54.0	32,574	52.5	<.001	1,511	54.3	10,741	50.2	<.001
Cannabis	673	8.4	9,480	15.3		197	7.1	3,404	15.9	
Opioid	1,331	16.7	8,510	13.7		561	20.2	2,402	11.2	
Other drug	1,673	20.9	11,520	18.6		513	18.4	4,859	22.7	
Index encounter type										

	Initiated Treatment (n=7,995)		Did not Initiate Treatment (n=62,084)			Engaged in treatment (n=2,782)		Did not engage in treatment (n=21,406)		
	n	%	n	%	p-value	n	%	n	%	p-value
Inpatient	n/a	n/a	n/a	n/a		xx	xx	xx	xx	
Primary care	2,312	28.9	29,456	47.5		xx	xx	xx	xx	
Emergency department	2,749	34.4	19,804	31.9		xx	xx	xx	xx	
Psychiatry/Addiction treatment	2,400	30.0	7,644	12.3		xx	xx	xx	xx	
Other outpatient	534	6.7	5,180	8.3	<.001	xx	xx	xx	xx	
Initiation encounter type										
Inpatient	xx	xx	xx	xx		246	8.8	7,357	34.4	
Primary care	xx	xx	xx	xx		280	10.1	2,302	10.8	
Psychiatry/AOD treatment	xx	xx	xx	xx		1,584	56.9	1,956	9.1	
Other outpatient	xx	xx	xx	xx		218	7.8	3,164	14.8	
Unknown	xx	xx	xx	xx		454	16.3	6,627	31.0	<.001
	mean	SD	mean	SD	p-value	mean	SD	mean	SD	p-value
Charlson comorbidity Index in year prior	0.72	1.43	0.76	1.51	0.012	0.77	1.56	1.67	2.28	<.001
Treatment utilization 45 days post index encounter										
Primary care	1.30	2.21	0.75	1.46	<.001	1.52	2.78	1.60	2.47	0.096
Emergency department	0.34	0.89	0.14	0.56	<.001	0.43	1.06	0.32	0.81	<.001
Psychiatry/AOD treatment	12.50	26.50	0.78	4.78	<.001	26.06	35.61	2.28	9.71	<.001

*
Initiation was estimated among patients with an index encounter in an outpatient or ED setting (i.e., not inpatient) (n=70,079)

**
Engagement was estimated among all patients who initiated AOD treatment, including patients with an index inpatient encounter (n=24,188)

Table 3.

Characteristics associated with Treatment Initiation and Engagement

	Treatment Initiation[*]			Treatment Engagement[**]			
	OR	95% CI		p-value	OR	95% CI		p-value
Gender								
Female	0.81	0.76	0.86	<.001	0.92	0.82	1.04	0.144
Male (ref)	--	--	--	--	--	--	--	--
Age								
18-29 (ref)	--	--	--	--	--	--	--	--
30-49	1.11	1.04	1.19	0.005	1.26	1.10	1.43	0.002
50-64	1.07	1.00	1.15	0.066	0.99	0.86	1.13	0.871
65+	0.82	0.74	0.90	<.001	0.51	0.43	0.62	<.001
Race/ethnicity								
American Indian/Alaska Native	0.90	0.72	1.12	0.335	0.92	0.62	1.38	0.688
Asian	0.83	0.72	0.95	0.011	0.92	0.70	1.20	0.512
Native Hawaiian/Other Pacific Islander	0.83	0.60	1.15	0.247	0.81	0.45	1.48	0.482
Black/African American	0.82	0.75	0.90	0.001	0.64	0.53	0.77	<.001
Hispanic	0.85	0.79	0.91	<.001	0.90	0.79	1.02	0.101
Other/Unknown	0.94	0.84	1.05	0.255	0.99	0.81	1.22	0.952
White (ref)	--	--	--	--	--	--	--	--
Substance abuse related psychiatric conditions in prior year	1.26	1.18	1.35	<.001	1.11	0.98	1.24	0.061
Substance abuse related medical conditions in prior year	1.18	1.10	1.26	<.001	0.87	0.77	0.99	0.040
Index encounter type								
Emergency Department	1.55	1.45	1.66	<.001	xx	xx	xx	
Inpatient	n/a	n/a	n/a	n/a	xx	xx	xx	
Psychiatry/AOD treatment	3.58	3.33	3.84	<.001	xx	xx	xx	
Other outpatient	1.19	1.06	1.32	0.004	xx	xx	xx	
Primary Care (ref)	--	--	--	--				
Initiation encounter type								
Inpatient	xx	xx	xx		0.40	0.32	0.50	<.001
Psychiatry/AOD treatment	xx	xx	xx		7.02	5.93	8.31	<.001
Other outpatient	xx	xx	xx		0.73	0.59	0.91	0.008
Unknown	xx	xx	xx		0.67	0.55	0.81	<.001
Primary Care (ref)	--	--	--	--	--	--	--	--

[*] Initiation was estimated among patients with an index encounter in an outpatient or ED setting (i.e., not inpatient) (n=70,079)

[**] Engagement was estimated among all patients who initiated AOD treatment, including patients with an index inpatient encounter (n=24,188)

Table 4.

Organizational Characteristics associated with Treatment Initiation and Engagement

	Treatment Initiation*			Treatment Engagement**		
	OR	95% CI	p-value	OR	95% CI	p-value
Primary care and specialty AOD treatment co-located						
At least one clinic but not all	2.77	1.89 4.05	0.001	3.55	1.50 8.43	0.013
None (ref)	--	-- --	--	--	-- --	--
Specialty treatment only available internally (excluding methadone treatment)						
At least one clinic but not all	1.73	0.94 3.18	0.070	2.27	1.07 4.83	0.038
None (ref)	--	-- --	--	--	-- --	--
Medication assisted treatment availability in primary care						
All clinics	1.44	0.48 4.38	0.411	1.33	0.34 5.25	0.593
At least one clinic but not all	1.20	0.54 2.65	0.563	1.78	0.66 4.78	0.179
None (ref)	--	-- --	--	--	-- --	--
Medication assisted treatment availability in specialty treatment						
All clinics	1.29	0.64 2.60	0.399	1.08	0.40 2.92	0.856
At least one clinic but not all (ref)	--	-- --	--	--	-- --	--
Behavioral medicine specialist availability in primary care						
All clinics	1.47	0.58 3.96	0.338	0.80	0.17 3.72	0.706
At least one clinic but not all	0.93	0.35 2.48	0.842	0.65	0.14 3.05	0.485
None (ref)	--	-- --	--	--	-- --	--
EHR use for referrals to specialty AOD treatment						
All clinics	0.98	0.68 1.41	0.880	0.54	0.33 0.88	0.025
At least one clinic but not all	0.35	0.21 0.58	0.005	0.17	0.08 0.36	0.003
None (ref)	--	-- --	--	--	-- --	--

Note: all models were run separately for each measure due to collinearity; models adjust for gender, age, race/ethnicity, and Charlson index

*
Initiation was estimated among patients with an index encounter in an outpatient or ED setting (i.e., not inpatient) (n=70,079)

**
Engagement was estimated among all patients who initiated AOD treatment, including patients with an index inpatient encounter (n=24,188)