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Which patients receive an Addiction Consult? A preliminary analysis of the INREACH (INpatient REadmission post-Addiction Consult Help) Study

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1. Introduction

Substance use disorders (SUDs) affect over 20 million Americans and are significant drivers of morbidity, mortality, and increased health care costs (Substance Abuse and Mental Health Services Administration., 2017). SUDs are prevalent among patients who are hospitalized, with at least 15% of hospitalized patients in Massachusetts having an SUD in 2014 (Center for Health Information And Analysis, 2016; Walley et al., 2012). In Massachusetts' adults, the estimated prevalence of opioid use disorder is as high as 4.6% (Barocas et al., 2018). In recent years, opioid-related hospitalizations have increased dramatically (Hickton & Leary, 2015; Massachusetts Health Policy Commission, 2017) with mortality rates among opioid-related hospitalizations increasing more than fourfold (Song, 2017). Simultaneously, increasing admissions related to complications of injection drug use have occurred (Ronan & Herzig, 2016); however, the underlying addiction still often goes unaddressed (Jicha, Saxon, Lofwall, & Fanucchi, 2018; Rosenthal, Karchmer, Theisen-Toupal, Castillo, & Rowley, 2016). Additionally, patients with SUDs have higher rates of utilizing emergency

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departments and more readmissions compared to patients without SUDs (Walley et al., 2012).

Engaging patients in the hospital to treat their SUD has been shown to be feasible (Shanahan, Beers, Alford, Brigandi, & Samet, 2010; Trowbridge et al., 2017; Velez, Nicolaidis, Korthuis, & Englander, 2017). Despite such demonstrations, hospitalization remains an underutilized opportunity to address patients' SUD, especially in patients who may not otherwise be seeking treatment (McDuff et al., 1997; Wei et al., 2015). Some hospitals have developed Addiction Consult Services (ACSs) to improve care for patients with SUD, to link them to outpatient treatment, and to decrease unnecessary and costly care utilization (Englander et al., 2017; Murphy, Chabon, Delgado, Newville, & Nicolson, 2009; Priest & McCarty, 2018; Trowbridge et al., 2017). These services are designed to address the diagnosis, management, and linkage to treatment issues for patients with SUDs. ACSs have been shown to reduce SUD severity and increase retention in treatment programs (Wakeman, Metlay, Chang, Herman, & Rigotti, 2017). Thus, it is essential to examine the characteristics of patients seen by these services.

Boston Medical Center started an inpatient ACS in 2015 to address SUDs. Referrals are not made systematically, but rather at the discretion of the primary inpatient care team (Trowbridge et al., 2017). Characteristics of patients receiving these services have not been well described. The aims of this study are twofold: 1) to describe the proportion and characteristics of hospitalized patients with an SUD who receive an addiction consult at a large urban safety net hospital; and 2) to explore characteristics associated with receiving an addiction consult.

2. Methods

We performed a retrospective cohort study of all adult patients with a primary or secondary discharge diagnosis of an SUD from July 17, 2015 to July 16, 2016 at Boston Medical Center (BMC).

2.1. Study setting

BMC is a 487-bed academic urban safety net hospital where an estimated 17.5% of hospitalized patients have an SUD (Walley et al., 2012).

The consult service in the period of this retrospective review consisted of a halftime attending physician, a halftime registered nurse, and rotating residents and Addiction Medicine fellows. The ACS may see patients only once during an admission, or many times depending on the length of stay and the severity of the addiction related problem. The role of the ACS team in managing patients at the bedside included education to enhance engagement with addiction treatment, overdose and relapse prevention, harm reduction, and recommending naloxone rescue kits. The ACS assisted in initiating medications for withdrawal management, as well as continuing medications treating patient's SUDs. On discharge, the ACS would assist in treatment linkage by collaborating with the primary hospital team and social work, as well as to post-discharge addiction providers, including local methadone and buprenorphine clinics. At the time of this study the team did not have

the staffing capacity to perform post-discharge follow-up; however, some patients were linked to outpatient care with a member of the inpatient team, including the addiction fellows who staffed a weekly outpatient discharge clinic where patients could continue to receive buprenorphine pending admission to another permanent outpatient clinic. During the study period, there was no proactive advertising of the consult service; information about the service spread mostly by word of mouth. Like other specialty consult services, referrals are made at the discretion of the primary inpatient care teams and are not made systematically. At the time of this study there was no screening for SUDs performed routinely at hospital admission that would trigger an ACS consult.

2.1.1. Study population—The study cohort included any patient 18 years or older admitted to BMC from July 17, 2015 to July 16, 2016 with an SUD primary or secondary discharge diagnosis code. Each discharge record could include up to four primary diagnosis codes and an unlimited number of secondary codes. The discharge diagnoses were recorded by the primary medical team at the time of discharge and were not generated by any consultant team. Possible substance use disorder diagnoses included cannabis, cocaine, alcohol, opioid, sedative, stimulant, and unknown (Appendix 1). Patients were excluded if they were under 18, or pregnant, as the hospital has a specific team that manages pregnant patients with SUDs. Clinical data was abstracted from the electronic medical record (EMR).

2.2 Data Collection

2.2.1. Covariates and Independent Variables—Age, sex, and race/ethnicity were collected and selected a priori as covariates based on clinical experience and prior literature showing these factors are associated with access to addiction treatment services in general. Independent variables included other demographics, general medical characteristics, SUD characteristics, and acute and chronic medical complications. Additional demographic variables included insurance status and housing status. General medical characteristics included Charlson Comorbidity Index (Charlson, Pompei, Ales, & MacKenzie, 1987), length of stay, primary service, if the patient required the intensive care unit (ICU), or a psychiatry consult and if the patient left the hospital against medical advice (AMA). Substance use characteristics included the types of SUD, the use of withdrawal monitoring assessments (e.g., Clinical Opioid Withdrawal Scale), overdose diagnosis, whether medications were prescribed for withdrawal management, and whether patients were admitted or discharged on medications for addiction treatment, including methadone or buprenorphine. Acute and chronic medical complications of substance included human immunodeficiency virus (HIV), hepatitis C, cellulitis/abscess, osteomyelitis, tenosynovitis, endocarditis, acute and chronic pancreatitis, delirium tremens, acute and chronic pancreatitis, seizures, and Wernicke-Korsakoff syndrome (Appendix 2).

2.2.2. Main dependent variable: receipt of an addiction consult—The ACS maintained a registry of referred patients for clinical purposes and the registry was used to find all completed addiction consults.

2.3. Statistical analysis

We calculated the proportion of patients with SUD who received a consult during their first admission of the study period, as well as the proportion of encounters that received a consult, because some patients had multiple admissions during the study period. Descriptive statistics on patient characteristics using the first admission for each patient were compared between groups (consult yes vs. no) using chi-square or Fisher's exact tests for dichotomous variables and *t*-tests or Wilcoxon Rank Sum tests for continuous variables as appropriate (Table 1).

We calculated Spearman correlation coefficients for each pair of independent variables and covariates. The correlation was >0.40 for four pairs of variables. In these cases we used clinical judgment to select variables for exploration in regression analyses. We chose to include the covariate age over Charlson Comorbidity Index as a more clinically significant way to categorize groups of patients. The categorical variable of ICU stay was used in the final model over primary service, as we felt clinically it was more important to document time in the ICU as a marker of acute illness severity. Opioid Use Disorder (OUD) was used in the final model over Hepatitis C Virus because OUD is a large focus of the consult service, and hepatitis C is not frequently addressed during an inpatient hospitalization as it is infrequently the cause of the acute presentation and due to bundled payments for hospital admissions, it would be very costly to hospitals to initiate hepatitis C treatment (Lasser et al., 2017). The variable of OUD was also used over inpatient methadone and/or buprenorphine administration as we did not have the details of whether medications were started before or after the patient received a consult and wanted to best characterize the patients who were selected for consultation more than the components of the consult itself.

We ran longitudinal, repeated measures analyses, using all admissions for each patient, with each admission categorized as being with or without a consult. To confirm our results, we also ran patient-level analyses using just the first admission for each patient.

In preliminary analyses, we constructed separate unadjusted models for each independent variable and covariate. Then we fit an adjusted model for each independent variable controlling for age, race, and sex as potential confounders. We constructed a final multivariable logistic regression model including statistically significant ($p<0.05$) and clinically significant independent variables from the initial adjusted analysis as well as the covariates age, race and sex (Table 2). For the primary analyses, we used multivariable generalized estimating equation (GEE) logistic regression models to examine the association between patient characteristics and receipt of a consult. The GEE models were used to account for the correlation due to including multiple admissions from a single patient. The GEE models were fit using an independence working correlation matrix, a logit link, and standard errors are based on the empirical-sandwich estimator. Confirmatory analyses were conducted using a first-order autoregressive working correlation structure with empirical standard errors and results were consistent. We reported odds ratios and 95% confidence intervals for each independent variable and covariate included in the multivariable model.

Finally, we performed sensitivity analyses using only the first admission for each patient to assess potential bias as there may be inherent differences between patients with repeat

admissions compared to those who do not. Due to the exploratory nature of these analyses, no adjustment was made for the multiple comparisons. We had complete demographic and clinical data from the medical records for all variables used in regression analyses. All analyses were conducted using two-sided tests and a significance level of 0.05. We performed the statistical analysis using SAS version 9.4 (SAS Institute, Inc., NC, USA). This study was approved by the Boston University Medical Campus Institutional Review Board.

3. Results

3.1. Sample characteristics

A total of 3905 patients with 5979 encounters were included in this study, as some patients had multiple admissions during the study period. A majority of patients had one admission during the study period (75%); however, 14% of patients had two admissions, and 11% of patients had three or more admissions. Among patients with a consult, 85% had only one admission during the study period, while 11% had two admissions and 4% had three or more admissions. Overall, a majority of patients with SUD were on a medical service (66%), and so were a majority of consult patients (74%). There were 22% of patients overall on a surgical team, while 9% of consult patient's referring team was surgical.

There were 694 consults (11.6%, 95% CI: 10.7% to 12.5%) across all of the encounters; 576 unique patients received a consult from the ACS (14.8%, 95% CI: 13.6% to 15.9%). The median age of patients receiving a consult at their first visit in the study period was 43 (25^{th} percentile: 32, 75^{th}percentile: 53). Patients receiving a consult were most commonly white (51%), male (68%), and had Medicaid insurance (73%). A majority of patients with a consult had opioid use disorder (78%) and over one-third was homeless (38%). Over one-half of patients with a consult also had acute complications (cellulitis/abscess, osteomyelitis, tenosynovitis, endocarditis, acute and chronic pancreatitis, delirium tremens, acute and chronic pancreatitis, seizures and Wernicke-Korsakoff Syndrome) related to substance use (57%). Overall, 5.3% of patients were admitted already on methadone or buprenorphine, and 13% of patients were discharged on them. This included 9.2% of consult patients admitted on methadone or buprenorphine and 31.1% of consult patients discharged on them. (Table 1)

3.2. Covariates associated with receiving an addiction consult

3.2.1. Primary repeated measures analysis—In the final multivariable logistic regression model, older patients had significantly lower odds of receiving an addiction consult (Adjusted Odds Ratio: 0.82, 95% CI 0.76–0.88 per 10-year increase), and patients with homelessness had higher odds of receiving a consult (AOR: 1.31, 95% CI 1.08–1.59). Patients with OUD had markedly higher odds of receiving an addiction consult (AOR 6.39, 95% CI 5.14–7.94) compared to patients with other non-opioid SUDs. Patients with acute complications from their substance use (AOR: 1.64, 95% CI 1.34–2.02), with HIV (AOR: 2.06, 95% CI 1.59–2.67) and with a psychiatry consult during admission (AOR: 1.75, 95% CI 1.37–2.23) had higher odds of receiving an addiction consult as compared to patients without these characteristics. Patients with longer length of stay also had higher odds (AOR: 1.02, 95% CI 1.01–1.03 per one-day increase), as did patients receiving benzodiazepines

and/or phenobarbital (AOR: 1.88, 95% CI 1.55–2.28). Patients with an overdose diagnosis had lower odds of receiving a consult (AOR: 0.71, 95% CI 0.53–0.96). Race/ethnicity, sex, insurance status, needing the ICU, and leaving against medical advice (AMA) were not significantly associated with receiving an addiction consult. (Table 2)

3.2.2 Sensitivity analysis using first admission only—The results of the sensitivity analyses including only the first admission for each patient were similar to the repeated measures analysis, with the exception of homelessness (AOR: 1.26, 95% CI 0.99–1.61) and having a longer length of stay (AOR: 1.01, 95% CI 1.00–1.02) were no longer statistically significantly associated with higher odds of receiving a consult, and female sex (AOR: 0.76, 95% CI 0.59–0.97) became associated with lower odds of receiving a consult; however, the strength and directions of all associations was overall similar except for the direction of association for the variable of leaving AMA, but this was not significant in either model (Appendix 3).

4. Discussion

This study found that a small proportion of patients (11.2%) with an SUD received a consult from the Addiction Consult Service. This low percentage may reflect both a lack of adequate workforce capacity to see all patients, as well as a reality that not all patients with SUD require a specialty consultation, just as a patient whose cancer is in remission does not require an Oncology consult, and a patient whose diabetes is well controlled does not require an Endocrine consult. The ACS is only able to see approximately 75–90% of requested consults, due to reasons such as patient discharge before the consult took place or the patient leaving AMA among other reasons, which highlights the need for increased staffing. As there is no proactive advertising of the consult service or standard screening done on admission for SUD that triggers a consult, the low percentage of patients receiving a consult may reflect a need for increased education of primary teams about the importance of addressing addiction in the hospital setting and the role of the ACS, including harm reduction services which are beneficial to patients in all stages of recovery.

The patients referred to the ACS did not differ from other patients with SUD in terms of general medical complexity as reflected by similar average Charlson Comorbidity scores, but these patients were complex in other ways. Patients with OUD, acute complications related to substance use, HIV infection, longer length of stay and a psychiatry consult all had higher odds of receiving an addiction consult. Similarly, they were more socially complex, as indicated by a higher odds of a consult among homeless patients. Thus, the data suggests that inpatient care teams appropriately referred some of their most challenging cases to the ACS, and those with a longer length of stay may have had more of an opportunity to meet with the consult service.

Patients receiving a psychiatry consult had higher odds of receiving an addiction consult, and it has been shown that patients diagnosed with OUD have high rates of concurrent medical comorbidities and mental health conditions (Shei et al., 2015). This relationship may be bi-directional, with the primary team consulting both services due to perceived complexity of the patients, or the psychiatric and addiction histories obtained by one team

may have highlighted the need for an additional consult. At this institution, a psychiatry consult will assist with withdrawal management for patients with SUD, but will not initiate medications or linkage to long-term treatment. In other settings it may be feasible to combine the role of these consult services or use the psychiatry service as a mechanism to expand the reach of the ACS.

In terms of acute complications related to substance use, patients with complications such as endocarditis often receive inadequate interventions, and pharmacotherapy is not routinely offered in settings without an addiction service (Jicha et al., 2018; Rosenthal et al., 2016). In this study patients with acute complications were more likely to receive a consult, demonstrating how ACSs are a potential targeted intervention to focusing on this high cost and complex patient population. Furthermore, future coordination between ACSs and outpatient teams may be useful in improving outcomes and lowering readmissions in this population.

Although alcohol use disorder is the most common SUD in the United States (Substance Abuse and Mental Health Services Administration., 2017), in our study, patients with OUD made up over three quarters of the ACS consults. This finding contrasts with other addiction consult services, whose distribution of primary SUD diagnosis was not different between consult and non-consult patients, with alcohol use disorder being the most common diagnosis in both groups (Fleming & Wilk, 1995; Wakeman et al., 2017). Patients with OUD may have had higher odds of receiving a consult because treatment of OUD and linkage to outpatient medication for OUD was a particularly useful capacity of this addiction consult service. This high rate of OUD in the consult group is further reflected in the elevated percentage of patients receiving methadone and/or buprenorphine in the consult group (57% vs 13%) as compared to the patients not receiving a consult in bivariate analyses. Our data did not capture whether the medication was started before, or after a consult. Thus, we are not able to conclude whether the medications were started per the suggestion of the consult team or rather the patients with more severe SUDs required medication, prompted primary teams to place a consult. In bivariate analyses there appeared to be high rates of cocaine use disorder among patients receiving a consult; however, this finding was not explored in the multivariable model as cocaine use often co-occurs with other use disorders, (Trowbridge et al., 2017), and thus there is likely overlap with the patients with OUD who were more likely to receive a consult. In addition, it is possible that only after the addiction consult was this diagnosis identified. As there are no FDA-approved medications to treat cocaine use disorder, this may highlight that the ACS team offers services beyond medications including diagnosis of SUD and bedside counseling. Future work may be warranted exploring the impact of the different components of an addiction consult.

Disparities in regards as to which patients received a consult were observed, with older patients having lower odds of receiving a consult. The proportion of older adults with SUD remains low compared with the general population, which may serve to perpetuate the misconception that older adults do not misuse substances (Le Roux, Tang, & Drexler, 2016). However, among people age 50 and older, SUD rates are projected to increase from 2.8 million in 2006 to 5.7 million in 2020 (Han & Moore, 2018; Kuerbis, Sacco, Blazer, &

Moore, 2014). Given these recent trends, it is essential for ACSs to ensure equal access to specialty addiction services for older adult patients with SUD.

OUD is associated with significant mortality, and in Massachusetts in 2015 the opioid-related death rate was twice the national average (Massachusetts Health Policy Commission, 2017). It is thus concerning that patients with an overdose diagnosis had lower odds of receiving an addiction consult, as hospitalization for overdose provides a critical opportunity to intervene and engage patients in treatment for SUD. While patients with an overdose diagnosis appeared to have higher odds of a consult in bivariate and unadjusted analyses, this association flipped to lower odds in the adjusted model. This may highlight the strength of the model in adequately addressing potentially confounding variables. In addition, the sensitivity analysis which was performed replicated these results and the Spearman correlation matrix confirmed that overdose was not highly correlated with any other variable in the model including OUD. However, it is still possible that these results represent unmeasured confounding from variables not included in the final multivariable model. A potential explanation for the decreased odds of a consult for patients with an overdose is that providers may assume patients who are actively using are not looking for treatment, despite literature showing that a majority of hospitalized patients with SUD are in fact interested in treatment (Englander et al., 2017). Patients with overdose may have shorter lengths of stay, making it a challenge for the ACS to see the patient prior to discharge; however, length of stay and overdose were not highly correlated in the Spearman matrix. Further details, such as type of overdose, were not available due to the retrospective nature of the data which could have illustrated some additional reasons why these patients were less likely to be seen. Previous research has also shown less than one third of patients with a non-fatal overdose access medication for addiction treatment in the year after the overdose, and that starting buprenorphine or methadone were associated with decreased opioid-related mortality (Larochelle et al., 2018). Future work should be done to ensure patients with overdose diagnoses are referred to the ACS, and creation of an overdose specific care pathway warrants consideration. One possible policy solution may be government interventions such as the 2018 act passed in Massachusetts to expand harm-reduction, treatment access, and recovery strategies for those with SUDs (Executive Office of Health and Human Services, 2018). This act included ensuring more timely evaluation after an opioid overdose and a requirement for emergency departments to offer medication for addiction treatment. While we have yet to see the results of such a policy, expansion of ACSs may help to provide staffing and support for similar interventions, however this would require hospitals and insurers to provide adequate funding and reimbursement for addiction treatment services, which will require advocacy at the local and federal level.

4.1. Strengths and limitations

The data in this study is retrospective and was collected only for clinical purposes, thus important details such as the severity of an individual's substance use disorder were unable to be fully characterized and the variables available were limited to those collected as part of routine clinical care. As discharge diagnoses were used for inclusion in this study it is possible that the involvement of ACS itself may have increased the chances that a SUD diagnosis was added to the chart, however the final diagnoses are recorded by the primary

team, and presumably the primary team had to have at least suspected a SUD to consult the ACS in the first place. Cannabis was collected using only the ICD9 code, which may have limited the subjects we captured for this data. The study was conducted at a single site urban academic medical center, which may limit generalizability of the results.

Despite these limitations, this paper clearly describes the proportion and characteristics of hospitalized patients with an SUD that receive treatment from an addiction consult service – an emerging tool to address addiction among hospitalized patients. Taking advantage of electronic medical records, we had access to a wealth of data that allowed examination of several clinically relevant characteristics in a large group of patients over a single year.

5. Conclusions

A minority of patients with substance use disorders received care from a specialty Addiction Consult Service, even in a setting where this service is readily available. Patients with greater addiction and medical complexity were more likely to be seen the by the Addiction Consult Service. Additional interventions may be needed to eliminate disparities in who is seen by the consult service, and to ensure every patient with an overdose diagnosis is receiving a comprehensive addiction evaluation, including harm reduction services. Future research is needed to assess outcomes of patients receiving an addiction consult, and how these services impact care utilization such as readmissions and post-discharge Emergency Department visits. Such future research will enable optimization of the use of this important resource.

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Declarations of interest

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Appendix

Appendix 1:

Substance Use Disorder Type Diagnosis List

Substance Type	ICD9	ICD10
opioid	305.5	F11.xx
cocaine	305.6x	F14.xx
alcohol	303.xx	F10.xx
	3 04.xx	
	305.0x	
	291.xx	
cannabis	305.2x	
sedative	305.4x	F13.xx

Substance Type	ICD9	ICD10
stimulant	305.7x	F15.xx
other	305.3x	F19.xx
	305.9x	
	305.8x	
	292.xx	

Appendix 2:

Medical Complications of Substance Use

Medical Complication	ICD9	ICD10
Cellulitis/abscess	682.xx	L02.xx
		L03.xx
Osteomyelitis	730.xx	M46.2x
		M86.xx
Tenosynovitis	727.xx	M65.xx
Endocarditis	421.xx	I33.xx
Pancreatitis	577.0x	K85.xx
	577.1x	K86.xx
Delirium Tremens	291.0x	F10.231
		F10.121
		F10.921
Wernicke/Korsakoff	291.1	E51.2
	294.0	F10.26
	265.1	
Seizure	293.0	G40.xx
	345.xx	R56.xx
	780.3x	
HIV	9: 042.xx; V08	B20-B24.xx
Hepatitis C	070.51	B18.xx
	070.41	B19.xx
	070.54	
	070.44	
	070.70	
	070.71	
	V02.62	

Appendix 3

Multivariable logistic regression model evaluating the association between patient characteristics and receiving an addiction consult using only the first admission for each patient from July 17, 2015 to July 16, 2016

Patient Characteristic	Unadjusted OR, 95% CI	Adjusted OR, 95% CI
Age (10 year)	0.72 (0.67,0.77)	**0.80 (0.72–0.87)**
Female	1.11 (0.90, 1.38)	**0.76 (0.59–0.97)**
Non-Hispanic White	1.58 (1.29, 1.93)	0.85 (0.67–1.08)
Homeless	2.15 (1.74,2.85)	1.26 (0.99–1.61)
Medicaid	2.18 (1.75,2.72)	1.22 (0.94–1.59)
Acute Complications[1]	2.44 (2.00, 2.99)	**1.74 (1.36–2.22)**
HIV	3.56 (2.70, 4.70)	**2.34 (1.69–3.23)**
ICU[2]	1.43 (1.14, 1.80)	1.34 (0.99–1.81)
Psychiatry Consult	2.20 (1.72,2.82)	**1.66 (1.22 – 2.24)**
OUD[3]	9.16 (7.21, 11.63)	**4.56 (3.34–6.23)**
Inpatient benzo/phenobarbital	1.68 (1.37,2.05)	**2.20 (1.71 – 2.82)**
Overdose diagnosis	1.58 (1.13,2.19)	**0.63 (0.42 – 0.95)**
Hospitalization LOS[4]	1.02 (1.01, 1.03)	1.01 (1.00, 1.02)
AMA[5]	1.46 (1.15, 1.86)	1.07 (0.74, 1.56)

[1]Acute complications includes cellulitis/abscess, osteomyelitis, tenosynovitis, endocarditis, acute and chronic pancreatitis, delirium tremens, acute and chronic pancreatitis, seizures and Wernicke-Korsakoff Syndrome

[2]Patient stayed at least one day in the Intensive Care Unit during admission

[3]OUD: opioid use disorder; comparing patients with any opioid use disorder vs. those with only non-opioid use disorders

[4]Hospitalization LOS: length of stay of hospital visit, per one-day increase

[5]AMA: patient left against medical advice

Abbreviations:

ACS Addiction Consult Service

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Highlights:

- Addiction Consult Services treat inpatients with substance use disorders
- A minority of patients receive a specialty addiction consult
- Patients with opioid use disorder had higher odds of receiving a consult
- Medically complex patients had higher odds of receiving a consult
- Patients with an overdose diagnosis had lower odds of receiving a consult

Table 1

Characteristics of patients with SUD admitted at Boston Medical Center from July 17, 2015 to July 16, 2016– overall and stratified by receipt of a consult (using first admission only for each patient)

Demographic Characteristics[1]	**Overall N= 3905**	**No Consult N = 3469**	**Consult N = 436**	**P-value**
Age				<.0001
- Median (25th, 75th percentile)	50.0 (38, 59)	51.0 (39, 59)	43.0 (32, 53)	
Female	30% (1156)	29% (1018)	32% (138)	0.3202
Race/ethnicity				<.0001
- Non-Hispanic White	41% (1615)	40% (1391)	51% (224)	
- Non-Hispanic Black	38% (1465)	39% (1351)	26% (114)	
- Hispanic/Latino	17% (661)	17% (577)	19% (84)	
- Non-Hispanic Other	4.2% (164)	4.3% (150)	3.3% (14)	
Alcohol Use Disorder	60% (2354)	62% (2161)	44% (193)	<.0001
Cocaine Use Disorder	21% (827)	19% (648)	41% (179)	<.0001
Cannabis Use Disorder	14% (545)	15% (505)	9% (40)	0.0022
Opioid Use Disorder	34% (1318)	28% (977)	78% (341)	<.0001
Sedative Use Disorder	2.6% (103)	2.0% (68)	8.0% (35)	<.0001
Stimulant Use Disorder	0.9% (37)	0.7% (25)	2.8% (12)	0.0004
Substance Use Disorder, substance not specified	5.1% (198)	4.4% (151)	11% (47)	<.0001
COWS[2] ordered	6.3% (246)	2.9% (102)	33% (144)	0.1206
Discharged Against Medical Advice	8.8% (345)	8.5% (295)	12% (50)	0.0545
Homeless	24% (938)	22% (772)	38% (166)	<.0001
Medicaid	58% (2247)	56% (1928)	73% (319)	<.0001
Acute complications[3]	38% (1473)	35%% (1224)	57% (249)	<.0001
HIV positive	7.9% (310)	6.5% (226)	19% (84)	<.0001
Hepatitis C Virus	30% (1164)	26% (900)	61% (264)	<.0001
Primary Service (N= 3563)[4]				<.0001
Medicine	65% (2338)	65% (2019)	74% (319)	
Surgery	23% (810)	25% (771)	9% (39)	
ICU	12% (415)	11% (342)	17% (73)	
ICU stay during admission[5]	20% (794)	20% (681)	26% (113)	
Hospitalization Length of stay (mean # of days)	4.3	4.1	5.9	<.0001
Psychiatry consulted during admission	13% (507)	12% (408)	23% (99)	<.0001
Charlson Comorbidity Index (mean)	2.4	2.5	2.3	0.2674
Overdose diagnosis on discharge summary	7.5% (294)	7.1% (247)	11% (47)	0.0063
Inpatient benzodiazepine and/or phenobarbital	37% (1455)	36% (1244)	48% (211)	<.0001
Inpatient methadone and/or buprenorphine	18% (697)	13% (447)	57% (250)	<.0001
Methadone and/or buprenorphine on admission medication list	5.3% (207)	4.8% (167)	9.2% (40)	0.0001

Demographic Characteristics[1]	**Overall N= 3905**	**No Consult N = 3469**	**Consult N = 436**	**P-value**
Methadone and/or buprenorphine on discharge medication list	13% (517)	11% (382)	31% (135)	<.0001
Naltrexone on admission medication list	0.8% (30)	0.7% (23)	1.6% (7)	0.0713
Naltrexone on discharge medication list	2.4% (95)	1.7% (59)	8.3% (36)	<.0001
Acamprosate on admission medication list	0.3% (13)	0.3% (11)	0.5% (2)	0.6491
Acamprosate on discharge medication list	0.7% (28)	0.6% (22)	1.4% (6)	0.1200
Disulfuram on admission medication list	0%	0%	0%	
Disulfuram on discharge medication list	0.4% (14)	0.2% (8)	1.4% 6)	0.0026
Topiramate on admission medication list	1.0% (40)	1.1% (37)	0.7% (3)	0.6169
Topiramate on discharge medication list	1.8% (71)	1.9% (66)	1.1% (5)	0.2656

[1]For all variables N=3905 unless otherwise noted

[2]Clinical Opioid Withdrawal Scale ordered during admission

[3]Acute complications includes cellulitis/abscess, osteomyelitis, tenosynovitis, endocarditis, acute and chronic pancreatitis, delirium tremens, acute and chronic pancreatitis, seizures and Wernicke-Korsakoff Syndrome

[4]Medicine included cardiology, family medicine, geriatrics, hospitalist, infectious disease, internal medicine, neurology, oncology, and renal. Surgery included general surgery/trauma (including SICU) and surgical subspecialties, and Intensive Care United included the Medical ICU and Cardiac Care Unit

[5]Patient stayed at least one day in the Intensive Care Unit during admission

Table 2

Evaluating the association between admission characteristics and receiving an addiction consult using multivariable logistic regression models with generalized estimating equations, including all admissions from July 17, 2015 to July 16, 2016

Patient Characteristic	Unadjusted OR, 95% CI	Adjusted OR, 95% CI
Age (per 10-year increase)	0.76 (0.71, 0.80)	**0.82 (0.76. 0.88)**
Female	1.10 (0.91, 1.34)	0.84 (0.68, 1.03)
Non-Hispanic White	1.47 (1.23, 1.76)	0.99 (0.81, 1.20)
Homeless	1.89 (1.59, 2.26)	**1.31 (1.08, 1.59)**
Medicaid Insurance	1.91 (1.58, 2.31)	1.21 (0.98, 1.49)
Acute Complications[1]	2.12 (1.76, 2.54)	**1.64 (1.34, 2.02)**
HIV	2.77 (2.20, 3.50)	**2.06 (1.59, 2.67)**
ICU[2]	1.32 (1.09, 1.60)	1.07 (0.83, 1.37)
Psychiatry Consult	2.30 (1.87, 2.81)	**1.75 (1.37, 2.23)**
OUD[3]	6.57 (5.39, 8.00)	**6.39 (5.14, 7.94)**
Inpatient benzodiazepine/phenobarbital	1.55 (1.32, 1.84)	**1.88 (1.55, 2.28)**
Overdose diagnosis	1.42 (1.10, 1.84)	**0.71 (0.53, 0.96)**
Hospitalization LOS[4]	1.03 (1.02, 1.05)	**1.02 (1.01, 1.03)**
AMA[5]	1.46 (1.15, 1.86)	0.88 (0.67, 1.15)

[1] Acute complications includes cellulitis/abscess, osteomyelitis, tenosynovitis, endocarditis, acute and chronic pancreatitis, delirium tremens, acute and chronic pancreatitis, seizures and Wernicke-Korsakoff Syndrome

[2] Patient stayed at least one day in the Intensive Care Unit during admission

[3] OUD: opioid use disorder; comparing patients with any opioid use disorder vs. those with only non-opioid use disorders

[4] Hospitalization LOS: length of stay of hospital visit, per one-day increase

[5] AMA: patient left against medical advice