The impact of addiction medicine consultation on outcomes in hospitalized patients

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Abstract

Background

Over the last several years, the incidence and prevalence of substance use disorders (SUD) and related acute illnesses have been rising in the US. Their diagnosis of SUD impacts the clinical course of many hospitalized patients. The primary objective of our study is to assess the impact of a newly implemented inpatient addiction medicine consult service on outcomes in patients with a SUD.

Methods

We included adult SUD patients hospitalized for 24 hours or greater between March 2018 and January 2022. We recorded demographic and clinical variables and analyzed the association between the occurrence of addiction medicine consultation (AMC) with the outcomes of left against medical advice (AMA) and 30-day readmission (READ).

Results

There were 1,020 encounters included in our study: 945 (93%) without AMC and 75 (7%) AMC. AMC patients were younger (53.2 vs. 56.93, P < 0.001), were often male (22.7% vs. 13%, P < 0.001), or had health insurance (74.7% vs. 85.4%, p = 0.015). Their years of use (30 years) and hospital length of stay (4 days) were similar between AMC and non-AMC groups. More patients were using intravenous drugs in the AMC group (25.3% vs 9.8%, < p < 0.001) and opioids (50.7% vs. 19.3%, P < 0.001). In a multivariate regression analysis for the outcomes of interest, after adjusting for demographic variables, AMC was not associated with the outcome AMA (P = 183) but was shown to have a much lower likelihood of 30-day readmission (0.3[0.1–0.8], P = 0.016).

Conclusion

We found that the practice of AMC was associated with similar rates of AMA but fewer 30-day readmission rates in patients with SUD. The comparable rate of AMA could be due to clinicians' higher propensity to consult AMC if patients threaten to leave the hospital. The findings of our study should be confirmed in larger trials but hold significant promise.

Background

The prevalence of substance use disorders has increased dramatically over the last two decades. It is estimated that in 2021 alone, 61.2 million people aged 12 or older (21.9% of the population) in the United States used illicit drugs, and 46.3 million (16.5% of the population) met the criteria of substance use disorder.(1) The consequences of this are dramatic, with more than 105,452 deaths due to overdoses and costs of more than 1 trillion dollars annually. (2, 3) Furthermore, during the COVID-19 pandemic, there were increased rates of overdose deaths .(4) Despite many calls for action, there is a lack of a coherent, comprehensive approach to this public health crisis.
Studies have reported that up to 15% of patients admitted have a substance use disorder (SUD). Hospitalizations due to opioid-related diagnoses have also increased from 136.8 per 100,000 population in 2005 to 275 per 100,000 population in 2019. The clinical course of hospitalized patients may be impacted by their diagnosis of SUD. The inpatient stay provides a window of opportunity to influence the care and health of patients with substance use disorders. Institutions across the US have begun to create inpatient addiction medicine consultation services where board-certified specialists meet patients while in the hospital, diagnose, and initiate appropriate treatment modalities. In studies performed before 2020, there has been a suggestion that addiction medicine consultation is associated with decreased rates of AMA and decreased readmission rates.

At our institution, we implemented an addiction medicine inpatient consultation service with board-certified addiction medicine specialists, advanced practice providers, a behavioral medicine psychologist, and an addiction navigator. We aimed to analyze the impact of this service on outcomes in a large population of hospitalized patients, including throughout the COVID-19 pandemic.

**Methods**

**Setting**

We performed a retrospective cohort study with a convenience sample of 1,020 patients admitted to Cooper University Hospital in Camden, New Jersey, between March 1, 2018, and January 31, 2022. Cooper University Hospital is a 653-bed tertiary care, Level-1 Trauma center. The institution is the only academic medical center in southern New Jersey and cares for underserved patients in Camden County and multiple more complex patients transferred from other counties. The study was approved by the Cooper Institutional Review Board (#-22-041).

**Patients**

We included patients ages 18 years or greater who were in the hospital for 24 hours or greater and had a substance use disorder (SUD) diagnosis.

**Addiction medicine service**

The addiction medicine service is staffed by a board-certified addiction medicine physician with primary training in internal medicine, emergency medicine, psychiatry, or family medicine, an advanced practice provider, a behavioral medicine psychologist, and an addiction navigator. Addiction medicine providers consult with patients throughout the hospital to provide diagnosis, intervention, and treatment of withdrawal and substance use disorders. These providers additionally link patients to treatment in the outpatient Cooper Center for Healing facility, which focuses on integrated care for those with SUD and mental illness, as well as other inpatient and outpatient programs for addiction treatment in the region.

**Variables and outcomes**
We recorded age (years), gender (male, female, other), race, Hispanic ethnicity (yes/no), admission diagnosis at the encounter, insurance status, and hospital length of stay. For substance use disorder, we collected the type of SUD, years of use, and presence of previous addiction medicine providers (yes/no). During the hospital stay, we recorded the reason for consultation, the time to consultation, and the intervention performed by the consultation team.

The primary outcomes from the study were leaving the hospital against medical advice (AMA) disposition and hospital readmission within 30 days of index encounter.

**Statistical methods**

We present categorical variables as percentages and continuous variables as means [SD] and medians [IQR]. We used Chi-Square tests, independent t-tests, and Mann-Whitney U tests to compare variables to addiction medicine consultations. We also performed a multivariable regression analysis to assess the independence of the association of the presence (or not) of the addiction medicine consultation with the outcomes of interest. All statistical analyses were performed using SPSS 27 (IBM, Armonk, NY).

**Results**

**Patients and comparisons between groups**

15,689 encounters met the initial inclusion criteria, and from that sample, we chose a convenience subset sample of 1,020 consecutive encounters. In the subset, there were 75 patients (7%) who had an addiction medicine consultation (AMC) during their hospital stay and 945 (93%) who did not. The patients included in the cohort had admission years ranging from 2018 until 2022 and were chosen randomly.

AMC patients were younger (53.2 years vs. 56.93 years, P < 0.001) and were less likely of female gender (22.7% vs. 13%, P < 0.001) or to have health insurance (74.7% vs. 85.4%, p = 0.015). Their years of use (30 years) and hospital length of stay (4 days) were similar between AMC and non-AMC groups. More patients reported injecting drugs in the AMC group (25.3% vs 9.8%, < p < 0.001) and opioids (50.7% vs. 19.3%, P < 0.001). Cocaine use was similar in both groups (36% vs. 36.5%, P = 0.930). There was no statistically significant difference between the two groups when we compared the proportion of patients previously seen by an addiction specialist (inpatient or outpatient) 40% vs. 30%, P = 0.066. All results are presented in Table 1.
### Table 1
Differences between patients who did and did not have Addiction medicine consultation

<table>
<thead>
<tr>
<th></th>
<th>AMC (n = 75)</th>
<th>Non-AMC (n = 945)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of patients</strong></td>
<td>71 (7%)</td>
<td>949 (93%)</td>
<td></td>
</tr>
<tr>
<td><strong>Age (Mean/ SD)</strong></td>
<td>53.2 (7.9)</td>
<td>56.93 (10.2)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Female Gender</strong></td>
<td>17 (22.7%)</td>
<td>406 (43%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>White</td>
<td>22 (29.3%)</td>
<td>163 (17.2%)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>34 (45.3%)</td>
<td>525 (55.6%)</td>
<td></td>
</tr>
<tr>
<td>Hispanic or other</td>
<td>19 (25.3%)</td>
<td>257 (27.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Insurance status</strong></td>
<td>56 (74.7%)</td>
<td>807 (85.4%)</td>
<td>0.015</td>
</tr>
<tr>
<td><strong>Substance use history</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>32 (42.7%)</td>
<td>347 (36.7%)</td>
<td>0.305</td>
</tr>
<tr>
<td>Marijuana</td>
<td>3 (4%)</td>
<td>164 (17.4%)</td>
<td>0.003</td>
</tr>
<tr>
<td>Opioid use</td>
<td>38 (50.7%)</td>
<td>182 (19.3%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Cocaine use</td>
<td>27 (36%)</td>
<td>345 (36.5%)</td>
<td>0.930</td>
</tr>
<tr>
<td>IVDU</td>
<td>19 (25.3%)</td>
<td>93 (9.8%)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Years of use</strong></td>
<td>30 [20–36.5]</td>
<td>30 [20–40]</td>
<td>0.923</td>
</tr>
<tr>
<td>Previously seen by an Addiction Specialist</td>
<td>30 (40%)</td>
<td>285 (30%)</td>
<td>0.066</td>
</tr>
<tr>
<td><strong>Hospital Length of stay</strong></td>
<td>4[2–8]</td>
<td>4[2–6]</td>
<td>0.089</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AMA</td>
<td>14 (18.7%)</td>
<td>81 (8.6%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Readmission</td>
<td>6 (8%)</td>
<td>171 (18.1%)</td>
<td>0.026</td>
</tr>
</tbody>
</table>

Values and p-values are presented.

### Interventions performed

Of the 75 addiction medicine consultations, 48 (64%) resulted in no intervention; counseling and options for outpatient follow-up were provided. 13 patients had buprenorphine started (17.3%), one that had buprenorphine dose changed, 4 (5%) started methadone as an inpatient, one that had outpatient methadone start set up, 2 with change in methadone doses and 6 with other therapeutic interventions. (Table 2)
Table 2
Interventions performed by the Addiction medicine team.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>No medication intervention, counseling, or outpatient follow-up options were provided.</td>
<td>48</td>
</tr>
<tr>
<td>Buprenorphine initiation inpatient</td>
<td>13</td>
</tr>
<tr>
<td>Adjusting buprenorphine dose</td>
<td>1</td>
</tr>
<tr>
<td>Methadone initiation</td>
<td>4</td>
</tr>
<tr>
<td>Methadone set up to start as an outpatient</td>
<td>1</td>
</tr>
<tr>
<td>Methadone dose change</td>
<td>2</td>
</tr>
<tr>
<td>Other interventions</td>
<td>6</td>
</tr>
</tbody>
</table>

Box and whisker plot showing the likelihood ratios of AMC Group vs. Non-AMC Group likelihood of readmission within 30 days. The AMC Group had a statistically significantly lower likelihood ratio for 30-day readmission than the non-AMC group.

Outcomes

There were more instances of AMA in the AMC group (N (18.7% vs. N 8.6% P = 0.004) but fewer readmissions (8% vs. 18.1%, P = 0.026). We then performed a multivariate regression analysis for the outcomes of interest. After adjusting for demographic variables, AMC was not associated with the outcome AMA (P = 0.134) but was shown to have a much lower likelihood of 30-day readmission (0.38[0.15–0.99], P = 0.049), shown in Fig. 1. Male gender was significantly associated with an increased likelihood of AMA (5.36[2.56–11.25], p < 0.001), and age was with a lower likelihood (0.97[0.94–0.99], p = 0.028). For the outcome of 30-day readmission, the male gender was associated with lower readmission risk (0.42[0.28–0.62], P < 0.001). For both outcomes, there was no difference between black and white patients.

Discussion

The implementation of an inpatient addiction medicine consultation service reduced the number of 30-day hospital readmissions in patients with SUD. Still, it did not affect rates of AMA during a period that included the COVID-19 pandemic.

To assess the impact of our consultation service, we chose standard hospital quality measures such as self-directed discharge (AMA) and 30-day readmissions. We did not include hospital length of stay. Many patients with SUD are admitted with bloodstream infections requiring prolonged antibiotic therapy. A long length of stay could be a success in some instances if the patients completed parenteral antibiotic treatment. Alternatively, a shorter length of stay may indicate high quality from a specialty consult service...
and patient engagement in care. Therefore, we used leaving against medical advice (AMA) and readmission within 30 days.

AMA is a well-cited risk for adverse health outcomes after hospitalization, including higher readmission, morbidity, and mortality rates.\(^{(14)}\) AMA rates are higher among SUD patients than the general population.\(^{(15)}\) One study found AMA rates in SUD patients up to three times compared to other patients.\(^{(16)}\) Reasons for leaving include withdrawal symptoms, severe pain, and the feeling of being discriminated against by hospital workers.\(^{(16)}\) Addiction medicine consultation did not result in less AMA among patients with SUD in our study. This may reflect a propensity to consult addiction medicine for patients at higher risk of AMA rather than the impact of the intervention itself. Indeed, there were notable differences between the groups, including higher rates of opioid use and injection drug use in the AMC group. Patients who have acute withdrawal symptoms and want to leave abruptly may be the same patients who get addiction medicine consultations; however, our study was not designed to address this issue specifically. Addiction Medicine consults resulted in similar rates of AMA, which may, in fact, point to a possible success of the consultation.

Readmission rates were lower in the AMC compared to the non-AMC group. Readmission rates can reflect appropriate quality of care.\(^{(17)}\)(18) Interventions by the addiction medicine team likely resulted in less symptom burden due to withdrawal treatment initiation as well as more engaged patients with possibly better adherence to other aspects of their treatments. The addiction medicine team connects the patients with outpatient programs, schedule appointments, and cares for the patients longitudinally across the continuum of care. However, our study did not examine treatment retention or follow-up.

Our results are concordant with findings from other studies. In a retrospective study of 125 patients with OUD admitted with a severe infection and who required antibiotics, Marks et al. showed that patients who had addiction medicine consultations (38 out of 125) were more likely to complete antibiotic therapy and less likely to be readmitted.\(^{(19)}\) The number of patients included in that study was relatively small (125 vs. 1,020 ) compared to ours, and the admission diagnoses were more uniform. In that study, patients who had consultations were also less likely to leave against medical advice. We chose to study patients with a multitude of diagnoses, which would help generalize our findings.

Other studies showed more benefits from addiction medicine consultation, such as reduced addiction severity and increased abstinence days after discharge,\(^{(20)}\) improved SUD engagement,\(^{(7)}\) and better patient experience. Due to the design of our study, we could not measure any of those outcomes.

Our study has significant limitations, including its retrospective nature, the absence of randomization for which patients get consultation vs. not, and the inability to find whether patients were offered a consultation but ultimately refused it. We also did not characterize every intervention done either by the primary team or the addiction medicine team (such as behavioral medicine consult, smoking cessation, housing resources...) but instead focused on the standard practice of the addiction medicine consult team. Finally, we did not take mortality into account in this study. Considering the high mortality rate
associated with opioid use disorder, our readmission rate may be lower than reported, as individuals who die cannot be readmitted to the hospital. Mortality represents an essential confounder that we were not able to account for.

**Conclusion**

Our study showed a statistically significant decrease in READ for patients who had consultation with the Addiction Medicine versus those who did not. Continued research in the area with careful consideration of the type of intervention performed is necessary to generalize the findings better.

**Declarations**

**Ethics approval and consent to participate**

The Cooper University Healthcare IRB approved the study: IRB # 22-041 for research. As per the IRB, informed consent was waived for this study. *All methods were carried out in accordance with relevant guidelines and regulations.*

**Consent for publication**

Not Applicable

**Availability of data and materials**

The data used for the study was obtained after a review of Electronic Health records from patients and was de-identified completely after collection was completed. The data can be obtained after a reasonable written request to the corresponding author.

**Competing interests**

The authors have no significant conflicts of interest.

**Funding**

There was no funding for this work

**Authors’ contributions**

ES, JR conceived the study and design. ES gathered the data. KH analyzed the results. JR, ES, KH, KA, and MS wrote the manuscript, revised it, and approved the final version

**References**


Figures

![Figure 1](image_url)

**Figure 1**

**Likelihood Ratio of Readmissions between AMC and non-AMC group**
Box and whisker plot showing the likelihood ratios of AMC Group vs. Non-AMC Group likelihood of readmission within 30 days. The AMC Group had a statistically significantly lower likelihood ratio for 30-day readmission than the non-AMC group.