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High Inpatient Utilization Among Veterans Health Administration Patients with Substance Use Disorders and Co-occurring Mental Health Conditions

Janelle M. Painter, PhD^a, Carol A. Malte, MSW^{b,c}, Anna D. Rubinsky, PhD^{b,c,h}, Timothy R. Campellone, PhD^{a,d}, Amanda K. Gilmore, PhD^e, John S. Baer, PhD^{b,c,f}, and Eric J. Hawkins, PhD^{b,c,g}

^aVA Puget Sound Health Care System, Seattle Division, 1660 S. Columbian Way (S-116-MHC) Seattle, WA 98108

^bHealth Services Research & Development (HSR&D) Seattle Center of Innovation for Veteran, Centered and Value-Driven Care, VA Puget Sound Health Care System, 1660 S. Columbian Way (S-152) Seattle, WA 98108

^cCenter of Excellence for Substance Abuse Treatment and Education (CESATE), VA Puget Sound Health Care System, 1660 S. Columbian Way (S-116-ATC) Seattle, WA 98108

^dUniversity of California, Berkeley, Department of Psychology, Tolman Hall #1650 University of California, Berkeley, Berkeley, CA 94720-1650

^eMedical University of South Carolina, National Crime Victims Research and Treatment Center, Department of Psychiatry & Behavioral Science, 67 President Street, MSC 861 2nd Fl. IOP South Building Charleston, SC 29425

^fDepartment of Psychology, University of Washington, 1410 NE Campus Parkway, Seattle, WA 98195

^gDepartment of Psychiatry & Behavioral Sciences, University of Washington, 1959 NE Pacific Street Box 356560, Room BB1644 Seattle, WA 98195-6560

^hKidney Health Research Collaborative (KHRC), Department of Medicine, University of California, San Francisco, and VA San Francisco Health Care System, 4150 Clement Street (111A1), San Francisco, CA 94121

Abstract

Background.—Substance use disorders (SUD) are common and costly conditions. Understanding high inpatient utilization (HIU) among patients with SUD can inform the development of treatment approaches designed to reduce healthcare expenditures and improve service quality.

Corresponding Author: Janelle M. Painter; Clinical Psychologist at the VA Puget Sound Health Care System; 1660 S. Columbian Way (S-116-PRRC), Seattle, WA 98108; Janelle.painter@va.gov; .

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Objectives.—To examine the prevalence, type and predictors of HIU among patients with SUD and co-occurring mental health conditions.

Methods.—Service utilization, demographic and clinical variables were extracted from a national sample of Veterans Health Administration patients with SUD-only (n=148,960), SUD plus serious mental illness (SUD/SMI; n=75,913), and SUD plus other mental illness (SUD/MI; n=245,675). Regression models were used to examine HIU during a follow-up year.

Results.—Prevalence of HIU among the SUD-only group was 6.2% (95% confidence interval (CI): 6.1%–6.3%) compared to 22.7% (95% CI: 22.4%–23.0%) and 9.7% (95% CI: 9.6%–9.8%) among the SUD/SMI and SUD/MI groups, respectively. Patients with SUD/MI represented nearly half of the HIU sample. Primary type of inpatient service use varied by comorbidity: SUD-only=medicine; SUD/SMI=psychiatric; SUD/MI similar use of psychiatric, SUD-related, and medicine. Predictors of HIU were generally similar across groups: older age, unmarried, homelessness, suicide risk, pain diagnosis, alcohol/opioid/sedative use disorders and prior year emergency department/inpatient utilization.

Conclusions.—Substantial reductions in HIU among a SUD population will likely require treatment approaches that target patients with less severe mental health conditions in addition to SMI. Cross-service collaborations (e.g., integration of medical providers in SUD care) and interventions designed to target issues and/or conditions that lead to HIU (e.g., homeless care services) may be critical to reducing HIU in this population.

Keywords

Veterans; high inpatient utilization; substance use disorders; mental illness

Introduction

Substance use disorders (SUD) are common and costly conditions accounting for a large percentage of overall global disease burden [1,2]. For a subset of patients, SUD are chronic, severe and recurrent conditions that are complicated to treat [3]. Such patients are characterized by high rates of acute care admissions and readmissions [4], recurring relapse [5,6], mental health and medical comorbidity [7,8], and complicating social conditions such as homelessness [9]. Recent studies suggest that this subset of patients returns to treatment multiple times and uses disproportionate substance use, mental health and medical services [10].

Evaluations of healthcare utilization consistently indicate that 5% of the United States (US) population accounts for 50% of healthcare costs [11]. With such large expenditures devoted to relatively few individuals, managed care systems have increased their focus on methods for identifying individuals at risk for high utilization and providing access to appropriate levels of less costly care [12,13]. Inpatient services and conditions associated with high inpatient utilization (HIU) are often the focus of such efforts, as hospital stays account for nearly one-third of all healthcare expenditures in the US [14]. However, little is known about HIU patterns, and factors associated with those patterns, among patients with SUDs. It is imperative to better identify those at risk of HIU to inform development and delivery of

services that more effectively address the unique needs of these patients and reduce hospitalizations.

Recent studies among Medicaid patients with HIU suggest that psychotic-, mood-, and alcohol-related disorders are among the most common conditions related to hospital stays [15] and readmissions [16]. Further, serious mental illness (SMI), chronic mental health conditions that result in substantial functional impairment, and less chronic and impairing mental health conditions (e.g., depression, anxiety disorders) are prevalent among SUD populations [17,18,19]. While it is likely that a large proportion of patients with SUD and HIU have co-occurring mental health disorders, little information exists on whether rates or predictors of HIU vary among patients with SUD depending on mental health comorbidity.

As the country's largest integrated healthcare delivery system and one of the principal providers of substance use treatment [20], the Veterans Health Administration (VA) provides a unique opportunity to examine the HIU patterns of patients with SUDs, depending on the presence of co-occurring mental health conditions. The present study extends our understanding of inpatient service utilization among patients with SUD and co-occurring mental health conditions by specifically examining whether the prevalence rates and predictors of HIU differ among those with SUD-only, SUD and co-occurring serious mental illness (SUD/SMI), and SUD and other co-occurring mental health disorders (SUD/MI). The aims of this study include: (1) estimate the unadjusted annual prevalence and 95% confidence intervals of HIU among VA patients with SUD-only, SUD/SMI, and SUD/MI; (2) determine if VA patients with SUD/MI and SUD/SMI are at increased odds of HIU compared to those with SUD-only; (3) describe patterns of utilization across inpatient service type among VA patients with SUD and HIU and determine if utilization differs by mental health comorbidity; and (4) given potential differences in symptom severity and functioning across these groups, identify demographic and clinical characteristics associated with HIU among VA patients with SUD-only, SUD/SMI, and SUD/MI.

Methods

Source of Data and Study Sample

This study used administrative medical records data from the VA Informatics and Computing Infrastructure (VINCI), a national data repository for all VA facilities that includes patient-level data on VA service utilization, as well as demographics and clinical diagnoses. VA patients aged 18 or older were eligible for study inclusion if they had a documented primary or secondary diagnosis of SUD from at least one outpatient visit or inpatient discharge at a VA facility between October 1, 2011 and September 30, 2012. Given that SUDs are often associated with recurring relapse, patients with current or remitted SUD diagnoses were identified from Internal Classification of Diseases, Ninth Revision Clinical Modification (ICD-9-CM) codes for alcohol use disorders and drug use disorders (see Table 1 for list of diagnostic codes).

To assess HIU, patients were followed for 12 months (hereafter referred to as the SUD follow-up year) following their initial SUD diagnosis (SUD index diagnosis). They were excluded if they died during the SUD follow-up year to ensure that all patients included in

this sample had equal opportunity for HIU. Study approval was obtained from the VA Puget Sound Institutional Review Board.

High Inpatient Utilization

Total number of days inpatient during the SUD follow-up year was classified into three mutually exclusive categories (medical, psychiatric, and SUD-related (e.g., detoxification) services) and combined to create a total inpatient utilization variable. Days inpatient was determined from inpatient location codes and diagnosis-related group (DRG) codes and did not include residential treatment stays. HIU was defined as the upper 10% of the study sample in terms of total inpatient utilization distribution and was coded into a binary measure. While various thresholds for identifying “high utilization” have been used, the top 10% is common [21,22].

Substance Use Disorder and Co-Occurring Mental Health Condition Classifications

Patients were categorized into one of three groups: SUD-only, SUD/SMI and SUD/MI. Co-occurring mental health conditions were determined from primary or secondary ICD-9-CM codes (see Table 1) documented from at least one outpatient visit or inpatient discharge one year before to 90 days after the SUD index diagnosis. This timeframe was created to identify chronic conditions that may not have been documented in the prior year (e.g., patient was new to VA care) and likely influenced inpatient utilization during the SUD follow-up year. As there is general consensus that psychotic (e.g., schizophrenia, schizoaffective disorders) and bipolar disorders are among the most impairing mental illnesses [23,24], patients with schizophrenia-spectrum or bipolar-spectrum disorders were assigned to the SUD/SMI group. Patients with PTSD, depressive, anxiety, or eating disorders were assigned to the SUD/MI group, and those without documentation of these mental health disorders were assigned to the SUD-only group.

Potential Predictors of HIU

We used the Gelberg-Andersen Behavioral Model for Vulnerable Populations [25] as a conceptual framework and prior studies [4,15,16,26,27,28,29] to identify potential predictors of HIU among patients within the three groups. Predictors were selected from the following three domains: predisposing characteristics (i.e., non-modifiable variables), enabling resources (i.e., modifiable variables), and perceived/evaluated need (i.e., patient experiences that might influence inpatient utilization). Predictors were identified from administrative data one year prior and 90 days after the SUD index diagnosis unless otherwise specified for the same reason as described above.

Predisposing factors included age, gender, race, ethnicity, engagement in Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) conflicts and VA service-connected disability rating >50% (i.e., an injury or illness incurred or aggravated during active military service and determines VA health care eligibility and benefits) at the time of the SUD index diagnosis.

Enabling resources included marital status at time of the SUD index diagnosis and housing status. *Housing status* was a binary measure based on the absence or presence of

homelessness as determined by at least one of the following indicators: 1) ICD-9-CM code v60.0 indicating lack of housing, and 2) VA outpatient clinic codes and/or residential treatment specialty codes indicating use of homeless services [30].

Perceived and evaluated need factors included suicide risk, medical comorbidity, pain diagnosis, specific SUD diagnoses, combined alcohol and drug use, specific mental health diagnoses, and year prior service use. *Suicide risk* was determined by at least one of the following indicators to calculate a binary measure: 1) patient record flags documenting high suicide risk and/or 2) ICD-9-CM codes documenting a suicide attempt [31]. *Medical comorbidity* was measured via a modified version [32] of the Charlson Comorbidity Index [CCI, 33] by creating a weighted score from 17 health conditions determined by ICD-9-CM codes. For the purposes of this study, CCI scores were assigned to three groups: 0, 1, 2 or greater, with higher scores reflecting greater comorbidity severity. A binary indicator of a *pain diagnosis* was determined by at least one ICD-9-CM diagnostic code indicating a chronic pain diagnosis [34]. Specific *substance use* and *mental health disorder* diagnoses were identified using ICD-9-CM diagnostic codes (see Table 1). *Combined alcohol and drug use disorder* was coded for any patient with at least one alcohol use disorder and one drug use disorder diagnosis to create a binary measure. Three binary measures of *year prior service use* were created based on any primary care, outpatient mental health (including SUD specialty services), or emergency department use obtained from administrative data in the 12 months prior to the SUD index diagnosis. A measure of *year prior inpatient service use* was based on the number of days inpatient in the 12 months prior to the SUD index diagnosis and categorized into no days, 1-7 days, and 8+ days.

Data Analysis

The annual prevalence of HIU was estimated across SUD groups with simple proportions and 95% confidence intervals (CI). The odds (and 95% CIs) of HIU among the SUD/SMI and SUD/MI groups compared to the SUD-only group and among the SUD/SMI compared to the SUD/MI group were estimated using unadjusted logistic regression. The number of inpatient days by specific service type and overall (medicine, psychiatric, SUD-related, and total) were compared in the HIU sample using unadjusted negative binomial regression models and estimated with incidence rate ratios and 95% CIs to describe patterns in inpatient utilization [35]. Among all SUD patients, separate multivariable logistic regression models were used to identify characteristics associated with HIU in the SUD-only, SUD/SMI and SUD/MI groups and estimate adjusted odds ratios and 95% CIs.

All multivariable logistic regression models included age, gender, race, ethnicity, OEF/OIF service, VA service-connected disability rating >50%, marital status, homelessness, suicide risk, CCI score, pain diagnosis, specific SUD diagnoses, specific mental health diagnoses, combined alcohol and drug use, year prior primary care, mental health, and emergency department visits, and year prior days inpatient. Logistic and negative binomial regressions were modeled with cluster robust estimates of variance were estimated to account for clustering/correlation between observations at the VA facility level. Because small differences can be statistically significant in large data sets, a p-value of <0.001 was the threshold for statistical significance in analyses.

Results

Patient Characteristics

We identified 470,548 VA patients eligible for this study: 31.7% (n=148,960) met criteria for the SUD-only group, 16.1% (n=75,913) met criteria for the SUD/SMI group, and 52.2% (n=245,675) met criteria for the SUD/MI group. Table 2 summarizes measured sociodemographic and clinical characteristics and year prior service utilization for the three patient groups. Most patients were male, 50 years or older, non-Hispanic, white, unmarried, had a documented alcohol use disorder, and had a pain diagnosis. Of note, over one-third of the SUD/SMI group was homeless, nearly one-half used both alcohol and drugs and had at least one ED visit in the year prior, and more than one-quarter was hospitalized in the year prior to the SUD index diagnosis.

Prevalence and Odds of High Inpatient Utilization

Overall, the mean number of inpatient days during the SUD follow-up year was 2.9 (SD=10.6), with 1.2 (5.8), 1.1 (7.3) and 0.7 (4.1) mean days in medicine, psychiatric and SUD-related services, respectively. The top 10% of VA patients with respect to inpatient utilization had 8 or more inpatient days, which was used as the cut-point to identify patients with HIU in the SUD follow-up year.

The prevalence of HIU among the SUD-only group was 6.2% (95% CI: 6.1%–6.3%) compared to 22.7% (95% CI: 22.4%–23.0%) among the SUD/SMI group, and 9.7% (95% CI: 9.6%–9.8%) among the SUD/MI group. Compared to VA patients with SUD-only, VA patients with SUD/SMI (OR = 4.44; 95% CI: 4.18 - 4.73) and SUD/MI (OR = 1.63; 95% CI: 1.54 - 1.72) had increased odds of HIU. Compared to the SUD/MI group, the SUD/SMI group had increased odds of HIU (OR = 2.73; 95% CI: 2.63 - 2.84).

Patterns of High Inpatient Utilization by Service Type

A total 50,212 VA patients were classified as high inpatient utilizers [SUD-only=9,211 (18.34%); SUD/SMI=17,200 (34.25%); SUD/MI=23,801(47.40%)]. Table 3 summarizes the number of days of specific inpatient service use during the SUD follow-up year among the three HIU groups. Overall, the primary type of inpatient service use varied by comorbidity with the SUD-only group primarily using medicine, SUD/SMI group primarily using psychiatric and the SUD/MI group using psychiatric, SUD-related, and medicine services to a similar degree.

Predictors of High Inpatient Utilization by Group

The results of the multivariable logistic regression models for each patient group are shown in Table 4. For all three groups, the following characteristics were associated with greater odds of HIU: older age, divorced/separated/never married (compared to married), homelessness, suicide risk, one or more medical comorbidities, pain diagnosis, alcohol use, opioid use and sedative use disorders, at least one year prior emergency department visit, and year prior inpatient service use. Having a primary care or mental health care visit in the year prior to the index SUD diagnosis appears protective for all groups, as evidenced by lower odds of HIU.

VA service connection disability rating >50% was associated with greater odds of HIU for the SUD-only and SUD/SMI groups. Stimulant use disorders, other substance use disorders, and depression were associated with greater odds of HIU for the SUD/SMI and SUD/MI groups. Racial differences also emerged for the SUD/SMI and SUD/MI groups, with black patients having lower odds of HIU than white patients. For the SUD/SMI group, OEF/OIF service and cannabis use disorders were associated with greater odds of HIU. Although associated with greater odds of HIU in the SUD/MI group, PTSD and anxiety were not associated with greater odds of HIU in the SUD/SMI group. For the SUD/MI group, patients with combined alcohol and drug use disorders had greater odds of HIU.

Discussion

This study takes an important first step in describing HIU among patients with SUD and mental health comorbidity. We identified differences in where care is received and examined predictors of HIU. Although the prevalence of HIU was markedly higher among the SUD/SMI group, with nearly 1 in 4 patients meeting HIU criteria in a one year period, the SUD/MI group, due to its larger size, represented the majority of the high inpatient utilizers with SUD. Further, type of inpatient service use varied by group, with the SUD-only group primarily utilizing medicine services, the SUD/SMI group primarily utilizing psychiatric services, and the SUD/MI group utilizing medicine, psychiatric and SUD-related inpatient services equally. Factors associated with HIU were similar across SUD comorbidity groups, with few characteristics uniquely predicting HIU in specific groups. Together, these findings suggest that different approaches to service development and implementation may be necessary to reduce HIU among those with SUD and mental health comorbidity.

Consistent with prior literature on utilization and costs associated with patients with SUD and mental health concerns [4,27,28,29,36], those with SUD and co-occurring SMI or other mental health conditions represented nearly 82% of HIU in our sample. Of note, the SUD/MI group, which is typically considered less functionally impaired than the SUD/SMI population, accounted for the largest proportion of HIU (47%). Thus, efforts to substantially reduce HIU among VA patients with SUD will require approaches to care that identify and treat the needs of patients with less severe mental health conditions. Furthermore, findings suggest that outreach efforts, coordination of services, and collaborations with VA specialty mental health and primary care clinics, where many patients with co-occurring SUD and other mental health conditions are treated, are necessary to ensure that patients with SUD at risk for HIU are linked to appropriate services.

Comprehensive care management programs are designed to provide proactive, inclusive, and collaborative care across multiple services to improve service quality and lower costs associated with unnecessary acute care. However, findings regarding the efficacy of care management models for patients with SUD are mixed [37,38,39], which may be related to the diverse needs of this chronic and complex population. Our finding that type of inpatient service use varied by SUD group provides greater clarity into where VA patients with SUD and co-occurring mental health conditions access acute care services and has implications for developing and locating care management approaches that are responsive to patient needs. Patients in the SUD/SMI group averaged over 16 times more psychiatric days

hospitalized than patients in the SUD-only group and over 2 times more than those in the SUD/MI group, underscoring a need for care management interventions that foster collaborations across acute emergency, outpatient psychiatric and SUD services and at least equal emphasis on the treatment of both mental health and substance use symptoms in traditional outpatient SUD specialty-care for this population in particular.

SUD-only patients' use of inpatient medicine services points to a need for enhanced coordination between outpatient medical and SUD services. This approach to care is consistent with a recent VA directive prompting the implementation of access to mental health services within primary care settings [40]. While integrated primary care and mental health services appear helpful for connecting patients presenting to primary care with mental health resources, this approach likely does not meet the clinical care needs of patients with chronic and severe conditions. Indeed, Trivedi and colleagues [41] found relatively little change in inpatient service use for veterans with SUD and SMI who received care in integrated primary care/ mental health settings compared to veterans with other mental health conditions that are more conducive to time-limited interventions (e.g., depression, anxiety). These findings suggest that integrating medical services within SUD specialty-care clinics and strengthening coordination between primary care and SUD specialty-care may be necessary to adequately serve the needs of this complex and chronic patient group.

This study expanded upon prior work by specifically identifying risks factors for HIU among patients with SUD and SMI or other mental health comorbidity. Several of the factors associated with increased odds of HIU in this study are similar to those previously reported in the mental health and substance use literatures, including older age, being unmarried or separated, homelessness, suicide risk, chronic medical illnesses, alcohol and opioid use disorders, emergency department visits and prior inpatient use [27,28,29,36,42,43]. Although not commonly reported in the substance use literature, our findings that indicate primary care and mental health care visits as protective factors for all groups are consistent with findings in the general medical literature [44], and support an underlying goal of care management approaches to promote coordination of services that address the spectrum of patients' needs [45].

Identified risk factors also point to key services such as acute crisis management, chronic pain services, chronic disease management, and homeless care services as well as evidenced-based behavioral and pharmacotherapy treatments for SUD that should be considered when designing a program to decrease HIU among those with SUD. As stimulant use disorders were associated with increased odds of HIU for the SUD/SMI and SUD/MI groups, evidence-based stimulant misuse interventions, such as contingency management, deserve specific consideration. In addition to being effective for reductions in cocaine, opiate, and polydrug use [46], contingency management has also demonstrated efficacy in enhancing treatment attendance [47].

This study had several limitations. First, we were unable to assess the association between the timing or progression of SUD and risk factors and the likelihood of HIU (i.e., which came first or which might cause or exacerbate the other). Second, although we attempted to capture all SUD-related inpatient care by using a combination of bed section and DRG

codes, it is possible that we underestimated SUD care received on medical and psychiatric inpatient units if multiple types of care were delivered. Third, there may be important characteristics that predict HIU among patients with SUD that were not available in VA administrative data (e.g., psychosocial stressors, barriers to treatment engagement). Similarly, the study did not have access to non-VA service utilization and, thus, we may have underestimated the prevalence of HIU in our sample. Fourth, this study relied on ICD-9-CM codes documented in the medical records to classify diagnostic groups. While this method of classification is subject to error and conditions may go undiagnosed, this is a widely-used approach to classifying VA administrative data and diagnoses are generally considered valid [48]. Finally, our findings may not generalize to veterans receiving healthcare from other systems or to non-veteran populations.

Of note, this study examined inpatient utilization for only one year. HIU observed here may be due to acute medical and/or mental health conditions (e.g., relapse after a period of sustained sobriety) or external factors such as unemployment or homelessness that, when addressed by traditional healthcare services, result in a return to less intense utilization patterns. It remains unknown if the VA patients identified in this sample are persistent or transient high utilizers. If transient, they may benefit from more traditional outpatient services whereas persistent high utilizers may benefit from more comprehensive care management programs [13]. Future studies could profitably explore whether observed patterns in HIU among VA patients with SUD and co-occurring mental illness are stable over time, providing greater specificity in the identification of patients who will most likely benefit from comprehensive care management programs aimed at improving care and reducing healthcare expenditures.

In sum, this study identified differences in prevalence rates of HIU and type of inpatient utilization among VA patients with SUD depending on the presence and severity of co-occurring mental health conditions. Taken together, these findings point to the importance of engaging patients with SUD and less severe mental health conditions in interventions designed to decrease HIU. Further, differences in utilization across inpatient service type provide insight into where to focus outreach attempts and cross-service collaborations (e.g., integration of medical providers in SUD care). Finally, patient characteristics among SUD patients associated with highest odds of HIU were generally consistent across groups and provide insights into key services to include in HIU interventions designed to treat patients with SUD and co-occurring mental health concerns (e.g., acute crisis management, chronic disease management and homeless care services).

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Table 1.

ICD-9 Codes by Diagnostic Group

Group	ICD-9 Code
Substance Use Disorders	Alcohol: 303.0x, 303.9x, 305.0x Stimulant: 304.2x, 304.4x, 305.6x, 305.7x Cannabis: 304.3x, 305.2x Opioid: 304.0x, 304.7x, 305.5x Sedative: 304.1x, 305.4x Other: 304.5x, 304.6x, 304.9x, 305.3x, 305.8x, 305.9x
Severe Mental Illness	Schizophrenia-spectrum disorders: 295.0X-295.4X, 295.6X-295.9X, 297.X-298.X Bipolar-spectrum disorders: 296.0X-296.1X, 296.4X-296.6X, 296.7, 296.8, 296.81, 296.89
Other Mental Illness	Depressive disorders: 296.2X-296.3X, 296.82, 300.4, 311 Anxiety disorders: 300.0X, 300.2X, 300.3 PTSD: 309.81 Eating disorders: 307.1, 307.5, 307.51, 307.59

Table 2.

National Sample Patient Characteristics by Diagnostic Group*

	SUD only (n=148,960)	SUD/SMI (n=75,913)	SUD/MI (n=245,675)
	n (%)	n (%)	n (%)
Age, M(SD)	57.6 (11.9)	51.5 (11.5)	52.2 (13.3)
Male	146,389 (98.3)	69,548 (91.6)	232,362 (94.6)
Race			
White	95,020 (63.8)	48,634 (64.1)	165,747 (67.5)
Black	39,130 (26.3)	20,659 (27.2)	55,621 (22.6)
Other	5,698 (3.8)	4,652 (6.1)	11,506 (4.7)
Missing/Not reported	9,112 (6.1)	1,968 (2.6)	12,801 (5.2)
Ethnicity			
Not Hispanic/Latino	127,552 (85.6)	67,399 (88.8)	214,337 (87.2)
Hispanic/Latino	8,445 (5.7)	5,364 (7.1)	18,053 (7.4)
Missing/Not reported	12,963 (8.7)	3,150 (4.2)	13,285 (5.4)
OEF/OIF Service	8,331 (5.6)	6,286 (8.3)	43,241 (17.6)
>50% VA Service Connection	13,782 (9.3)	24,439 (32.2)	78,594 (32.0)
Marital Status			
Married	53,375 (35.8)	18,872 (24.9)	94,009 (38.3)
Divorced/Separated	55,460 (37.2)	29,554 (38.9)	84,384 (34.4)
Never married/Single	39,063 (26.2)	27,139 (35.8)	65,645 (26.7)
Missing/Not reported	1,062 (0.7)	348 (0.5)	1,637 (0.7)
Homeless	19,476 (13.1)	25,691 (33.8)	48,830 (19.9)
Suicide Risk	233 (0.2)	7,614 (10.0)	10,102 (4.1)
Charlson Score			
0	76,855 (51.6)	38,069 (50.2)	133,998 (54.5)
1	55,628 (37.3)	29,776 (39.2)	87,380 (35.6)
2+	16,477 (11.1)	8,068 (10.6)	24,297 (9.9)
Pain Diagnosis	88,305 (59.3)	54,026 (71.2)	177,799 (72.4)
Substance Use Disorders			
Alcohol	120,802 (81.1)	57,379 (75.6)	196,057 (79.8)
Cannabis	15,762 (10.6)	23,278 (30.7)	50,314 (20.5)
Stimulant	19,932 (13.4)	26,633 (35.1)	46,264 (18.8)
Opioid	10,325 (6.9)	11,046 (14.6)	29,458 (12.0)
Sedative	742 (0.5)	3,567 (4.7)	6,818 (2.8)
Other	22,025 (14.8)	28,488 (37.5)	58,200 (23.7)

	SUD only (n=148,960)	SUD/SMI (n=75,913)	SUD/MI (n=245,675)
	n (%)	n (%)	n (%)
Alcohol + Drug Disorder	22,485 (15.1)	34,364 (45.3)	72,509 (29.5)
MI Diagnoses			
Depressive DO	0 (0.0)	15,245 (20.1)	185,651 (75.6)
PTSD	0 (0.0)	26,671 (35.1)	120,531 (49.1)
Anxiety DO	0 (0.0)	21,185 (27.9)	82,933 (33.8)
Bipolar DO	0 (0.0)	45,171 (59.5)	0 (0.0)
Psychotic DO	0 (0.0)	38,890 (51.2)	0 (0.0)
Eating DO	0 (0.0)	357 (0.5)	608 (0.3)
1 YP PC Visit	105,926 (71.1)	64,194 (84.6)	205,492 (83.6)
1 YP MH Visit	31,931 (21.4)	66,433 (87.5)	177,996 (72.5)
1 YP ED Visit	35,780 (24.0)	35,006 (46.1)	81,217 (33.1)
YP Days Inpatient			
None	137,998 (92.6)	54,488 (71.8)	211,493 (86.1)
1-7 Days	7,279 (4.9)	8,628 (11.4)	19,582 (8.0)
8+ Days	3,683 (2.5)	12,797 (16.9)	14,600 (5.9)

Note. SUD=substance use disorder, SMI=serious mental illness, MI=mental illness, M=mean, SD=standard deviation, OEF/OIF=Operation Enduring Freedom/ Operation Iraqi Freedom, DO=disorder, PTSD=Posttraumatic Stress Disorder, YP= year prior to SUD index diagnosis, PC=primary care, MH=mental health; ED=emergency department.

* Group differences were significant at the $p < 0.001$ level for all variables.

Table 3.Inpatient Utilization Among High Inpatient Utilizers by Diagnostic Group^{*}

	<u>SUD-only</u> (n=9,211)	<u>SUD/SMI</u> (n=17,200)		<u>SUD/MI</u> (n=23,801)		
	Mean (SD)	Mean (SD)	IRR (95% CI) ^a	Mean (SD)	IRR (95% CI) ^b	IRR (95% CI) ^c
Total Days Inpatient	19.8 (18.9)	27.8 (30.2)	1.41 (1.37 - 1.44)	21.3 (19.9)	1.08 (1.05 - 1.10)	1.31 (1.28 - 1.33)
Total Medicine Days	15.8 (18.2)	4.8 (12.2)	0.31 (0.29 - 0.32)	8.6 (15.7)	0.55 (0.53 - 0.57)	0.56 (0.53 - 0.58)
Total Psychiatric Days	1.1 (7.7)	17.5 (28.4)	16.62 (14.28 - 19.34)	6.4 (13.8)	6.08 (5.22 - 7.07)	2.74 (2.64 - 2.84)
Total SUD-Related Days	3.0 (7.7)	5.5 (12.2)	1.87 (1.75 - 1.99)	6.3 (11.6)	2.13 (2.01 - 2.25)	0.88 (0.84 - 0.91)

Note. SUD=substance use disorders, SMI=serious mental illness, MI=mental illness, SD=standard deviation, IRR= unadjusted incidence rate ratio, CI=confidence interval,

^aSUD/SMI compared with SUD-only,

^bSUD/MI compared with SUD-only,

^cSUD/SMI compared with SUD/MI.

^{*} All group comparisons were significant at the $p < 0.001$ level.

Table 4.

Characteristics Associated with High Inpatient Utilization by Diagnostic Group

	SUD Only (n=148,960) AOR (95% CI)	SUD/SMI (n=75,913) AOR (95% CI)	SUD/MI (n=245,675) AOR (95% CI)
Age	1.01 (1.01 - 1.02) *	1.01 (1.00 - 1.01) *	1.01 (1.01 - 1.01) *
Male	1.37 (1.13 - 1.67)	1.09 (1.01 - 1.19)	1.13 (1.04 - 1.23)
Race			
White			
Black	1.02 (0.94 - 1.12)	0.88 (0.82 - 0.95) *	0.83 (0.77 - 0.90) *
Other	1.19 (1.05 - 1.34)	1.04 (0.95 - 1.14)	0.98 (0.89 - 1.07)
Missing/Not reported	0.78 (0.67 - 0.91)	0.78 (0.68 - 0.90) *	0.67 (0.60 - 0.74) *
Ethnicity			
Not Hispanic/Latino			
Hispanic/Latino	1.05 (0.87 - 1.27)	0.93 (0.84 - 1.04)	0.90 (0.77 - 1.06)
Missing/Not reported	0.72 (0.62 - 0.82) *	0.84 (0.76 - 0.93) *	0.84 (0.76 - 0.92) *
OEF/OIF Service	0.76 (0.62 - 0.94)	1.27 (1.16 - 1.39) *	1.01 (0.95 - 1.08)
>50% VA Service Connection	1.18 (1.10 - 1.27) *	1.23 (1.18 - 1.29) *	1.05 (1.01 - 1.09)
Marital Status			
Married			
Divorced/Separated	1.27 (1.21 - 1.34) *	1.14 (1.09 - 1.20) *	1.19 (1.15 - 1.23) *
Never married/Single	1.33 (1.25 - 1.42) *	1.21 (1.14 - 1.27) *	1.18 (1.13 - 1.24) *
Missing/Not reported	1.35 (1.03 - 1.78)	1.00 (0.70 - 1.44)	1.02 (0.82 - 1.28)
Homeless	1.57 (1.41 - 1.74) *	1.50 (1.42 - 1.58) *	1.73 (1.66 - 1.81) *
Suicide Risk	3.21 (2.09 - 4.93) *	2.20 (2.04 - 2.36) *	2.85 (2.63 - 3.08) *
Charlson Score			
0			
1	3.16 (2.99 - 3.33) *	1.56 (1.49 - 1.64) *	1.90 (1.83 - 1.97) *
2+	2.93 (2.71 - 3.18) *	1.58 (1.49 - 1.68) *	1.76 (1.67 - 1.85) *
Pain Diagnosis	1.29 (1.23 - 1.37) *	1.16 (1.10 - 1.22) *	1.28 (1.23 - 1.32) *
Substance Use Disorders			
Alcohol	1.39 (1.27 - 1.52) *	1.16 (1.08 - 1.24) *	1.20 (1.14 - 1.27) *
Cannabis	0.89 (0.81 - 0.98)	1.15 (1.09 - 1.22) *	1.02 (0.96 - 1.08)
Stimulant	1.11 (1.02 - 1.21)	1.17 (1.11 - 1.23) *	1.18 (1.11 - 1.25) *

	SUD Only (n=148,960)	SUD/SMI (n=75,913)	SUD/MI (n=245,675)
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Opioid	1.43 (1.30 - 1.57) *	1.22 (1.14 - 1.31) *	1.49 (1.42 - 1.57) *
Sedative	2.02 (1.44 - 2.84) *	1.39 (1.27 - 1.53) *	1.53 (1.40 - 1.67) *
Other	1.05 (0.98 - 1.14)	1.12 (1.05 - 1.19) *	1.27 (1.20 - 1.35) *
Alcohol + Drug Disorder	1.07 (0.97 - 1.19)	1.10 (1.03 - 1.17)	1.19 (1.13 - 1.26) *
Mental Health Disorders			
Depression		1.28 (1.18 - 1.38) *	1.48 (1.40 - 1.57) *
PTSD		1.03 (0.98 - 1.08)	1.09 (1.04 - 1.14) *
Anxiety		1.08 (1.03 - 1.14)	1.09 (1.05 - 1.14) *
Eating		1.19 (0.89 - 1.59)	1.27 (0.96 - 1.66)
Bipolar		1.88 (1.72 - 2.06) *	
Psychotic		2.40 (2.23 - 2.57) *	
1 YP PC Visit	0.65 (0.61 - 0.70) *	0.56 (0.53 - 0.59) *	0.59 (0.56 - 0.63) *
1 YP MH Visit	0.74 (0.68 - 0.80) *	0.53 (0.50 - 0.56) *	0.59 (0.56 - 0.61) *
1 YP ER Visit	1.93 (1.79 - 2.07) *	1.44 (1.33 - 1.56) *	1.60 (1.49 - 1.72) *
YP Days Inpatient			
0			
1-7 Days	2.03 (1.86 - 2.22) *	1.35 (1.25 - 1.44) *	1.74 (1.64 - 1.85) *
8+ Days	4.07 (3.71 - 4.47) *	2.46 (2.26 - 2.67) *	3.48 (3.22 - 3.76) *

Note. SUD=substance use disorders, SMI=serious mental illness, MI=mental illness, AOR=adjusted odds ratio, CI=confidence interval, OEF/OIF=Operation Enduring Freedom/Operation Iraqi Freedom, YP=year prior to SUD index diagnosis, PC=primary care, MH=mental health, ED=emergency department,

* p<.001. Group sample sizes decreased in adjusted logistic regression analyses compared to initial group sample sizes reported in Table 1 due to patients missing one or more covariates.