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Hospitalization Outcomes of People Who Use Drugs: One Size Does Not Fit All

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1. Introduction

The US Centers for Disease Control and Prevention (CDC) estimates that 2.0 million people in the U.S., have an opioid use disorder (OUD) although the true prevalence is likely higher (Barocas et al., 2018; SAMHSA, 2019). Hospitalization rates of people with OUD are surging, resulting in increasing healthcare costs (Reinhart et al., 2018; Tookes, Diaz, Li, Khalid, & Doblecki-Lewis, 2015; Wurcel et al., 2016). People with OUD have worse hospital outcomes compared to those without OUD, including increased length of stay, 30-day readmission rates, infection-related morbidity and mortality (Nordeck et al., 2018; Oh et al., 2018; Tookes et al., 2015). People with OUD also have high rates of being discharged from the hospital against medical advice (AMA), a hospital outcome associated with increased risk of readmission and increased mortality (Choi, Kim, Qian, & Palepu, 2011; Glasgow, Vaughn-Sarrazin, & Kaboli, 2010; Oh et al., 2018; Lianping Ti & Ti, 2015).

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Author Statement

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More than 90% of people who use heroin report using other substances, including stimulants (methamphetamine or cocaine), alcohol, or sedatives (John et al., 2018). Use of other types of substances in addition to opioids is associated with worse OUD treatment outcomes and increased risk of fatal opioid overdose (Gladden, O'Donnell, Mattson, & Seth, 2019; Kandel, Hu, Griesler, & Wall, 2017; Perez de los Cobos, Trujols, Ribalta, & Casas, 1997). Despite this, little is known about the differences in hospital outcomes between people with OUD alone and people who have OUD in addition to another substance use disorder (SUD). This study aims to compare the hospitalization outcomes of people with OUD alone versus people with OUD as well as additional SUD(s). The primary outcomes of interest are (1) AMA discharge and (2) 30-day hospital readmission.

2. Materials and Methods

This study was granted exemption by the Tufts Medical Center Health and Sciences Investigational Review Board.

2.1. Data Source

We analyzed data from the Nationwide Readmissions Database (NRD) from 2013, which is the largest U.S. readmissions database and is maintained by the Healthcare Cost and Utilization Project (HCUP) and sponsored by the Agency for Healthcare Research and Quality (AHRQ) (National Readmission Database, 2013). The NRD is constructed from state inpatient databases of participating sites and contains discharge records from inpatients treated at U.S. academic medical centers and community hospitals (excluding federal hospitals, rehabilitation facilities, and long-term acute care facilities). Emergency department visits are not included in the database nor are observation admissions. Approximately 85% of State Inpatient Databases (SID) from the 21 participating HCUP Partner organizations contribute to the NRD. The NRD contains over 14 million unweighted discharges and represents about 50% of the U.S. population.

2.2. Study Population

Consistent with previous work on hospital utilization by people with OUD (Oh et al., 2018; Wurcel et al., 2016), our study population was men and women aged 18-65 admitted to the hospital who had at least one International Classification of Diseases, Ninth Revision (ICD-9) code (Table 1) indicative of opioid misuse or use disorder, including codes for opioid-type dependence, opioid abuse and opioid-related poisonings. We excluded people who died during hospital admission (1%). Because hospitalizations for childbirth could be different than hospitalizations for acute illness, we excluded any woman hospitalized for a delivery admission (2.4%). Hospitalizations related to childbirth were defined based on any presence of an ICD-9 code for normal deliveries, mechanical deliveries, and complications with deliveries, consistent with previous literature(Tyler, 2016). National estimates were produced using sampling weighting, clustering, and stratum per HCUP guidelines.

2.2.1 Variables: The independent variable of interest is the presence of non-opioid substance use disorders. Non-opioid SUDs were identified through ICD-9 codes for alcohol use, cocaine, amphetamines (including methamphetamines) and sedative use. Cocaine and

amphetamines were analyzed together and collectively referred to as “stimulants.” We analyzed data on the presence of clinical syndromes, including bacterial and fungal infections (endocarditis, sepsis, bacteremia, osteomyelitis, skin and soft tissue infections), psychiatric diagnoses (anxiety disorders, dissociative and somatoform disorders, personality disorders, schizophrenia-spectrum disorders, mood disorders, and other non-organic psychoses) and overdose (Table 1). As the order of the ICD-9 diagnostic codes listed in the NRD does not reflect the relative severity of the issues, the clinical syndromes could be present in the “primary” diagnosis location or “other” diagnosis location. The Elixhauser comorbidity index—a method of categorizing comorbidities based on International Classification of Diseases codes—was used to identify renal, cardiac, depression, liver and HIV/AIDS co-morbidities (Elixhauser, Steiner, Harris, & Coffey, 1998). The index was adjusted by removing the Elixhauser defined drug use group to avoid co-linearity.

2.2.2 Outcomes: Primary outcomes included (1) hospitalization that ended with discharge against medical advice (AMA) and/or (2) readmission within 30-days. “AMA discharge” was one of the options in the category of “Hospital Disposition” in the database. The 30-day readmissions variable was created using the HCUP nationwide readmissions database syntax.

2.3 Statistical Analysis

Admissions were weighted for national estimates of patient-level data using NRD guidelines. Stratum and clusters were also accounted for per HCUP guidelines. Continuous variables were presented as medians [IQR] and categorical variables were presented as frequencies and percentages. We constructed multivariable logistic regression models for the primary outcomes: AMA discharges and 30-day readmission. We included drug use patterns, age, sex, infection, overdose, psychiatric diagnosis, insurance type and location of hospital. Consistent with other HCUP analyses related to SUD, we dichotomized the location of the hospital into urban (areas and towns with >50,000 residents) and rural (counties with no town greater than 50,000 residents) (Owens, Fingar, McDermott, Muhuri, & Heslin, 2019). The NRD collects up to twenty-five diagnoses. Research with overdose-related billing codes has shown that the use of OUD in any diagnosis, rather than just in primary diagnosis, provides an analysis with greater sensitivity, without a loss of specificity (Slavova, Bunn, & Talbert, 2014; Unick & Ciccarone, 2017). In the analyses of drug use patterns, the reference group was OUD alone, and patterns of multiple SUDs were coded as subgroups. We constructed multivariable logistic regression models for the primary outcomes: AMA discharges and 30-day readmission. An individual may have contributed multiple encounters and had multiple instances of a particular outcome (e.g., multiple AMA discharges). The outcomes for each model were dichotomized such that either they experienced the outcome (regardless of frequency) or they did not. We chose this regression approach over a generalized estimating equation approach since our analysis focused on patient-level factors associated with the primary outcomes rather than the effect of patterns of healthcare utilization (e.g., multiple admissions) on the primary outcomes. Significance was determined as having a P-value of less than 0.05. We performed data analysis using SAS 9.4.

3. Results

Our dataset includes 405,566 weighted (182,067 unweighted) hospitalized people with OUD (Table 2). The median age of patients was 40 years old, 48% percent were women, and the vast majority of hospitals (98%) were in urban locations. Thirty-five percent of people were insured through Medicaid, 21% through Private insurance, 20% through Medicare, and the remaining 23% used self-pay, no charge, or other insurance. About one-fourth (22%) had a bacterial/fungal infection, two-thirds (62%) of people had a psychiatric diagnosis, and 15% had opioid overdose linked to the admission.

Approximately one-third of people had OUD in addition to another SUD, and the most common co-occurring SUD was stimulant use disorder (11%) followed by alcohol use disorder (8%) and sedative use disorder (7%). Twelve percent of people had at least one hospitalization stay linked with a 30-day readmission, and 13% percent of people had a hospital admission that ended with AMA discharge.

3.1 Results from multivariable logistic regression

The presence of any additional SUD led to increased risk of AMA discharge and 30-day discharge. People with multiple concurrent SUDs (opioids, stimulants, alcohol, and sedatives) were at the highest risk for both AMA discharge (aOR 3.84, CI 3.34, 4.40) and 30-day readmission (aOR 4.00, CI 3.55, 4.52) compared to people with OUD alone. People with stimulant use disorder in addition to OUD were 83% more likely to leave AMA and 30% more likely to be readmitted within 30 days compared to people with OUD alone (Table 3).

Other covariates associated with increased risk of AMA discharge included younger age, (aOR 0.99, CI 0.98, 0.99), urban hospital (aOR 1.42, CI 1.14, 1.77), and an infection diagnosis (aOR 1.77, CI 1.66, 1.89). Compared to those with private insurance, people with Medicaid, Medicare, self-pay, and no-charge had increased odds of being discharged AMA (aOR 1.73, CI 1.56, 1.92; aOR 1.51, CI 1.38, 1.66; aOR1.57, CI 1.38, 1.80; aOR 1.32; CI 1.09, 1.58), respectively. Female sex (aOR 0.69,CI 0.66, 0.73) and having one or more comorbidities in addition to SUD, per Elixhauser Comorbidity Index was associated with decreased odds of leaving AMA (aOR 0.96, CI 0.94, 0.98).

Infection (aOR 2.40, CI 2.32, 2.48), increased age (aOR 1.01, CI 1.01, 1.012), urban location (aOR 1.16, CI 1.01, 1.34), psychiatric diagnoses (aOR 2.21, CI 2.12, 2.31) and having 1 or more comorbidities in addition to SUD (aOR 1.07, CI 1.06, 1.09) were associated with increased odds of 30-day readmission. Female sex was also associated with decreased odds of a 30-day readmission (aOR 0.95, CI 0.92, 0.98).

4. Discussion

Our analysis demonstrates high frequency of suboptimal hospitalization outcomes in people with OUD. Moreover, the presence of additional SUDs in people with OUD was associated with increased 30-day readmission and AMA discharge, with a layered effect of worse outcomes as the number of co-occurring substance use disorders increased. This is an

increasingly salient issue as the epidemic of drug use in the U.S, OUD commonly co-occurs with SUDs. For example, only 17% of toxicology results from opioid-related deaths in Massachusetts between 2014-2015 showed opioids alone (Barocas et al., 2019; Gladden et al., 2019). Nationally, in the first half of 2018, 62.6% of opioid overdose deaths showed co-use of at least one non-opioid drug (Gladden et al., 2019). Greater awareness of the changing epidemiology is needed in the hospitalsetting.

There are a multitude of reasons why individuals with OUD may be discharged AMA (L. Ti et al., 2015). Commonly, however, it is the result of inadequate management of pain and withdrawal symptoms can be a driving factor for AMA discharges in people who use opioids (McNeil R 2014; Simon, Snow, & Wakeman, 2019; Summers, Hellman, MacLean, Rees, & Wilkes, 2018). This is unnecessary since opioid cravings, withdrawal and use disorder can be managed with opioid agonist treatment (e.g. methadone and buprenorphine), resulting in decreased AMA discharges and mortality (Chan et al., 2004; Pytell & Rastegar, 2018; Rodger et al., 2018). Similarly, symptoms of stimulant withdrawal and dependence can cause significant discomfort leading people to leave AMA (Lee, Jenner, Harney, & Cameron, 2018). One explanation for increased risk of AMA discharge in patients with OUD and additional SUD is suboptimal management of withdrawal or cravings from substances other than opioids.

In light of increasing cocaine and methamphetamine use nationwide, there is a need for increased education of clinicians to ask about and address all substance use—not just opioids. Patients with SUD can have heterogeneous drug use patterns, and each of the use disorders needs explicit attention. Our data provide additional support for the importance of consulting addiction specialists, as patients who use multiple drugs may have concurrent pathophysiologic pathways of addiction and overlapping withdrawal syndromes. Inpatient addiction medicine and addiction psychiatry consultation services improve hospitalization outcomes for people who use opioids and to facilitate linkage to SUD treatment in the community (Chan et al., 2004; Marks et al., 2018; Trowbridge et al., 2017).

Notably, we found a lower frequency (13%) of AMA discharge than previous studies which ranged from 25% to 57% (Chan et al., 2004; Choi et al., 2011; Stranges, Wier, Merrill, & Steiner, 2009; Lianping Ti & Ti, 2015). These studies, however, were published prior to the widespread implementation of contemporary opioid treatment strategies, such as the use of buprenorphine and methadone for withdrawal management in the inpatient medical setting. As in previous studies, female sex and older age were associated with decreased odds of leaving AMA (Alfandre, 2009; Schlauch, Reich, & Kelly, 1979; Stranges et al., 2009; Weingart, Davis, & Phillips, 1998). The relationship between sex, substance use, and AMA discharges is complicated and poorly understood, and there is a vast literature exploring the impact of sex on both substance use and treatment engagement (Bartley & Fillingim, 2013; Kent, Patel, & Varela, 2012; McHugh, Votaw, Sugarman, & Greenfield, 2018; Weinstein et al., 2017). Recent literature, including a recent Cochrane review, has not demonstrated a difference in withdrawal management by sex, making this an unlikely explanation of our findings (Gowing, Ali, White, & Mbewe, 2017; Janakiram et al., 2018; McHugh et al., 2018; Rosenbloom et al., 2018). Increased risk of AMA discharge with younger age is likely related to psychosocial factors that are not currently fully understood. For example, younger

patients have been noted to be more impulsive, which could lead to deciding to leave AMA (Argyriou, Um, Carron, & Cyders, 2018).

We did not find any statistically-significant association between psychiatric illness and risk of AMA discharge. There are several studies showing increased AMA discharge rates in the patients with psychiatric illness; however, these studies do not adjust for the presence of SUD (Tawk R, 2013; Weingart et al., 1998). A 2013 study found that while psychiatric disorders increased the risk of AMA discharges, when patients with SUDs were removed from the analysis, patients with psychiatric disorders were less likely to leave AMA compared to those without psychiatric disorders (Tawk R, 2013). This suggests that substance use could possibly potentiate or confound the relationship between psychiatric illness and AMA discharges, which could explain our findings. Notably, our dataset does not include information regarding capacity to leave AMA and involuntary hospitalization status; factors that disproportionately affect patients with psychiatric diagnoses and preclude the possibility of AMA discharge.

A person with psychiatric illness in addition to OUD was more than twice as likely to be readmitted within 30-days, a finding consistent with previous research studies. (Dickens, Weitzel, & Brown, 2016; Germack, Caron, Solomon, & Hanrahan, 2018). Despite advances in addiction-related care, it can often be difficult to find a safe disposition for patients with overlapping SUDs and psychiatric illness. There are still significant barriers, remnants of a “systematic stigmatization of addiction”, that prevent post-acute care SUD treatment, and that negatively impact patients following hospitalization (Wakeman & Rich, 2017). One study in Boston found that 27% of homeless people were readmitted within 30 days, and in this population 50% had psychiatric illness and SUD (Racine, Munson, Gaeta, & Baggett, 2019). The authors or this study suggest investment in medical respite programs, and cite data from another Boston-based study that showed a 50% reduction in re-admission if people who were homeless were discharged to a respite home, compared to their “own care” (Kertesz et al., 2009).

Our results should be viewed in light of previous attempts by the medical community to understand and classify people who use more than one type of drug. In the DSM-IV, the diagnosis of “polysubstance dependence” was suggested in two clinical scenarios: (1) when the specific substance cannot be identified or (2) where the dependence involves so many substances that the clinician prefers to indicate a combination of substances rather than list each specific substance (Connor, Gullo, White, & Kelly, 2014; Schuckit et al., 2001). However, the term was frequently misunderstood and lacked specificity, so it was removed from the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (Hasin et al., 2013). Our findings suggest that the term “polysubstance” is flawed in its ability to capture the heterogeneity of different patterns of concurrent SUDs.

There were a number of limitations to our study. Our study uses an administrative database, which relies on physician documentation and coding to determine the presence of substance use disorders. As physicians may not inquire about or code for all SUDs, we may be underestimating the true prevalence of people with multiple SUDs. Furthermore, the method of drug use (e.g. intravenous, inhalation, intranasal) is not captured by the diagnostic codes

utilized. Injection-related practices are linked to infections more than inhalation or intranasal practices. We could not measure the temporality between AMA discharge and 30-day readmissions; therefore, we are unable to compare characteristics of index admissions and readmissions, or establish the rate of readmissions following prior AMA discharges. Neither race nor ethnicity was available in the database, limiting our ability to identify the relationship between race and ethnicity and the outcomes of interest (Barocas et al., 2019). Additional social determinants of health, such as homelessness, are also not captured in the NRD, but invariably associated with discharge disposition and readmission risk. Only 2% of hospitals were rural, compared to 12% in other datasets with similar definitions of rural (Hall & Owings, 2014), so rural hospitals are likely underrepresented in this dataset. Additionally, for our analyses, we combined cocaine and amphetamine-type drugs together in one category as “stimulants,” which may fail to capture important differences between people that use these two types of drugs.

Finally, only 35% of admissions of people with OUD had a co-occurring SUD, which is lower than suggested by toxicology reports of overdoses (Barocas et al., 2019) and surveys with people who use drugs(John et al., 2018). Our study examines only the 2013 database, and therefore fails to capture the impact of changes in patterns of SUDs which are occurring across the country over time, including increasing methamphetamine use in people with OUD and the transition of the illicit opioid supply from heroin to fentanyl and fentanyl analogues (Ellis, Kasper, & Cicero, 2018; Jones, Underwood, & Compton, 2019; Pardo, 2019; Strickland, Havens, & Stoops, 2019). We hope the results of this study prompt further investigation into hospitalization outcomes in relationship to substance use patterns.

4.1 Conclusions

Our study is among the first to show the layered negative impact of additional SUDs on the hospital outcomes of people with OUD. Development of sustainable interventions aimed at improving hospitalization outcomes for people with SUDs must take into consideration the heterogeneity of drug use patterns.

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References

Alfandre DJ (2009). "I'm going home": discharges against medical advice. Mayo Clinic Proceedings, 84(3), 255–260. doi:10.1016/s0025-6196(11)61143-9 [PubMed: 19252113]

Argyriou E, Um M, Carron C, & Cyders MA (2018). Age and impulsive behavior in drug addiction: A review of past research and future directions. Pharmacology, Biochemistry and Behavior, 164, 106–117. doi:10.1016/j.pbb.2017.07.013

Barocas JA, Wang J, Marshall BDL, LaRochelle MR, Bettano A, Bernson D, Walley AY (2019). Sociodemographic factors and social determinants associated with toxicology confirmed polysubstance opioid-related deaths. Drug and Alcohol Dependence, 200, 59–63. doi:10.1016/j.drugalcdep.2019.03.014 [PubMed: 31100636]

Barocas JA, White LF, Wang J, Walley AY, LaRochelle MR, Bernson D, … B. P. Linas (2018). Estimated Prevalence of Opioid Use Disorder in Massachusetts, 2011-2015: A Capture-Recapture

Analysis. American Journal of Public Health, 108(12), 1675–1681. doi:10.2105/ajph.2018.304673 [PubMed: 30359112]

Bartley EJ, & Fillingim RB (2013). Sex differences in pain: a brief review of clinical and experimental findings. British Journal of Anaesthesia, 111(1), 52–58. doi:10.1093/bja/aet127 [PubMed: 23794645]

Chan ACH, Palepu A, Guh DP, Sun H, Schechter MT, O'Shaughnessy MV, & Anis AH (2004). HIV-positive injection drug users who leave the hospital against medical advice: the mitigating role of methadone and social support. Journal of Acquired Immune Deficiency Syndromes, 35(1), 56–59. [PubMed: 14707793]

Choi M, Kim H, Qian H, & Palepu A (2011). Readmission rates of patients discharged against medical advice: a matched cohort study. PloS One, 6(9), e24459. doi:10.1371/journal.pone.0024459 [PubMed: 21931723]

Connor JP, Gullo MJ, White A, & Kelly AB (2014). Polysubstance use: diagnostic challenges, patterns of use and health. Curr Opin Psychiatry, 27(4), 269–275. doi:10.1097/yco.0000000000000069 [PubMed: 24852056]

Dickens C, Weitzel D, & Brown S (2016). Mr. G And The Revolving Door: Breaking The Readmission Cycle At A Safety-Net Hospital. Health Affairs, 35(3), 540–543. doi:10.1377/hlthaff.2015.0967 [PubMed: 26953309]

Elixhauser A, Steiner C, Harris DR, & Coffey RM (1998). Comorbidity measures for use with administrative data. Medical Care, 36(1), 8–27. [PubMed: 9431328]

Ellis MS, Kasper ZA, & Cicero TJ (2018). Twin epidemics: The surging rise of methamphetamine use in chronic opioid users. Drug and Alcohol Dependence, 193, 14–20. doi:10.1016/j.drugalcdep.2018.08.029 [PubMed: 30326396]

Germack HD, Caron A, Solomon R, & Hanrahan NP (2018). Medical-surgical readmissions in patients with co-occurring serious mental illness: A systematic review and meta-analysis. General Hospital Psychiatry, 55, 65–71. doi:10.1016/j.genhosppsych.2018.09.005 [PubMed: 30414592]

Gladden RM, O'Donnell J, Mattson CL, & Seth P (2019). Changes in Opioid-Involved Overdose Deaths by Opioid Type and Presence of Benzodiazepines, Cocaine, and Methamphetamine - 25 States, July-December 2017 to January-June 2018. MMWR: Morbidity and Mortality Weekly Report, 68(34), 737–744. doi:10.15585/mmwr.mm6834a2

Glasgow JM, Vaughn-Sarrazin M, & Kaboli PJ (2010). Leaving against medical advice (AMA): risk of 30-day mortality and hospital readmission. Journal of General Internal Medicine, 25(9), 926–929. doi:10.1007/s11606-010-1371-4 [PubMed: 20425146]

Gowing L, Ali R, White JM, & Mbewe D (2017). Buprenorphine for managing opioid withdrawal. Cochrane Database Syst Rev, 2, Cd002025. doi:10.1002/14651858.CD002025.pub5 [PubMed: 28220474]

Hasin DS, O'Brien CP, Auriacombe M, Borges G, Bucholz K, Budney A, … Grant BF (2013). DSM-5 Criteria for Substance Use Disorders: Recommendations and Rationale. The American journal of psychiatry, 170(8), 834–851. doi:10.1176/appi.ajp.2013.12060782 [PubMed: 23903334]

Janakiram C, Chalmers NI, Fontelo P, Huser V, Lopez Mitnik G, Iafolla TJ, … Dye BA (2018). Sex and race or ethnicity disparities in opioid prescriptions for dental diagnoses among patients receiving Medicaid. Journal of the American Dental Association, 149(4), 246–255. doi:10.1016/j.adaj.2018.02.010 [PubMed: 29599018]

John WS ZH, Mannelli P, Schwartz RP, Subramaniam GA, Wu LT (2018). Prevalence, patterns, and correlates of multiple substance use disorders among adult primary care patients. - PubMed - NCBI. Drug and Alcohol Dependence(181), 79–87. doi:doi: 10.1016/j.drugalcdep.2018.01.035

Jones CM, Underwood N, & Compton W (2019). Increases in Methamphetamine Use among Heroin Treatment Admissions in the United States, 2008-2017. Addiction. doi:10.1111/add.14812

Kandel DB, Hu M-C, Griesler P, & Wall M (2017). Increases from 2002 to 2015 in prescription opioid overdose deaths in combination with other substances. Drug and Alcohol Dependence, 178, 501–511. doi:10.1016/j.drugalcdep.2017.05.047 [PubMed: 28719884]

Kent JA, Patel V, & Varela NA (2012). Gender disparities in health care. Mount Sinai Journal of Medicine, 79(5), 555–559. doi:10.1002/msj.21336 [PubMed: 22976361]

Kertesz SG, Posner MA, O'Connell JJ, Swain S, Mullins AN, Shwartz M, & Ash AS (2009). Post-hospital medical respite care and hospital readmission of homeless persons. J Prev Interv Community, 37(2), 129–142. doi:10.1080/10852350902735734 [PubMed: 19363773]

Lee NK, Jenner L, Harney A, & Cameron J (2018). Pharmacotherapy for amphetamine dependence: A systematic review. Drug and Alcohol Dependence, 191, 309–337. doi:10.1016/j.drugalcdep.2018.06.038 [PubMed: 30173086]

Marks LR, Munigala S, Warren DK, Liang SY, Schwarz ES, & Durkin MJ (2018). Addiction medicine consultations reduce readmission rates for patients with serious infections from opioid use disorder. Clinical Infectious Diseases, ciy924–ciy924. doi:10.1093/cid/ciy924

McHugh RK, Votaw VR, Sugarman DE, & Greenfield SF (2018). Sex and gender differences in substance use disorders. Clinical Psychology Review, 66, 12–23. doi:10.1016/j.cpr.2017.10.012 [PubMed: 29174306]

McNeil R SW, Wood E, Kerr T (2014). Hospitals as a 'risk environment': an ethno-epidemiological study of voluntary and involuntary discharge from hospital against medical advice among… - PubMed - NCBI. Social Science Medicine, 105, 59–66. [PubMed: 24508718]

National Readmission Database. (2013). Retrieved from: http://www.hcup-us.ahrq.gov/nisoverview.jsp

Nordeck CD, Welsh C, Schwartz RP, Mitchell SG, Cohen A, O'Grady KE, & Gryczynski J (2018). Rehospitalization and substance use disorder (SUD) treatment entry among patients seen by a hospital SUD consultation-liaison service. Drug and Alcohol Dependence, 186, 23–28. doi:10.1016/j.drugalcdep.2017.12.043 [PubMed: 29529456]

Oh DHW, Wurcel AG, Tybor DJ, Burke D, Menendez ME, & Salzler MJ (2018). Increased Mortality and Reoperation Rates After Treatment for Septic Arthritis of the Knee in People Who Inject Drugs: Nationwide Inpatient Sample, 2000-2013. Clinical Orthopaedics and Related Research, 476(8), 1557–1565. doi:10.1097/01.blo.0000534682.68856.d8 [PubMed: 29762153]

Owens PL, Fingar KR, McDermott KW, Muhuri PK, & Heslin KC (2019). Inpatient Stays Involving Mental and Substance Use Disorders, 2016: Statistical Brief #249 Healthcare Cost and Utilization Project (HCUP) Statistical Briefs. Rockville (MD): Agency for Healthcare Research and Quality (US).

Pardo B, Taylor J, Caulkins JP, Kilmer B, Reuter P, and Stein BD (2019). The Future of Fentanyl and Other Synthetic Opioids. Retrieved from Santa Monica, Calif: https://www.rand.org/pubs/research_reports/RR3117.html

Perez de los Cobos J, Trujols J, Ribalta E, & Casas M (1997). Cocaine use immediately prior to entry in an inpatient heroin detoxification unit as a predictor of discharges against medical advice. American Journal of Drug and Alcohol Abuse, 23(2), 267–279. [PubMed: 9143638]

Pytell JD, & Rastegar DA (2018). Who Leaves Early? Factors Associated With Against Medical Advice Discharge During Alcohol Withdrawal Treatment. Journal of Addiction Medicine. doi:10.1097/adm.0000000000000430

Racine MW, Munson D, Gaeta JM, & Baggett TP (2019). 30-Day Hospital Readmission Among Homeless Individuals With Medicaid in Massachusetts. Medical Care. doi:10.1097/mlr.0000000000001234

Reinhart M, Scarpati LM, Kirson NY, Patton C, Shak N, & Erensen JG (2018). The Economic Burden of Abuse of Prescription Opioids: A Systematic Literature Review from 2012 to 2017. Appl Health Econ Health Policy, 16(5), 609–632. doi:10.1007/s40258-018-0402-x [PubMed: 30027533]

Rodger L, Glockler-Lauf SD, Shojaei E, Sherazi A, Hallam B, Koivu S, … Silverman M (2018). Clinical Characteristics and Factors Associated With Mortality in First-Episode Infective Endocarditis Among Persons Who Inject DrugsMortality in First-Episode Infective Endocarditis Among Persons Who Inject DrugsMortality in First-Episode Infective Endocarditis Among Persons Who Inject Drugs. JAMA Network Open, 1(7), e185220–e185220. doi:10.1001/jamanetworkopen.2018.5220 [PubMed: 30646383]

Rosenbloom JM, Burns SM, Kim E, August DA, Ortiz VE, & Houle TT (2018). Race/Ethnicity and Sex Both Affect Opioid Administration in the Emergency Room. Anesthesia and Analgesia. doi:10.1213/ane.0000000000003517

SAMHSA. (2019). Key substance use and mental health indicators in the United States: Results from the 2018 National Survey on Drug Use and Health. Retrieved from Center for Behavioral Health Statistics and Quality: https://www.samhsa.gov/data/

Schlauch RW, Reich P, & Kelly MJ (1979). Leaving the hospital against medical advice. New England Journal of Medicine, 300(1), 22–24. doi:10.1056/nejm197901043000106 [PubMed: 758156]

Schuckit MA, Danko GP, Raimo EB, Smith TL, Eng MY, Carpenter KK, & Hesselbrock VM (2001). A preliminary evaluation of the potential usefulness of the diagnoses of polysubstance dependence. Journal of Studies on Alcohol, 62(1), 54–61. [PubMed: 11271965]

Simon R, Snow R, & Wakeman S (2019). Understanding why patients with substance use disorders leave the hospital against medical advice: A qualitative study. Substance Abuse, 1–7. doi:10.1080/08897077.2019.1671942

Slavova S, Bunn TL, & Talbert J (2014). Drug overdose surveillance using hospital discharge data. Public Health Reports, 129(5), 437–445. doi:10.1177/003335491412900507 [PubMed: 25177055]

Stranges E, Wier L, Merrill C, & Steiner C (2009). Hospitalizations in which Patients Leave the Hospital against Medical Advice (AMA), 2007. Healthcare Cost and Utilization Project (HCUP) Statistical Briefs, Statistical Brief #78. doi:https://www-ncbi-nlm-nihgov.ezproxy.library.tufts.edu/books/NBK53965/

Strickland JC, Havens JR, & Stoops WW (2019). A nationally representative analysis of "twin epidemics": Rising rates of methamphetamine use among persons who use opioids. Drug and Alcohol Dependence, 204, 107592. doi:10.1016/j.drugalcdep.2019.107592 [PubMed: 31586804]

Summers PJ, Hellman JL, MacLean MR, Rees VW, & Wilkes MS (2018). Negative experiences of pain and withdrawal create barriers to abscess care for people who inject heroin. A mixed methods analysis. Drug and Alcohol Dependence, 190, 200–208. doi:10.1016/j.drugalcdep.2018.06.010 [PubMed: 30055424]

Tawk R FS, Mullner R (2013). Associations of mental, and medical illnesses with against medical advice discharges: the National Hospital Discharge Survey, 1988-2006. - PubMed - NCBI. Administration and Policy in Mental Health and Mental Health Services Research, 40(2), 124–132. [PubMed: 22057857]

Ti L, Milloy MJ, Buxton J, McNeil R, Dobrer S, Hayashi K, … Kerr T (2015). Factors Associated with Leaving Hospital against Medical Advice among People Who Use Illicit Drugs in Vancouver, Canada. PloS One, 10(10), e0141594. doi:10.1371/journal.pone.0141594 [PubMed: 26509447]

Ti L, & Ti L (2015). Leaving the Hospital Against Medical Advice Among People Who Use Illicit Drugs: A Systematic Review. American Journal of Public Health, 105(12), e53–59. doi:10.2105/ajph.2015.302885 [PubMed: 26469651]

Tookes H, Diaz C, Li H, Khalid R, & Doblecki-Lewis S (2015). A Cost Analysis of Hospitalizations for Infections Related to Injection Drug Use at a County Safety-Net Hospital in Miami, Florida. PloS One, 10(6), e0129360. doi:10.1371/journal.pone.0129360 [PubMed: 26075888]

Trowbridge P, Weinstein ZM, Kerensky T, Roy P, Regan D, Samet JH, & Walley AY (2017). Addiction consultation services - Linking hospitalized patients to outpatient addiction treatment. Journal of Substance Abuse Treatment, 79, 1–5. doi:10.1016/j.jsat.2017.05.007 [PubMed: 28673521]

Tyler D, Sutton Keisha, Johnson Tara. (2016). Diagnostic Coding in Obstetrics and Gynecology. In A. C. o. O. a. Gynecologists (Ed.): The American Congress of Obstetricians and Gynecologists.

Unick GJ, & Ciccarone D (2017). US regional and demographic differences in prescription opioid and heroin-related overdose hospitalizations. International Journal on Drug Policy, 46, 112–119. doi:10.1016/j.drugpo.2017.06.003 [PubMed: 28688539]

Wakeman SE, & Rich JD (2017). Barriers to Post-Acute Care for Patients on Opioid Agonist Therapy; An Example of Systematic Stigmatization of Addiction. Journal of General Internal Medicine, 32(1), 17–19. doi:10.1007/s11606-016-3799-7 [PubMed: 27393486]

Weingart SN, Davis RB, & Phillips RS (1998). Patients discharged against medical advice from a general medicine service. Journal of General Internal Medicine, 13(8), 568–571. [PubMed: 9734795]

Weinstein ZM, Kim HW, Cheng DM, Quinn E, Hui D, Labelle CT, … Samet, J. H. (2017). Long-term retention in Office Based Opioid Treatment with buprenorphine. Journal of Substance Abuse Treatment, 74, 65–70. doi:10.1016/j.jsat.2016.12.010 [PubMed: 28132702]

Wurcel AG, Anderson JE, Chui KK, Skinner S, Knox TA, Snydman DR, & Stopka TJ (2016). Increasing Infectious Endocarditis Admissions Among Young People Who Inject Drugs. Open Forum Infect Dis, 3(3), ofw157. doi:10.1093/ofid/ofw157 [PubMed: 27800528]

Highlights:

- One third of people with opioid use disorder (OUD) admitted to the hospital in 2013 had another substance use disorder
- Thirteen percent of people with OUD were discharged against medical advice, and 12% of people were readmitted within 30 days.
- Co-morbid drug use disorders were associated with increased odds of AMA discharge and 30-day readmission

Table 1.

ICD-9 Codes Used to Define Drug Use and Clinical Syndromes

	ICD-9 Code
Drug Use	
Opioids	E850.0, E850.2, 304.00-304.03, 304.70-304.73, 305.50-305.53, 965.01, 965.09, 965.00, 965.01, 965.02, 965.09
Cocaine	304.21-304.23, 305.60-305.63, 970.81
Amphetamines	304.41-304.43, 305.71-305.73, 969.72
Sedatives	305.40-305.43;304.10-304.13
Other	304.60-304.63, 304.80-304.83, 304.90-304.93, 305.90-305.93, 648.33, 648.34
Alcohol	305.00-305.03
Clinical Syndromes	
Overdose	965.00, 965.01, 965.02, 965.09
Skin and Soft Tissue Infections	400, 324.0, 324.1, 324.9, 326, 567.22, 567.31, 567.38, 569.5, 572.0, 590.1, 681.00-681.02, 681.10, 681.1, 681.9-683.0, 709.8, 728.86, 723.6, 729.30, 729.39, 785.4
Endocarditis	112.81, 421.0, 421.1, 421.9, 424.0-424.3, 424.90, 424.91, 424.99
Bacteremia/Sepsis	0380, 0381.0-0381.2, 0381.9, 0382, 0383, 0384.0-0384.4, 0384.9, 0388, 0389, 415.12, 422.92, 449, 785.52, 790.7, 995.90- 995.92
Osteoarticular Infections	730.89-731.00, 729.99-730.30
Psychiatric diagnosis	300.00-300.9, 301.0-301.9, 311, 295.00-295.95, 296.00-296.99, 298.0-298.9, V62.84

Table 2:

Demographic, Drug-Related and Disease-Related Information about Hospitalized Patients with Opioid Use Disorder

	Weighted N = 405566 Admissions	
Age (Median [IQR])	40 [29, 521]	
Female	193973 (48%)	
Age Categories		
18-29	105591 (26%)	
30-39	89950 (22%)	
40-49	82908 (20%)	
50-59	92993 (23%)	
60-65	34124 (8%)	
Urban Location of Hospital	396414 (98%)	
Comorbidity Present		
Cardiac	29143 (7%)	
Renal	10769 (3%)	
Liver	18502 (5%)	
HIV/AIDS	2561 (1%)	
Depression	91768 (23%)	
Insurance Type		
Private insurance	86532 (21%)	
Medicare	82561 (20%)	
Medicaid	142237 (35%)	
Self-pay	59600 (15%)	
No charge	8415 (2%)	
Other	25468 (6%)	
Missing	255 (1%)	
Drug Used		
Opioids	405566 (100%)	
Opioids only	265381 (65%)	
Opioids + Stimulant *	45103 (11%)	
Opioids + Alcohol	33168 (8%)	
Opioids + Sedative	28211 (7%)	
Opioids + Stimulant + Alcohol	15083 (4%)	
Opioids + Alcohol + Sedative	5534(1%)	
Opioids + Stimulant + Sedative	9407 (2%)	
Opioids + Stimulant + Alcohol + Sedative	3680 (1%)	
Readmission ≤ 30 days	47233 (12%)	
AMA Discharge	52191 (13%)	
Clinical Syndrome Present %	**Primary Diagnosis**	**Any Diagnosis**
Bacterial/Fungal Infections ‡	55817 (14%)	90473 (22%)

	Weighted N = 405566 Admissions	
Endocarditis	2074 (0.5%)	11868 (3%)
Bacteremia or Sepsis	27133 (7%)	44486 (11%)
Osteomyelitis	2644 (1%)	8342 (2%)
Skin or Soft Tissue Infections	27981 (7%)	53536 (13%)
Overdose	14854 (4%)	62612(15%)
Psychiatric diagnoses	83092(21%)	250770 (62%)

*Amphetamine and/or cocaine use

‡More than one infectious disease diagnosis may be present.

%Please see Table 1 for list of ICD-9 codes used for clinical syndromes.

Table 3:

Factors associated with leaving AMA and 30-day readmissions in people who use opioids Weighted N=402,221

	AMA Discharges	30 Day Readmissions
	AOR (95% CI)	**AOR (95% CI)**
Opioids only	REF	REF
Opioids + Stimulant *	1.83 (1.73, 1.96)	1.30 (1.23, 1.37)
Opioids + Alcohol	1.31 (1.23, 1.39)	1.68 (1.58, 1.79)
Opioids + Sedative	1.55 (1.42, 1.69)	1.27 (1.18, 1.37)
Opioids + Stimulant + Alcohol	2.41 (2.24, 2.60)	2.56 (2.36, 2.79)
Opioids + Alcohol + Sedative	2.22 (1.98, 2.50)	2.57 (2.28, 2.90)
Opioids + Stimulant + Sedative	2.61 (2.19, 3.10)	1.87 (1.68, 2.09)
Opioids + Stimulant + Alcohol + Sedative	3.84 (3.34, 4.40)	4.00 (3.55, 4.52)
Age (years)	0.99 (0.98, 0.99)	1.01 (1.01, 1.012)
Urban	1.42 (1.14, 1.77)	1.16 (1.01, 1.34)
Female	0.69 (0.66, 0.73)	0.95 (0.92, 0.98)
Infection	1.77 (1.66, 1.89)	2.40 (2.32, 2.48)
Overdose	1.01 (0.95, 1.08)	0.96 (0.92, 1.01)
Psychiatric Diagnosis	0.99 (0.94, 1.04)	2.21 (2.12, 2.31)
Elixhauser sum of comorbidities	0.96 (0.94, 0.98)	1.07 (1.06, 1.09)
Insurance Type		
Private insurance	REF	REF
Medicaid	1.73 (1.56, 1.92)	1.34 (1.28, 1.41)
Medicare	1.51 (1.38, 1.66)	1.49 (1.41, 1.57)
Self-pay	1.57 (1.38, 1.80)	1.01 (0.93, 1.08)
No charge	1.32 (1.09, 1.58)	0.99 (0.89, 1.10)
Other	1.14 (0.995, 1.30)	0.99 (0.91, 1.08)

*Amphetamine and/or cocaine use