



Rural and Urban Differences in Factors Associated with Inpatient Hospital Stays for Substance Use Disorder

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Increased prevalence of substance use disorder (SUD) can increase the use of health services and costs associated with treatment, drug overdoses, drug-related injuries, and chronic health conditions. The purpose of this two-brief series is to describe the lengths and costs of inpatient hospital stays for SUDs and to examine whether there were differences between stays for rural and urban residents. Using 2018 all-payer claims data from seven states, this first brief includes descriptive statistics for inpatient hospital stays with a primary diagnosis of SUD.

Background

The effects of illicit and illegal drug use, excessive alcohol use, and misuse of other substances are felt by individuals as well as community members, their families, and caregivers. The estimated costs of SUD directly attributable to crime, lost work productivity, and health care due to substance use and misuse well exceeds half a trillion dollars each year; direct medical cost for hospital inpatient SUD care is greater than \$13 billion annually.^{1,2} Across rural counties in the United States, more than 20 million people struggle with SUD, misusing opioids, alcohol, stimulants, or some combination.³ Research has shown residents in many rural areas have limited access to the resources necessary to overcome or manage SUD compared to urban residents. Resources such as evidence-based treatment programs, specialty services, or health care providers specifically trained to help those with SUD are less available in rural areas than in urban areas.³⁻⁵

Limited access to SUD prevention and treatment services can result in increased inpatient hospital utilization. The rate of opioid-related inpatient hospital stays nearly doubled over the last decade. In 2007, the national rate of opioid-related inpatient hospital stays was 159 per 100,000 population. By 2017, the national rate of opioid-related inpatient hospital stays had risen to 300 per 100,000 population.⁶

Key Takeaways

- **Medicare and Medicaid were the primary payers for a higher proportion of rural inpatients,** while urban inpatients were more likely to have private insurance coverage for inpatient hospital stays.
- **The percentage of inpatient stays for primary SUD diagnosis** admitted through court or law enforcement channels was four and a half times higher for rural residents than for urban residents.
- **The proportion of rural inpatients who resided in areas with no access to buprenorphine waived physicians** is more than nine times higher than for urban inpatients.

Similarly, efforts to address SUD vary across the nation, which are impacted by inequitably distributed resources, knowledge, social determinants of health, and tools used to prevent and treat SUD.⁷ Prior research has investigated many of these differences but little progress has been made in documenting the influence that geography plays in the variation in the use and costs of inpatient hospital services. Specifically, the lack of research and information examining inpatient hospital utilization by patients with SUD and behavioral health diagnoses in rural areas represents a major gap in knowledge for health care providers and those developing local, state, and national policies to address SUD.

This brief is the first of two by the Rural Health Equity Research Center describing and analyzing the effects of SUD on hospital inpatient use and costs. This first brief provides an inpatient stay level description of patient characteristics, primary payers, and an indication of available county level treatment resources, and the hospitals within which they occurred. The second brief examines factors associated with lengths of stay for inpatient admissions with a primary diagnosis of SUD among rural and urban populations.

Analysis of SUD-related inpatient hospital stays and their costs is especially relevant to policymakers engaged in designing and implementing SUD treatment policies and guidance in resource-challenged areas. Our aim is to provide rural decision-makers with useful planning information as SUD mortality and morbidity patterns change over time, including changes in the prevalence of opioid and methamphetamine use disorders. In particular, rural communities, treatment program administrators, and decision-makers need information about the financial implications of SUD treatment in community hospitals, which offer vital access to care.

Methods

We used data from the Healthcare Cost and Utilization Project (HCUP), the largest longitudinal hospital care data set in the United States. HCUP's State Inpatient Data (SID) includes data for all stays—for rural and urban residents—at community hospitals in 32 participating states. We selected seven states using two key criteria. First, we identified states with the top percentiles of rates of opioid-related inpatient hospital stays (i.e., greater than 280 per 100,000 population). Second, we identified states with the largest rural populations among states providing inpatient data to HCUP. The following HCUP states were selected for this study: Kentucky, Maine, Michigan, North Carolina, Vermont, Washington, and West Virginia.

Our analysis used a retrospective cross-sectional design and focused on multivariate statistical models that examined factors associated with inpatient stay costs and length of stay (LOS) occurring in 2018. Following methods described by Owens, et al., stays of interest included those for a principal diagnoses related to SUD, including either opioid, stimulant, alcohol, sedative, cannabis, or other substances depending on whether the primary diagnosis code matched the listed conditions. Full details of the method as well as diagnosis codes are available in the appendices of the Owens article.⁸ Rural and urban residence assignment was based on the National Center for Health Statistics (NCHS) rural definition.⁹ The NCHS definition uses a six-level urban-rural scheme for counties and county-equivalents to discern differences based on population size and adjacency to heavily populated urban areas. Urban (metropolitan) counties are categorized into one of four levels while rural (nonmetropolitan) counties

are categorized into one of two levels. For this analysis, NCHS codes one through four were classified as urban whereas five and six were rural. HCUP Cost-to-Charge files facilitated conversion of reported hospital charges into costs.

Results

We examined a total of 81,857 inpatient hospital stays among patients with a primary SUD diagnosis; 64,045 inpatient hospital stays (78%) for residents from urban areas and 17,812 inpatient hospital stays (22%) for residents from rural areas. **Exhibits 1 and 2** provide summary statistics of inpatient hospital admissions by patients' rural or urban residence. Due in part to the large number of patients included in the analysis and also from inherent group variation, differences between rural and urban patients were statistically significant across many of the characteristics. Below, we highlight those variables where we found both statistical as well as clinically meaningful differences based on variable context between admissions for rural and urban residents.

Exhibit 1: Patient Characteristics for Inpatient Hospital Stays with a Primary SUD Diagnosis

Characteristics	Total (%)	Rural (%)	Urban (%)
Total stays (n)	81,857	17,812	17,812
Percent of stays	100.0	21.8	78.2***
Patient Age Category			
5-19 years	1.7	1.9	1.6
20-44 years	47.1	47.7	46.9
45-64 years	42.2	41.5	42.4*
65-75 years	7.1	7.1	7.1
75+ years	1.9	1.9	1.8
Sex			
Male	62.8	61.5	63.1***
Female	37.2	38.5	36.9***
Race/Ethnicity			
White	79.2	85.9	77.5***
Black	12.8	6.0	14.5***
Hispanic	2.6	1.8	2.8***
Other	3.3	4.7	2.9***
Missing	2.1	1.6	2.2***

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. Skilled Nursing Facility (SNF); Intermediate Care Facility (ICF); Assisted Living Facility (ALF); Nursing Facility (NF). Race and ethnicity other category includes American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander, as well as individuals indicated within multiple categories.

In general, patients from rural areas were younger, more often female and White, and had a primary SUD diagnosis more likely related to opioids, stimulants or other/miscellaneous substances as compared to urban patients – other/miscellaneous substances included hallucinogens and other inhalant-related psychoactive substance abuse. In contrast, a higher proportion of urban inpatients were diagnosed with alcohol-related SUD (difference of 4.9%) and had five or more comorbidities (difference of 2.3%) as compared to inpatients from rural areas.

Exhibit 2: Condition Characteristics for Inpatient Hospital Stays with a Primary SUD Diagnosis

Condition Characteristics	Total (%)	Rural (%)	Urban (%)
Type of SUD Diagnosis			
Opioids	10.2	10.9	10.0***
Stimulants	7.6	8.2	7.5**
Alcohol	53.3	49.5	54.4***
Sedatives	5.7	6.1	5.6*
Cannabis	12.0	11.6	12.1
Other/Miscellaneous	11.2	13.7	10.5***
Secondary Condition			
Secondary SUD	34.7	34.5	34.8
Depression	30.8	30.1	31.0*
Psychoses	16.0	14.5	16.5***
None Identified	18.5	20.9	17.7***
Number of Elixhauser Comorbidities			
0	6.8	7.5	6.6***
1-2	39.8	41.3	39.4***
3-4	34.8	34.4	34.9
5+	18.6	16.8	19.0***

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. Skilled Nursing Facility (SNF); Intermediate Care Facility (ICF); Assisted Living Facility (ALF); Nursing Facility (NF). Race and ethnicity other category includes American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander, as well as individuals indicated within multiple categories.

Two variables included in our analysis centered around how patients entered the health care system – admission type and admission source (**Exhibit 3**). Admission type categorizes inpatient hospital stays into either emergency, urgent, elective, or other/missing. Other/missing included instances where

coding for these variables was not included on the patient claim and could also include newborn delivery or trauma center – both of which were not included in our dataset. Admission source is derived from the Uniform Billing Specifications and uses the same coding as the point of origin data element on the UB-04 claim form. Both urban and rural admissions were similar in terms of admission type – around 86% of all inpatient hospital stays came through either the emergency department or an urgent care setting – though we did observe a sizable difference in the specific type with a lower percentage of rural inpatients entering through the emergency department and a higher percentage entering by way of urgent care settings (differences of -9.9% and +10.1%, respectively) as compared to urban patients. The percentage of inpatients with a primary SUD diagnosis admitted through court or law enforcement channels was four and half times higher for rural residents than for urban residents (5.8% vs 1.3%, respectively). In addition, there were admission-source differences with a significantly higher percentage of urban inpatients coming from non-health care facilities (difference of 9.4%).

Exhibit 3: Admission Characteristics for Inpatient Hospital Stays with a Primary SUD Diagnosis

Admission Characteristics	Total (%)	Rural (%)	Urban (%)
Admission Type			
Emergency	64.3	56.6	66.5***
Urgent	22.1	30.0	19.9***
Elective	13.2	13.2	13.2
Other/Missing	0.4	0.2	0.5***
Admission Source			
Non-health care facility	78.1	70.8	80.2***
Clinic or physician's office	7.6	9.7	7.0***
Transfer from a different hospital	7.4	10.9	6.4***
Transfer from a SNF, ICF, ALF, or other NF	0.5	0.5	0.5
Transfer from another health care facility	2.8	0.9	3.3***
Transfer from within the hospital	0.0	0.0	0.0
Court/law enforcement	2.3	5.8	1.3***
Other/Missing	1.3	1.3	1.3

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. Skilled Nursing Facility (SNF); Intermediate Care Facility (ICF); Assisted Living Facility (ALF); Nursing Facility (NF). Race and ethnicity other category includes American Indian or Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander, as well as individuals indicated within multiple categories.

County Resource Indicators of Inpatients

We examined three county level variables that spoke to essential health care access and SUD resources available where inpatients resided. The two HPSA designations identify areas of need and prioritization of health care resources and buprenorphine-designated physicians per 10,000 population categorizes the number of providers waived (at the county level) to prescribe buprenorphine to patients in office settings rather than limiting this service to specialized opioid treatment programs. Buprenorphine is used in medication-assisted substance use treatment and, for our purposes, provides an indication of the level of services and

resources available to those with SUD. **Exhibit 4** shows findings for the county level resource variables.

Health Professional Service Area (HPSA) designations identify underserved populations lacking access to adequate care through a shortage of either primary medical, dental, or mental health providers within an identified geographic area, population group, or health care facility.¹⁰ For this analysis, we included whether the county where an inpatient resided was either a designated HPSA or not, whether only part of the county was a designated HPSA, or if the whole county was a designated HPSA. In addition, we included only primary care and mental health designation status. It is important to note that Maine and West Virginia were not included in HPSA designation descriptions due to limitations in the state provided data.

Exhibit 4: County Resource Indicators of Inpatients Treated for SUD

County Characteristics	Total (%)	Rural (%)	Urban (%)
Mental Health HPSA[^]			
Not a HPSA	6.6	7.0	6.4*
Whole County	20.8	67.0	9.2***
Partial County	72.7	26.0	84.3***
Primary Care HPSA[^]			
Not a HPSA	8.5	10.5	8.0***
Whole County	5.1	18.4	1.7***
Partial County	86.5	71.1	90.3***
Buprenorphine-designated Physicians per 10,000 Population[^]			
0	2.7	9.6	1.0
>0-1	16.2	20.0	15.2
>1-2	43.4	27.8	47.2
>2-3	20.5	21.7	20.2
>3-5	11.0	10.6	11.1
5+	6.2	10.2	5.2

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. HPSA – Health Professional Shortage Area. ^ – ME and WV not included due to HCUP variable availability.

We observed significant differences across all categories of both types of HPSA measures included for both rural and urban inpatients based on their county of residence. Across all inpatient admissions with a primary SUD diagnosis, 93.4% and 91.5% originated from counties with either a whole or partial

designation for Mental Health and Primary Care, respectively. Among inpatients from rural areas, a far greater percentage resided in counties wholly designated as HPSAs – 67.0% versus 9.2% for Mental Health and 18.7% versus 1.7% for Primary Care. Similar differences were observed for partial county designation but in the other direction. Inpatients from rural counties were less likely to originate from partially designated counties than their urban counterparts – 26.0% to 84.3% for Mental Health and 71.1% to 90.3% for Primary Care, respectively.

Primary Payers of Inpatient SUD Care

The primary payer for inpatient SUD stays varied by residence of the patient (**Exhibit 5**). The differences between rural and urban resident inpatient hospital stays were significant for all primary payer categories. Primary payer differentiates the type of entity expected to have principal responsibility for paying each inpatient claim. Within the HCUP data, the expected primary payer is divided into one of several categories including Medicare, Medicaid, and private insurance. Also included are self-pay and no-charge/other. No-charge/other captures free care provided by charity, research, or as part of teaching activities and also other instances where a primary payer was not identified. However, coding for self-pay and no-charge/other varied by state. Medicare and Medicaid together made up the majority primary payer for 68% and 60% of rural and urban inpatients, respectively, with patients from rural areas more likely to receive such coverage than patients from urban areas. For both rural and urban patients, Medicaid was the largest primary payer of SUD related inpatient stay claims with 44% and 40% respectively. Conversely, patients from urban areas more often had private insurance listed as the primary payer (difference of 6.5%) than rural resident patients.

Exhibit 5: Primary Payers of Inpatient Care for SUD

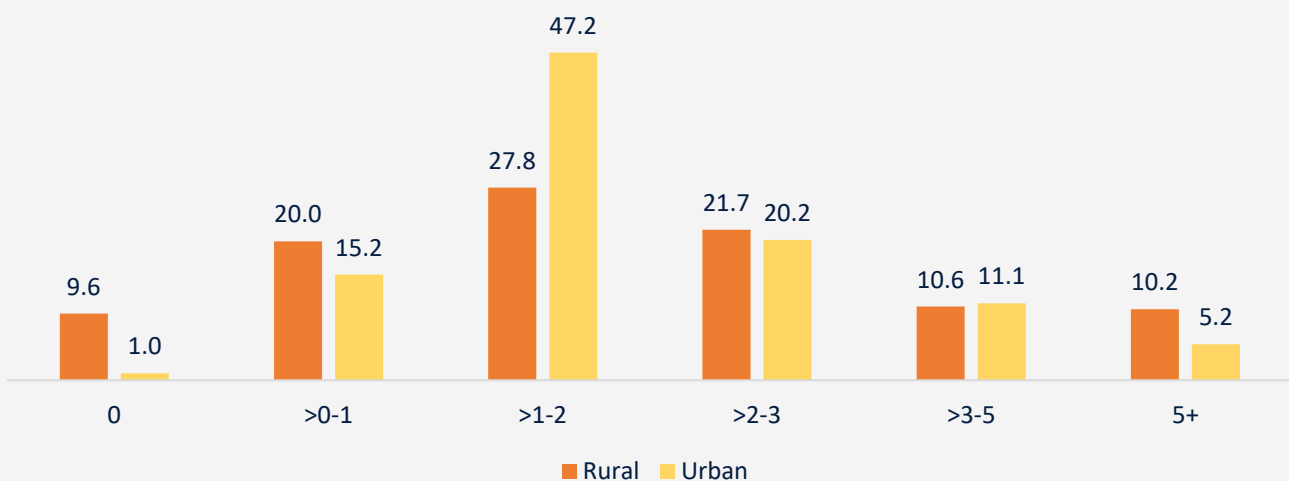
Primary Payer	Total (%)	Rural (%)	Urban (%)
Medicare	21.0	23.8	20.2***
Medicaid	40.9	44.3	39.9***
Private Insurance	23.8	18.7	25.2***
Self-pay/Uninsured	9.7	9.0	9.9***
No charge/other	4.7	4.2	4.8***

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. Medicare includes both fee-for-services and managed care Medicare patients; Medicaid includes both fee-for-service and managed care Medicaid patients; no charge/other includes worker's compensation, CHAMPUS, CHAMPVA, Title V, and other government programs.

Buprenorphine-Designated Physicians

Buprenorphine is a medication for opioid use disorder that suppresses withdrawal symptoms and relieves opioid related cravings in a safe and controlled way, and is used in combination with counseling and behavioral therapy to treat Opioid Use Disorder (OUD). Buprenorphine-designated physicians are approved by the Substance Abuse and Mental Health Services Administration (SAMHSA) to treat between 30 and 275 patients. The number of patients that eligible providers may treat depends on years of program participation and training received – more details about participation and training requirements and guidelines are available at [samhsa.gov](https://www.samhsa.gov). **Exhibit 6** provides a more detailed view of county-level inpatient SUD stays by the number of buprenorphine-designated physicians per capita, in rural and urban counties. The percentage of rural inpatients coming from areas with no buprenorphine-designated physicians was more than nine times higher than urban inpatients (9.6% and 1.0%, respectively). Additionally, a greater percentage of inpatients from areas with fewer than one buprenorphine-designated physician per 10,000 population lived in rural, as opposed to urban, areas (20.0% and 15.2%, respectively). The greatest proportion of both rural and urban patients resided in areas with between one and three buprenorphine-designated physicians (49.5% and 67.4%, respectively). However, a greater percentage (difference of 13.4%) of inpatients from urban areas had access to at least one buprenorphine-designated physician per 10,000 population compared to rural areas.

Exhibit 6: Percentage of Inpatient SUD Stays from Counties with Buprenorphine-designated Physicians, per 10,000 Population



Hospital Characteristics

We examined three hospital characteristics – number of beds, type (i.e., prospective payment system hospital (PPS) or reasonable cost, e.g., critical access hospital [CAH]), and whether the hospital was in a rural or urban area. **Exhibit 7** provides summary results for hospital characteristic variables. It is

important to note that, due to differing variable availability with the HCUP state datasets, hospital bed size and hospital type could not be calculated for Maine or Michigan, and hospital rurality analysis did not include Maine, Michigan, or West Virginia.¹¹

As expected, most rural SUD inpatients were seen at smaller hospitals than their urban counterparts – a majority of inpatient hospital stays from rural county residents (51.0%) were at hospitals with fewer than 200 beds whereas two of three inpatient hospital stays by urban residents were at hospitals with 200 or more beds.

Exhibit 7: Characteristics of Hospitals and Market Factors Where Rural and Urban Patients Sought Inpatient Care

Hospital Characteristics	Total (%)	Rural (%)	Urban (%)
Hospital Bed Size[^]			
6-25	1.5	3.7	0.8***
26-49	1.1	2.8	0.6***
50-99	11.2	15.2	9.9***
100-199	24.2	29.0	22.7***
200-299	17.6	17.9	17.6
300-399	10.9	15.3	9.5***
400-499	5.9	2.4	7.0***
500+	27.5	13.6	31.9***
Hospital Type[^]			
Prospective Payment System Hospital (PPS)	97.3	95.4	97.9***
Critical Access Hospital (CAH)	2.7	4.6	2.1***
Hospital Rurality (FORHP Definition)⁺			
Urban	80.6	36.9	94.0***
Rural	19.4	63.1	6.0***

NOTES: Authors' estimates of HCUP data. Differences may reflect rounding; *p<0.05, **p<0.01, ***p<0.001 denotes statistical significance of difference between rural and urban. [^] – ME and MI not included due to HCUP variable availability. ⁺ – ME, MI, and WV not included due to HCUP variable availability.

When examining hospital and market factors by inpatient hospital stays, we saw a similar pattern to that of inpatient stay characteristics – statistically significant differences across all variables but most showing small variation in absolute proportions. In most cases, differences were small enough to be considered of little relevance while a few reveal informative trends. Bed size, primary payer, and buprenorphine-designated physicians per 10,000 population were statistically and meaningfully significant and will be further explored in multivariate analyses.

Conclusion

This analysis used a retrospective cross-sectional design and focused on offering descriptive statistics for factors associated with 2018 inpatient stay cost and length of stay (LOS) for SUD treatment. Descriptive statistical analysis provides the foundational understanding needed for more advanced analytical methods used in the second brief of this series. While we observed statistically significant differences between rural and urban inpatients across all 16 included measures, 10 of these measures differed by a clinically meaningful amount of five or greater percent (race/ethnicity, admission type, admission source, bed size, primary payer, mental health and primary care HPSA designation, buprenorphine-designated physicians, and hospital rurality).

Descriptive analyses of inpatient hospital stays, hospital characteristics, and county resources provide a baseline for understanding access to SUD inpatient care and context for further research. The states included in this analysis – Kentucky, Maine, Michigan, North Carolina, Vermont, Washington, and West Virginia – provided a diverse cross section of states that included large rural populations.

Time spent in the hospital and the amount paid for services are two important resources that can indicate the level and intensity of care provided. This brief illustrates that these resources are used significantly different to treat rural and urban residents. The literature has documented differences between rates of inpatient hospital stays for SUD among rural and urban residents, but little analysis exists on the relationships between hospital characteristics and with either LOS or cost of stay, as well as with differences in available inpatient resources between rural and urban areas. SUD treatment needs among both rural and urban populations continue to grow and evolve, as have the inpatient costs of treating overdoses, injuries, and conditions associated with substance use. Additional research on inpatient SUD care delivery is important due to the limited access to rural hospital and community SUD resources and constraining payment structures on LOS for many rural hospitals.

This analysis sheds additional light on the importance of looking at resource and structural differences in the way SUD care is provided and how those with SUD enter the care system. In particular, we found that the proportion of inpatients entering the hospital by way of law enforcement or courts was four and a half times higher for rural than urban residents. This finding, coupled with the finding that a higher share of inpatients coming from rural counties wholly designated as primary care or mental health HPSAs and a greater reliance on government sponsored health insurance, suggests that more study is necessary to identify ways to improve and streamline access to SUD care for rural residents.

Limitations

Study results should be interpreted considering the limitations. First, our analysis was based on inpatient discharge data from seven states. To counter the limited number of states included in the analysis, we chose states with the intent to obtain broad representation while selecting states with large rural populations. Second, while HCUP SID data share a common structure, available measures vary by state and year. Third, though the all-payer structure of the HCUP SID captures nearly all hospitalized patients within each of the included states, people experience SUD in a variety of ways and may obtain care outside of the inpatient setting or as a complement to the hospital setting.

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