



2019 Drug Overdose Hospital Discharges in Tennessee

**Tennessee Department of Health
Office of Informatics and Analytics**

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Contents

Executive Summary	3
Introduction	5
Drug Overdose Hospital Discharges	7
<i>All Drug Overdose Outpatient Visits and Inpatient Stays</i>	7
<i>Opioid Overdose Outpatient Visits and Inpatient Stays</i>	8
<i>Benzodiazepine, Stimulant, and Synthetic Opioid Overdoses</i>	9
Drug Overdose Hospital Discharges by Sex	11
Drug Overdose Hospital Discharges by Race	13
Drug Overdose Hospital Discharges by Age	15
Drug Overdose Hospital Discharges by Intentionality	16
Drug Overdose Hospital Discharges by Primary Payer	17
Drug Overdose Hospital Discharges by County of Residence	18
<i>All Drug Overdoses</i>	18
<i>Opioid (Excluding Heroin) Overdoses</i>	19
<i>Heroin Overdoses</i>	20
<i>Benzodiazepine Overdoses</i>	21
<i>Stimulant Overdoses</i>	22
Fatal and Nonfatal Drug Overdose Trends	24
Annual Cost of Nonfatal All Drug Overdose Discharges in TN, 2019	25
<i>Introduction</i>	25
<i>Annual Cost by Grand Divisions and Discharge Type</i>	26
<i>Annual Cost by Drug and Discharge Type</i>	27
<i>Annual Cost by Hospital and Discharge Type</i>	28
<i>Annual Cost by Bed Size and Discharge Type</i>	29
Technical Notes	30

Executive Summary

This report describes hospital discharges related to drug overdoses in Tennessee (TN) in 2019 using data from the TN Hospital Discharge Data System. Inpatient and outpatient hospital discharges due to drug overdoses are described overall and by sex, race, age, and cost. Tennessee is still in the midst of increasing rates of drug overdose mortality and morbidity. The rates of all drug and opioid overdose deaths continue to increase in TN. The age-adjusted rate for all drug overdose deaths was 27.4 per 100,000 residents in 2018 and 31.2 per 100,000 residents in 2019. The age-adjusted rate for all opioid overdose deaths was 19.9 per 100,000 residents in 2018 and 23.4 per 100,000 residents in 2019. The number and rate of nonfatal drug overdoses is much higher than for overdose deaths. There are more than 13 nonfatal overdose discharges per overdose death in TN. Briefly summarized below are key epidemiologic data trends for nonfatal drug overdoses in Tennessee:

Nonfatal overdoses due to any drug continue to increase for outpatient visits, but not inpatient stays

- In 2019, there were 23,910 all drug overdose hospital discharges among TN residents. Of these, 7,240 (30.3%) were inpatient stays and 16,670 (69.7%) were outpatient visits. About 11,447 discharges (68.7%) after an outpatient visit and 3,715 discharges (51.3%) after an inpatient stay for a drug overdose were discharged to home with or without follow-up.
- The rate of drug overdose outpatient visits due to any drug increased in 2019 compared to 2018, while drug overdose inpatient stays decreased.
 - The rate of overdose outpatient visits increased from 252.7¹ in 2018 to 255.5 in 2019. The rate of overdose inpatient stays decreased from 103.2 in 2018 to 102.8 in 2019.
- The highest overdose rates for all drug outpatient visits were among males, persons aged 25-34 years, and White Tennesseans. For inpatient stays, all drug overdose rates were highest among those aged 55-64 years, females, and Black Tennesseans.

Nonfatal opioid overdoses (excluding heroin) are increasingly likely to be treated in an outpatient setting

- In 2019, there were 4,282 hospital discharges for opioid overdoses (excluding heroin). Of these opioid overdose discharges, 66.1% were outpatient visits and 33.9% were inpatient stays.
- The rate of opioid overdose outpatient visits increased (2018: 35.7, 2019: 42.2) and inpatient stays decreased (2018: 21.8, 2019: 19.1) from 2018 to 2019.
- Compared to males, females had higher rates for opioid overdose inpatient stays (19.8 vs. 18.2) but lower rates for outpatient visits (33.7 vs. 50.7). Opioid overdose rates were higher among White Tennesseans (compared to Black Tennesseans) for both outpatient visits and inpatient stays. Opioid overdose rates were highest among 25-34 year-olds for outpatient visits and among 55-64 year-olds for inpatient stays.

¹ All rates in this report are age-adjusted and per 100,000 residents unless otherwise specified.

Nonfatal heroin overdoses are increasing, particularly for inpatient stays

- The rate of heroin overdose outpatient visits increased from 48.3 to 52.1 from 2018 to 2019 (a 7.9% increase). The rate of heroin overdose inpatient stays increased from 5.8 to 6.8 from 2018 to 2019 (a 17.2% increase). Rates were higher for White Tennesseans (compared to Black Tennesseans) and males (compared to females) for both outpatient visits and inpatient stays.

Nonfatal cocaine and amphetamine overdoses are increasing

- Rates of cocaine and amphetamine (including methamphetamine) overdose outpatient visits and inpatient stays were higher among males (compared to females). Cocaine overdose rates were higher among Black Tennesseans (compared to White Tennesseans) while amphetamine overdose rates were higher among White Tennesseans (compared to Black Tennesseans).

The cost of nonfatal overdoses is not evenly distributed across TN Grand Divisions, overdose type, or hospital characteristics

- The cost of overdose is not evenly distributed across the state. Middle TN has the most expensive inpatient stays, while West TN has the most expensive outpatient visits.
- Nonfatal overdoses involving opioids (excluding heroin) were the most expensive for inpatient stays, while overdoses involving benzodiazepine were the most expensive outpatient visits.
- The largest hospitals in the state (with over 350 beds) had the most expensive inpatient stays, while the smallest hospitals in the state (with less than 50 beds) had the most expensive outpatient visits.

Introduction

The purpose of this report is to describe drug overdose hospital discharges in the State of Tennessee (TN) in 2019. This report meets the legislative requirement to summarize aggregate claims data on all inpatient and outpatient discharges that include a drug poisoning diagnosis as reported for the calendar year two years prior to the current year by licensed hospitals.² Data presented here are from the TN Statewide Hospital Discharge Data System (HDDS) from 2018 to 2019.³ The HDDS contains billing codes from discharges at hospitals statewide for inpatient hospitalizations and outpatient visits, including emergency department visits. These billing codes (since October 1st, 2015) are based on the International Classification of Diseases, Tenth Revisions, Clinical Modification (ICD-10-CM) and provide a standardized method for identification of drug overdoses using administrative data.

The current report includes discharges for TN residents at non-federal, acute care hospitals for eight drug overdose morbidity statistics:

- (1) **All drug overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of drugs, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (2) **Opioid overdose (excluding heroin)** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of all opioid drugs regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (3) **Heroin overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of heroin, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (4) **Methadone overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of methadone, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (5) **Other synthetic opioid overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of other synthetic opioids, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (6) **Benzodiazepine overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of benzodiazepines, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (7) **Cocaine overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of cocaine, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).
- (8) **Amphetamine (including methamphetamine) overdose** outpatient visits or inpatient stays - caused by nonfatal acute poisonings due to the effects of amphetamines, regardless of intent (e.g., intentional, unintentional, assault, or undetermined).

² Tennessee Code Annotated (T.C.A.), Section 68-1-108: <http://www.lexisnexis.com/hottopics/tncode/>

³ https://www.tn.gov/content/dam/tn/health/program-areas/reports_and_publications/2020-Hospital-Discharge-Data-System-User-Manual.pdf

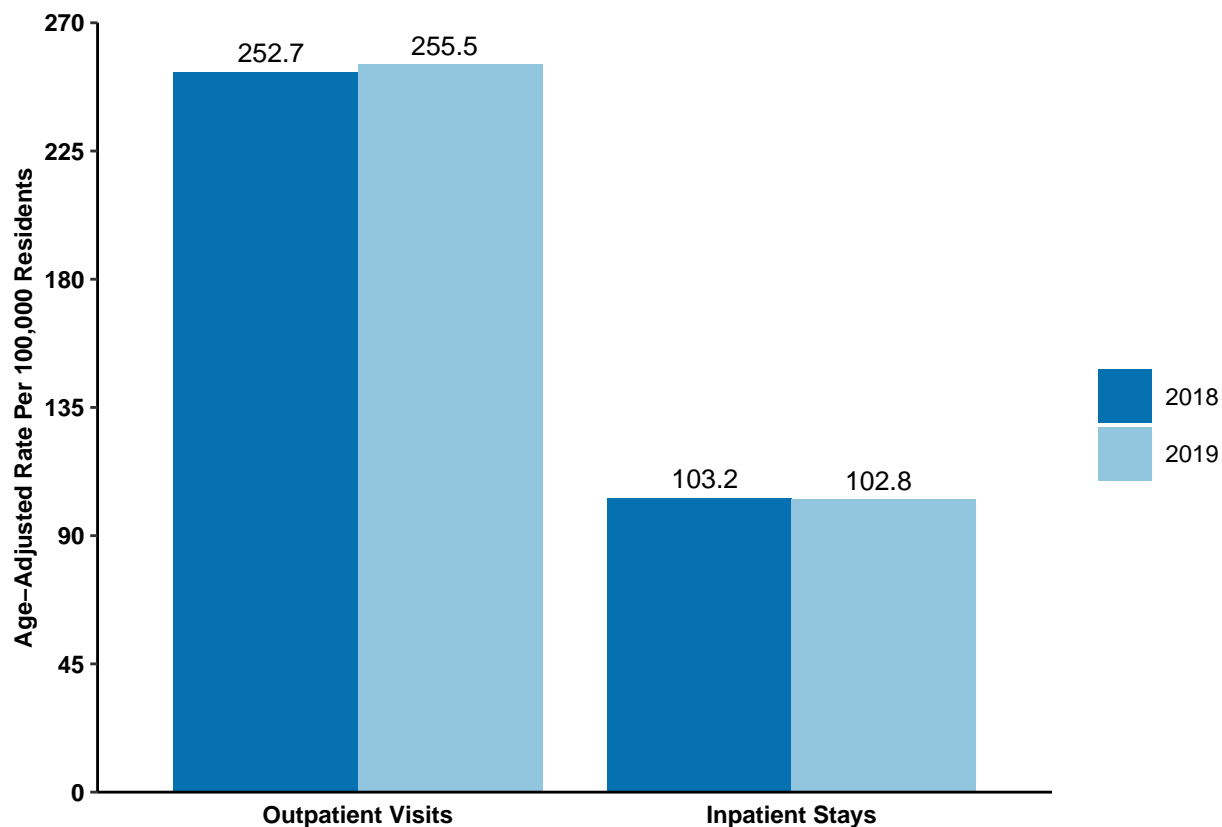
Events related to late effects, adverse effects, under-dosing, dependence, abuse, withdrawal and chronic poisonings due to the effects of drugs (e.g., damage to organs from long-term drug use), are excluded. Unless otherwise indicated, data exclude records with discharge status of deceased. As <0.2% of discharge records in Tennessee are coded as a subsequent encounter or sequela, morbidity statistics presented in this report are limited to only initial and missing encounters following Prevention for the States/Data-Driven Prevention Initiative Programs definitions.⁴

⁴Centers for Disease Control and Prevention (2018). CDC's Opioid Overdose Indicator Support Toolkit: Guidance for building and reporting on opioid-related mortality, morbidity, and PDMP indicators (Version 3.0). Atlanta, GA.

Drug Overdose Hospital Discharges

All Drug Overdose Outpatient Visits and Inpatient Stays

Age-Adjusted Rates for All Drug Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

In 2019, there were 23,910 nonfatal⁵ drug overdose hospital discharges among TN residents. This total is comprised of 7,240 inpatient stays (30.6%) and 16,670 outpatient visits (69.4%). The above figure shows age-adjusted rates for all drug overdose⁶ outpatient visits and inpatient stays in TN during 2018 to 2019. For outpatient visits,⁷ the age-adjusted rates increased from 252.7 in 2018 to 255.5 in 2019. For inpatient stays, the age-adjusted rates decreased from 103.2 in 2018 to 102.8 in 2019.

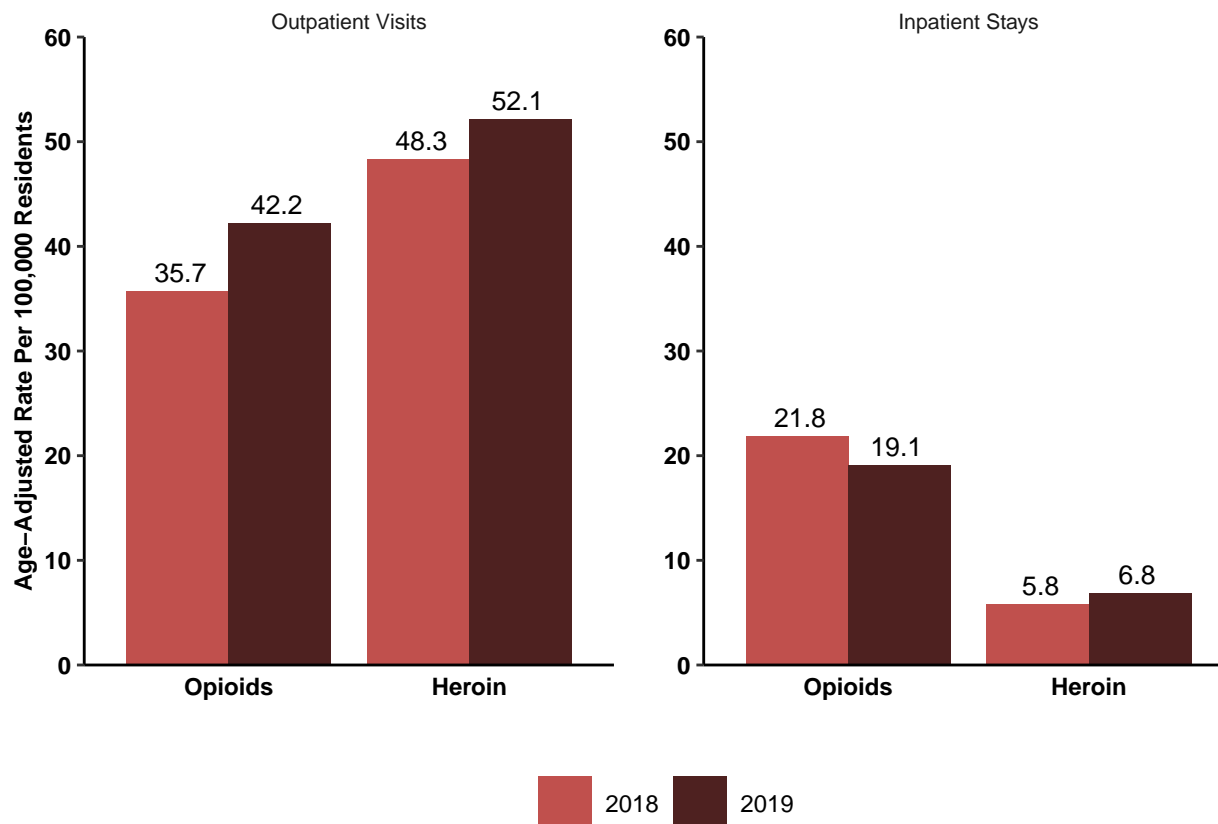
⁵This number does not include 247 TN residents (197 inpatients, 50 outpatients) who died of a drug overdose in the hospital.

⁶All drug overdose outpatient visits and inpatient stays are defined as drug overdoses caused by nonfatal acute poisonings due to the effects of drugs, regardless of intent (e.g., intentional, assault, unintentional, or undetermined). Identified using ICD10CM diagnosis codes (see Technical Notes for specific codes).

⁷Outpatient visits include primarily emergency department visits, but also include any observation period of 23 hours or less, ambulatory surgeries or certain diagnostic services (such as MRIs or CT scans).

Opioid Overdose Outpatient Visits and Inpatient Stays

Age-Adjusted Rates for Opioid (Excluding Heroin) and Heroin Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

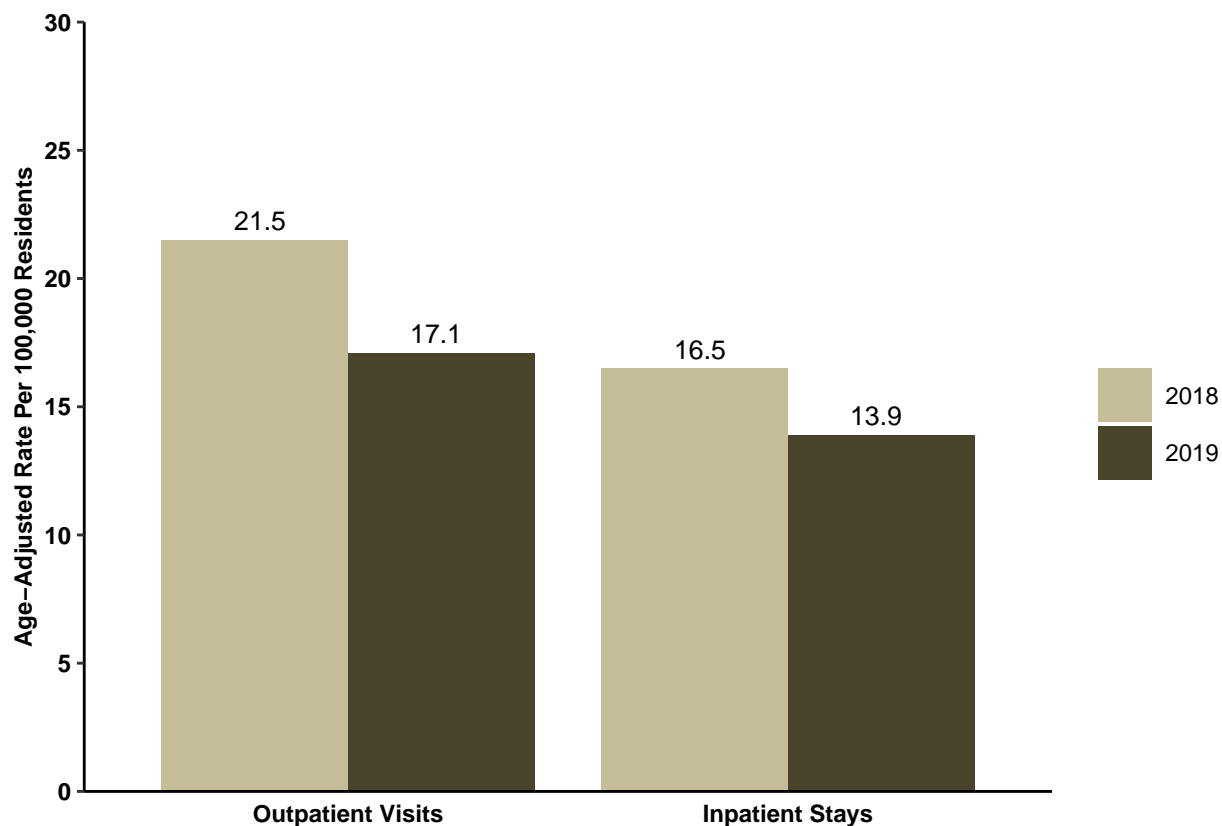
In 2019, there were 4,282 hospital discharges for opioid⁸ overdose (excluding heroin). Of these opioid overdose discharges, 2,831 were outpatient visits and 1,451 were inpatient stays. Heroin⁹ overdose discharges accounted for 3,769 of all overdoses, including 3,331 outpatient visits and 438 inpatient stays. The above graph shows age-adjusted rates for outpatient visits and inpatient stays for both opioid and heroin overdoses during 2018 and 2019. Rates for outpatient visits for opioids increased, while rates for inpatient stays decreased from 2018 to 2019. Inpatient stays (5.8 in 2018 to 6.8 in 2019) and outpatient visits (48.3 in 2018 to 52.1 in 2019) for heroin overdoses increased from 2018 to 2019.

⁸ Opioid overdose (excluding heroin) inpatient stays or outpatient visits caused by nonfatal acute poisonings due to the effects of all opioids, regardless of intent (e.g., unintentional, intentional, assault, or undetermined). Unless otherwise stated, opioid overdose does not include heroin. Identified using ICD-10-CM diagnosis codes (see Technical Notes for specific codes).

⁹ Heroin overdose inpatient stays or outpatient visits caused by nonfatal acute poisonings due to the effects of heroin, regardless of intent (e.g., unintentional, intentional, assault, or undetermined). Identified using ICD-10-CM diagnosis codes (see Technical Notes for specific codes).

Benzodiazepine, Stimulant, and Synthetic Opioid Overdoses

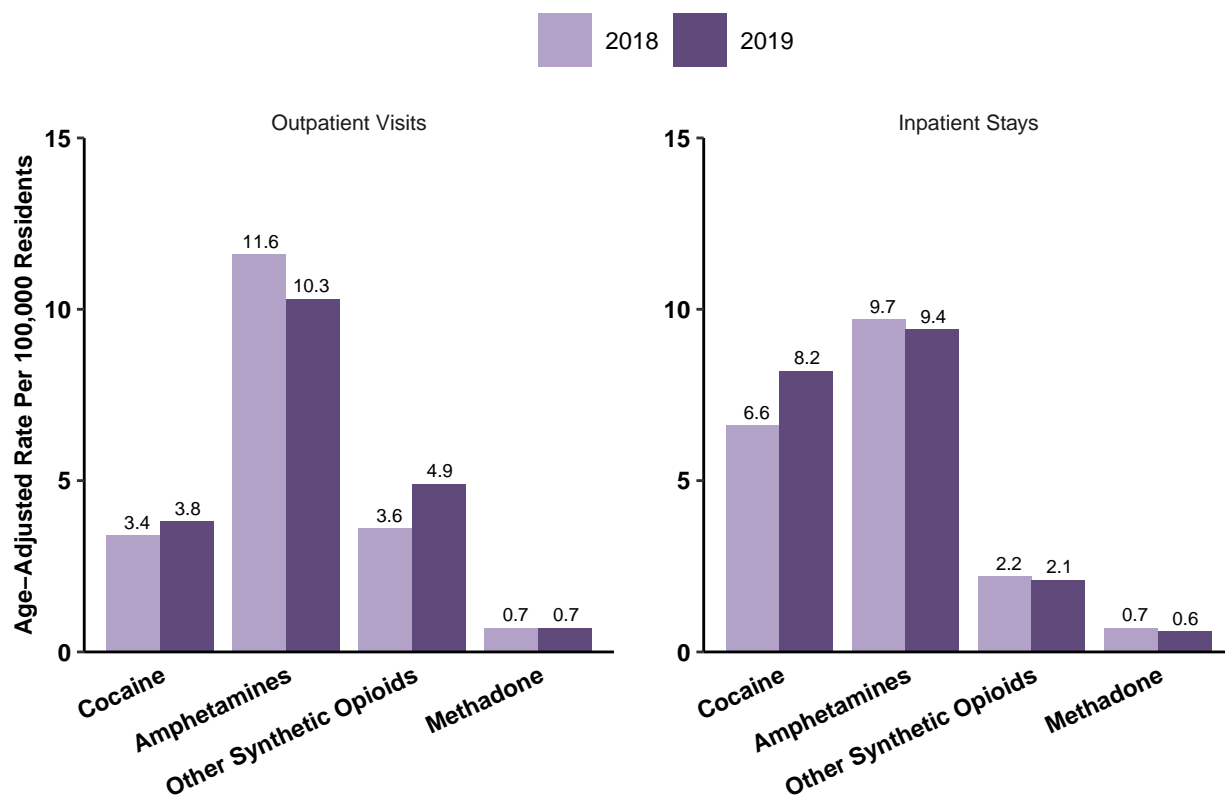
Age-Adjusted Rates for Benzodiazepine Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

In 2019, there were 2,163 hospital discharges for benzodiazepine overdose. Of these benzodiazepine overdose discharges, 1,160 were outpatient visits and 1,003 were inpatient stays. The age-adjusted rates (per 100,000 TN residents) for outpatient visits and inpatient stays for benzodiazepine overdoses in 2018 and 2019 are shown above. A slight reduction in benzodiazepine overdose rates from 2018 to 2019 was observed for both outpatient visits (21.5 in 2018 to 17.1 in 2019) and inpatient stays (16.5 in 2018 to 13.9 in 2019).

Age-Adjusted Rates for Stimulant and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019



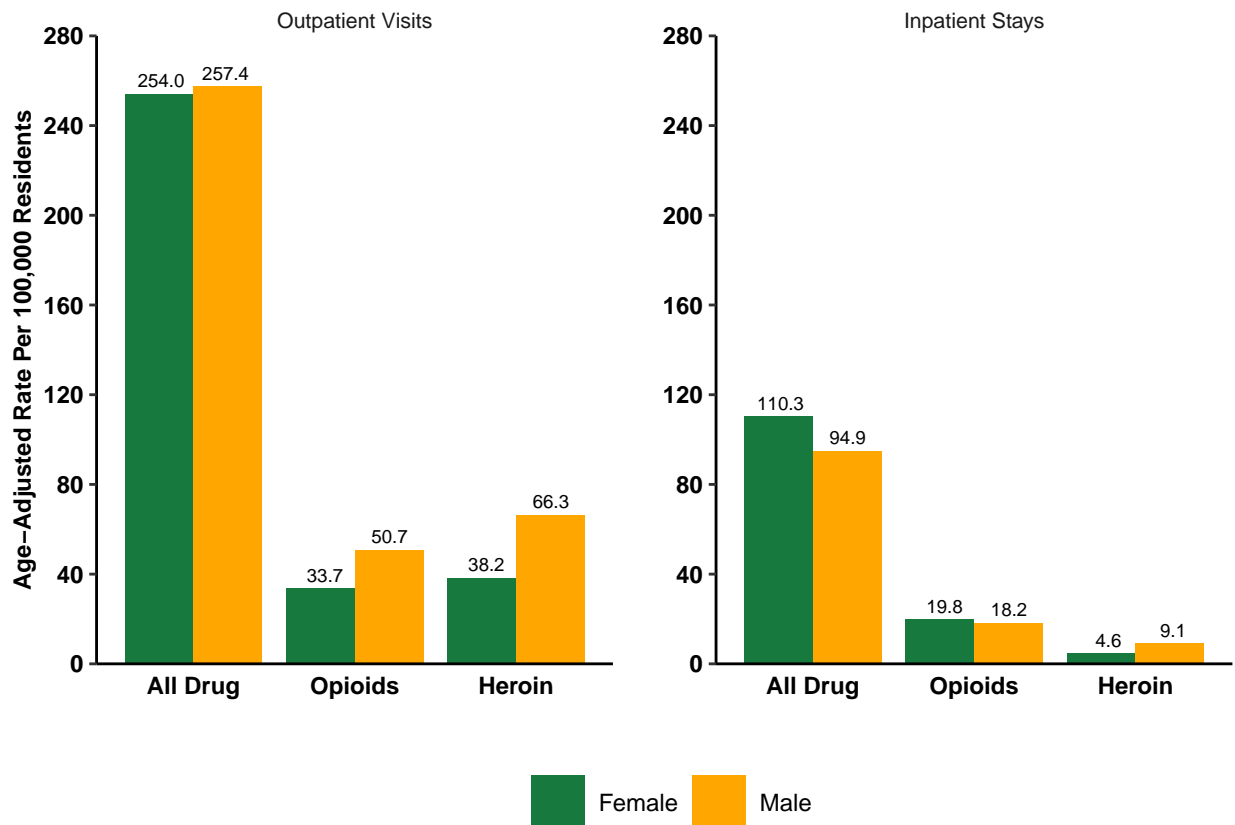
Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

In 2019, the total number of other drug related overdose discharges were as follows: cocaine (838), amphetamine¹⁰ (1,255), other synthetic opioids (468), and methadone (92). Cocaine overdoses were more frequently inpatient stays (n=585) as compared to outpatient visits (n=253). The number of outpatient visits for amphetamine and other synthetic opioid overdoses were higher as compared to inpatient stays. The age-adjusted rates for cocaine and other synthetic opioid overdose outpatient visits increased from 2018 to 2019, while rates of outpatient visits for amphetamines decreased during the same period. Inpatient stays for cocaine overdose increased, while inpatient stays for synthetic opioids, methadone, and amphetamine overdoses decreased slightly from 2018 to 2019.

¹⁰ Amphetamine overdoses include methamphetamine.

Drug Overdose Hospital Discharges by Sex

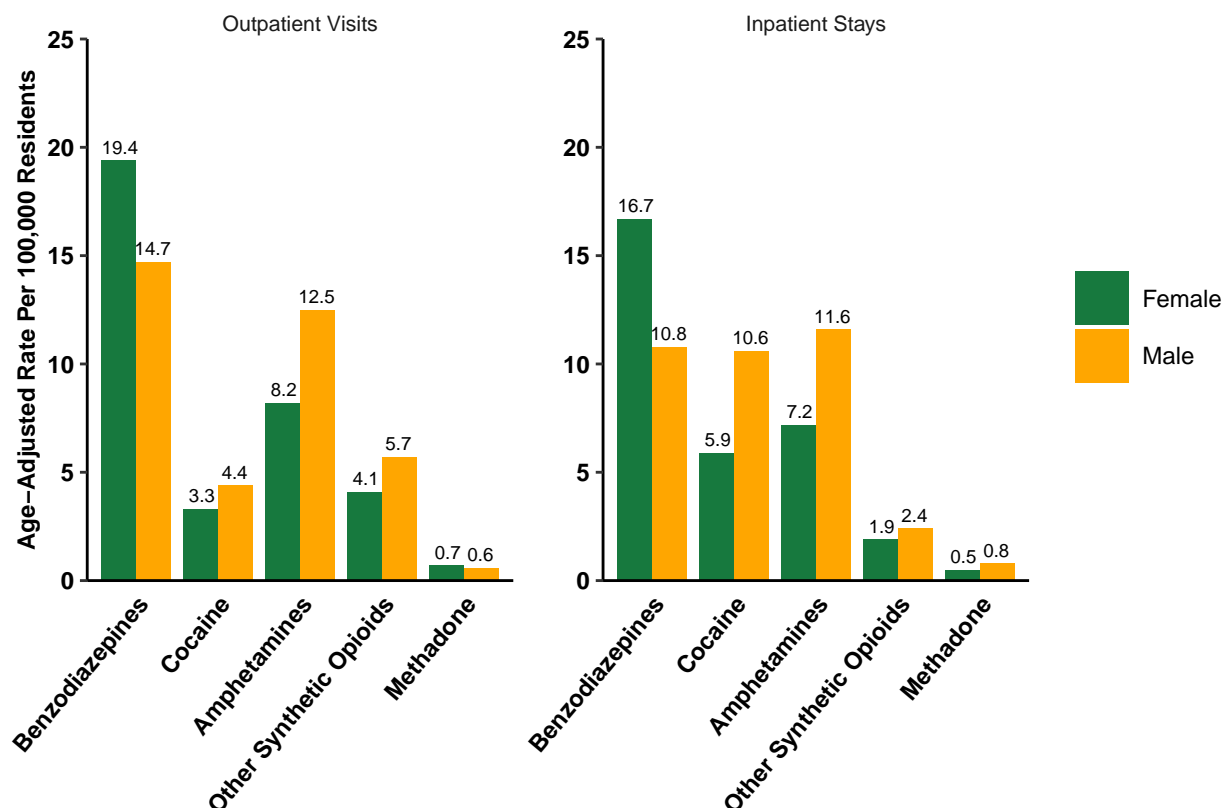
Age-Adjusted Rates for All Drug, Opioid and Heroin Overdose Outpatient Visits and Inpatient Stays by Sex in TN, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

In 2019, females accounted for 51.8% (12,385) of all drug overdose hospital discharges compared to 48.2% (11,524) for males. Outpatient visits were the most common type of discharge for both females (8,375) and males (8,295). The figure above displays the 2019 age-adjusted rates in TN for all drug, opioid (excluding heroin), and heroin overdoses among males and females. The rates of all drug (257.4 vs. 254.0), opioid (50.7 vs. 33.7) and heroin (66.3 vs. 38.2) overdose outpatient visits were higher for males than females, while females had higher rates of all drug (110.3 vs. 94.9) and opioid (19.8 vs. 18.2) overdose inpatient stays than males. Compared to females, males had higher rates of heroin overdose inpatient stays (9.1 vs. 4.6).

Age-Adjusted Rates for Benzodiazepine, Stimulant, and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays by Sex in TN, 2019



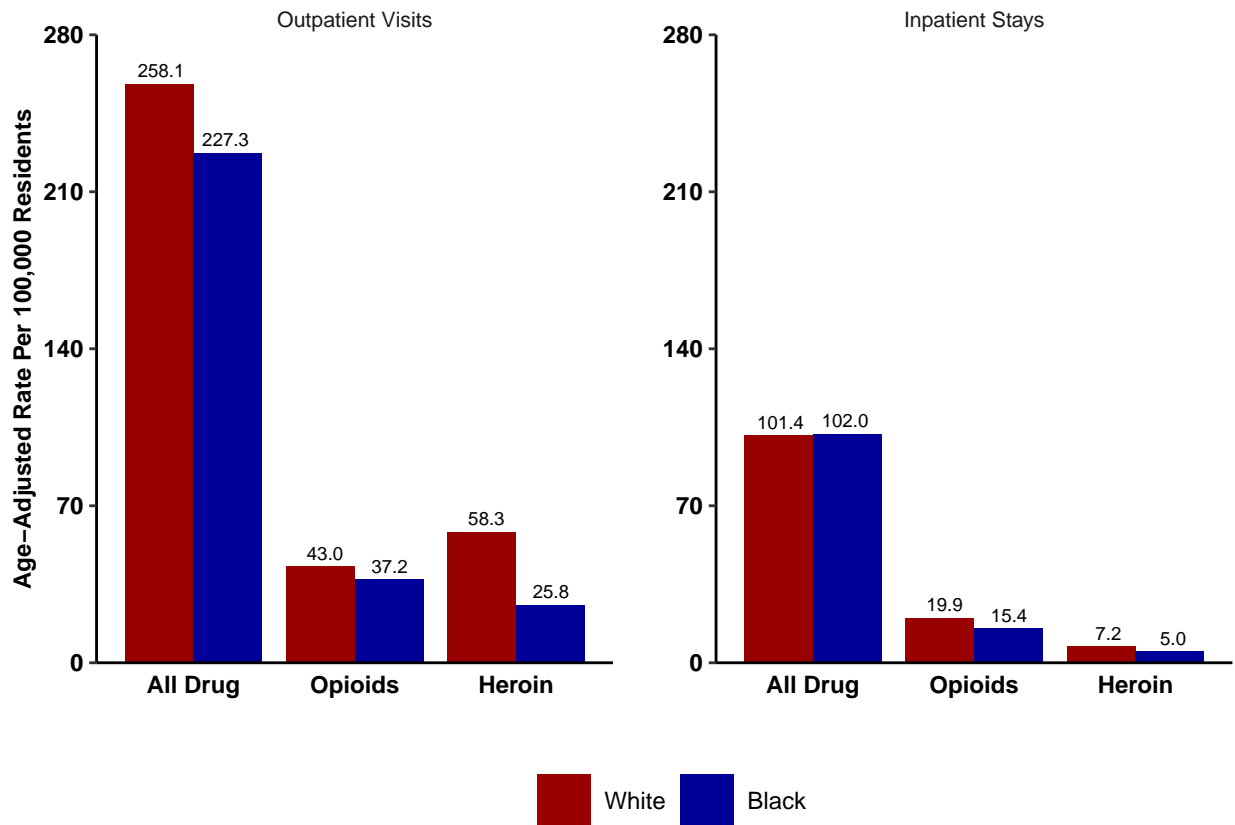
Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

The figure above shows age-adjusted rates for females and males in 2019 for select overdose discharges. Males had higher outpatient visits for cocaine (4.4 vs. 3.3) and amphetamine¹¹ (12.5 vs. 8.2) overdoses, compared to females. Rates of benzodiazepine overdose outpatient visits were higher for females compared to males (19.4 vs. 14.7). Similar patterns were observed for inpatient stays with males having higher rates of cocaine and amphetamine overdoses and females having higher rates of benzodiazepine overdoses. Both outpatient visits and inpatient stays for other synthetic opioid overdoses were higher for males compared to females. Rates of methadone overdose outpatient visits were slightly lower for males, while inpatient stays for methadone overdose were slightly higher for males than for females.

¹¹ Amphetamine overdoses include methamphetamine.

Drug Overdose Hospital Discharges by Race

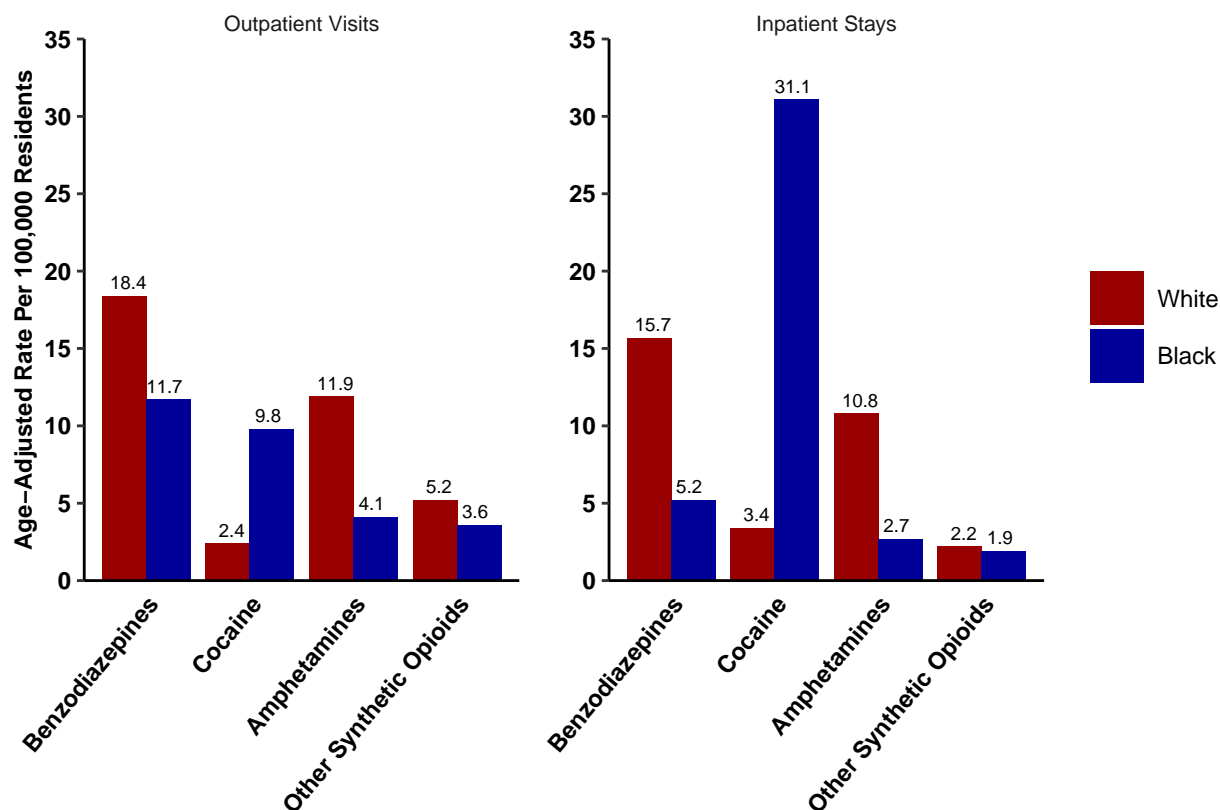
Age-Adjusted Rates for All Drug, Opioid and Heroin Overdose Outpatient Visits and Inpatient Stays by Race in TN, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

In 2019, White Tennesseans accounted for 18,866 (80.1%) of all drug overdose hospital discharges, Black Tennesseans made up 4,038 (17.2%), and other or unknown races accounted for the remaining 641 (2.7%) discharges. Outpatient visits were the most common type of discharge for both White (13,135) and Black (2,808) Tennesseans. The above figure shows the age-adjusted rates (per 100,000 TN residents) for all drug, opioid (excluding heroin) and heroin overdoses by race. White Tennesseans had the highest age-adjusted rates for opioid and heroin overdoses in both outpatient and inpatient settings, while rates of inpatient stays for all drug overdoses were slightly higher among Black Tennesseans compared to White Tennesseans.

Age-Adjusted Rates for Benzodiazepine, Stimulant, and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays by Race in TN, 2019



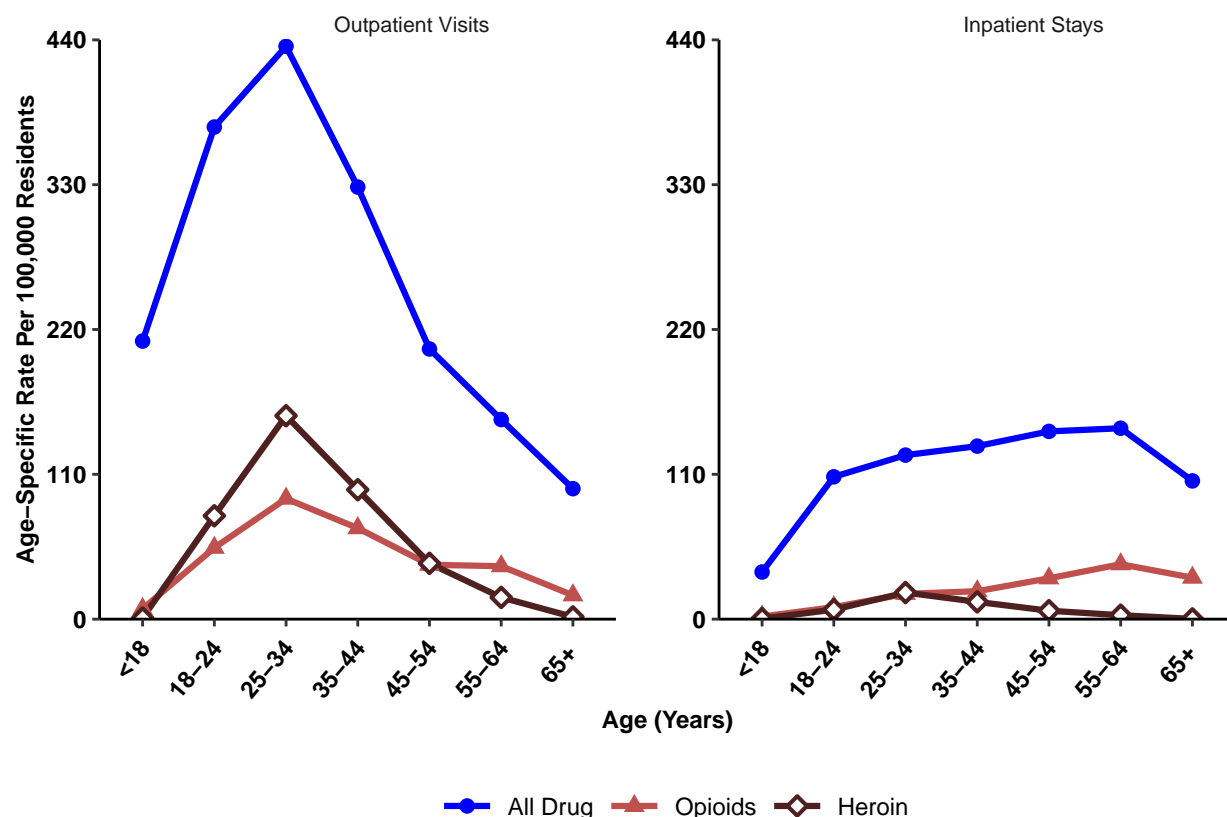
Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

The above figure shows the age-adjusted rates per 100,000 TN residents for benzodiazepine, cocaine, other synthetic opioids, and amphetamine overdose outpatient visits and inpatient stays by race. In 2019, compared to Black Tennesseans, White Tennesseans had higher age-adjusted rates for benzodiazepine, amphetamine,¹² and other synthetic opioids overdose outpatient visits and inpatient stays, while Black Tennesseans had higher rates for cocaine overdoses (outpatient visits: 9.8 vs. 2.4 and inpatient stays: 31.1 vs. 3.4) than White Tennesseans.

¹²Amphetamine overdoses include methamphetamine.

Drug Overdose Hospital Discharges by Age

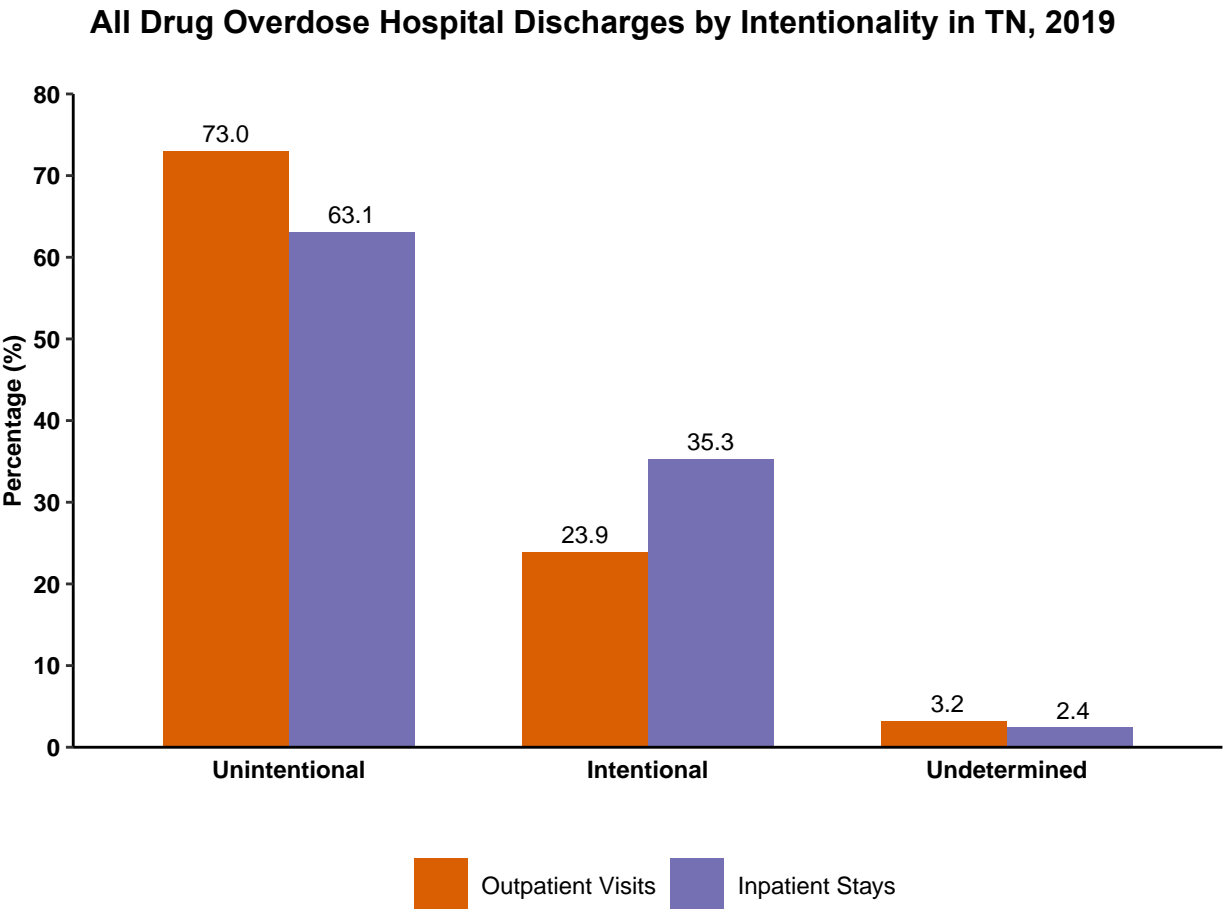
Age-Specific Rates for Drug Overdose Outpatient Visits and Inpatient Stays by Age groups in TN, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

The figure above displays 2019 age-specific rates (per 100,000 residents) for all drug, opioid (excluding heroin) and heroin overdoses in TN. Patients aged 25-34 years had the highest rates of all drug (435.1), opioid (91.5), and heroin overdose (154.5) outpatient visits. Rates for heroin overdose outpatient visits were lower than the rates for opioid overdose outpatient visits among those aged 45 years or older. For inpatient stays, all drug (145.0) and opioid (41.7) overdose rates were highest among those aged 55-64 years, while heroin overdose rates were highest among those aged 25-34 years (20.2).

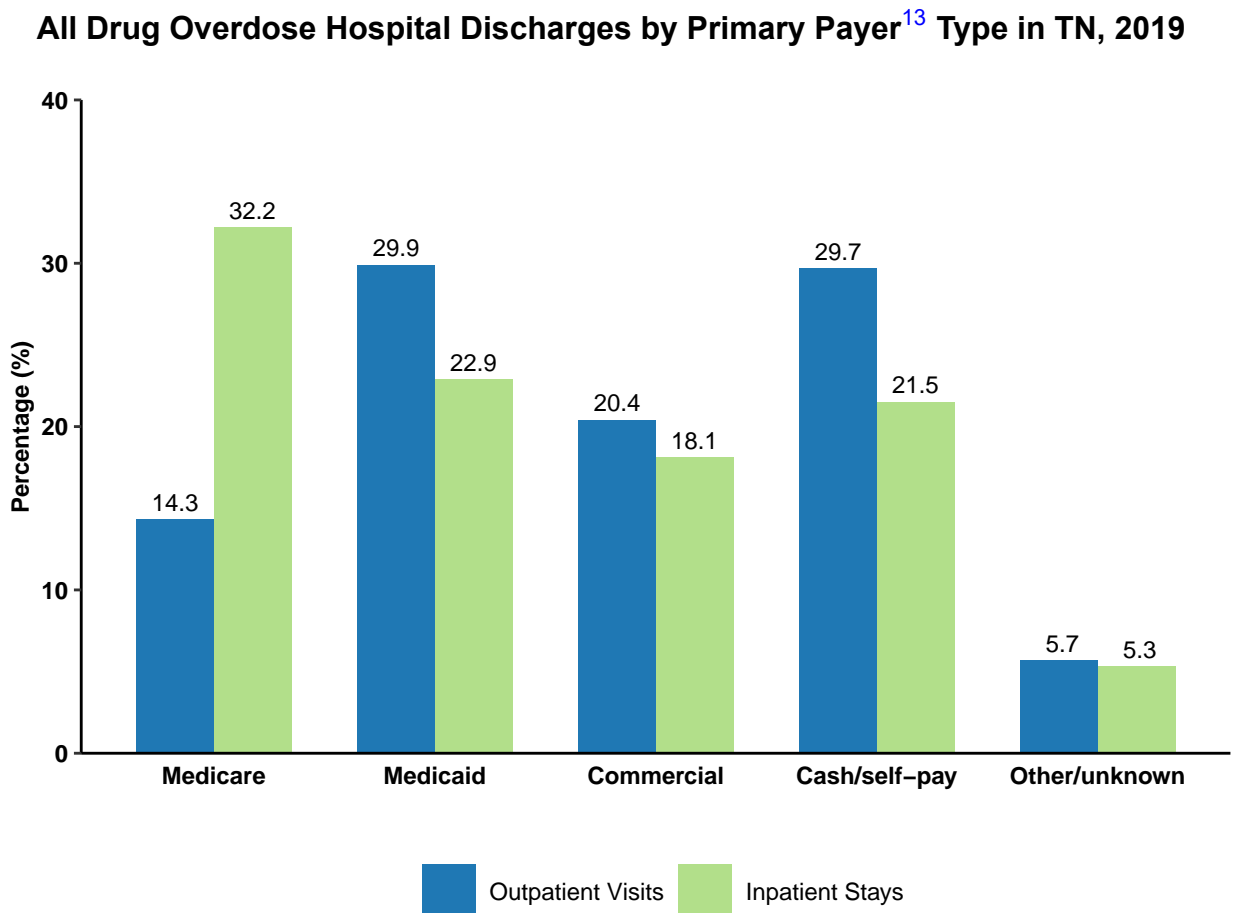
Drug Overdose Hospital Discharges by Intentionality



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

The above figure shows all drug overdose intent in the outpatient and inpatient setting. In 2019, about 73% of all drug overdose outpatient visits (n=12,171) and 63.1% of inpatient stays (n=4,569) in Tennessee were due to unintentional poisoning while about one quarter of outpatient visits and 35.3% of inpatient stays were intentional. Three percent of all drug overdose discharges were undetermined, while overdoses due to assault were 0.2%.

Drug Overdose Hospital Discharges by Primary Payer



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

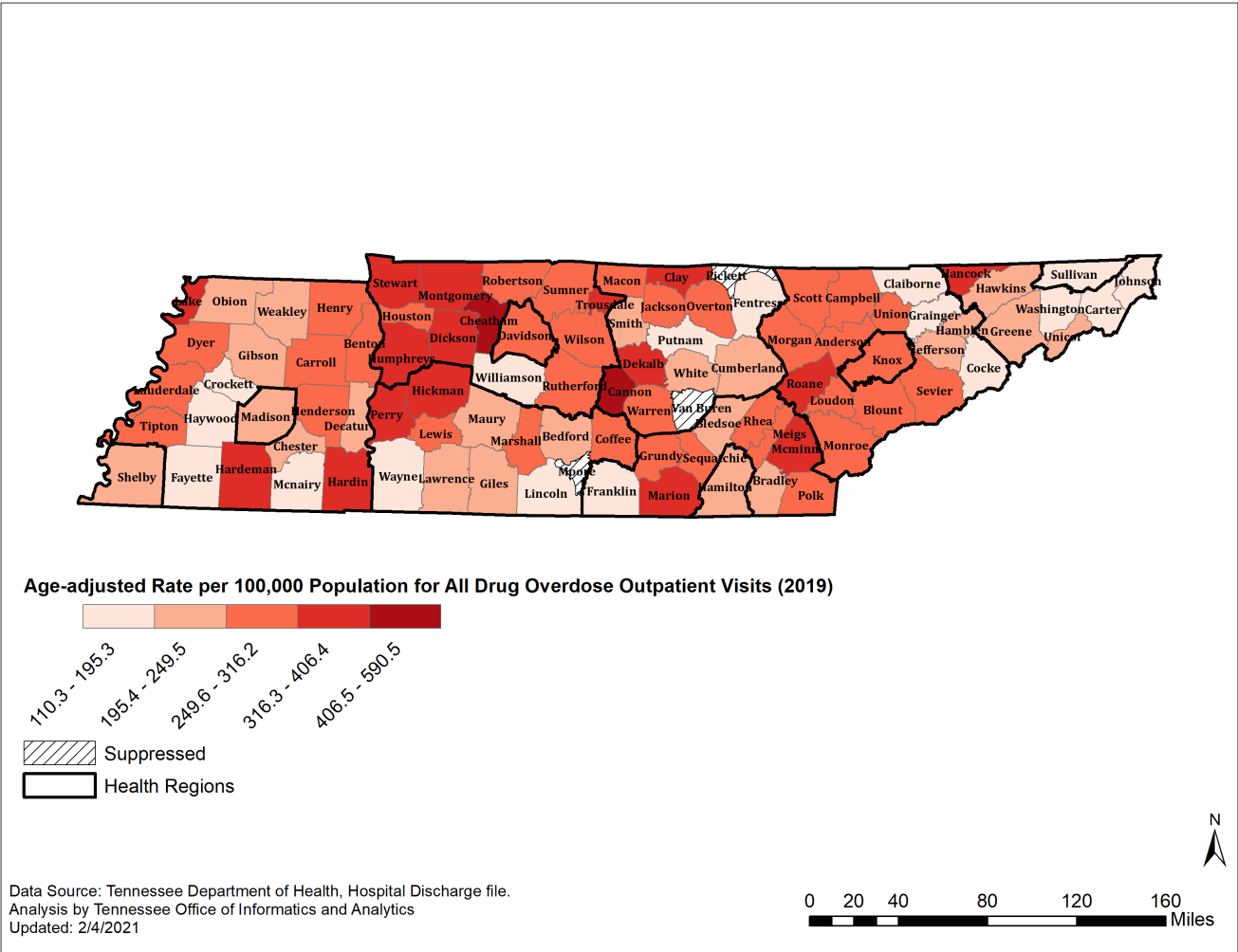
The above figure shows the payers billed for hospital discharges due to all drug overdose. In 2019, among all drug overdose outpatient visits, Medicaid including TennCare and Cash/self-pay were the most common primary payers billed for all drug overdose visits (about 30%), followed by commercial insurance (20.4%). For inpatient stays related to all drug overdoses, the most common primary payer was Medicare (32.2%) followed by Medicaid (22.9%) and cash/self-pay (21.5%).

¹³Primary Payer is determined according to the name or type of payer organization from which the hospital first receives payment for the bill.

Drug Overdose Hospital Discharges by County of Residence

All Drug Overdoses

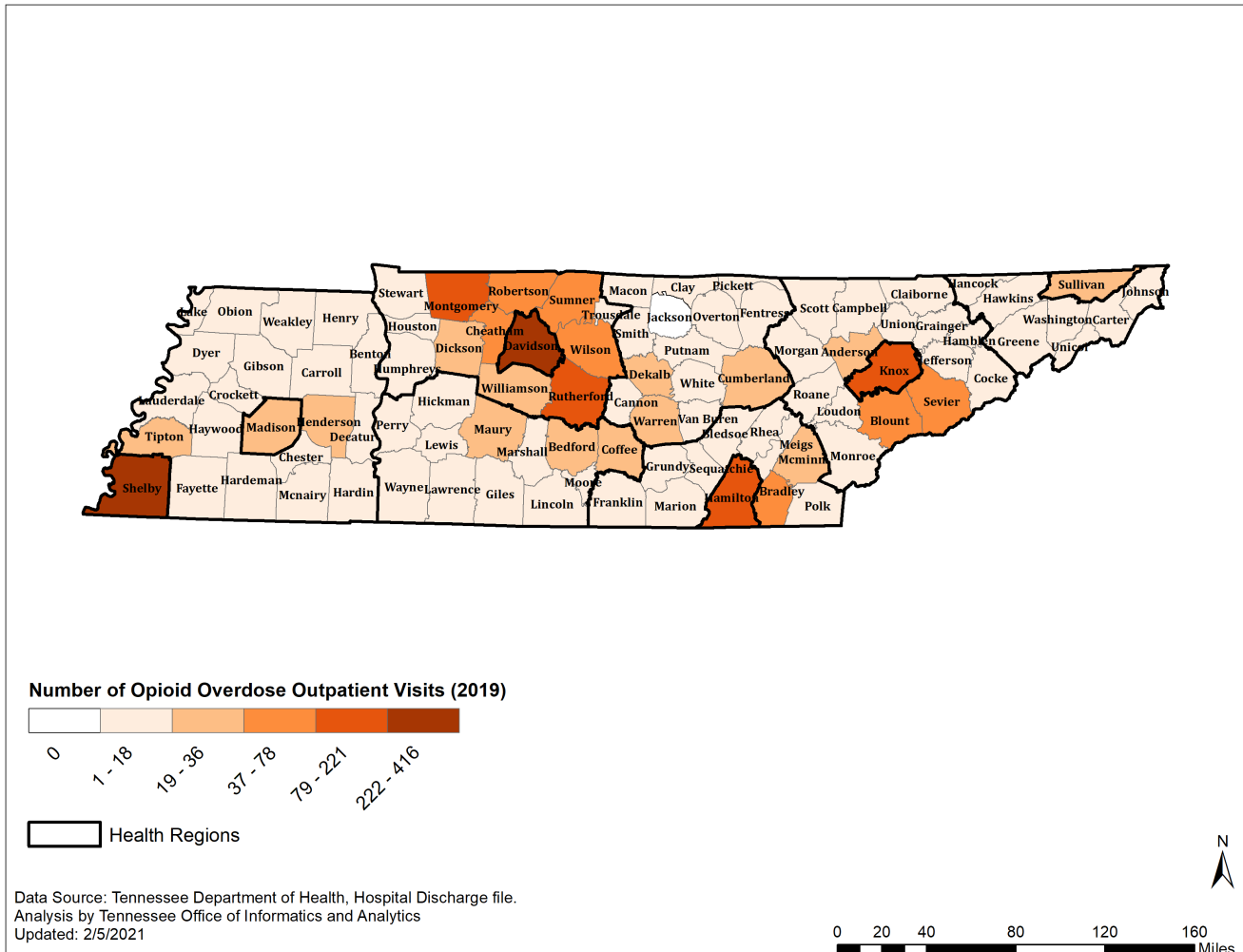
Age-Adjusted Rates for All Drug Overdose Outpatient Visits in TN, 2019



The above map shows age-adjusted rates per 100,000 for all drug overdose outpatient visits in 2019 by TN county of residence. The rates ranged from 110.3 in Washington County to 590.5 in Cheatham County for all drug overdose outpatient visits. Cannon and Cheatham counties had the highest rates for all drug overdose outpatient visits in 2019 (>406.4).

Opioid (Excluding Heroin) Overdoses

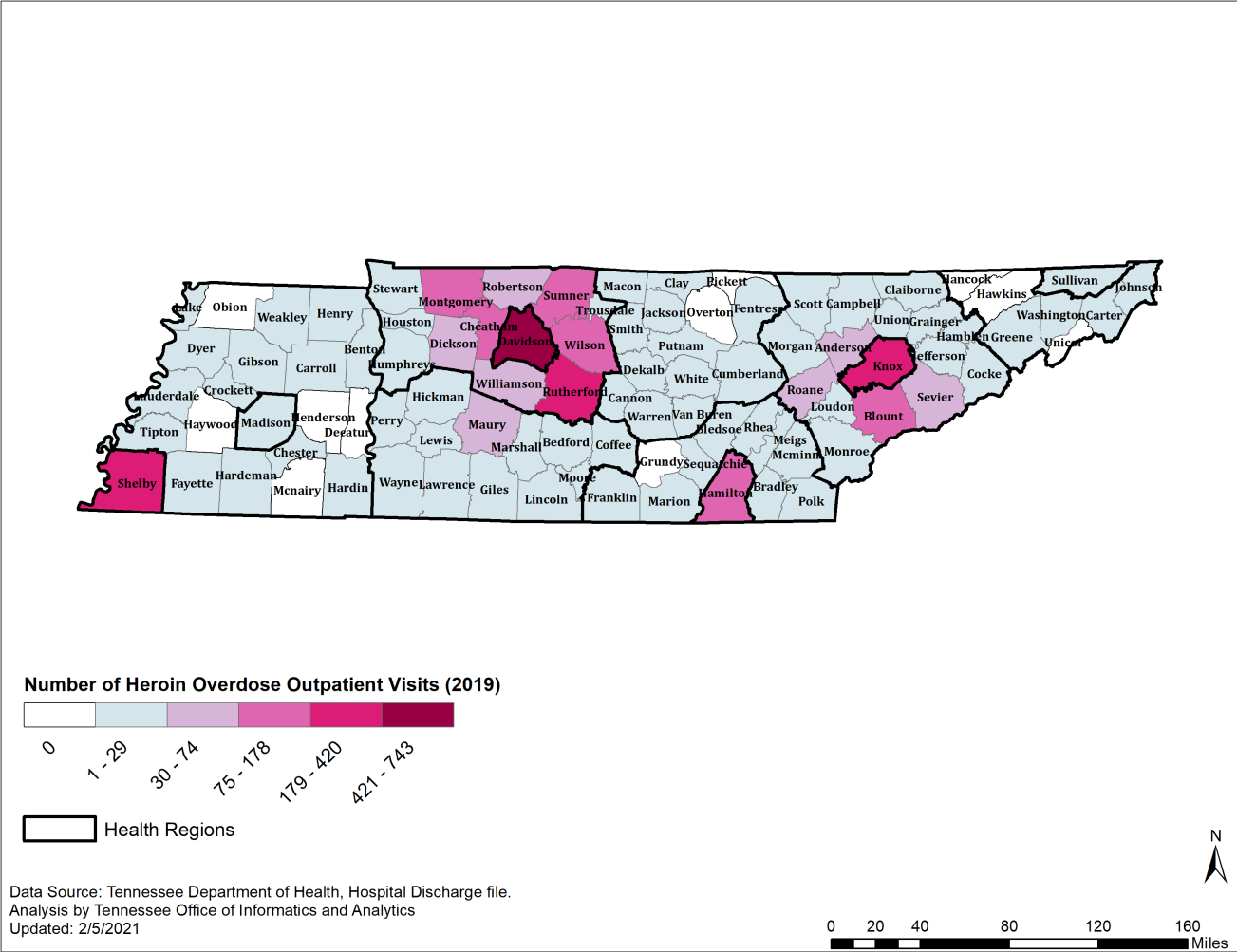
Number of Opioid (Excluding Heroin) Overdose Outpatient Visits in TN, 2019



The above map shows the number of opioid (excluding heroin) overdose outpatient visits in 2019 by TN county of residence. Jackson County residents had no opioid overdose outpatient visits. Davidson, Hamilton, Knox, Montgomery, Rutherford, and Shelby counties had 79 or more opioid overdose outpatient visits in 2019.

Heroin Overdoses

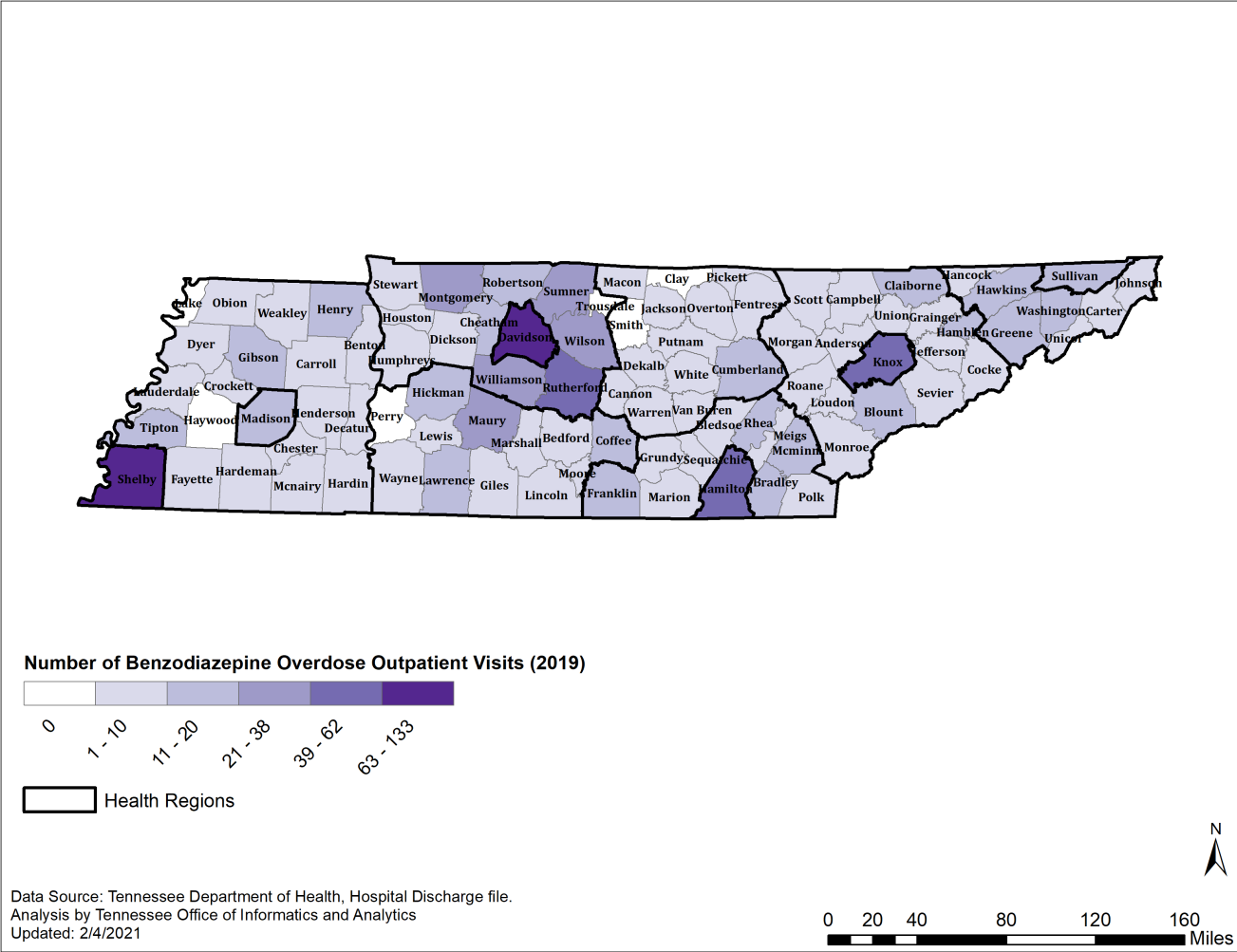
Number of Heroin Overdose Outpatient Visits in TN, 2019



The above map shows the number of heroin overdose outpatient visits in 2019 by TN County of residence. Residents of eleven counties (Decatur, Grundy, Hancock, Hawkins, Haywood, Henderson, McNairy, Obion, Overton, Pickett, and Unicoi) had no heroin overdose outpatient visits. Four counties (Rutherford, Shelby, Knox, and Davidson) had >178 heroin overdose outpatient visits in 2019.

Benzodiazepine Overdoses

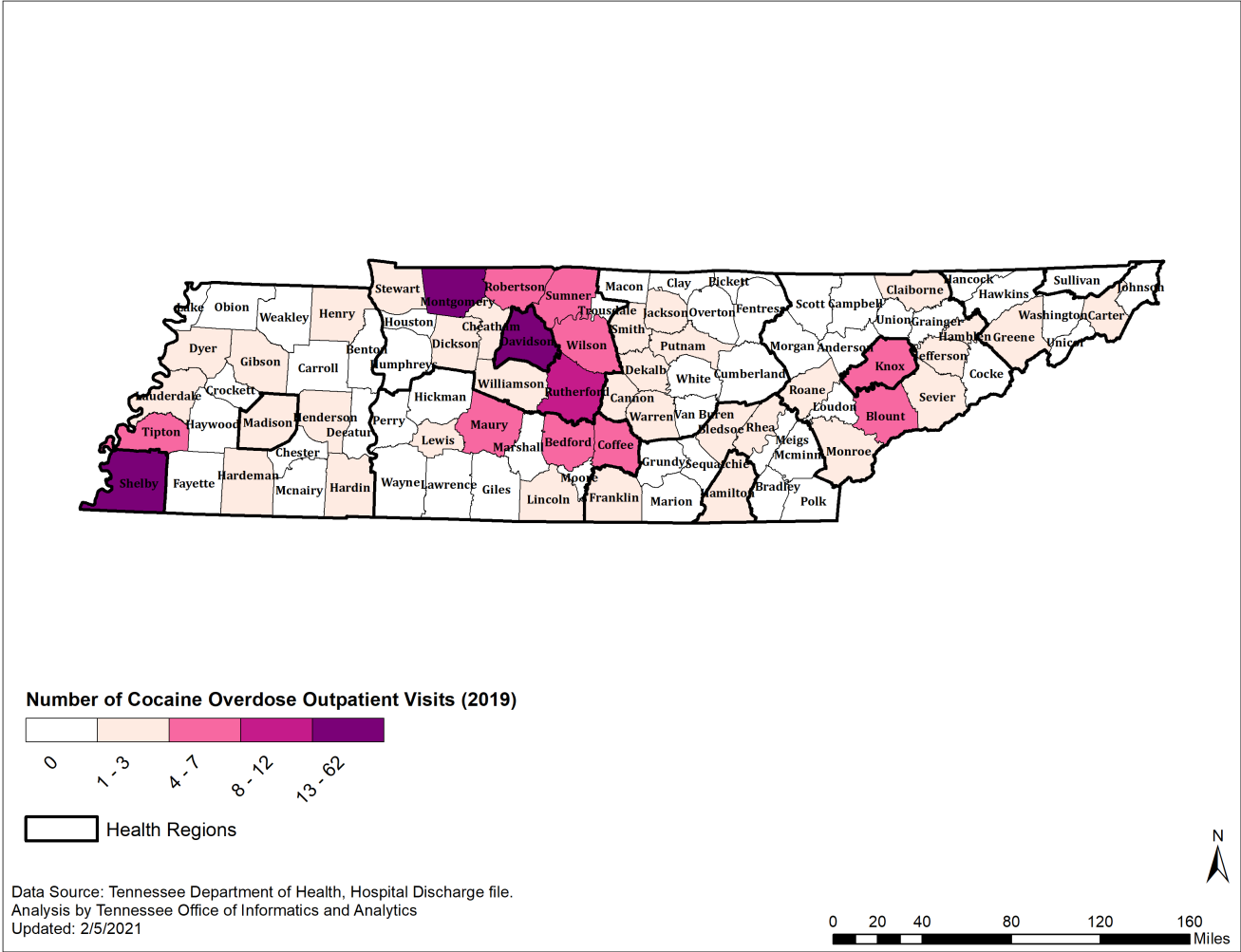
Number of Benzodiazepine Overdose Outpatient Visits in TN, 2019



The above map shows the number of benzodiazepine overdose outpatient visits in 2019 by TN county of residence. Residents of six counties (Clay, Haywood, Lake, Perry, Smith, and Trousdale) had no reported benzodiazepine overdose outpatient visits. Four counties (Hamilton, Knox, and Rutherford) had 39 to 62 benzodiazepine overdose visits, while Davidson (117 visits) and Shelby (133 visits) counties had the highest number of benzodiazepine overdose outpatient visits in 2019.

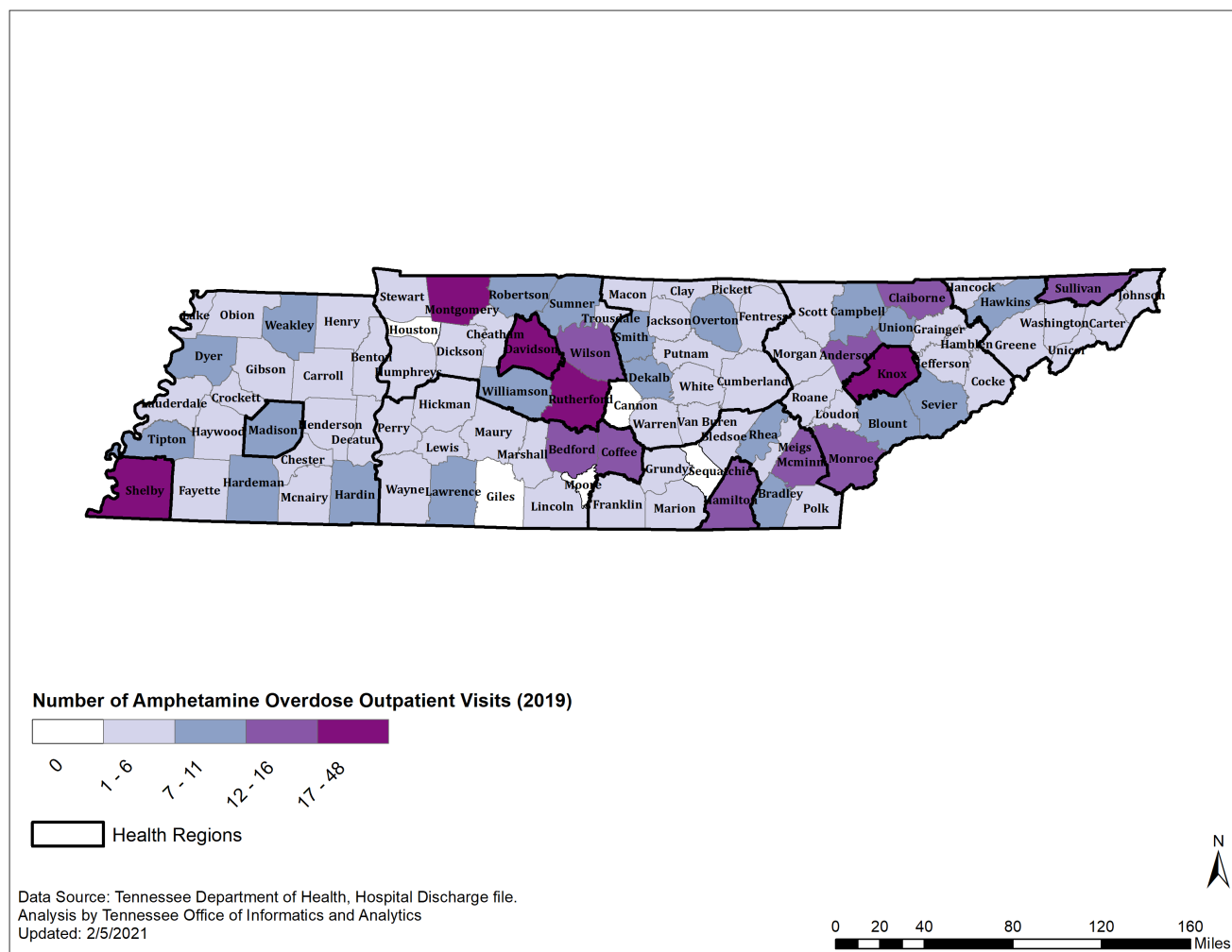
Stimulant Overdoses

Number of Cocaine Overdose Outpatient visits in TN, 2019



The above map shows the number of cocaine related overdose outpatient visits in 2019 by TN county of residence. Montgomery (41 visits), Shelby (42 visits) and Davidson counties (62 visits) had the highest number of cocaine overdose outpatient visits in 2019.

Number of Amphetamine Overdose Outpatient Visits in TN, 2019



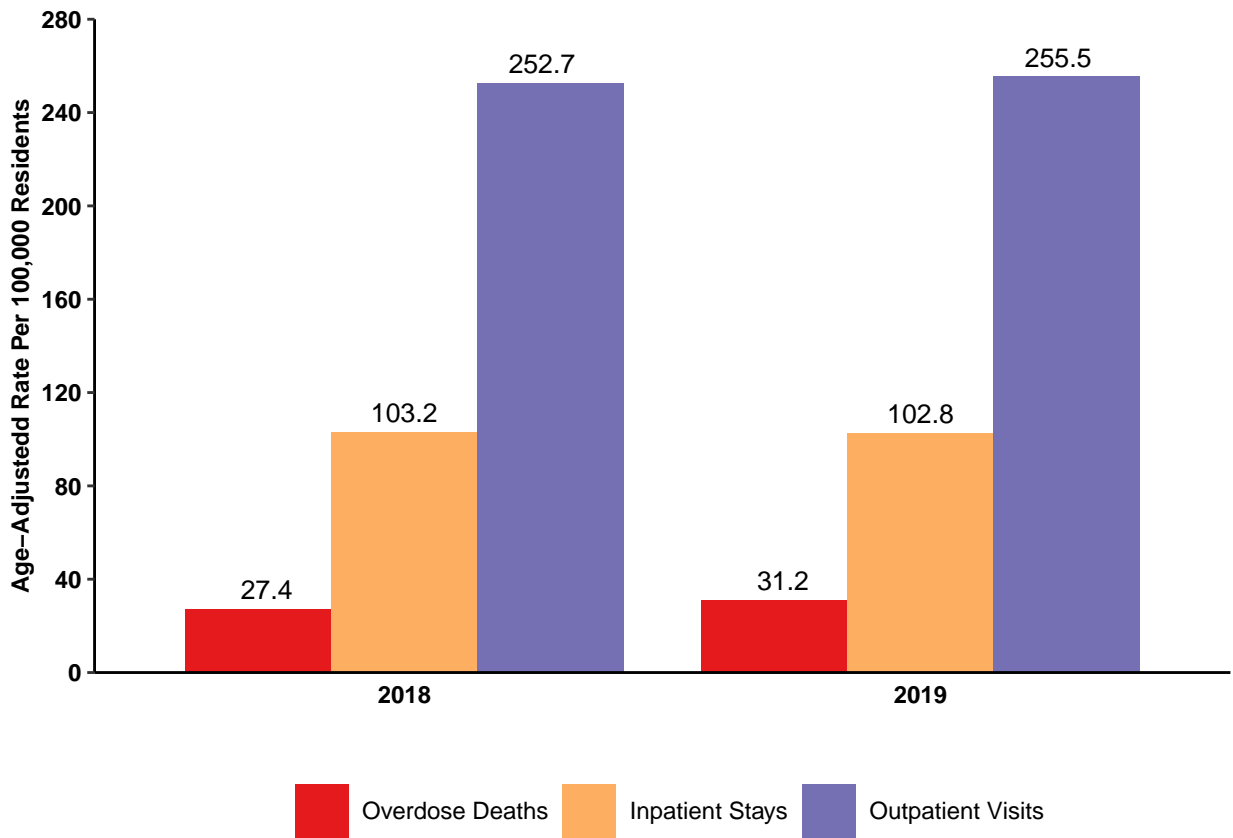
The above map shows the number of amphetamine¹⁴ overdose outpatient visits in 2019 by TN county of residence. Residents of five counties (Cannon, Giles, Houston, Moore, and Sequatchie) had no reported amphetamine overdose outpatient visits. Davidson, Knox, Montgomery, Rutherford, and Shelby counties had the highest number (>16) of amphetamine overdose outpatient visits.

¹⁴Amphetamine overdoses include methamphetamine.

Fatal and Nonfatal Drug Overdose Trends

The following figure shows nonfatal overdose hospital discharge rates alongside fatal overdose rates from 2018 to 2019. The death rates are derived from the TN Vital Statistics Death Statistical File and include overdose deaths that occur both in and out of hospitals. The majority of overdose deaths occur outside of hospitals. In 2019, 2,089 TN residents died of a drug overdose. Among hospital discharge patients, 197 inpatients and 50 outpatients were reported deceased. Similar to the nonfatal hospital discharge rates presented above, the below rates exclude records with the discharge status of deceased.

Age-Adjusted Rates for All Drug Overdose Hospital Discharges and Deaths in TN, 2018-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System.

Rates of death from all drug overdoses increased from 27.4 in 2018 to 31.2 in 2019. Concurrently, rates for outpatient visits also increased while inpatient stays declined slightly since 2018.

Annual Cost of Nonfatal All Drug Overdose Discharges in TN, 2019

Introduction

Substance use disorder and related overdose events, even if nonfatal, have been shown to have large, long-term costs for our society.¹⁵ These can come in the form of physical and emotional distress, lost wages and productivity, shortened lifespans, costs of treatment, and more. Overdoses that are treated in a hospital often come with a particularly large and immediate cost. Healthcare resources are expensive, and many parties may end up covering the cost of these services: the patient, their insurance provider, the government, or sometimes the hospital itself. Quantifying this cost is therefore critical to understanding the true financial burden of overdose in TN.

Calculating the cost of care can be done in a variety of ways, but it is usually not possible to generate the precise final amount that each payer spent on a given overdose event. Healthcare billing is extraordinarily complicated, and a wide variety of factors can impact these values. Instead, many researchers calculate the estimated cost of all healthcare resources utilized during a visit, using a well-tested standard method called a Cost to Charge Ratio (CCR).¹⁶ This method is ideal for analysis because it provides a standardized estimate of what a hospital spent in treating a patient, removing variation due to pricing differences, profit margins, and other factors. This standardization is critical because hospitals often have dramatically different pricing schemes, which can make their raw bills difficult to compare.¹⁷

Hospital data needed for cost of care calculations was provided by the Joint Annual Report (JAR),¹⁸ a comprehensive financial survey completed each year by every non-federal general acute care hospital in the state. Full details on the methodology used to calculate the cost of care is presented [on pages 33-34]. The final value, hereafter referred to as “cost” for simplicity, should be interpreted as the estimated total amount that the hospital spent during each overdose event, even for treatments not directly related to the overdose.

In this section, the costs of overdose in TN are reported for several key metrics. For all analyses, the costs are reported separately for inpatient stays and outpatient visits, because these two categories have very different costs. The median 2019 cost of overdose by TN Grand Division, overdose type, hospital type, and hospital bed size are presented. Caution should be exercised in the interpretation and use of the values presented here. These costs are estimates, and should not be interpreted as real values that any party actually paid for the care received. Due to health insurance negotiation rates, copays, deductibles, and other factors, the patient and their insurer are unlikely to pay either the full amount charged, or the amount calculated as the cost of a visit.

¹⁵Florence, Curtis, Feijun Luo, and Ketra Rice. 2021. “The Economic Burden of Opioid Use Disorder and Fatal Opioid Overdose in the United States, 2017.” *Drug and Alcohol Dependence* 218:108350. doi: 10.1016/j.drugalcdep.2020.108350.

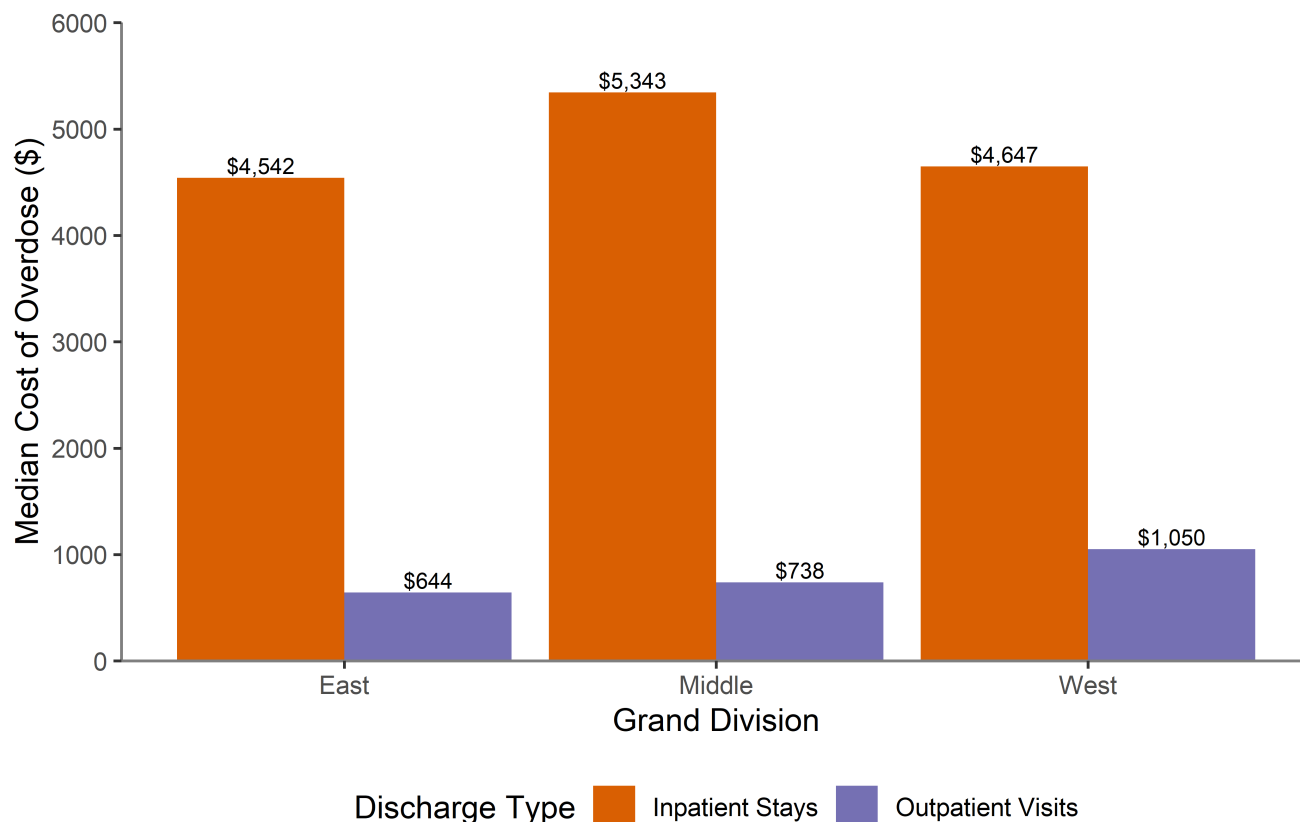
¹⁶Hsu, Douglas J., Ellen P. McCarthy, Jennifer P. Stevens, and Kenneth J. Mukamal. 2017. “Hospitalizations, Costs and Outcomes Associated with Heroin and Prescription Opioid Overdoses in the United States 2001-12.” *Addiction* (Abingdon, England) 112(9):1558-64. doi: 10.1111/add.13795.

¹⁷Robinson, Bryce R. H., Timothy A. Pritts, Dennis J. Hanseman, Gregory C. Wilson, and Daniel E. Abbott. 2014. “Cost Discrepancies for Common Acute Care Surgery Diagnoses in Ohio: Influences of Hospital Characteristics on Charge and Payment Differences.” *Surgery* 156(4):814-24. doi: 10.1016/j.surg.2014.06.071.

¹⁸JAR Reports information can be accessed at: <https://www.tn.gov/health/health-program-areas/statistics/health-data/jar.html>

Annual Cost by Grand Divisions and Discharge Type

Median Annual Cost of Nonfatal All Drug Overdose in TN by Grand Divisions¹⁹ and Discharge Type, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System and Joint Annual Report.

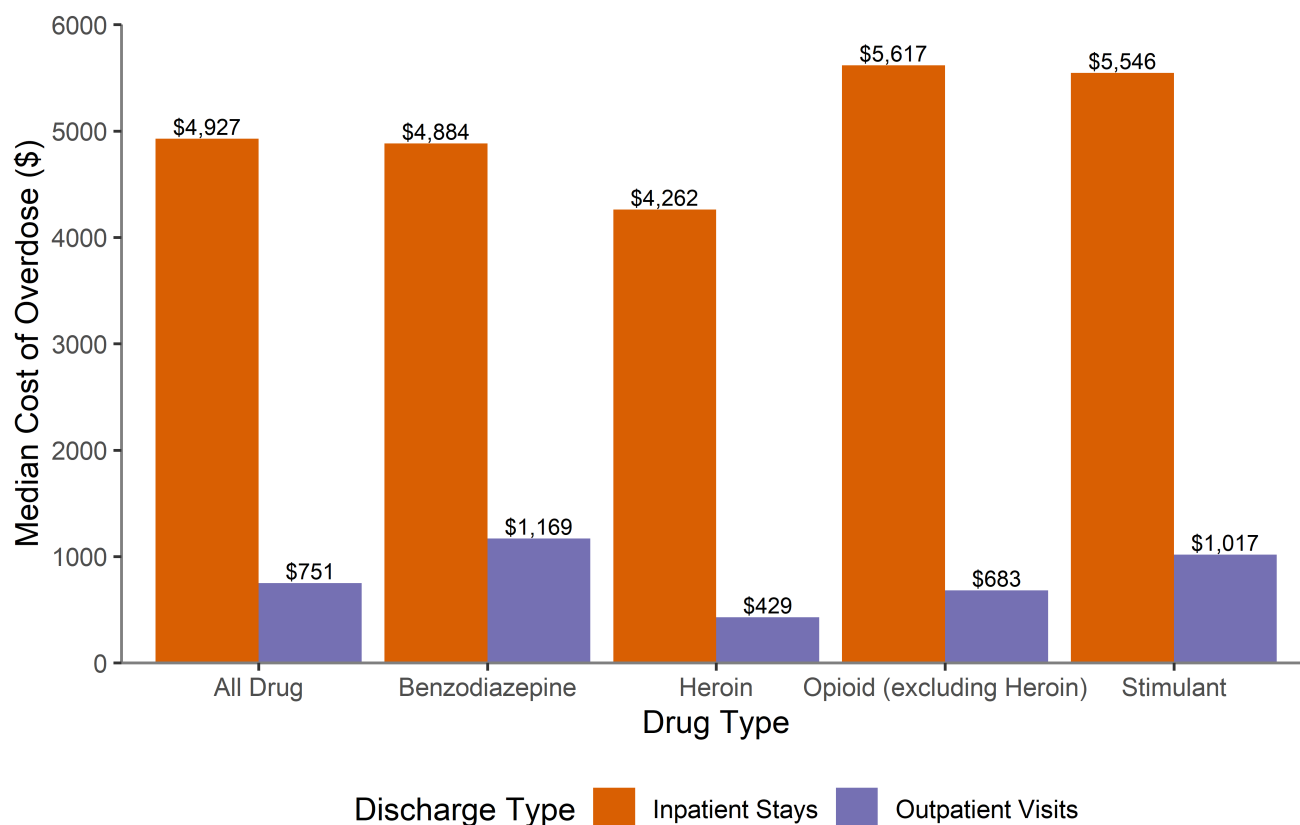
The graph above presents the median cost of an overdose in each grand division of Tennessee. An overdose that involves an inpatient stay was the most expensive in Middle TN, at \$5,343 [IQR²⁰: \$3,334.02-\$8,653.61], but an outpatient visit was the most expensive in West TN, costing \$1,050 [IQR: \$553.9-\$1,625.35]. Regional variation in cost may be explained by regional differences in both patient factors (complexity of the overdose, quickness of treatment, comorbidities) and hospital characteristics (size, ownership type, efficiency).

¹⁹<https://tncounties.org/TCCA/Resources/Grand-Divisions-Map/TCCA/Resources/Grand-Divisions-Map.aspx?hkey=849aa91a-5940-404b-b5b2-151bca37ec88>

²⁰Interquartile Range: The top and bottom values of the middle 50% of the data, presented here as the 25th and 75th percentile of the costs.

Annual Cost by Drug and Discharge Type

Median Cost of Nonfatal Overdose by Drug and Discharge Type in TN, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System and Joint Annual Report.

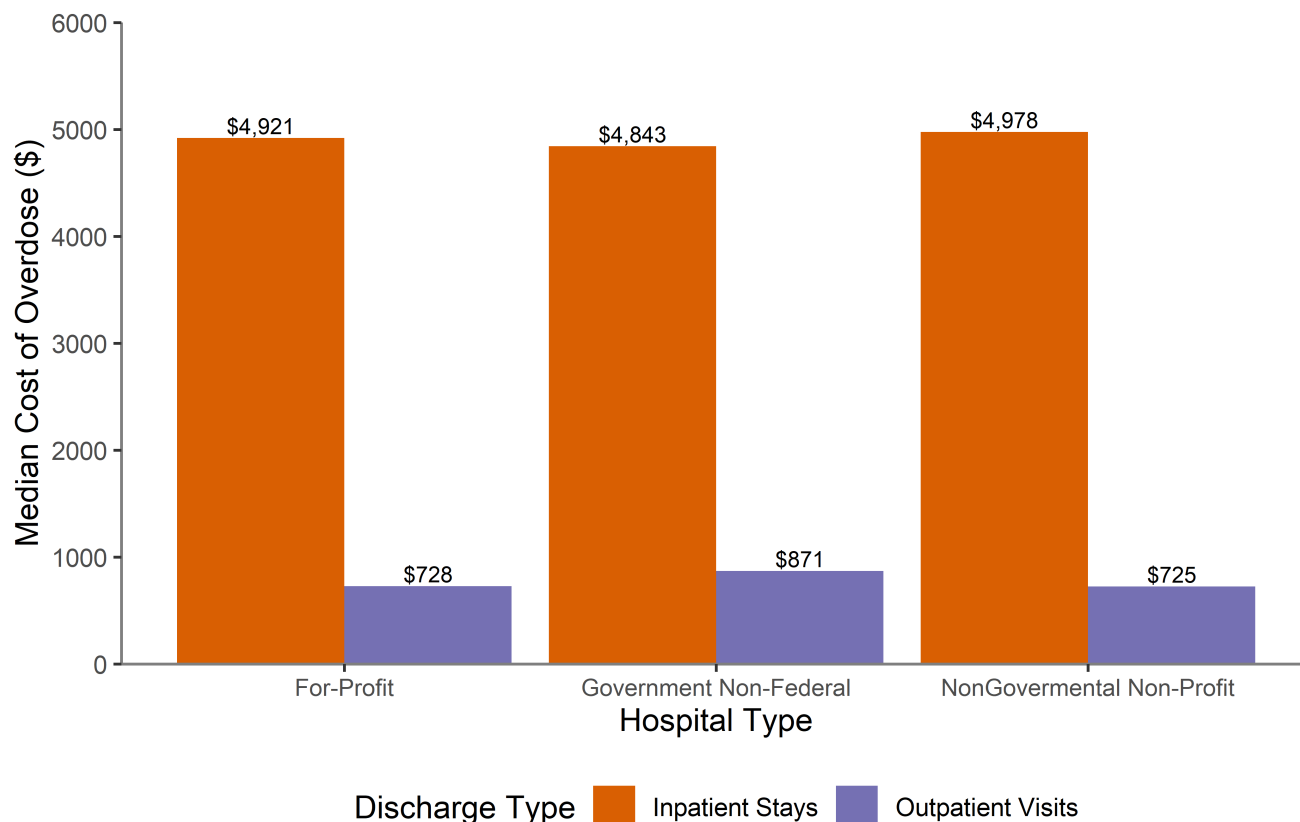
The above graph presents the median cost of an overdose by drugs involved in the overdose. These categories are not mutually exclusive, as a patient may overdose simultaneously on two or more of the substances presented above, and would be included in both estimates.²¹ Nonfatal opioid overdoses were the most expensive for inpatients (\$5,617, IQR²²: \$3,540.99-\$9,128.35). Benzodiazepine overdoses were the most expensive for outpatients (\$1,169, IQR: \$715.44-\$1,933.08). Heroin overdoses were the least expensive for both categories, with median inpatient stays costing \$4,262 [IQR: \$2,808.22-\$7,115.52] and median outpatient visits costing \$429 [IQR: \$234.29-\$775.71].

²¹The only exception to this rule is heroin: a heroin overdose may also include other opioids, but the opioid overdoses exclude heroin by definition.

²²Interquartile Range: The top and bottom values of the middle 50% of the data, presented here as the 25th and 75th percentile of the costs.

Annual Cost by Hospital and Discharge Type

Median Cost of Nonfatal All Drug Overdose by Hospital and Discharge Type in TN, 2019



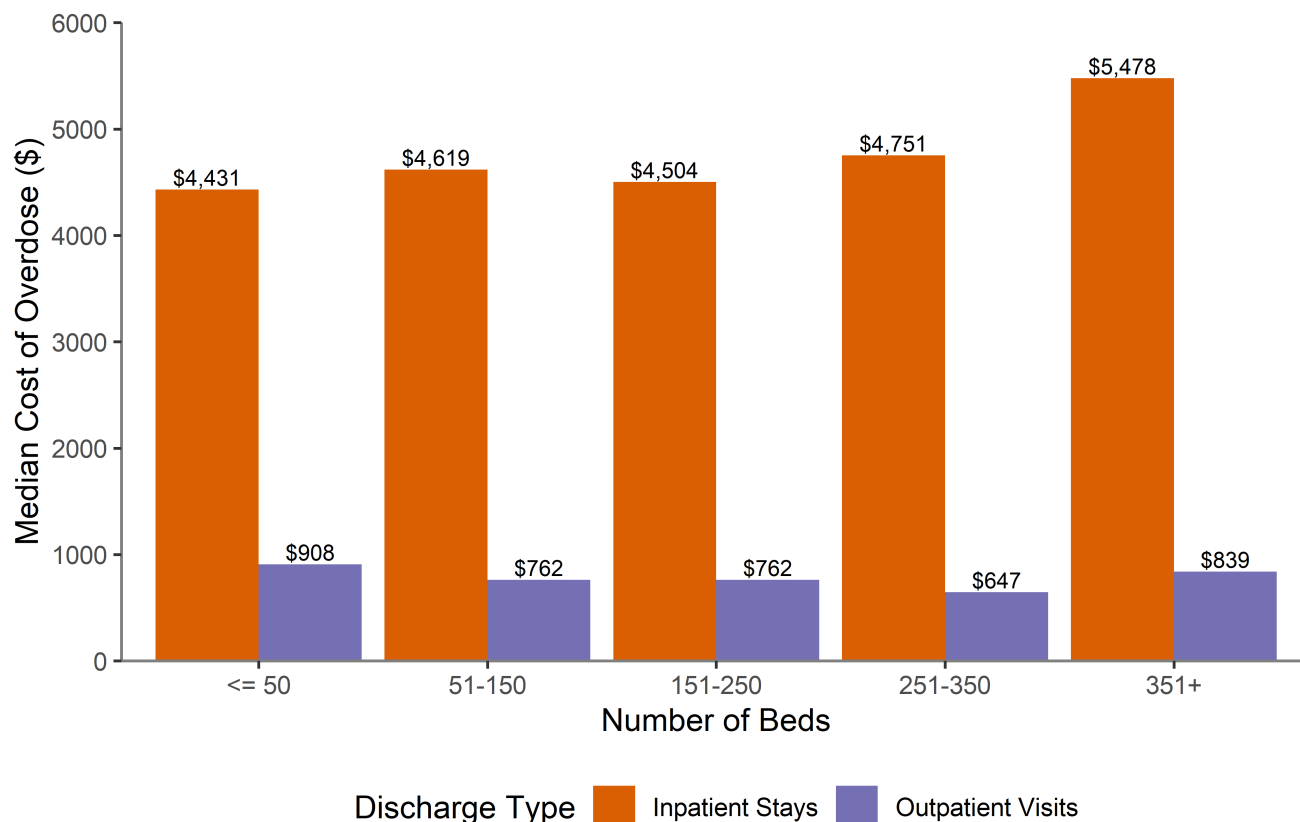
Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System and Joint Annual Report.

This graph presents the median cost of nonfatal overdose by hospital type. Hospitals with non-standard categories (N=2) are excluded. Government non-federal hospitals²³ (N=24), which are owned or operated by the State, have the most costly outpatient visits, while non-governmental non-profit hospitals (the most common type of hospital with an N of 51) have the highest median inpatient costs. For-profit hospitals (N=44) are in the middle for both discharge types. It should be noted, however, that the median cost differences are quite small. The most costly and least costly inpatient categories are only separated by \$135, and outpatient values are similarly close.

²³These counts only include hospitals that treated at least one overdose during 2019.

Annual Cost by Bed Size and Discharge Type

Median Cost of Nonfatal All Drug Overdose by Bed Size and Discharge Type in TN, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 10, 2021). Limited to TN residents. Data Source: Hospital Discharge Data System and Joint Annual Report.

This graph presents the median cost of care by bed size. Small hospitals with 50 or fewer beds have the lowest median inpatient costs, but the highest outpatient costs. Hospitals with more than 350 beds have the highest median inpatient costs, and the second highest median outpatient costs. It should be noted that hospital bed size is related to location. Smaller hospitals are often in more rural areas, while larger hospitals are generally located in metropolitan areas. Patients with complex cases may also be transferred to these larger facilities for more intensive treatment, which can drive up costs. In TN, hospitals²⁴ with 51-150 beds are the most common (N=52), followed by those with <=50 beds (N=27). In 2019, there were 14 hospitals (11%) in the state with over 350 beds, but those facilities treated 28% of all nonfatal overdoses. There were also 14 hospitals in the 151-250 category, and 14 in the 251-350 category, which jointly treated 41% of all nonfatal overdoses.

²⁴These counts only include hospitals that treated at least one overdose during 2019.

Technical Notes

List of Figures:

1. Age-Adjusted Rates for All-Drug Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019, page 7
2. Age-Adjusted Rates for Opioid (Excluding Heroin) and Heroin Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019, page 8
3. Age-Adjusted Rates for Benzodiazepine Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019, page 9
4. Age-Adjusted Rates for Stimulant and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays in TN, 2018-2019, page 10
5. Age-Adjusted Rates for All Drug, Opioid and Heroin Overdose Outpatient Visits and Inpatient Stays by Sex in TN, 2019, page 11
6. Age-Adjusted Rates for Benzodiazepine, Stimulant, and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays by Sex in TN, 2019, page 12
7. Age-Adjusted Rates for All Drug, Opioid and Heroin Overdose Outpatient Visits and Inpatient Stays by Race in TN, 2019, page 13
8. Age-Adjusted Rates for Benzodiazepine, Stimulant, and Synthetic Opioid Overdose Outpatient Visits and Inpatient Stays by Race in TN, 2019, page 14
9. Age-Specific Rates for Drug Overdose Outpatient Visits and Inpatient Stays by Age groups in TN, 2019, page 15
10. All Drug Overdose Hospital Discharges by Intentionality in TN, 2019, page 16
11. All Drug Overdose Hospital Discharges by Primary Payer Type in TN, 2019, page 17
12. [Map] Age-Adjusted Rates for All Drug Overdose Outpatient Visits in TN, 2019, page 18
13. [Map] Number of Opioid (Excluding Heroin) Overdose Outpatient Visits in 2019 by TN County of Residence, page 19
14. [Map] Number of Heroin Overdose Outpatient Visits in 2019 by TN County of Residence, page 20
15. [Map] Number of Benzodiazepine Overdose Outpatient Visits in 2019 by TN County of Residence, page 21
16. [Map] Number of Cocaine Overdose Outpatient visits in 2019 by TN County of Residence, page 22
17. [Map] Number of Amphetamine Overdose Outpatient Visits in 2019 by TN County of Residence, page 23
18. Age-Adjusted Rates for All Drug Overdose Hospital Discharges and Deaths in TN, 2018-2019, page 24
19. Median Annual Cost of Nonfatal All Drug Overdose in TN by Grand Divisions and Discharge Type, 2019, page 26
20. Median Cost of Nonfatal Overdose by Drug and Discharge Type in TN 2019, page 27
21. Median Cost of Nonfatal All Drug Overdose by Hospital and Discharge Type in TN 2019, page 28
22. Median Cost of Nonfatal All Drug Overdose by Bed Size and Discharge Type in TN, 2019, page 29

Definition of Measures

Inpatient stays are inpatient hospitalizations generally lasting longer than 24 hours while outpatient visits are those less than 24 hours. Outpatient visits include primarily emergency department visits but also include any observation period of 23 hours or less, ambulatory surgeries or certain diagnostic services (such as MRIs or CT scans).

Overdose is determined by the International Classification of Disease, Clinical Modification, 10th revision codes (ICD-10-CM). Tennessee's Hospital Discharge Data System (HDDS) includes up to 18 diagnosis fields and three fields for external causes of injury codes (abbreviated as e-codes). Coding may or may not be based on urine/tox screens and rely on patient report, clinician diagnosis, and the availability of appropriate billing codes, and therefore may not accurately represent the actual drugs present during the overdose. Relevant ICD-10-CM codes for each revision are listed for each drug indicator definition below.

Age-adjusted rates for all drug overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of drugs, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T36-50 (poisoning by drugs, medicaments, and biological substances) with intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for opioid overdose excluding heroin outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of all opioids excluding heroin, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T40.0X (poisoning by opium),
 - T40.2X (poisoning by other opioids),
 - T40.3X (poisoning by methadone),
 - T40.4X (poisoning by synthetic narcotics),
 - T40.60 (poisoning by unspecified narcotics), or
 - T40.69 (poisoning by other narcotics) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
 - Exclusions: T401.1X (poisoning by heroin), any intent/any encounter type.
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for heroin overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of heroin, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T40.1X (poisoning by heroin) with

- intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for Benzodiazepine overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of benzodiazepine, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T42.4X (poisoning by benzodiazepine) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for other synthetic opioids overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of other synthetic opioids (excludes methadone), regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T40.4X (poisoning by synthetic opioids) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for methadone overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of methadone, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T40.3X (poisoning by methadone) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for cocaine overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of cocaine, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T40.5X (poisoning by cocaine) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age-adjusted rates for amphetamine (includes methamphetamine) overdose outpatient visits and inpatient stays

- Numerator - count of outpatient visits or inpatient stays caused by acute poisonings due to the effects of amphetamines, regardless of intent
 - Any mention of ICD-10-CM diagnosis codes:
 - T43.62 (poisoning by amphetamines) with
 - intent codes 1-4 (unintentional, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- Denominator - Yearly state population in 100,000s

Age/Race/Sex stratification

- Age is determined according to date of birth and at date of admission to hospital.
- Race and sex are reported by the hospital to the hospital discharge data system.
- Due to low numbers, patients of unknown race, Native American, Alaskan Native, Asian or Pacific Islander were not included in the analyses.

Age-adjustment is used for all nonfatal overdose rates except for those stratified by age. Age-adjusted rates were calculated using 2000 U.S. standard population for age-adjustment. The rate for a specific age group in a given population was multiplied by the proportion of people in the same age group in the 2000 U.S. standard population; adding across age groups yields the final age-adjusted rate.

Primary Payer Type

Primary Payer is determined according to the name or type of payer organization from which the hospital first receives payment for the bill. The payer types for this report are categorized as

- Medicare
- Medicaid
- Commercial
- Cash/self-pay
- Other/unknown (including Cover TN, Cover Kids, workers compensation, Division of Health Services, federal, military, medically indigent).

Detailed Explanation of How the Cost of Care is Calculated

In order to calculate the cost of care, we need the total charges charged to a patient and a hospital's Cost-to-Charge Ratio (CCR). Annual CCR values for hospitals in TN are calculated using the Joint Annual Report (JAR), a comprehensive financial survey completed each year by every non-federal general acute care hospital in the state. This survey is required, and thus has minimal missing data (no facilities that treated an overdose were missing data in 2019). The total annual cost reported by each hospital is divided by the total revenue reported over the same time period to obtain each facility's CCR. These CCRs are calculated annually, as a hospital's circumstances and pricing may change over time. On the patient side, the HDDS provides the total reported charges for each overdose. These charges reflect the maximum bill that was incurred during the visit, and include all relevant resources (such as nursing, room and board, treatments, supplies, and more). The only expense that may not be

included is doctor fees, if the physician was not a direct employee of the hospital. Patient charges are matched with the appropriate hospital's CCR using the hospital's JAR ID, a TN-specific hospital ID code, and the year of care. Total charges are then multiplied by the CCR to arrive at an estimated cost for that visit (how much the hospital may have actually spent on their care). The table below defines each number used to calculate the final cost. While the final cost is an estimate, all other numbers used in the calculation are directly from existing data sources.

Number	Unit	Definition	Source
Total Charges	Patient	The total amount billed by the hospital to the patient for care provided during the overdose event, before any deductions are applied due to insurance, copays, or other factors.	HDDS
Total Revenue	Hospital	The total (gross) amount that a hospital earned in a year, including all patient payments for all services	JAR
Total Cost	Hospital	The total amount that a hospital reported spending in a year on all services	JAR
Cost-to-Charge Ratio (CCR)	Hospital	Total Cost divided by Total Revenue. Represents the ratio of a hospital's revenue that was spent and is almost always less than 1 (hospitals generally earn more than they spend).	Calculated
Cost of Care	Patient	Total Charges multiplied by CCR. This estimates the total amount of money that the hospital spent on a patient's care. This adjustment corrects for the portion of a patient's charges that were really contributing to a hospital's revenue, not the cost of care.	Calculated

An Example: A patient experienced a nonfatal outpatient overdose. The hospital charged him \$800 for his visit, which included the cost of naloxone, nursing, and the use of an ER bed for three hours. This number was reported to the HDDS. In last year's JAR, the hospital reported earning \$1,000,000, but only reported spending \$500,000. This means that their cost to charge ratio is 0.5 ($500,000/1,000,000$)-roughly 50% of their income is used on the cost of care, and the rest is revenue. With this ratio, we can estimate that 50% of the patient's bill was covering the cost of treating him, and the other 50% was revenue for the hospital. This means that the hospital spent \$400 ($\$800 * 0.5$) on his care. His final cost of care would be reported as \$400. Different hospitals have very different ratios of revenue. Small rural facilities may spend 90-95 percent of their revenue on costs, while larger urban hospitals may spend only 30-40 percent. Utilizing this ratio allows for comparison of patients across hospitals and get a clear estimate of how much these facilities are actually spending on overdoses. These costs influence how much payers spend, as hospitals will not generally accept payment lower than the cost of care.

Time Period 2018 - 2019

Inclusion/Exclusion Criteria

- Only Tennessee residents were considered
- Only discharges from non-federal, acute care hospitals were included
- Excludes patients discharged as dead/deceased

- Late effects, adverse effects, under-dosing, and chronic poisonings due to the effects of drugs were excluded

Data Sources

- Tennessee Hospital Discharge Data System (HDDS) 2018-2019
- Hospital data was obtained from the 2019 Joint Annual Report . See <https://www.tn.gov/health/healthprogramareas/statistics/healthdata/jar.html> for more details.
- Fatal overdose data come from the Tennessee Death Statistical File
- Population data was obtained from CDC Wonder bridged race population estimates. The vintage year of the populations corresponds to the year of the indicator. (See <http://wonder.cdc.gov/bridged-race-population.html> for more details).

General Limitations of the Measures

- Nonfatal overdoses are only captured as hospital discharges and do not include those nonfatal overdoses that do not end up at an acute-care facility.
- Limited to non-federal acute care-affiliated facilities. Excludes Veterans Affairs and other federal hospitals, rehabilitation centers, and psychiatric hospitals.