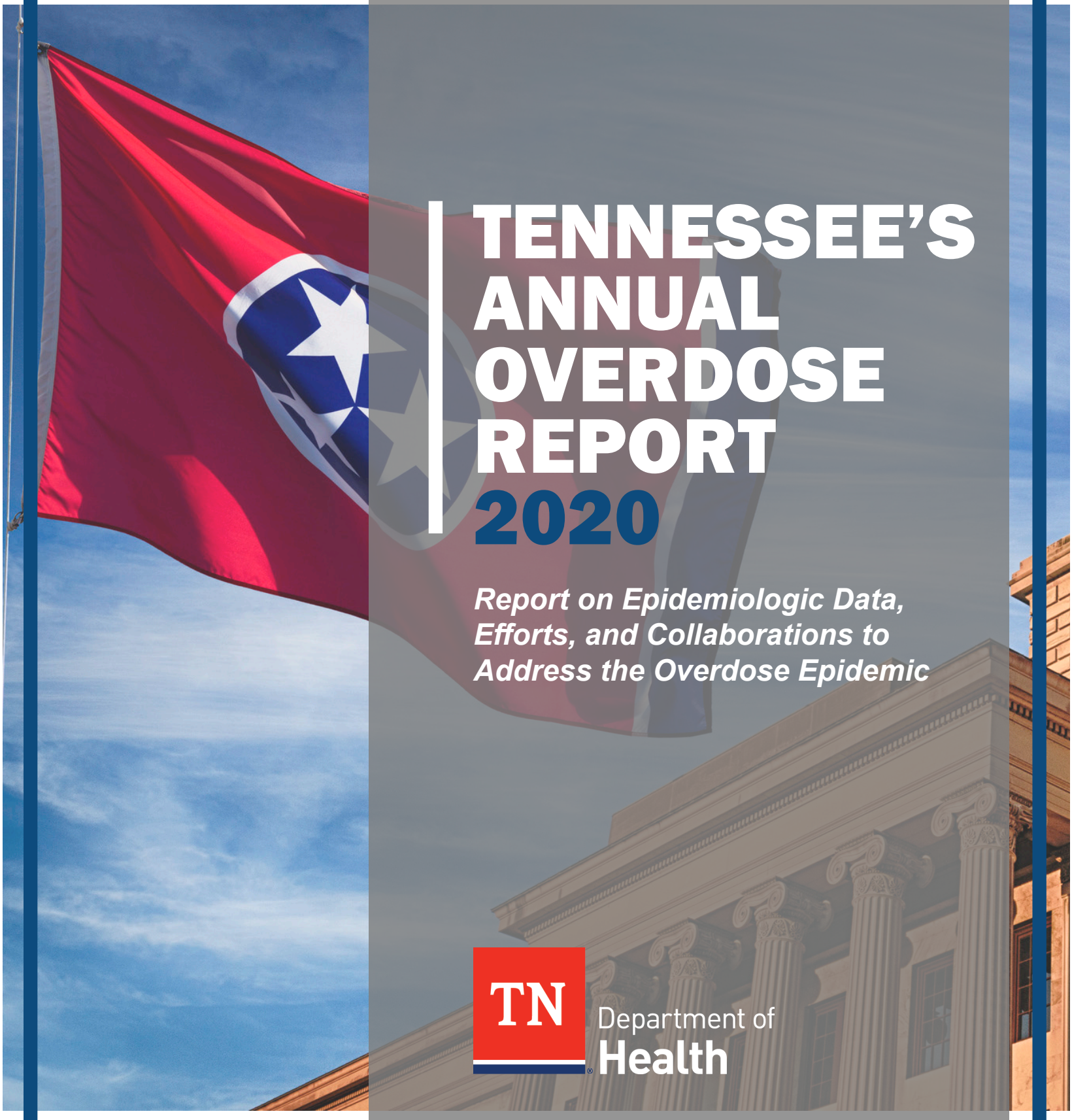

TENNESSEE'S ANNUAL OVERDOSE REPORT 2020

Report on Epidemiologic Data, Efforts, and Collaborations to Address the Overdose Epidemic

TN Department of Health

Produced by
The Office of Informatics & Analytics
Tennessee Department of Health

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TN Department of Health

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Who Are We?

About the Office of Informatics & Analytics

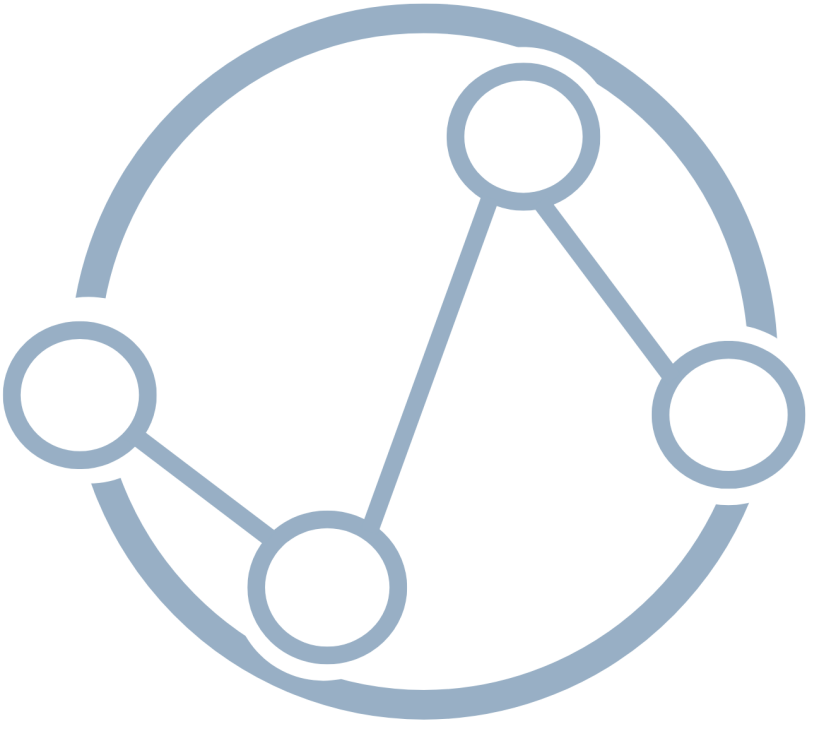
Since its inception in 2016, the Office of Informatics & Analytics (OIA) has worked steadily to build a robust data infrastructure that guides best practices for data sharing, interoperability, analysis, and reporting for the Tennessee Department of Health (TDH). OIA consists of three units that work on specific aspects of the data lifecycle: Data Governance, Core Informatics, and Advanced Analytics and Visualization.

Data Governance leads the development of TDH's data governance strategy, including data collection, sharing, release, and oversight. The Data Governance unit confers with scientists, statisticians, and legal counsel to set standards for processes that assess and approve data releases. They work to balance the need to provide good data to advance public health with requirements designed to protect the privacy of the individuals whom the data represent. Data Governance runs the TDH Institutional Research Board (IRB) and Data Release Committees (DRC) which serve as the approval bodies for much of the data that are released from TDH. The unit also runs the TDH Data Request System which allows internal and external requesters to initiate the process of receiving data and routes requests to the IRB, DRC, or the appropriate data steward at TDH.

Core Informatics serves a number of roles in developing and maintaining best practices and standards for public health reporting and interoperability. This work includes participation in the development of national health data standards, consultation and endorsement for TDH data and reporting activities, and development of electronic case reporting methods. Core Informatics established and maintains TDH's Drug Overdose Reporting System and the TDH Trading Partner Registry. The Informatics unit is also responsible for the development and architecture of the Integrated Data System (IDS), which brings data from across the department into a single unified system. The IDS is being designed to support various divisions across TDH to provide a definitive source for linked data that has been rigorously checked and validated.

Advanced Analytics and Visualization (AAV) has created a robust data and analytic infrastructure for several projects and programs that support the TDH, including analytics focusing on drug overdose and prescription use and abuse in Tennessee. AAV has expertise in producing timely, reliable, and high-quality analyses and data visualizations. The unit has also developed expertise on the translation and dissemination of data to broad audiences, including the creation of infographics that have been used across content areas to capture the impact of health conditions. OIA AAV values innovation and data agility—whether for enhanced data analytics and creating dynamic visualizations, or for exploring newly emerging techniques in the fields of data science and biostatistics.

The creation of this report was led by the Advanced Analytics and Visualization unit, with support from Data Governance and Core Informatics.



Office of Informatics & Analytics

Executive Summary

Tennessee (TN) is adapting to an evolving overdose epidemic. Overall, state trends in overdose and prescribing reflect a shift from an epidemic largely driven by prescription pain relievers to one that now includes illicit opioids and stimulants. For two years, we have observed a sustained decrease in the number of overdose deaths that involved prescription pain relievers. Prior to that, TN, like much of the country, began to be impacted by the introduction of the powerful illicit drug fentanyl into our communities. Fentanyl overdose deaths have increased ten-fold in the last five years alone. In recent years, overdose deaths involving stimulants have increased rapidly as well. Now more than any time recently, the data clearly demonstrate that the overdose problem in TN involves a wide variety of drugs. These new realities suggest that we need to transition from an opioid-centered perspective to a focus on substance use disorder, broadly.

The Tennessee Department of Health (TDH) and health departments around the country are taking a data-driven approach to understanding this evolving epidemic. Through state support and federal funding from the Centers for Disease Control and Prevention (CDC) and the Bureau of Justice Assistance (BJA), the Office of Informatics and Analytics (OIA) is able to support a comprehensive and multi-faceted data-driven response to the opioid epidemic in TN. We use mortality, morbidity, and prescription data and rigorous public health surveillance and epidemiologic methods to provide accurate and timely information to understand the epidemic. OIA strongly supports dissemination of data through a variety of projects and collaborative statewide efforts.

The first three sections of this report provide an overview of state trends in fatal overdose, nonfatal overdose, and controlled substance prescribing. Throughout, we highlight some of the surveillance programs that are led by OIA to provide these data. The final section showcases OIA's projects and partnerships in 2019 and beyond.

Here, we briefly summarize a few key selected epidemiologic data trends:

Opioid overdose deaths continued to increase in TN through 2018, and most involved more than one contributing drug (Mortality data section, starting page: 12).

- The rate of all drug overdose deaths increased, with an age-adjusted rate of 19.4 per 100,000 residents in 2014 and an age-adjusted rate of 27.4 per 100,000 residents in 2018.
- Overdose deaths involving prescription opioids (pain relievers) decreased for a second year in a row from a high of 739 overdose deaths in 2016 to 548 overdose deaths in 2018.
- Deaths due to combined opioid (any type) and benzodiazepines remained high in 2018 (354 overdose deaths), but showed a downward trend for a second time (522 overdose deaths in 2016).

Drug overdose deaths due to illicit opioids have increased substantially through 2018 (Mortality data section, starting page: 12).

- The rate of fentanyl overdoses continued to increase substantially, from 7.9 per 100,000 residents in 2017 to 11.5 per 100,000 residents in 2018, with counts increasing from 500 to 742.
- The number of overdose deaths in TN involving heroin increased by 18% between 2017 and 2018, with counts increasing from 311 to 367.
- Deaths involving stimulants other than cocaine, a category that includes primarily deaths due to methamphetamine, have also increased substantially over the past five years with a sharp rise in 2018 (73 deaths in 2014; 462 deaths in 2018)
- Deaths involving cocaine have also increased in recent years but declined from 2017 to 2018. The rate of cocaine overdose deaths increased in TN from 2014 to 2017 with an age-adjusted rate of 2.0 per 100,000 TN residents in 2014 (134 total deaths) to 4.6 per 100,000 TN residents in 2017 (306 total deaths), followed by a decrease in rate in 2018 (3.8 per 100,000; 251 total deaths).

Non-fatal opioid overdoses increased through 2018, including rapid increases in heroin overdoses (Morbidity data section, starting page: 46).

- In 2018, for every drug overdose death, more than 13 non-fatal overdose discharges were identified in Tennessee's Statewide Hospital Discharge Data System (HDDS) having been treated in the emergency department (ED) or hospital.
- In TN, outpatient visits for all drug overdoses increased and ranged from 232.9 per 100,000 in 2016 to 252.7 per 100,000 in 2018. Though females compared to males had higher age-adjusted rates for all drug overdoses, the largest increase in age-adjusted rate was observed for males (205.4 per 100,000 in 2016 to 242.0 per 100,000 in 2018).
- A steep increase in heroin overdose outpatient visits was observed among Whites, ranging from 27.6 per 100,000 in 2016 to 56.2 per 100,000 in 2018.
- Persons aged 25-34 years consistently had the highest counts of non-fatal opioid overdoses (including heroin). Overdoses for this age group increased 28% from 2017 to 2019. Persons aged 35-44 years of age were the second highest age group to experience non-fatal opioid overdoses (including heroin). This age group increased in non-fatal opioid overdoses (including heroin) by 37% from 2017 to 2019.

The number of opioid prescriptions for pain has declined between 2015 and 2019 (Prescribing data section, starting page: 86).

- From 2018 to 2019, the rate of opioid prescriptions for pain decreased in every TN county.
- The number of opioid prescriptions for pain has declined between 2015 and 2019. At the highest in Q3 2015, 2.04 million prescriptions of opioids for pain were filled (representing a rate of 309 prescriptions per 1,000 residents). Since this peak, opioid prescriptions for pain have fallen to 1.28 million filled prescriptions in Q4 2019 (a rate of 189 per 1,000 residents), representing a decrease of 37.3%.
- The number of patients filling opioids for pain has fallen about 33.3% since 2015.

Indicators of risky opioid prescribing practices have continued to decrease.

- The percentage of patients who received opioid prescriptions for pain that exceed 90 morphine milligram equivalents (MME) per day has declined from 2015 to 2019. In early 2015, 10.9% of all opioid for pain patients received an opioid for pain with a daily MME greater than 90. In late 2019, this decreased to 6.6% of patients received a prescription of more than 90 daily MME.
- The percentage of patients filling opioid prescriptions for pain who had overlapping benzodiazepine prescriptions (>1 overlapping day) has continued to decrease steadily from a high of 22.3% in early 2015 to 14.1% at the end of 2019.
- In TN, the rate of Multiple Provider Episodes (MPE) for opioid prescriptions for pain has declined rapidly over the last five years, from 36.8 per 100,000 residents in the first half of 2015 to 5.5 per 100,000 residents in the last half of 2019.

The number of prescriptions for benzodiazepines has declined between 2015 and 2019.

- From 2018 to 2019, the rate of benzodiazepine prescriptions decreased in every TN county.
- From 2015-2019, benzodiazepine prescriptions peaked in Q3 2015 at 1.04 million prescriptions filled (157 per 1,000 residents) and have decreased to 652,000 filled prescriptions in Q4 2019 (96 per 1,000 residents), a 37.5% reduction.
- The number of patients filling benzodiazepine prescriptions fell about 34.6% from its peak in 2015.

Controlled Substance Monitoring Database (CSMD) reporting expanded to include gabapentin, allowing us to present preliminary data.

- From the beginning of reporting in Q3 2018 through 2019, around 500,000 gabapentin prescriptions were filled in each quarter. The number of patients filling gabapentin prescriptions has likewise remained steady at around 250,000 patients each quarter.
- Much like opioid and benzodiazepine rates, gabapentin prescription rates tend to be lower in the more populous counties and higher in rural areas.

Highlights from the Projects & Partnerships section include (Projects & Partnerships section, starting page: 118):

- Data dissemination to the local and regional stakeholders and the public.
- Details about OIA's Integrated Data System (IDS) which supports many of our surveillance and data dissemination activities.
- Several projects that aim to maximize the department's use of data from the CSMD to prevent inappropriate prescribing.
- Partnership with TDH's Opioid Response Coordinating Office (ORCO) to identify three areas in the state considered "high-impact" to receive enhanced prevention and treatment programs and services.
- Partnership with Vanderbilt University Medical Center (VUMC) to develop a predictive model of overdose risk using machine learning techniques.
- Overviews of the federal grants that support this work.

Abbreviations

The following abbreviation table can serve as a reference for the 2020 Tennessee Annual Overdose Report:

Abbreviations	Title
BJA	Bureau of Justice Assistance
CDC	Centers for Disease Control and Prevention
COAP	Comprehensive Opioid Abuse Site-Based Program
CSMD	Controlled Substance Monitoring Database
CSTE	Council of State and Territorial Epidemiologists
DATA 2000	Drug Access Treatment Act of 2000
DataFlux	SAS's Data Management Studio
DDPI	Data-Driven Prevention Initiative
DEA	Drug Enforcement Administration
DOR	Drug Overdose Reporting
DOSE	Drug Overdose Surveillance and Epidemiology
ED	Emergency Department
EHR	Electronic Health Record
EMS	Emergency Medical Services
ESOOS	Enhanced State Opioid Overdose Surveillance
ESRI	Environmental Systems Research Institute
ESSENCE	Electronic Surveillance System for the Early Notification of Community-based Epidemics
FDA	Food and Drug Administration
HIA	High Impact Areas
HDDS	Hospital Discharge Data System
IDS	Integrated Data System
ICD-10	International Classification of Diseases, 10th Revision
ICD-10-CM	International Classification of Diseases, 10th Revision, Clinical Modification
IJIS	Integrated Justice Information System
IMED	Interim Medical Examiner Database
LARS	Licensing and Regulatory System
MAT	Medication-Assisted Treatment
MME	Morphine Milligram Equivalent
MPE	Multiple Provider Episode
NCHS	National Center for Health Statistics
NPI	National Provider Identifier
NSSP	National Syndromic Surveillance Program
NVDRS	National Violent Death Reporting System
OD2A	Overdose Data to Action

Abbreviations	Title
OIA	Office of Informatics and Analytics
OGC	Office of General Counsel
ORCO	Opioid Response Coordinating Office
OSCME	Office of the State Chief Medical Examiner
OUD	Opioid Use Disorder
PDMP	Prescription Drug Monitoring Program
PDMP-TTAC	Prescription Drug Monitoring Program- Training and Technical Assistance
PfS	Prevention for States
PMPi	PMP Interconnect
Q1-Q4	Quarter 1-Quarter 4
QC	Quality Control
ROI	Report of Investigation
ROPS	Regional Overdose Prevention Specialists
SA	Short-Acting
SAS	Statistical Analysis System
SNOMED-CT	Systematized Nomenclature of Medicine - Clinical Terms
SUDORS	State Unintentional Drug Overdose Reporting System
TBI	Tennessee Bureau of Investigation
TCA	Tennessee Code Annotated
TDH	Tennessee Department of Health
TDMHSAS	Tennessee Department of Mental Health and Substance Abuse Services
TN	Tennessee
VRISM	Vital Records Information System Management
VUMC	Vanderbilt University Medical Center

DRUG OVERDOSE DEATHS

In 2018, drug overdose deaths continued to increase in Tennessee (TN). From 2014 to 2018, drug overdose deaths increased nearly 44%. Although the number of deaths from prescription opioid (pain relievers) overdoses decreased in 2017 and again in 2018, overdose deaths due to heroin and fentanyl have continued to rise. In 2018, more Tennesseans died from the illicit drug fentanyl than prescription opioids. In this section, trends in drug overdose deaths in TN, such as these, will be highlighted. Additionally, this section will provide an overview of the State Unintentional Drug Overdose Reporting System (SUDORS) and its impact in understanding the overdose epidemic.

1,818

the number of Tennesseans who died of a drug overdose in 2018.

Introduction

Statewide drug overdose death statistics presented in this section are derived from the Tennessee Department of Health (TDH) Death Statistical Files, the primary source of finalized statewide mortality data in Tennessee[1]. This file contains death certificate information for all individuals who have died in the state of Tennessee as well as TN residents who died out of state. For in-state deaths, causes of death are approved by county medical examiners and standardized by the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS) using ICD-10 codes[2]. The ICD-10 coding scheme classifies drug overdose deaths as poisonings and provides information on intent and contributing substances.

For drug overdose deaths, *Intent* refers to suicide or homicide (intentional) or accidental overdose (unintentional). *Contributing substances* include the drug(s) that caused the overdose death.

As each state sends death certificate data to NCHS for ICD-10 coding, death statistics can be compared across U.S. jurisdiction and to overall national mortality statistics. A key limitation of NCHS coding is lack of ICD-10 T codes for specific drug types that are important to monitor for public health surveillance, including fentanyl, buprenorphine, and specific types of prescription drugs (such as oxycodone and hydrocodone[3,4]). As NCHS ICD-10 codes do not capture all specific types of drug overdoses, OIA has developed methods for scanning and summarizing the text fields that comprise the cause of death[5]. OIA in collaboration with the Office of the State Chief Medical Examiner (OSCME) is working to incorporate data from the medical examiners' death reports to enhance drug overdose death surveillance. In this section of the Tennessee Annual Overdose Report, we will describe drug overdose deaths in TN from 2014-2018 using ICD-10 codes and literal cause of death text from death certificates.

Key Facts

All drug overdose deaths continued to increase in TN with elevations observed regardless of sex and race.

Prescription opioid death rates have continued to decrease in TN since 2016.

The rate of stimulant overdose deaths in TN had a sharp increase from 2014 to 2018.

1 Tennessee Department of Health. Bureau of Policy, Planning and Assessment. Division of Health Statistics. Death Statistical File User Manual. January 2014.

2 https://www.cdc.gov/nchs/nvss/instruction_manuals.htm

3 Adele Lewis, TDH Deputy State Chief Medical Examiner. How to Best Certify Deaths Due to Substance Use. https://www.tn.gov/content/dam/tn/health/documents/officeofthestatechiefmedicalexaminersoffice/resourcesforthemedicalexaminer/Certification_drug_overdose.pdf

4 Ossiander EM: Using textual cause-of-death data to study drug poisoning deaths. Am J Epidemiol 2014, 179(7):884-894;Slavova S, O'Brien DB, Creppage K, Dao D, Fondario A, Haile E, Hume B, Largo TW, Nguyen C, Sabel JC et al: Drug Overdose Deaths: Let's Get Specific. Public Health Rep 2015, 130(4):339-342.

5 Trinidad JP, Warner M, Bastian BA, Minino AM, Hedegaard H. Using Literal Text From the Death Certificate to Enhance Mortality Statistics: Characterizing Drug Involvement in Deaths. Natl Vital Stat Rep. 2016 Dec;65(9):1-15.

Methods & Data Quality

Death Certificate Data Quality for Drug Overdose Statistics

Completeness of cause of death information is critical when using mortality statistics to monitor trends and evaluate drug overdose-related mortality burden in susceptible populations. Information on specific types of drugs may be missing from the death certificate based on availability of toxicology analysis and drug reporting differences by time and by jurisdiction. This can result in underestimates of the contribution of drug class and types to drug overdose deaths.

Epidemiologists used the following ICD-10 codes to identify incomplete cause of death information in the death certificate data:

- **R99:** Cause of death is blank, listed as 'PENDING,' or listed as 'UKNOWN'
- **T509:** Cause of death is drug overdose, but the type of drug involved is unknown
- **T406:** Cause of death is opioid overdose, but the type of opioid involved is unknown

When determining the percentages of these deaths in the TN death records, we compare R99 deaths to the total number of deaths, T509 deaths to the total number of drug overdoses, and T406 deaths to the total number of opioid overdoses. As shown in the table below, information on cause of deaths has decreased in 2018 in comparison to any other year; whereas, information on type of drugs involved in overdose deaths and opioid deaths has improved during 2014-2018.

	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
R99 Deaths	528	0.8	548	0.8	501	0.7	523	0.7	628	0.8
T509 Deaths	171	12.9	128	8.4	142	8.2	124	6.7	99	5.2
T406 Deaths	60	4.5	49	3.2	29	1.7	48	2.6	23	1.2

What does this mean for the Overdose Mortality Statistics?

Impact of R99 Deaths

There are three code distinctions that impact the information about an overdose death. When a death is coded with an R99 code, it signifies the cause of death is unknown. Having the fewest possible deaths coded as R99 is important as patterns and trends can be distinguished from cause of death data that are helpful for public health responses. It is likely that some R99 coded deaths are due to drug overdose. This report, therefore, may be undercounting drug overdose deaths that are reported as R99s.

Impact of T509 Deaths

Deaths coded with T509 do attribute cause of death to a drug overdose, however, the drug type is unknown. Drug overdose deaths without a drug type/s attributed (such as opioid or stimulant) are still counted as drug overdoses, but without information about a drug type it should be acknowledged that this report may be undercounting certain drug type overdose deaths (such as opioid or stimulant).

Impact of T406 Deaths

Similar to T509 coded deaths, T406 coded deaths do attribute the cause of death to a drug overdose, however, T406 codes indicate the presence of an opioid as the cause of death. A code of T406, however, does not signify the type of opioid involved in the death. Without the type of opioid information available, deaths in a specific opioid drug category (such as fentanyl or heroin) may be undercounted in this report.

Important Note for 2018 Overdose Deaths

TDH is aware of an undercount of overdose deaths in 2018, primarily those occurring in Shelby County. A higher number of deaths of Shelby County residents were reported with unknown causes of death due to more pending death investigations than in previous years[6].

How did this Occur?

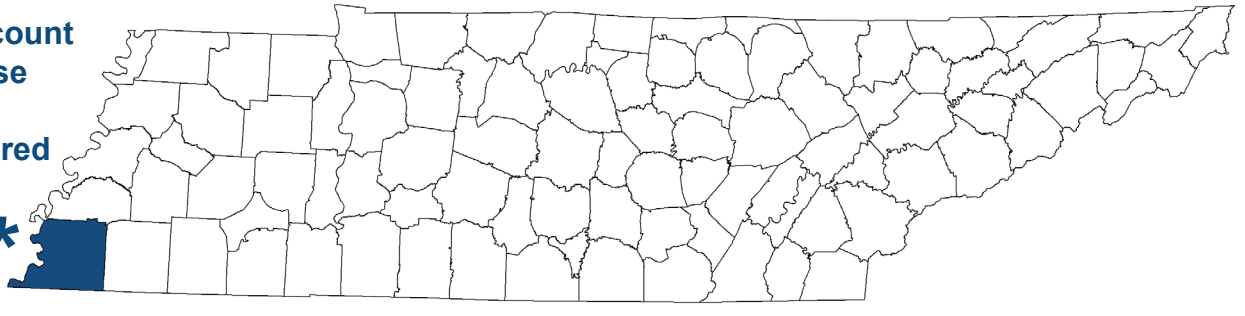
The process of submitting death certificate data from the previous calendar year to CDC closes in July of each year (e.g., 2018 deaths are finalized in July 2019). Deaths which do not have a cause of death listed at this time are given a code by CDC indicating that the cause was undetermined. Drug overdose deaths often take longer to determine than other causes because they require autopsy and toxicology reports to be completed and reviewed before a final cause is determined. Therefore, overdose deaths may be more likely to be coded as unknown causes by the CDC and not represented in the official counts provided by TDH. In 2018, a large number of deaths that occurred in Shelby County did not have completed cause of death information at the time the CDC coding process was finalized. For example, approximately 1.9% of Shelby county deaths in 2018 (nearly 200) were still pending as of the final submission to CDC. While it is not likely that all of these deaths will be determined to be overdose-related, this represents a large increase from 2017 (0.6% pending in Shelby) and an even larger increase from 2016 (0.2% pending in Shelby).

What does this mean for the Overdose Mortality Statistics?

We advise caution in interpreting the downward trend in overdose deaths across all categories of drugs among Shelby County residents for 2018. As more information becomes available to TDH, revised estimates may be possible. We anticipate these revisions, if available, will reflect an increasing trend in overdose deaths in Shelby County that is in line with similar trends in the other large, urban counties in the rest of the state. **As of December 23, 2019, an additional 50 deaths were reported for Tennessee in 2018.**

Our final death count of 1,818 will not include the additional 50 deaths (approximately 40 out of the 50 occured in Shelby County) as we will continue to use the data analysis methodology and timeline established by the CDC.

An undercount of overdose deaths in 2018 occured in Shelby County

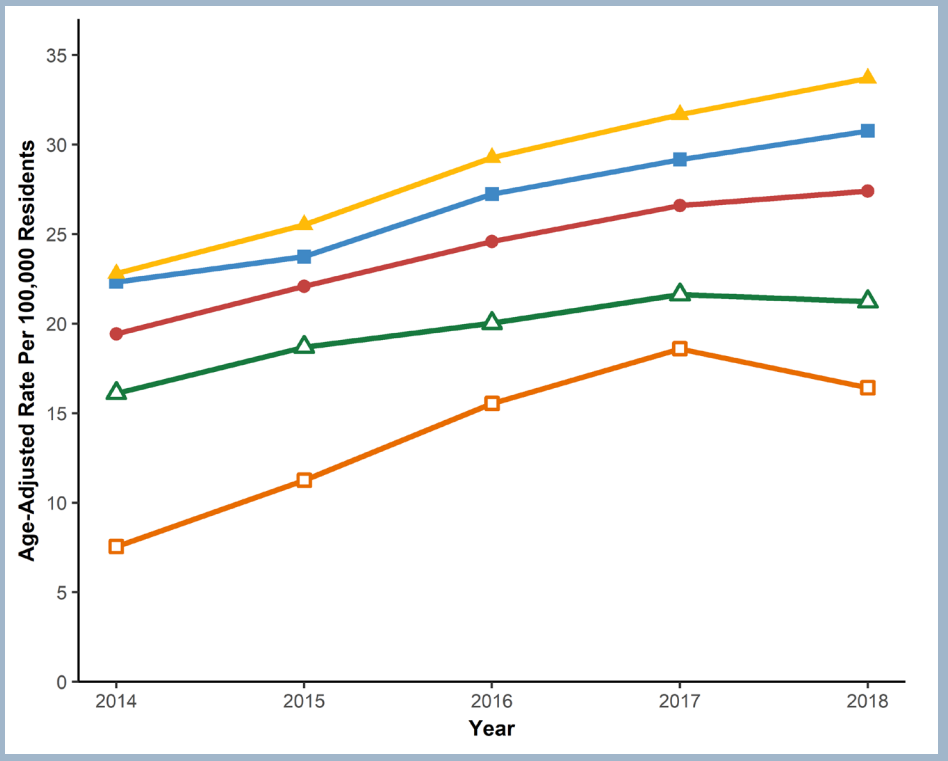


6 2018 Tennessee Drug Overdose Deaths: https://www.tn.gov/content/dam/tn/health/documents/pdo/Fatal%20Drug%20Overdose%20in%20TN%20Report.pdf

All Drug Overdose Deaths

All drug overdose deaths[7] continue to increase in TN. The total number of all drug overdose deaths by year were as follows: 1,263 (2014), 1,451 (2015), 1,631 (2016), 1,776 (2017), and 1,818 (2018).

Age-Adjusted Rates for All Drug Overdose Deaths by Sex and Race in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Data Source: TN Death Statistical File.

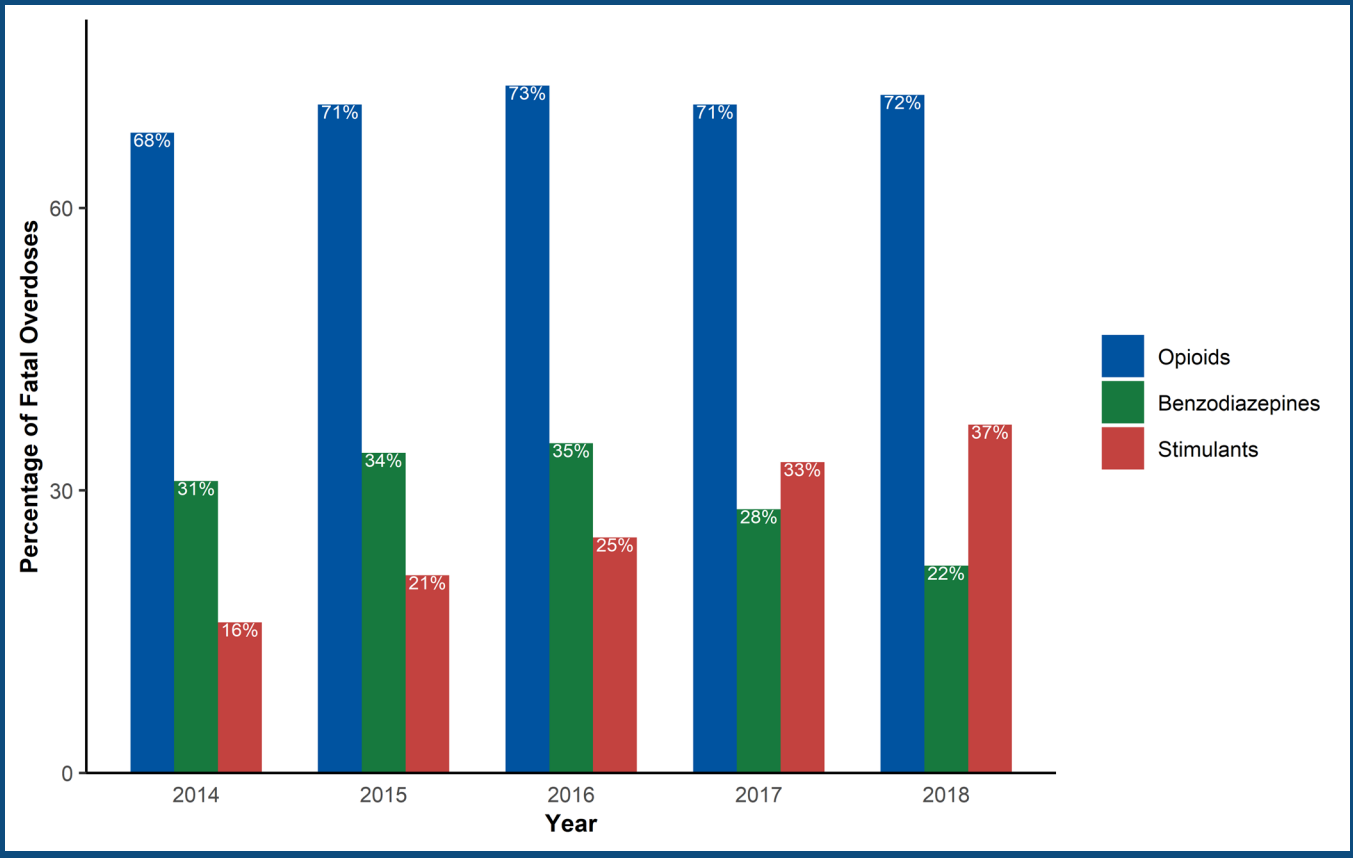
As shown in the figure above, the age-adjusted rate for all drug overdoses per 100,000 TN residents increased from 19.4 in 2014 to 27.4 in 2018. Rates increased for males, as well as Whites[8]. The highest rates were observed for males and Whites in 2018, with age-adjusted rates of 33.7 per 100,000 TN residents and 30.8 per 100,000 TN residents, respectively. Among Blacks, the age-adjusted rate increased from 7.6 per 100,000 TN residents in 2014 to 18.6 per 100,000 TN residents in 2017 followed by a decrease in 2018 to 16.4 per 100,000 TN residents.

Additional visualizations that show the number of all drug overdose deaths and the age-adjusted death rates for all drug overdose by TN county of residence are not included in this section, but can be found at the end of this report in **Appendix D (pg 153)**.

7 Drug overdose deaths caused by acute poisonings, regardless of intent (i.e., unintentional, suicide, assault, or undetermined).

8 Other races were excluded due to small sample sizes, which preclude calculation of reliable rates.

Opioids, Benzodiazepines and Stimulants Present in All Drug Overdoses in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Data Source: TN Death Statistical File.

The above figure displays the proportion of all drug overdose deaths that involved opioids, benzodiazepines, and stimulants (cocaine and amphetamines combined) as a contributing substance. Categories are **not mutually exclusive**. The proportion of all drug overdose deaths involving any type of opioid increased from 68% in 2014 to 73% in 2016, and in 2017 decreased to 71%, and again increased to 72% in 2018. The proportion of all drug overdoses involving benzodiazepines ranged from 31% to 35% during 2014 to 2016, and then decreased to 22% in 2018. During 2014 to 2018, stimulants increased from 16% in 2014 to 37% of all drug overdose deaths in 2018.

The drug categories above are not mutually exclusive, which means one overdose death could involve multiple contributing substances and be counted for more than one category.

Polydrug Deaths in Tennessee

We identified 3,146 deaths in the TN death records from 2014 to 2018 that involved usage of multiple drugs (i.e., polydrug deaths) and had an underlying cause of death due to drug overdose. In 2014, 34.2 % (432 out of 1,263 total) of overdoses were identified as polydrug, but in 2018, that percentage rose to 39.7 % (721 out of 1,818 total). These patterns are also observed among opioid deaths, with polydrug opioid deaths increasing from 49.7% of the total (428 out of 861) in 2014 to 53.6% of the total (699 out of 1,304) in 2018. For additional analysis and visualization on polydrug death in TN, please see Appendix **D (pg 153)**.

Polydrug Overdoses in TN, 2014-2018

	2014		2015		2016		2017		2018	
	Yes	%	Yes	%	Yes	%	Yes	%	Yes	%
All Drugs	432	34.2	569	39.2	699	42.9	725	40.8	721	39.7
Opioids	428	49.7	560	54.2	681	57.4	706	55.7	699	53.6
Heroin	71	48.3	118	57.6	156	60.0	179	57.6	191	52.0
Fentanyl	29	42.0	90	53.3	170	57.8	285	57.0	376	50.7
Buprenorphine	23	48.9	33	66.0	48	69.6	51	69.9	50	60.2
Benzodiazepines	356	91.8	455	92.5	536	93.5	459	91.1	369	90.2
Other Stimulants	50	68.5	69	61.6	121	64.7	190	59.6	301	65.2
Cocaine	88	65.7	130	64.0	163	65.2	208	68.0	182	72.5

Analysis conducted by the Office of Informatics and Analytics, TDH (last updated February 4, 2020). Limited to TN residents.
Data Source: TN Death Statistical File.

What is a polydrug death?

In TN there are a rising number of drug overdoses (both fatal and non-fatal) that are considered polydrug or polysubstance. Polydrug use occurs when an individual is exposed to multiple drugs, with or without their knowledge[9]. It is especially dangerous to use drugs in combination with one another and by doing so increases the risk of the individual having an overdose. However, it is often the case that individuals are unaware they are taking drugs in combination, as illicit drugs may be contaminated with other illicit substances. One such substance that has commonly been found in combination with other substances (either intentionally or from accidential contamination) is fentanyl.

Why is discussing polydrug deaths important?

Although the opioid epidemic is well-publicized, it is important to recognize that the majority of TN opioid overdose deaths are polydrug. Additionally, the majority of Tennesseans with a substance use disorder are polysubstance users (e.g. other drugs, alcohol). As programs and policies are developed to address the drug overdose epidemic, we must move from an opioids-only perspective to a comprehensive understanding of substance use disorders to ensure effective prevention and treatment measures[10].

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9 Centers for Disease Control and Prevention (2019). Other Drugs (Polysubstance). Retrieved from: https://www.cdc.gov/drugoverdose/data/otherdrugs.html

10 Cicero, T. J., Ellis, M. S., & Kasper, Z. A. (2020). Polysubstance Use: A Broader Understanding of Substance Use During the Opioid Crisis. American journal of public health, 110(2), 244–250. https://doi.org/10.2105/AJPH.2019.305412

Opioid-Related Drug Overdose Deaths

What is an Opioid?

Opioids are a class of drugs that include the illegal drug heroin as well as powerful pain relievers available legally by prescription (e.g. hydrocodone, oxycodone). When an opioid is taken, it signals the release of endorphins, chemicals that minimize the perception of pain and boost feelings of pleasure. This combination makes opioids highly effective as pain relievers, but dangerous due to their high potential for misuse and addiction.

What is an Opioid Overdose?

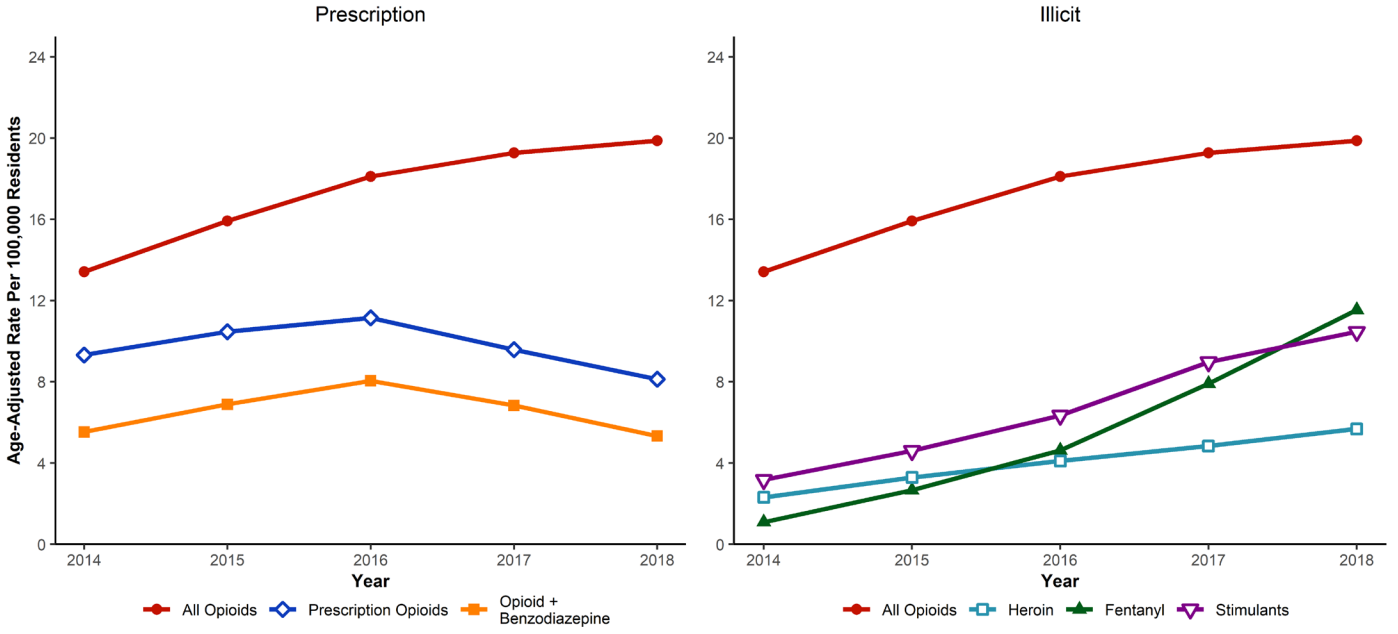
An opioid overdose can occur when an opioid is taken in excess amounts or in combination with other drugs. This is because opioids affect the brain's regulation of breathing. During an overdose, opioids can slow breathing until it eventually stops, resulting in death. All drugs can cause an overdose, including medications prescribed by a doctor or purchased over the counter. Not all opioid overdoses are fatal. Naloxone, also known as Narcan, is the only successful opioid overdose reverse medication. Resources on where to learn more about naloxone and naloxone administration can be read in the blue box below.

Why is this important to Tennessee?

In 2018, drug overdose deaths continued to increase in TN. From 2014 to 2018, TN drug overdose deaths increased nearly 44%. This epidemic continues to evolve. Opioids have consistently been common contributing causes among drug overdose deaths in TN. While deaths involving opioids identified as “pain relievers” (i.e., those typically obtained through a prescription) have decreased for the past two years, deaths involving **any** opioid have continued to increase. The increase in opioid overdose deaths appears to be primarily driven by deaths involving heroin and fentanyl. Heroin and fentanyl are two of the most common opioids that are obtained illicitly. In 2018, more Tennesseans died from the powerful illicit drug fentanyl than prescription opioids. Deaths involving stimulants other than cocaine, a category that includes primarily deaths due to methamphetamine, have also increased substantially over the past five years with a sharp rise in 2017. Deaths involving cocaine have also increased in recent years but declined in 2018.

Opioid overdose deaths are preventable with Naloxone (Narcan), the only successful opioid overdose reversal medication. To learn more about the signs and symptoms of an overdose or get trained to administer naloxone, please use the resources provided by the Department of Health (https://www.tn.gov/behavioral-health/substance-abuse-services/prevention/prevention/rops.html) or contact your Regional Overdose Prevention Specialist (ROPS) who may be able to provide additional information and trainings.

Age-Adjusted Rates for Opioid Overdose Deaths in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Limited to Black and White TN residents for analyses by race. Data Source: TN Death Statistical File.

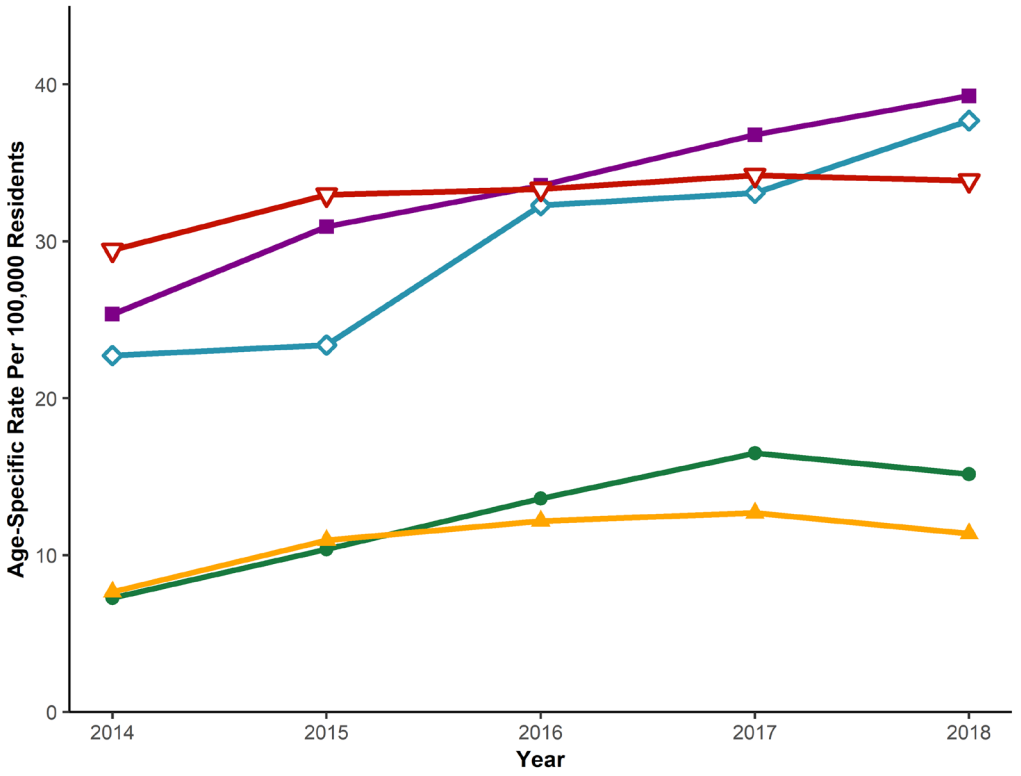
As shown above, the rate of all opioid overdose deaths[11] continued to increase in TN with an age-adjusted rate of 13.4 per 100,000 TN residents in 2014 and an age-adjusted rate of 19.9 per 100,000 TN residents in 2018. The number of all opioid overdose deaths increased from 861 in 2014 to 1,304 in 2018. Prescription opioid death rates[12] increased slightly during 2014 to 2016 (from 9.3 per 100,000 to 11.2 per 100,000 TN residents), and decreased in 2017 and 2018 to 9.6 per 100,000 and 8.1 per 100,000 TN residents, respectively. Deaths due to combined opioid (any type) and benzodiazepines[13] remained high in 2016 (522 deaths), but showed a downward trend for the first time in 2017 to a rate of 6.8 per 100,000 TN residents and continue to decrease in 2018 to a rate of 5.3 per 100,000 TN residents.

Substantial increases were observed for heroin[14] and fentanyl[15] since 2014. The rate of heroin overdose increased from 2.3 per 100,000 TN residents in 2014 to 5.7 per 100,000 TN residents in 2018, with counts increased from 147 to 367. The rate of fentanyl overdoses increased from 1.1 per 100,000 TN residents in 2014 to 11.5 per 100,000 TN residents in 2018, with counts increasing from 69 to 742. Stimulants[16] are also on the rise, increasing from 3.2 per 100,000 TN residents in 2014 to 10.5 per 100,000 TN residents in 2018.

Overall, the trends above reflect the shift from prescription pain relievers to illicit opioids in the epidemic of overdose deaths in TN.

11 Drug overdose deaths caused by acute poisonings that involve any opioid as a contributing cause of death.
12 Drug overdose deaths caused by acute poisonings that involve prescription opioids as a contributing cause of death (e.g., hydrocodone, oxycodone, morphine).
13 Drug overdose deaths caused by acute poisonings that involve both an opioid and benzodiazepine as a contributing cause of death.
14 Drug overdose deaths caused by acute poisonings that involve heroin as a contributing cause of death.
15 Drug overdose deaths caused by acute poisonings that involve fentanyl.
16 Drug overdose deaths caused by acute poisonings that involve mainly cocaine and amphetamines.

Age-Specific Rates for Opioid Overdose Deaths in TN, 2014-2018



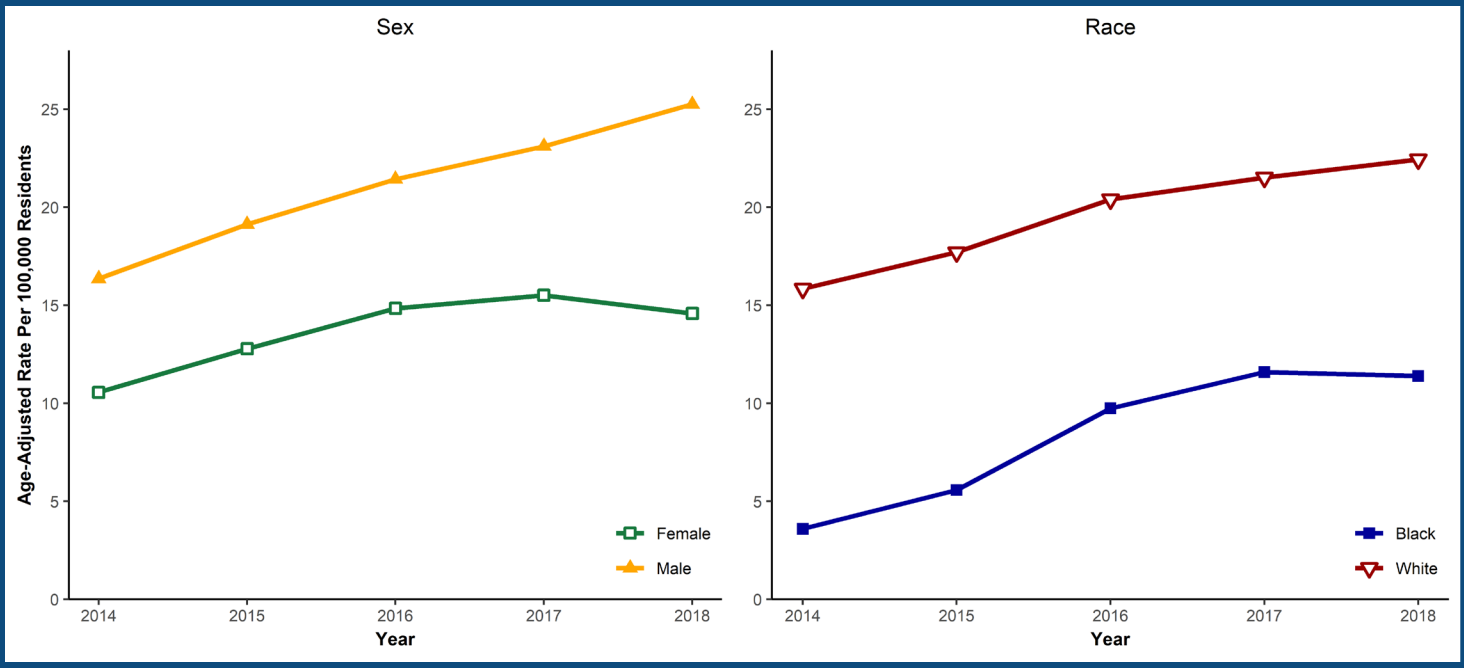
Analysis by the Office of Informatics and Analytics, TDH (last updated November 27, 2019). Limited to TN residents ≥ 18 years. Table excludes deaths for individuals < 18 years of age as rates were considered unreliable. Data Source: TN Death Statistical File.

Legend

- 18-24 Years
- 25-34 Years
- 35-44 Years
- 45-54 Years
- 55+ Years

The graph above displays the age-specific rates for opioid overdose deaths in TN during 2014 to 2018. For all opioid overdose deaths, persons aged 35-44 years and 25-34 years had the highest rates of death in 2018. For 25-34 year-olds, the rate of opioid deaths increased in such a way that the gap between 35-44 years old was much smaller in 2018, increasing to 37.7 per 100,000. The lowest rates were observed among individuals aged 18-24 years and ≥ 55 years. For 45-54 years old, the rate decreased slightly from 2017 to 2018.

Age-Adjusted Rates for All Opioid Overdose Deaths by Race and Sex in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Limited to Black and White TN residents for analyses by race. Data Source: TN Death Statistical File.

The graph above presents age-adjusted rates for opioid overdose deaths by sex and race (Black and White) for 2014 to 2018. Males had higher age-adjusted rates for all opioid overdose deaths compared to females. While rates continued to increase for males, the rates for females has leveled off. Whites had higher age-adjusted rates for opioid overdose deaths compared to Blacks. Whites experienced increasing rates across this period while the rates for Blacks leveled off in 2017 and 2018.

The total drug overdose deaths in Tennessee involving opioids increased by 3% between 2017 and 2018.

Thirty-nine out of 95 counties (41%) in TN had an increase in opioid overdose deaths from 2017 to 2018, whereas, 18 counties reported no change in opioid overdose deaths. Although it appears that the largest decrease in opioid overdose deaths was in Shelby County[17] (159 deaths in 2017 to 123 deaths in 2018), please recall that there was an undercount of deaths in Shelby County for 2018. The largest increase was observed in Knox County (196 deaths in 2017 to 218 deaths in 2018).

The counties that experienced an increase of ≥10 overdose deaths involving opioids from 2017 to 2018 were:

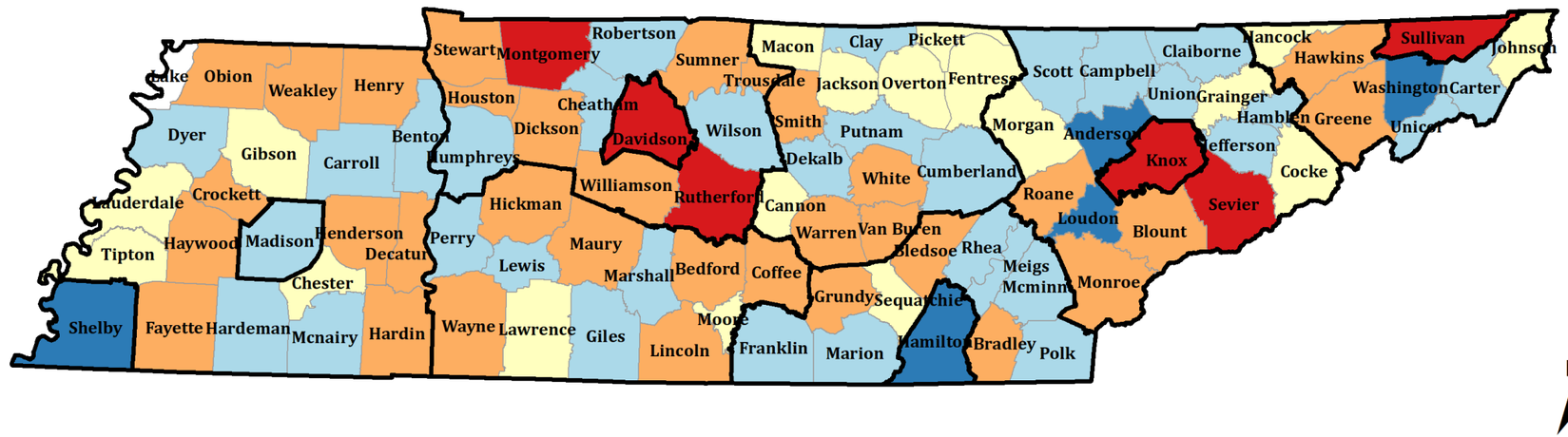
- Davidson County
- Knox County
- Montgomery County
- Rutherford County
- Sevier County
- Sullivan County

Counties with a decrease of ≥10 overdose deaths involving opioids from 2017 to 2018 were:

- Anderson County
- Hamilton County
- Loudon County
- Shelby County
- Washington County

17 The Tennessee Department of Health is aware of an undercount of overdose deaths in 2018, primarily occuring in Shelby County. For additional information please see page 15, or the 2018 Tennessee Drug Overdose Deaths Report: https://www.tn.gov/content/dam/tn/health/documents/pdo/Fatal%20Drug%20Overdose%20in%20TN%20Report.pdf

Change in the Number of Opioid Overdose Deaths by TN County of Residence, 2017-2018[17]



Change in Opioid Overdose Deaths by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No opioid death
- Health Regions

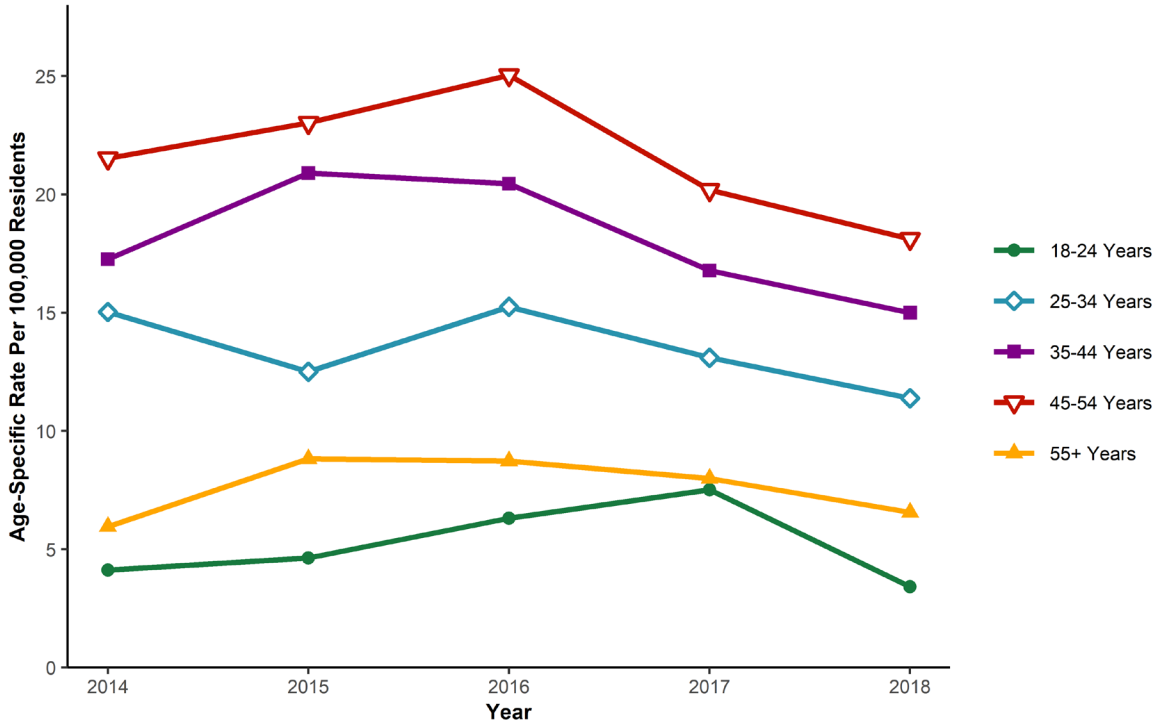
Miles
0 15 30 60 90 120

Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents.
Data Source: TN Death Statistical File.

Prescription Opioid Overdose Deaths

The next few pages will focus on overdose deaths involving prescription opioids. In TN, we defined prescription opioid overdose deaths as those due to prescription opioids such as hydrocodone, oxycodone, tramadol, and methadone. Note that categories of death are not mutually exclusive and deaths involving prescription opioids may have also involved illicit drugs like fentanyl. If you are interested in learning more about the prescribing trends for opioids in TN, please read the Prescription Trends in Tennessee section.

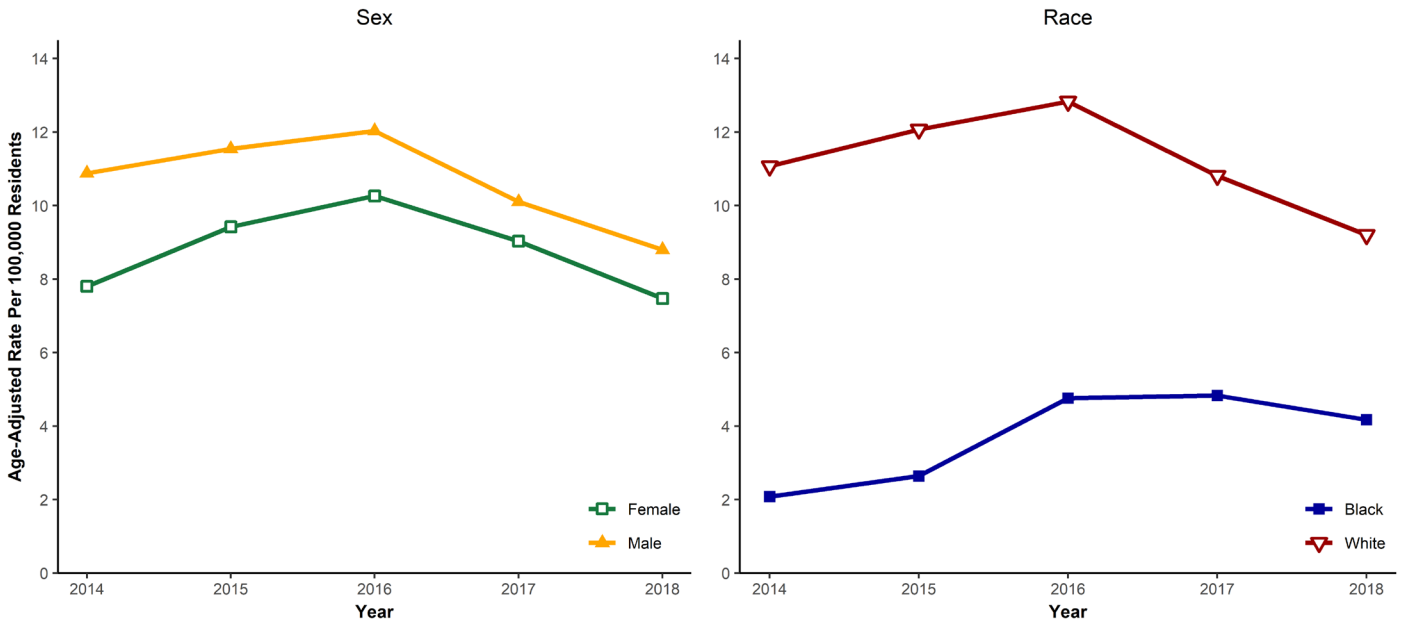
Age-Specific Rates for Prescription Opioid Overdose Deaths in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 27, 2019). Limited to TN residents ≥ 18 years. Data Source: TN Death Statistical File.

The above graph shows age-specific rates for prescription opioid overdose deaths during 2014-2018. Decreases are noted for each age group between 2017 and 2018 with a sharp decrease in the 18-24 year old age group from 7.5 to 3.4 per 100,000.

Age-Adjusted Rates for Prescription Opioid Overdose Deaths by Race and Sex in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Limited to Black and White TN residents for analyses by race. Data Source: TN Death Statistical File.

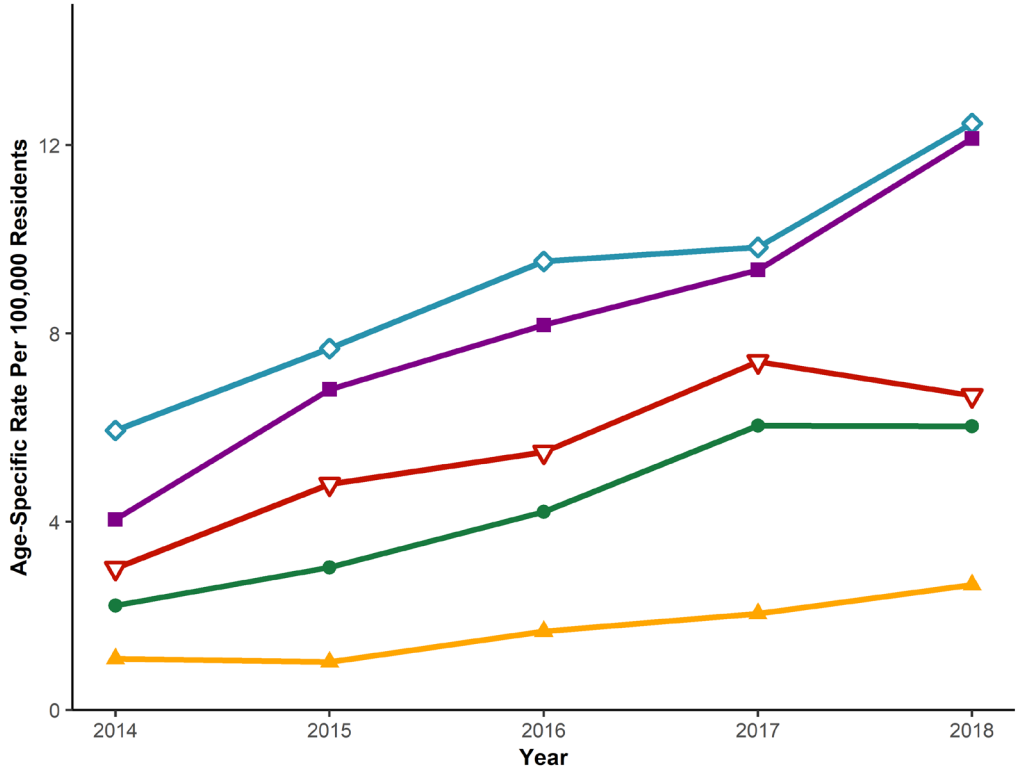
The above graph presents age-adjusted rates for prescription opioid overdose deaths by sex and race (Black and White) for 2014 to 2018. Males have higher rates than females, with a similar trend in rates over time. Specifically, the decrease seen for overall age-adjusted rates for prescriptions opioid overdoses from 2016 to 2018 was observed for both males and females. While Whites have higher rates than Blacks in TN, rates decreased sharply for Whites from 2016 to 2018, but not for Blacks.

The rates of overdose deaths involving prescription opioids decreased for males and females, all ages, and races in TN from 2017 to 2018.

Heroin Overdose Deaths

The next few pages will focus on overdose deaths involving the illict opioid, heroin. Heroin is an illegal, semi-synthetic opioid that is made from morphine and in 2018 was involved in roughly 20% of all drug overdose deaths in TN.

Age-Specific Rates for Heroin Overdose Deaths in TN, 2014-2018



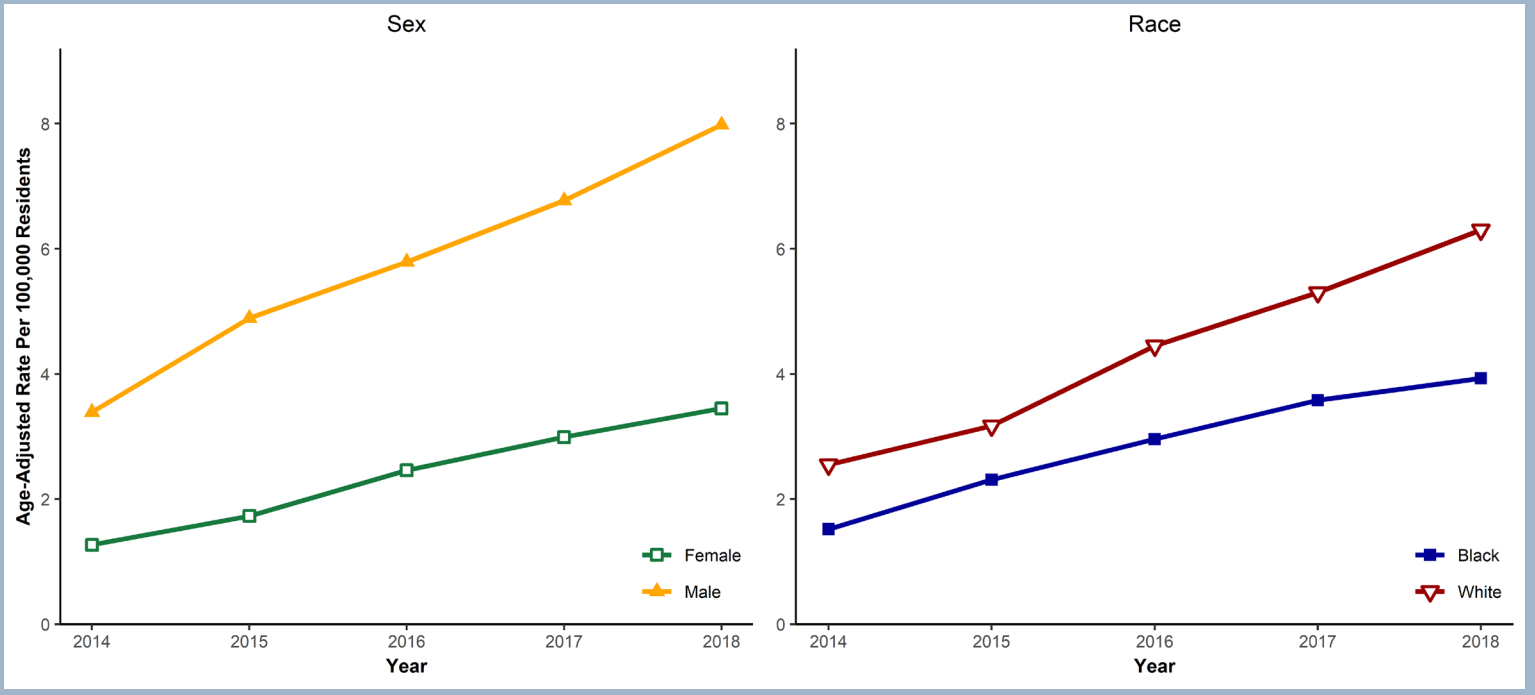
Analysis by the Office of Informatics and Analytics, TDH (last updated November 27, 2019). Limited to TN residents ≥ 18 years. Data Source: TN Death Statistical File.

Legend

- 18-24 Years
- 25-34 Years
- 35-44 Years
- 45-54 Years
- 55+ Years

The above graph displays age-specific rates for heroin overdose deaths in TN from 2014 to 2018. Individuals aged 25-34 years had the highest rates, with increases from 5.9 per 100,000 in 2014 to 12.5 per 100,000 TN residents in 2018. Individuals aged 35-44 years were the age group with the second highest rates of heroin overdose deaths, with increases from 4.1 per 100,000 in 2014 to 12.1 per 100,000 TN residents in 2018. An increasing trend was seen for over 55 years whereas, a decrease in rate was observed among the 45-54 years age group from 2017 to 2018.

Age-Adjusted Rates for Heroin Overdose Deaths by Race and Sex in TN, 2014-2018

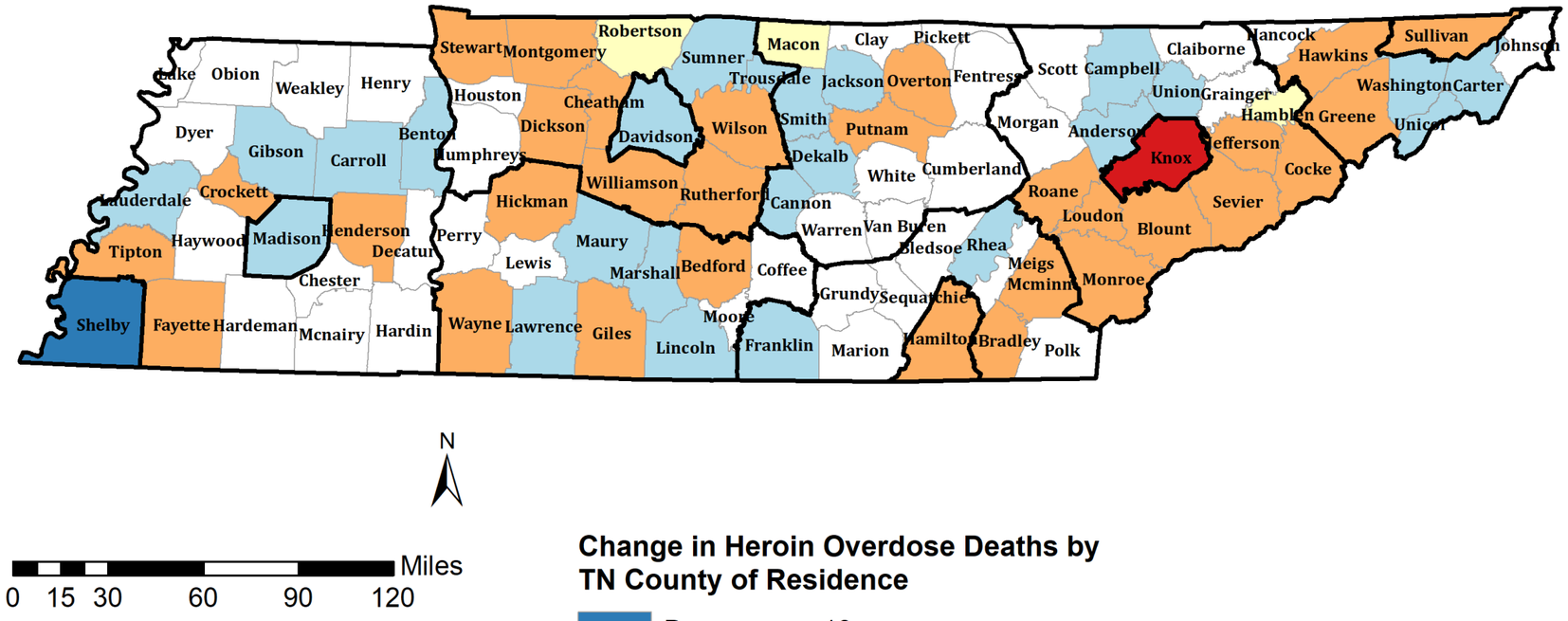


Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Limited to Black and White TN residents for analyses by race. Data Source: TN Death Statistical File.

The above graph presents age-adjusted rates for heroin overdose deaths by sex and race (Black and White) for 2014 to 2018. Males had a higher age-adjusted rate for heroin deaths, compared to females, with an increasing trend more apparent among males than females. Whites had higher age-adjusted rates for heroin deaths compared to Blacks. Similar to trends in sex, both races continued to see an increase in heroin deaths in 2018.

The total drug overdose deaths in TN involving heroin increased by 18% between 2017 and 2018.

Change in the Number of Heroin Overdose Deaths by TN County of Residence, 2017-2018[18]



Change in Heroin Overdose Deaths by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No heroin death
- Health Regions

Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents.
Data Source: TN Death Statistical File.

Only 25 counties reported a decrease of heroin deaths from 2017 to 2018. Although it appeared that Shelby County[19] had the largest decrease in the number of heroin overdose deaths (59 deaths in 2017 to 47 deaths in 2018), please recall there was an undercount in number of drug overdose deaths in Shelby County.

Three counties reported no change in heroin overdose death from 2017 to 2018, whereas, 31 counties had an increase (32%) of heroin overdose deaths from 2017 to 2018 with Knox County (45 deaths in 2017 to 67 deaths in 2018) having the highest increase in the number of heroin overdose deaths.

The county that experienced an increase of ≥10 overdose deaths involving heroin from 2017 to 2018 was:

- **Knox County**

The county with a decrease of ≥10 overdose deaths involving heroin from 2017 to 2018 was:

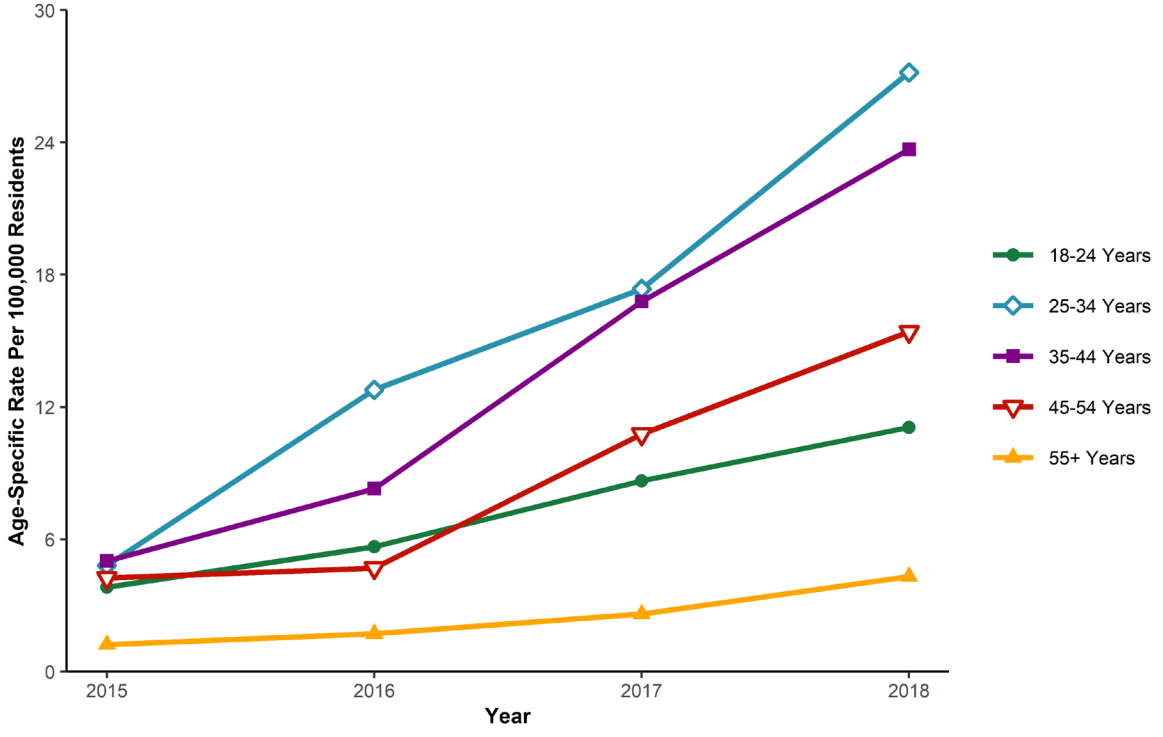
- **Shelby County[18]**

18 The Tennessee Department of Health is aware of an undercount of overdose deaths in 2018, primarily occuring in Shelby County. For additional information please see page 15, or the 2018 Tennessee Drug Overdose Deaths Report: https://www.tn.gov/content/dam/tn/health/documents/pdo/Fatal%20Drug%20Overdose%20in%20TN%20Report.pdf

Fentanyl Overdose Deaths

The next few pages will focus on overdose deaths involving fentanyl in TN. Fentanyl is a semi-synthetic opioid that is more powerful than both heroin and most opioid pain relievers, making it especially dangerous[19]. While fentanyl can be legally prescribed, overdose deaths in TN primarily involve illicitly-manufactured fentanyl (IMF). Illicit (non-pharmaceutical) fentanyl has increased as a contributing substance in overdose deaths since 2014 in TN and roughly half (50.7%) of the deaths involving fentanyl in 2018 were found to be polydrug. This rise in overdose deaths and number of deaths being reported as polydrug is likely due to fentanyl often being found mixed in with other illicit drugs (such as heroin, cocaine, or methamphetamine). Fentanyl in combination with other illicit drugs poses a high risk for overdose due to fentanyl's high potentacy.

Age-Specific Rates for Fentanyl Overdose Deaths in TN, 2015-2018

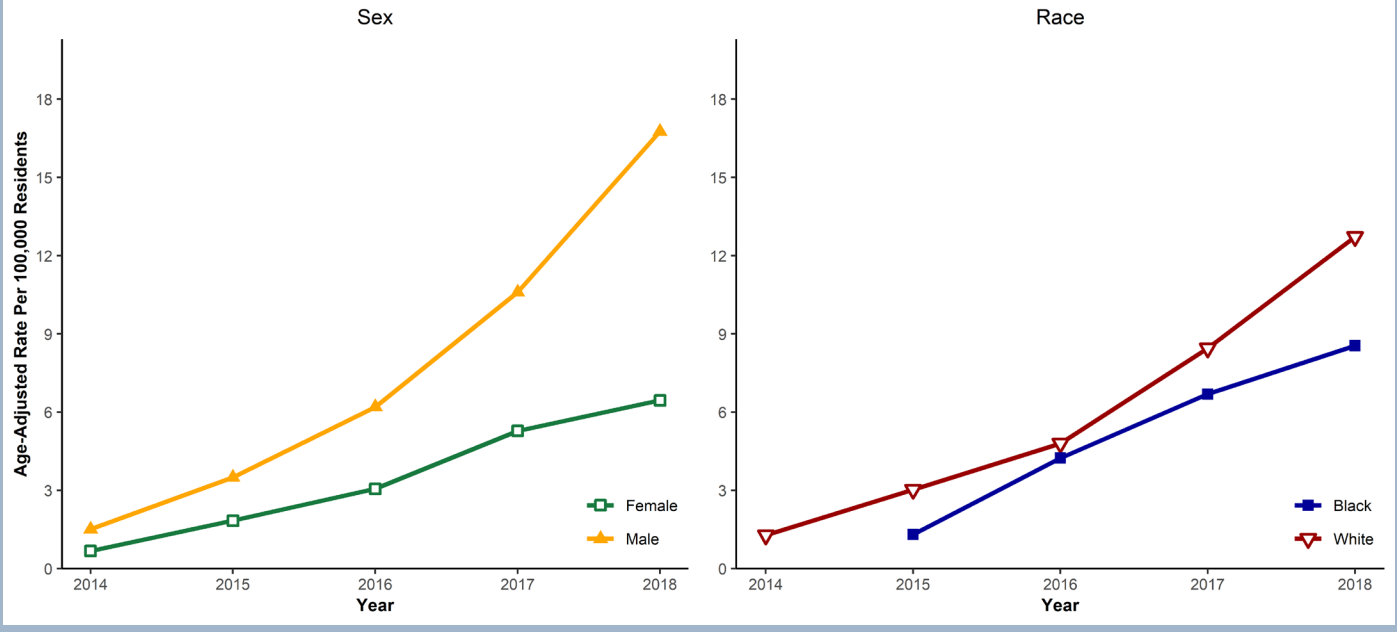


Analysis by the Office of Informatics and Analytics, TDH (last updated November 27, 2019). Limited to TN residents ≥ 18 years. Rates for counts ≤ 10 were considered unreliable and not calculated for 2014 . Data Source: TN Death Statistical File.

The above graph displays age-specific rates for fentanyl overdose deaths in TN for 2015 -2018 (the number of fentanyl deaths in 2014 were too low to calculate reliable rates). All age groups showed an increase in fentanyl overdose deaths between 2015 and 2018. Individuals aged 25-34 years had the highest overdose rates, increasing from 4.8 per 100,000 in 2015 to 27.2 per 100,000 in 2018. Rates for 35-44 year olds were also rapidly increasing.

19 Centers for Disease Control and Prevention (2019). Other Drugs (Polysubstance). Retrieved from: https://www.cdc.gov/drugoverdose/data/otherdrugs.html

Age-Adjusted Rates for Fentanyl Overdose Deaths by Race and Sex in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 27, 2019). Limited to TN residents. Limited to Black and White TN residents for analyses by race. Rates for counts ≤ 10 were considered unreliable and not calculated for Blacks for 2014. Data Source: TN Death Statistical File.

The total drug overdose deaths in TN involving fentanyl increased by 48% between 2017 and 2018.

The above graph presents age-adjusted rates for fentanyl overdose deaths by sex and race (Black and White) for 2014 to 2018. Males had higher age-adjusted rates for all fentanyl overdose deaths, compared to females with increasing trends among both males and females. Rates for Whites were higher than Blacks for fentanyl overdoses, with increases in both race groups through 2018.

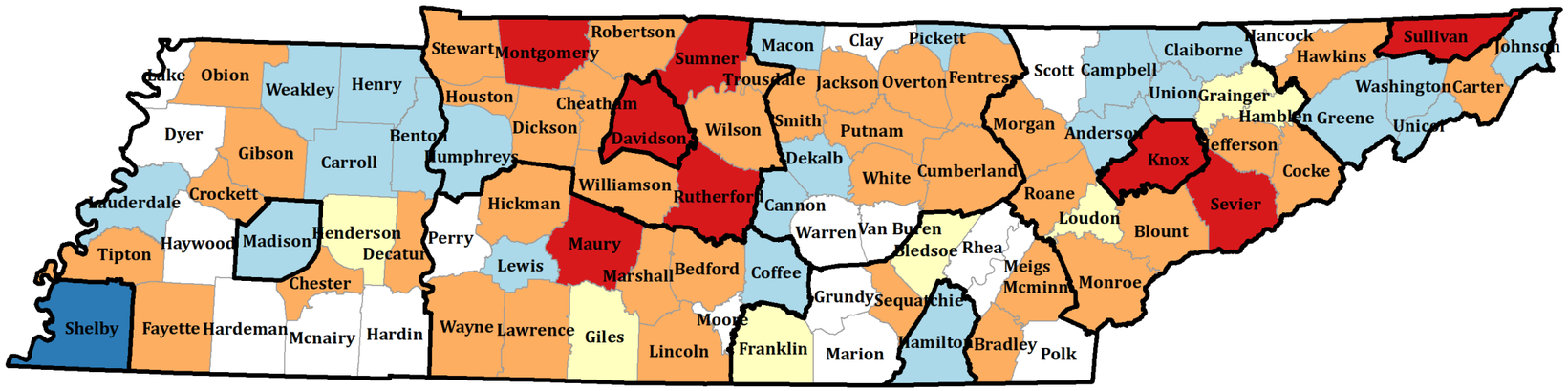
Initially, metropolitan areas and their surrounding counties were most affected by fentanyl overdose deaths. This map shows that is no longer the case as rural counties have experienced increases in fentanyl deaths. Forty-seven counties out of 95 counties (49%) had an increase in fentanyl overdose deaths from 2017 to 2018 with Davidson County (75 in 2017 vs 140 in 2018) having the highest increase in fentanyl overdose deaths. Only 23 counties showed a decrease in fentanyl overdose deaths, whereas, 7 counties had no change in fentanyl overdose deaths from 2017 to 2018. Although it appears that Shelby County had the highest decease in the number of fentanyl overdose deaths, please recall there was an undercount of overdose deaths in Shelby County[20] for 2018.

The counties that experienced an increase of ≥10 overdose deaths involving fentanyl from 2017 to 2018 were:

- Davidson County
- Maury County
- Montgomery County
- Knox County
- Rutherford County
- Sevier County
- Sullivan County
- Sumner County

20 The Tennessee Department of Health is aware of an undercount of overdose deaths in 2018, primarily occuring in Shelby County. For additional information please see page 15, or the 2018 Tennessee Drug Overdose Deaths Report: https://www.tn.gov/content/dam/tn/health/documents/pdo/Fatal%20Drug%20Overdose%20in%20TN%20Report.pdf

Change in the Number of Fentanyl Overdose Deaths by TN County of Residence, 2017-2018[20]



Change in Fentanyl Overdose Deaths by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No fentanyl death
- Health Regions

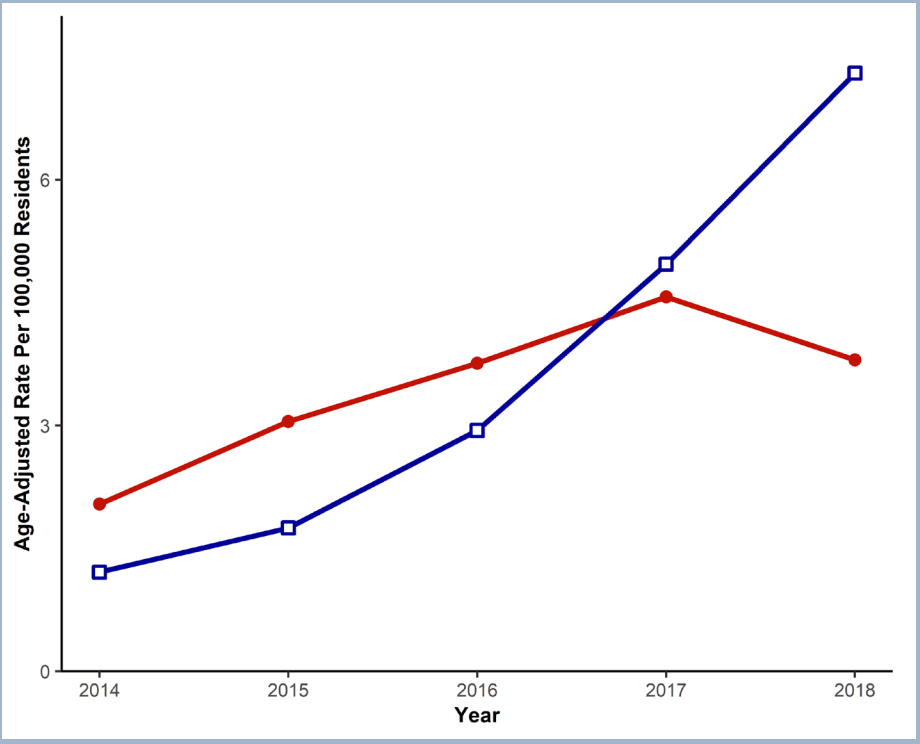
0 15 30 60 90 120 Miles

Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents.
Data Source: TN Death Statistical File.

Stimulant Overdose Deaths

The next few pages will focus on overdose deaths involving stimulants in TN. In this report, a stimulant is considered any psychostimulant with abuse potential. This includes both illicit drugs (such as methamphetamine, cocaine, and ecstasy) as well as drugs that can be legally obtained by a prescription (such as medications prescribed to treat attention deficit hyperactivity disorder (ADHD) and depression). All of these drugs, both the legal and illicit, are addictive and have abuse potential. For the first graph below, stimulant information will be separated into two categories: cocaine and other stimulants (including methamphetamine) to show the different trends that exist within stimulant overdose deaths as a whole.

Age-Adjusted Rates for Stimulant Overdose Deaths in TN, 2014-2018

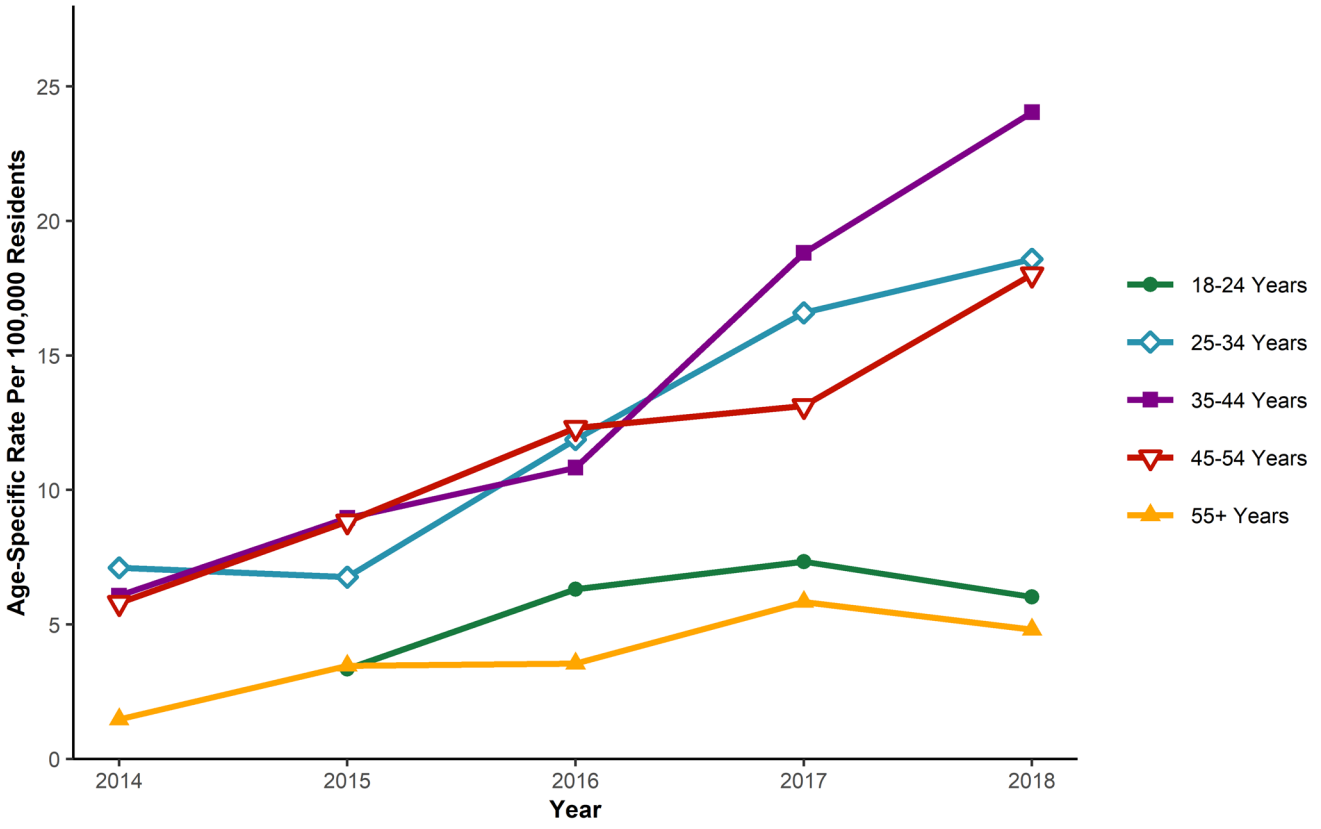


Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents. Data Source: TN Death Statistical File.

Deaths involving cocaine[21] have also increased in recent years but declined from 2017 to 2018. The rate of cocaine overdose deaths increased in TN from 2014 to 2017 with an age-adjusted rate of 2.0 per 100,000 TN residents in 2014 (134 total deaths) to 4.6 per 100,000 TN residents in 2017 (306 total deaths), followed by a decrease in rate in 2018 (3.8 per 100,000; 251 total deaths). The rate of other stimulants[22] (excluding cocaine) had a sharp increase from 2014 (1.2 per 100,000) to 2018 (7.3 per 100,000).

21 Drug overdose death caused by acute poisonings that involve cocaine as a contributing cause of death.
22 Drug overdose death caused by acute poisonings that involve other stimulants (excluding cocaine).

Age-Specific Rates for Stimulant[23] Overdose Deaths in TN, 2014-2018



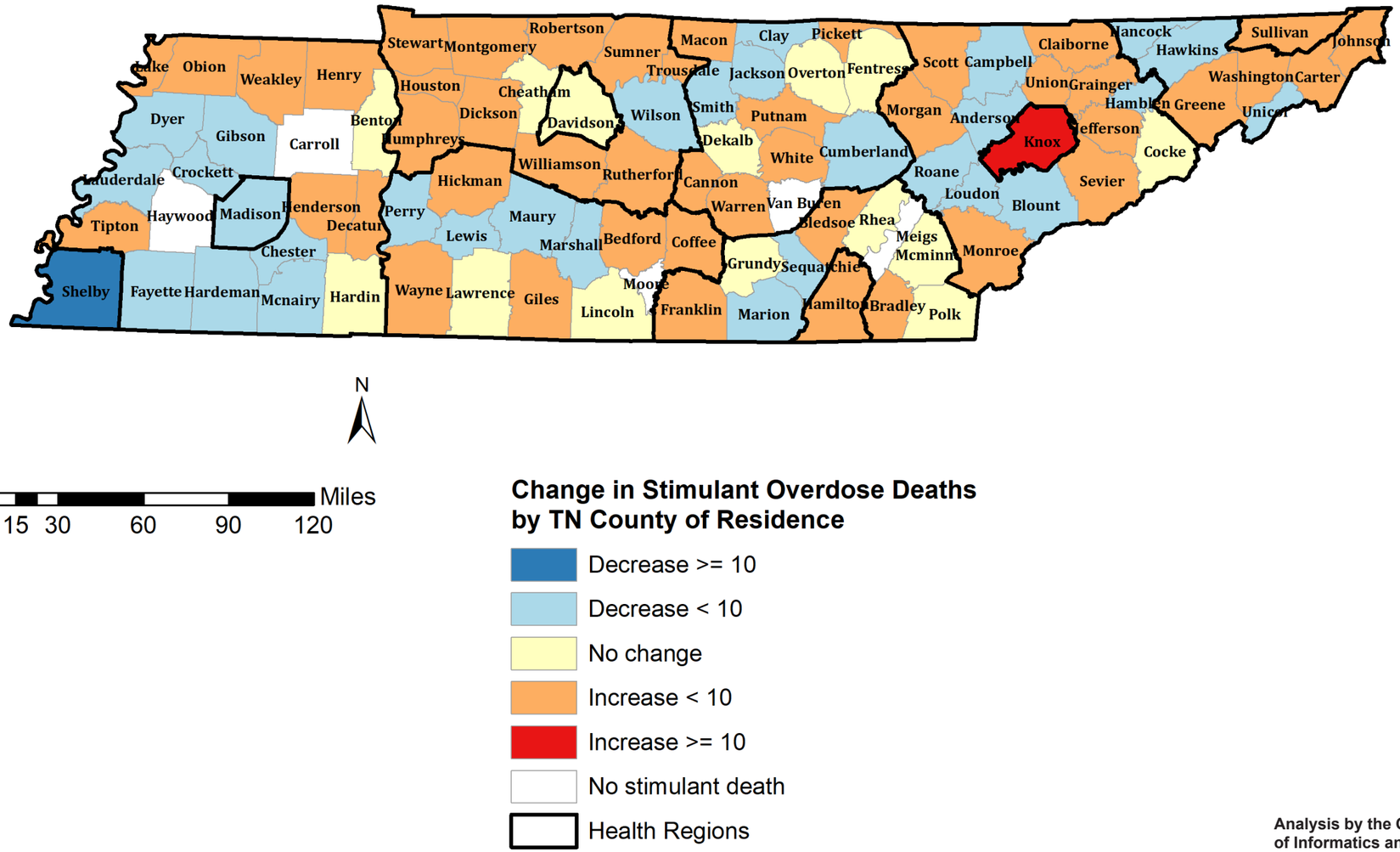
Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents ≥ 18 years. Data Source: TN Death Statistical File.

The above graph shows age-specific rates for stimulant[23] overdose deaths in TN. All age groups showed an increase in stimulant overdose deaths between 2014 and 2018. Individuals aged 35-44 years had the highest overdose rates, increasing from 6.1 per 100,000 in 2014 to 24.0 per 100,000 in 2018. Rates for Tennesseans aged 45-54 years old were also rapidly increasing.

The total drug overdose deaths in TN involving stimulants increased by 14% between 2017 and 2018.

23 Drug overdose deaths caused by acute poisonings that involve mainly cocaine and amphetamines.

Change in the Number of Stimulant[24] Overdose Deaths in TN by County of Residence, 2017-2018[25]



Change in Stimulant Overdose Deaths by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No stimulant death
- Health Regions

Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019). Limited to TN residents.
Data Source: TN Death Statistical File.

In the map on the left, forty-six out of the ninety-five counties (48%) had an increase in stimulant[25] overdose deaths from 2017 to 2018. Fourteen counties reported no change in stimulant overdose deaths from 2017 to 2018. Although the largest decrease in stimulant overdose death was observed in Shelby County (92 deaths in 2017 to 76 deaths in 2018), please recall Shelby County had an undercount of overdose deaths for 2018. The largest percent increase was observed in Knox County (89 deaths in 2017 to 119 deaths in 2018).

The county that experienced an increase ≥10 overdose deaths involving opioids from 2017 to 2018 was:

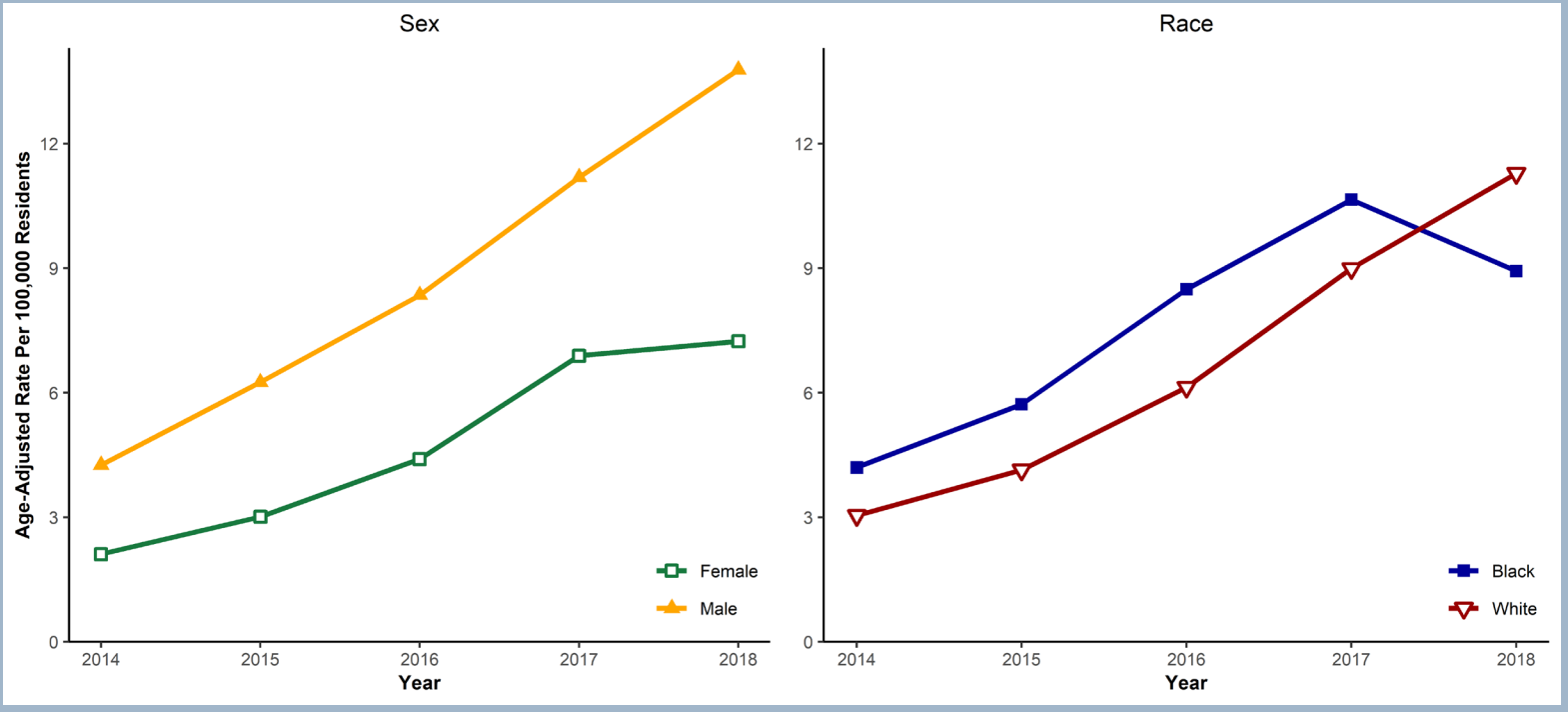
- **Knox County**

The county with a decrease of ≥10 overdose deaths involving opioids from 2017 to 2018 was:

- **Shelby County[26]**

24 Drug overdose deaths caused by acute poisonings that involve mainly cocaine and amphetamines.
25 The Tennessee Department of Health is aware of an undercount of overdose deaths in 2018, primarily occuring in Shelby County. For additional information please see page 15, or the 2018 Tennessee Drug Overdose Deaths Report: https://www.tn.gov/content/dam/tn/health/documents/pdo/Fatal%20Drug%20Overdose%20in%20TN%20Report.pdf

Age-Adjusted Rates for Stimulant[26] Overdose Deaths by Race and Sex in TN, 2014-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated November 26, 2019).
Limited to TN residents. Limited to Black and White residents for analyses by race. Data Source: TN Death Statistical File.

The above graph represents age-adjusted rates for stimulant overdose deaths by sex and race (Black and White) for 2014 to 2018. Males had higher age-adjusted rates for all stimulant overdose deaths, compared to females, with increasing trends seen among males. Rates for Whites were lower than Blacks for stimulant overdoses, with rates for Whites surpassing Blacks in 2018.

When analyzed by race, rates for cocaine (not pictured above) are higher in Blacks (8.0 per 100,000 TN residents in 2018) as compared to Whites (3.0 per 100,000 TN residents in 2018). However, rates for other stimulants including methamphetamine (not pictured above) for Whites (8.9 per 100,000 TN residents in 2018) as compared to Blacks (1.8 per 100,000 TN residents).

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26 Drug overdose deaths caused by acute poisonings that involve mainly cocaine and amphetamines.

Section Spotlight

Overview of the State Unintentional Drug Overdose Reporting System for the State of Tennessee: A Transition from ESOOS to OD2A

As the burden of the opioid epidemic grew, the CDC initiated the State Unintentional Drug Overdose Reporting System (SUDORS) in response to the need for better fatal overdose information. SUDORS is a component of the National Violent Death Reporting System (NVDRS). This surveillance system was originally funded by the Enhanced State Opioid Overdose Surveillance (ESOOS) grant and data collection for first round grant recipients started in 2016. In 2017, The Office of Informatics and Analytics (OIA) received funding for ESOOS and TN began participation in SUDORS.

SUDORS originally collected data on unintentional and undetermined opioid overdose deaths identified via case identification by appropriate unintentional and undetermined intent drug poisoning ICD-10 underlying cause of death codes, as well as supporting contributing cause ICD10 T-codes. After cases were identified, data were collected from death certificates, report of investigation (ROI), toxicology reports, autopsy reports, and the Controlled Substance Monitoring Database (CSMD). Data were abstracted from these sources to collect information on demographics, injury and death, personal circumstances, toxicology, weapons, overdose information, as well as a summary narrative, all according to information requested by CDC. The table below shows the number of variables falling into each category.

A more in depth look at the materials associated with the SUDORS project can be seen in the previous annual report on page 38-39 (2019 TN Annual Overdose Report)

SUDORS Data Components and Number of Variables

Data Component	Number of Variables
Demographics	37
Injury and death	66
Circumstances	36
Overdose	77
Toxicology	Varies by number of substances
Weapon	1 (always poisoning)
Narrative	Text Summary

After abstraction into Excel template sheets, abstracted data were checked and then entered into NVDRS. Under the ESOOS grant, data were collected for July 2017-December 2018. Unintentional and undetermined fatal opioid overdoses for this time period surmounted to n=1,790.

SUDORS Transition to OD2A

On September 1, 2019, funding for SUDORS transferred to the Overdose to Action (OD2A) grant. Under OD2A, SUDORS data are submitted on **ALL** drug overdose deaths of undetermined or unintentional intent occurring during January 2019 through December 2021 through six different data submission deadlines. SUDORS data are submitted to CDC with a six-month time lag. To support OD2A efforts, the SUDORS team has developed a new case identification method using appropriate cause of death codes coupled with a dual text search method.

The SUDORS team works closely with the Office of the State Chief Medical Examiner (OSCME) throughout the abstraction process to request ROI and autopsy reports, correct data errors, and discuss cases that may overlap between SUDORS and NVDRS.

SUDORS Data Collection Process Summary

The SUDORS data collection starts with the occurrence and confirmation of a drug overdose death. Once a death occurs, a medical examiner determines if an autopsy is to be conducted. Autopsies are generally conducted for deaths with the following scenarios:

- trauma or violence
- sudden deaths
- unexpected deaths of infants or children
- prisoners or persons in state custody
- occurring on the job
- believed to represent a threat to public health
- where the identity of the person is unknown or unclear
- where neglect or abuse of extended care residents are suspected or confirmed
- any suspicious/unusual/unnatural manner or found dead
- where the body is to be cremated

The toxicology and autopsy together confirm an overdose case. Once an autopsy is conducted, the medical examiner determines if the autopsy is sent to the state of TN for archiving. If an autopsy is sent, it is used in data collection for SUDORS. The SUDORS data collection process from death to data entry is documented in the graphic on the next page "Sudors Data Collection Process" for one data submission cycle. This information was compiled in partnership with OSCME. Our first SUDORS OD2A data submission for TN's fatal overdoses in January to June 2019 will be submitted on March 10, 2020. For additional details regarding the SUDORS data collection process and timeline, please use the graphic on the following page that was prepared by the TDH SUDORS team in collaboration with the OSCME.

Learn more about SUDORS, the OD2A grant, and other CDC funded activities focused on the Overdose Epidemic.

SUDORS Data Collection Process

(Prepared by TDH SUDORS Team & OSCME)

1. A death occurs and requires an autopsy.

within 24-48 Hours

2. An autopsy is conducted at a regional center.

within 60-90 days+

3. Completed autopsy is sent to a medical examiner (ME) in the county of death to sign the death certificate. The ME can then choose to send the autopsy to the state.

4. If the State receives the autopsy it goes through a QC check and is stored in IMED, if not the death certificate is used to abstract cases.

Steps 5-9 take 1-6 months

5. SUDORS deaths are queried based on the case selection method through a death certificate database.

6. Autopsy and ROI reports are requested from OSCME.

7. SUDORS Case data is linked to the Controlled Substance Monitoring Database.

8. SUDORS data is abstracted into Excel templates for the demographics, injury/death, circumstances, overdose, toxicology, and narrative tabs and validated again.

9. Data is entered into SUDORS/NVDRS and validated. After validation, data is submitted to the CDC by deadline and the QC report is completed.

CDC will send the QC report back within 2-3 months

10. The CDC completes the QC report and sends back to SUDORS team for review.

KEY

QC - Quality Control

SUDORS - State Unintentional Drug Overdose Reporting System

ROI - Report of Investigation

OSCME- Office of the State Chief Medical Examiner

IMED- Interim Medical Examiner Database

NVDRS - National Violent Death Reporting System

Current SUDORS Work Under OD2A

So far in OD2A, the SUDORS team has primarily been focused on data abstraction and submission. The first OD2A deadline for SUDORS data submission falls on March 10, 2020. This data submission includes deaths occurring in TN from January 1, 2019 to June 30, 2019. For this first submission, the team has identified 942 all-drug unintentional and undetermined overdose cases. Data were abstracted using death certificate data, reports of investigation, and autopsy data. The chart below shows the proportion of data sources available for these cases as of February 5, 2020.

Data Source	n(%)
Death Certificate	942 (100%)
Report of Investigation	627 (67%)
Autopsy	653 (69%)

We were able to do a brief preliminary analysis of the submitted SUDORS data using demographic components and toxicology. These numbers have not undergone the quality review process with the CDC. The chart below shows demographic characteristics of the abstracted cases.

Demographic Data	All cases n= 942 n(%)
Age	
15-34 years	303 (32.2%)
35-54 years	444 (47.2 %)
55+ years	194 (20.6 %)
Race	
White	810 (86.0 %)
Gender	
Male	616 (65.4 %)
Marital Status	
Married or Domestic Partnership	224 (23.8 %)
Never Married	402 (42.7 %)
Widowed/Divorced/Separated	295 (31.3 %)
Education by Degree	
< High School	200 (21.8 %)
High School Graduate or GED	469 (51.2 %)
> High School	248 (27.0 %)
State of Residence	
Tennessee	888 (94.3 %)

SUDORS Current Work Continued

From the 942 SUDORS identified cases, only 653 of these cases had toxicology reports available. The chart below identifies the top ten frequently reported substances in the toxicology report.

Substance in Toxicology* *These categories are not mutually exclusive, as multiple substance may be present in one toxicology report	Toxicology Reports Available n= 653 n(%)
Fentanyl+ Analogs	379 (60.0 %)
Methamphetamine	310 (47.4 %)
Amphetamine	228 (34.9 %)
Naloxone	192 (29.4 %)
THC-Cannabinoid	188 (28.7 %)
Heroin	143 (21.9 %)
Ethanol	131 (20.0 %)
Cocaine	109 (16.7 %)
Oxycodone (Oxy/Oxycontin)	97 (14.8 %)
Alprazolam (Xanax)	89 (13.6 %)

SUDORS Rapid Identification Enhancement

An additional component of SUDORS includes rapidly identifying counts of suspected opioid overdose deaths within one month of death. The CDC has proposed using death scene investigation data, presumptive toxicology testing, or police reports to identify cases. Due to the time lag in this data reaching the state, the SUDORS team has been brainstorming additional strategies and partnerships to rapidly identify these cases. Stay tuned for more information on how TN will rapidly identify opioid overdose deaths within one month of death.

Learn more about our partners in the Office of the State Chief Medical Examiner in TN!

NON-FATAL DRUG OVERDOSE

For every drug overdose death, more than 13 non-fatal overdose discharges were identified in Tennessee's Statewide Hospital Discharge Data System (HDDS) having been treated in the emergency department or hospital in 2018. Persons aged 25-34 years consistently had the highest counts of non-fatal opioid overdoses (including heroin). Persons in this age group also had the highest rates for stimulant outpatient visits from 2016 to 2018. These trends indicate the need to transition from an opioid-centered perspective to a focus on substance use disorder more broadly. In this section, trends in non-fatal drug overdose hospital discharges, such as these, will be highlighted. Additionally, this section will explain the three data sources of non-fatal overdose data, including data and trends that emerged from these sources.

23,565

the number of drug-related discharges for all outpatient visits and inpatient stays in Tennessee in 2018.

Introduction

In this section of the Tennessee Annual Overdose Report, we will describe non-fatal drug overdose trends in Tennessee (TN) from two separate data sources. The majority of the data and trends in this section are from the Tennessee Statewide Hospital Discharge Data System (HDDS). An introduction to this system is below and an explanation of the different non-fatal data sources can be read on the following page.

Below we describe drug-related morbidity indicators based on inpatient and outpatient discharge records using HDDS[26] for the three most recent years of available data. The HDDS contains billing codes from discharges at hospitals statewide for inpatient hospitalizations and outpatient visits, including emergency department visits. These billing codes 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 four primary drug overdose morbidity statistics for inpatient stays and outpatient visits with a discharge date between January 1, 2016 and December 31, 2018. We describe drug overdoses overall and by age, race, and sex, as feasible. Definitions for these indicators are based on guidelines from the Centers for Disease Control and Prevention (CDC) Toolkit 3.0 developed for use by the Prevention for the States (PfS) and Data-Driven Prevention Initiative Programs (DDPI)[27]. The validity of the definitions has been evaluated by cross-jurisdiction analyses and expert consultation conducted by the Council for State and Territorial Epidemiologists (CSTE) ICD-10-CM Drug Poisoning Indicators Workgroup. Briefly, the drug overdose morbidity indicators include:

1. **All drug overdose outpatient visits or inpatient stays** - caused by non-fatal acute poisonings due to the effects of drugs.
   Intent: suicide, unintentional, assault or undetermined.

2. **Opioid overdose excluding heroin outpatient visits or inpatient stays** - caused by non-fatal acute poisonings due to the effects of all opioid drugs, excluding heroin.
   Intent: suicide, unintentional, assault or undetermined.

3. **Heroin overdose outpatient visits or inpatient stays** - caused by non-fatal acute poisonings due to the effects of heroin.
   Intent: suicide, unintentional, assault or undetermined.

4. **Stimulant overdose excluding caffeine outpatient visits or inpatient stays** - caused by non-fatal acute poisonings due to the effects of stimulants (excluding caffeine).
   Intent: suicide, unintentional, assault or undetermined.

Events related to late effects, adverse effects, underdosing 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. Since the ICD-10-CM transition, which added codes for encounter type (initial encounter, subsequent encounter, sequela), <0.2% of discharge records in TN are coded as a subsequent encounter or sequela. Therefore, the below indicators are limited to only initial and missing encounters following PfS and DDPI indicator definitions.

26 Documentation manual available online: http://www.tha-hin.com/Files/HDDSManual18.pdf
27 Centers 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 (Versions 3.0). Atlanta, GA.

Understanding Non-Fatal Data Sources

The Tennessee Department of Health (TDH) has access to three primary data systems that contain non-fatal drug overdose data and information. Each of the data systems are unique, and understanding the nuances about each distinctive data system is important when interpreting the data and information in this report.

The non-fatal data for this report primarily comes from the **Hospital Discharge Data System (HDDS).** Data from HDDS are considered confirmed drug overdoses. HDDS data in this report highlights all drug overdose, opioid (excluding heroin), heroin, and stimulant (excluding caffeine) data. As HDDS represents the most complete data source of confirmed drug overdoses statewide, it is featured as the primary data source in this report.

The HDDS contains Tennessee (TN) hospital discharge data. HDDS data are comprised of billing codes from discharges at hospitals statewide on inpatient hospitalizations and outpatient visits, including emergency department visits. HDDS billing codes are based on the ICD-10-CM codes. ICD-10-CM is a standardized method for identification of disease and other morbidities. Identifying overdose discharges relies on drug poisoning ICD-10-CM codes that are captured within the HDDS. This report includes data and information on drug overdose discharges (all drug overdose, opioid, heroin, and stimulant) for TN residents from non-federal, acute care hospitals with inpatient stays and outpatient visits with a discharge date between January 1, 2016 and December 31, 2018. TDH releases provisional HDDS data on a quarterly basis and finalizes the data annually. This report uses these finalized data.

In 2016, the TN State Legislature passed amendments authorizing TDH to collect health records maintained by any facility to facilitate investigations regarding opioid misuse, overdose, and death (Tennessee Code Annotated (TCA), Title 68, Chapter 11, Part 314). The data system that was created to receive these data was named the **Drug Overdose Reporting (DOR)** system. Data reported to the DOR system include non-fatal opioid overdose data from licensed TN facilities including emergency room departments, acute care hospitals, rehabilitation facilities, and free-standing ambulatory surgical treatment centers that are a part of a hospital. DOR data do not include psychiatric hospitals/units or substance abuse treatment facilities within a hospital.

Data from DOR in this report include opioid overdose discharges for TN residents between January 1, 2017 and December 31, 2019. Like HDDS, DOR data are based on ICD-10-CM billing codes. However, unlike HDDS, DOR data are received weekly rather than quarterly. DOR data allow for more timely analyses and closer to real-time responses for cases where data show opioid overdose increases or spikes. One limitation to DOR data are that some TN facilities are still onboarding to the DOR system. Currently, about 115 facilities report to DOR out of 125 facilities. HDDS contain data from all state facilities. Because data from DOR are timelier than data from HDDS, DOR data are used primarily for rapid analyses which inform biweekly opioid overdose working groups and programs that use the data and information to target resources (e.g. the distribution of naloxone) or activities for opioid overdose prevention and education. DOR data are not yet publicly available, however, HDDS overdose data, aggregated at the state, region, and county ldevel, are publicly available and can be accessed via the TDH Drug Overdose Data Dashboard.

The third source for non-fatal drug overdose data is **Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE)**, a syndromic surveillance data system developed by CDC's BioSense and maintained by CDC's National Syndromic Surveillance Program (NSSP). Syndromic monitoring uses health data that precedes hospital diagnosis. ESSENCE relies on a CDC-developed algorithm that searches discharge diagnosis codes, SNOMED (Systematized Nomenclature of Medicine), and chief complaint text. Data reported to ESSENCE include data for suspected overdose cases (all drug overdose, all opioid, heroin, and stimulant). Cases identified through ESSENCE are considered suspected because clinical or laboratory confirmation is not yet available.

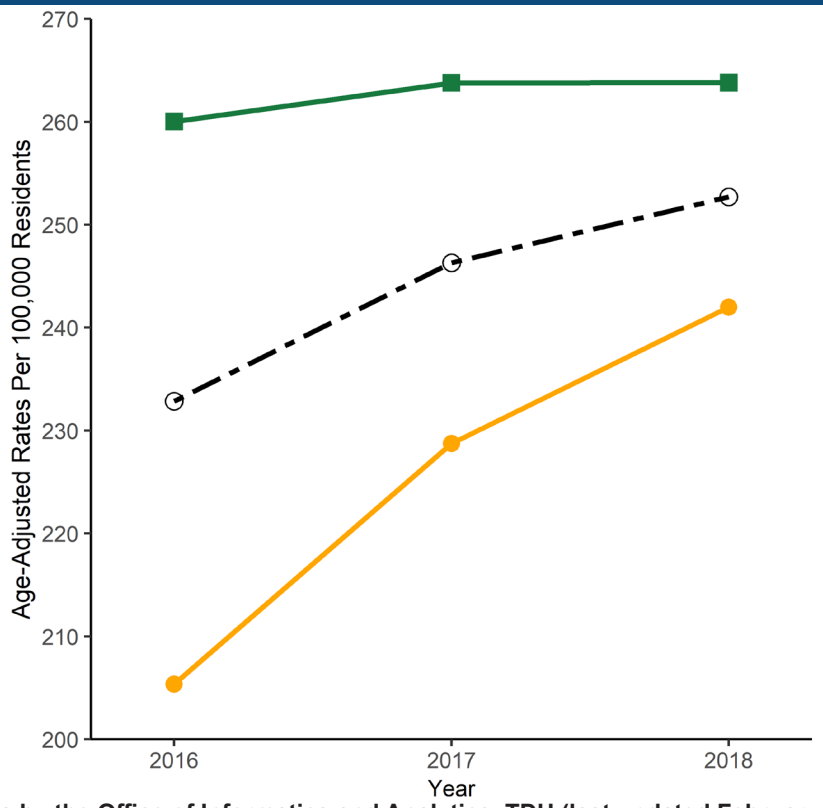
Since ESSENCE data are updated daily, the data are useful for the early detection (before confirmation) of outbreaks or pinpointing clusters. However, ESSENCE data are not clinically or laboratory confirmed, caution should be taken when interpreting the data. Syndromic surveillance often identifies more suspected cases than the true confirmed number of cases. Due to this limitation, ESSENCE has lower sensitivity compared to HDDS and DOR. Around 90 TN facilities are currently reporting to ESSENCE.

TDH Non-Fatal Drug Overdose Data Sources Table

Data Source	Data Source Characteristics	Drug Overdose Indicators	Geographic level	Most Recent Available Data
TN Hospital Discharge Data System (HDDS)	• Data are received quarterly • Data include outpatient visits (primarily Emergency Department visits and 23 hours or less observations) and inpatient stays (longer than 24 hours) from non-federal, acute care hospitals • All hospital facilities in TN report HDDS data	• Billing data for ICD-10-CM coded non-fatal overdoses including all drug overdose, opioid, heroin, and stimulant (excluding caffeine)	TN, Region, County, Address	• Due to privacy restrictions, data are embargoed for 18 months before public release • 2017 data are publicly available
TN Drug Overdose Reporting System (DOR)	• Data are received weekly • Data include non-federal Emergency Department (ED) and acute care hospitals and freestanding ambulatory surgical treatment centers affiliated with a hospital • Approximately 115 (out of 125) facilities report to DOR	• Billing data for ICD-10-CM coded opioid overdose only • Future data will include SNOMED codes, stimulants, benzodiazepines, and muscle relaxants	TN, Region, County, Address	• Data are not publicly available • Previous week (Sunday-Saturday)
Syndromic Surveillance (ESSENCE)	• Data are received daily • Data include Emergency Department (ED) facilities • Approximately 90 facilities (out of 125) report to ESSENCE	• Data are suspected data, before clinical or laboratory confirmation • Syndromic data include all drugs, all opioid, heroin, and all stimulants • Identification of overdose cases relies on a CDC-developed algorithm that searches discharge diagnosis codes or SNOMED codes and chief complaint text	Region, Health Facility Region, County	• Daily updates • Data are available internally to TDH

All Drug Non-fatal Overdose

Age-Adjusted Rates for All Drug Overdose Outpatient Visits by Sex in TN, 2016-2018



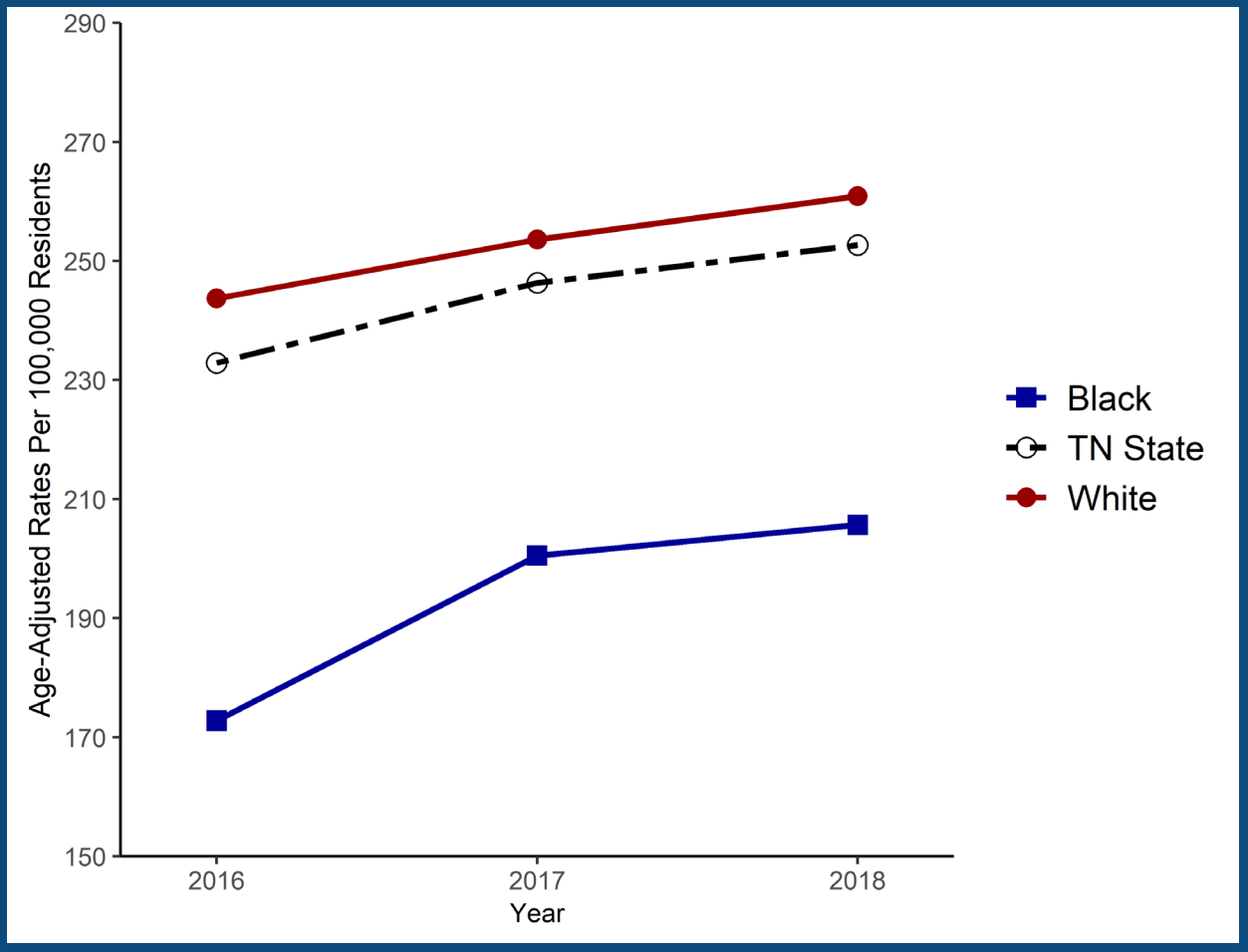
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

Legend

- Female
- Male
- TN State

The above graph shows age-adjusted rates for all drug overdose outpatient visits by sex during 2016 to 2018. In TN, outpatient visits for all drug overdoses increased and ranged from 232.9 per 100,000 in 2016 to 252.7 per 100,000 in 2018. Though females compared to males had higher age-adjusted rates for all drug overdoses, the largest increase in age-adjusted rate was observed for males (205.4 per 100,000 in 2016 to 242.0 per 100,000 in 2018).

Age-Adjusted Rates for All Drug Overdose Outpatient Visits by Race in TN, 2016-2018

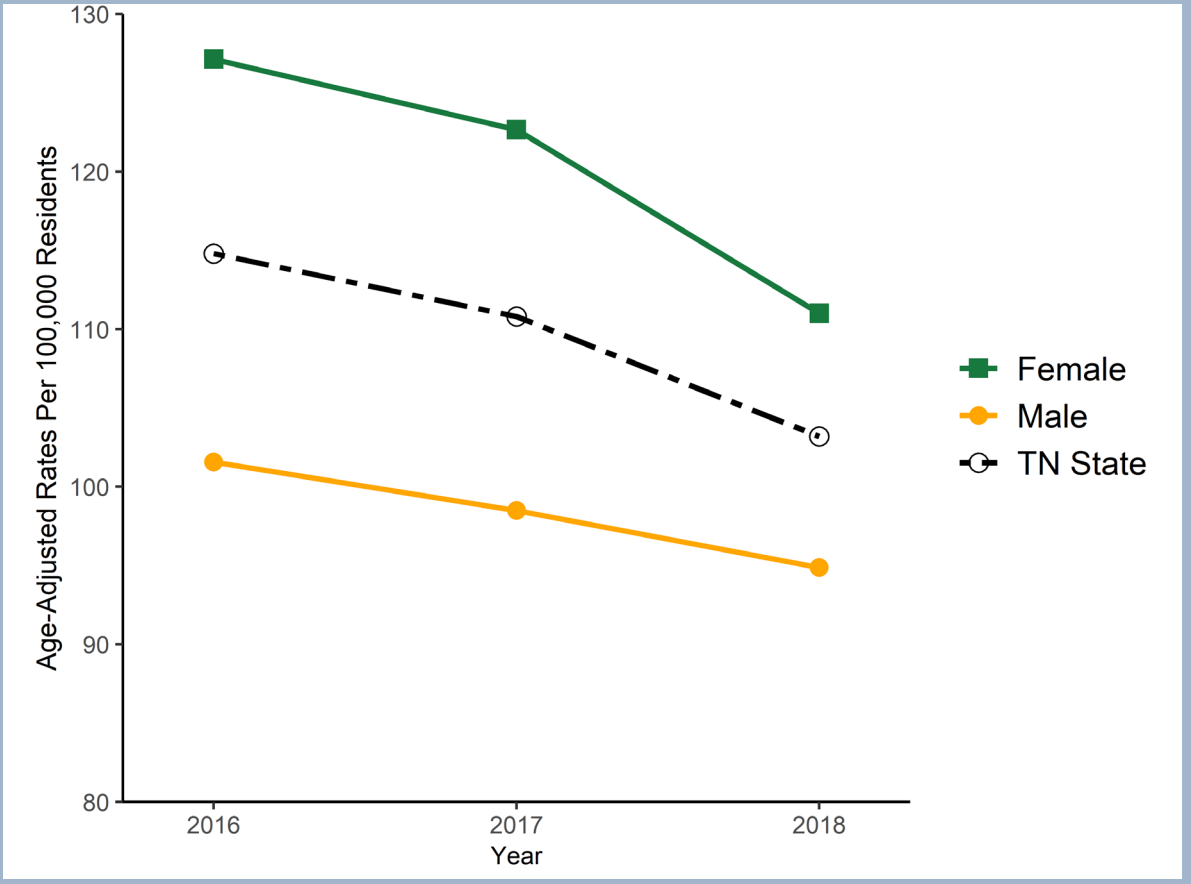


Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The above graph shows age-adjusted rates for all drug overdose outpatient visits by race (Black and White) during 2016 to 2018. In TN, outpatient visits for all drug overdoses increased and ranged from 232.9 per 100,000 in 2016 to 252.7 per 100,000 in 2018. Though Whites compared to Blacks had higher age-adjusted rates for all drug overdoses, the largest increase in age-adjusted rate was observed for Blacks (172.8 per 100,000 in 2016 to 205.7 per 100,000 in 2018).

In TN, all drug overdose outpatient visits increased for both Whites and Blacks from 2016 to 2018.

Age-Adjusted Rates for All Drug Overdose Inpatient Stays by Sex in TN, 2016-2018

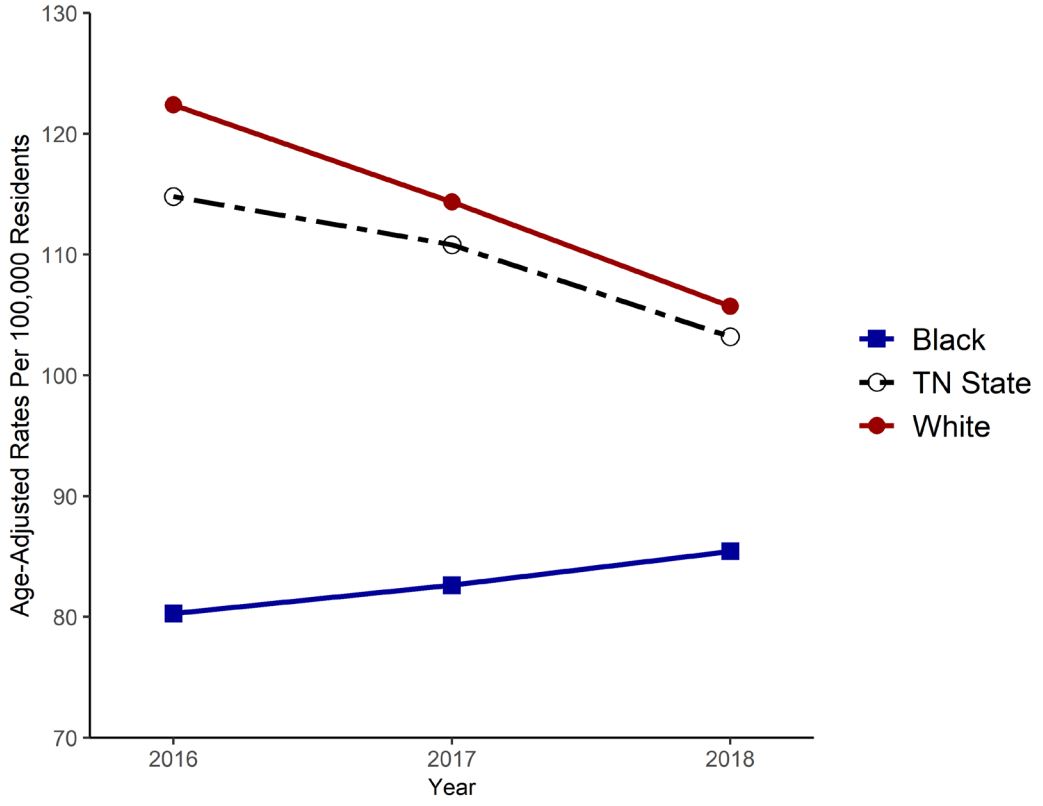


Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

Age-adjusted rates for inpatient stays for an all drug overdose by sex during 2016 to 2018 are shown above. In TN, inpatient stays for all drug overdoses decreased and ranged from 114.8 per 100,000 in 2016 to 103.2 per 100,000 in 2018. Females had higher age adjusted rates for all drug overdose inpatient stays than males, while both showed a decrease in age adjusted-rates over time. Rates for females decreased from 127.1 in 2016 to 111.1 per 100,000 in 2018 while in males, rates decreased from 101.6 in 2016 to 94.8 per 100,000 in 2018.

In TN, inpatient stays for all drug overdoses decreased from 2016 to 2018.

Age-Adjusted Rates for All Drug Overdose Inpatient Stays by Race in TN, 2016-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

Age-adjusted rates for inpatient stays for an all drug overdose by race (Black and White) during 2016 to 2018 are shown above. In TN, inpatient stays for all drug overdoses decreased and ranged from 114.8 per 100,000 in 2016 to 103.2 per 100,000 in 2018. An increase in rate was observed among Blacks from 2016 (80.3 per 100,000) to 2018 (85.3 per 100,000) while Whites showed a decrease in age-adjusted rate from 122.4 in 2016 to 105.7 per 100,000 in 2018.

An increase in rates for all drug overdose inpatient stays was observed among Blacks while Whites showed a decrease from 2016 to 2018.

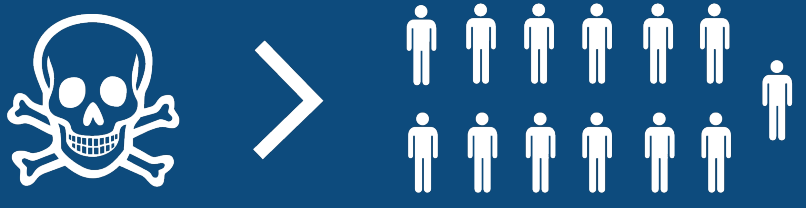
History of Non-Fatal Overdose Outpatient Visits or Inpatient Stays in the Year before Death*

History of Non-Fatal Overdose Outpatient Visits or Inpatient Stays the Year before Death among 2018 Drug Overdose Decendents in TN (n= 1,818)			
Number of Patients with one or more non-fatal overdose in the year before death, identified in TN HDDS			
	Outpatient Visits	Inpatient Stays	Total Outpatient Visits and Inpatient Stays
All drug overdose	193	103	269[a]
Opioid (excluding heroin) overdose	55	36	88[a]
Heroin Overdose	101	30	125[a]
Stimulant (excluding caffeine) Overdose	7	19	26

[a] Outpatient visits and inpatient stays may not sum to the total as a patient may have had more than one visit. Outpatient visits, include emergency visits, as well as other visits lasting < 23 hours.
* This analysis is based on provisional hospital discharge data that was current as of February 14, 2020.

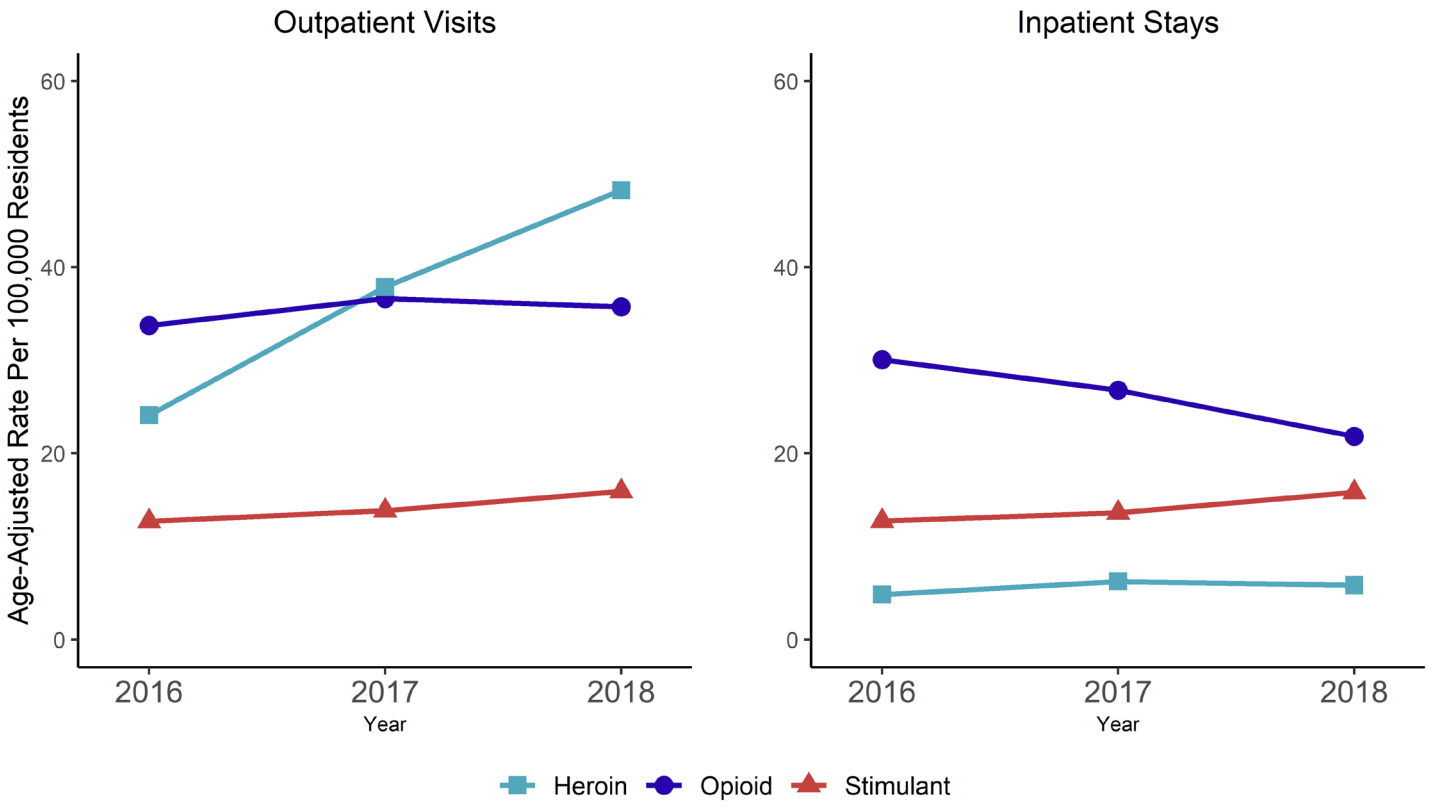
In 2018, for every drug overdose death, more than 13 non-fatal overdose discharges were identified in Tennessee's Statewide HDDS having been treated in the emergency department or hospital. At least 14.8%, 4.8%, 6.9%, 1.4% of overdose decedents in 2018 had an all drug, opioid excluding heroin, heroin or stimulant (excluding caffeine) non-fatal overdose in the year before their death, respectively.

Among 269 decedents with 1 or more non-fatal overdoses in the year before death, the total number of discharges was 361 for all drug outpatient visits or inpatient stays. This included 242 outpatient visits (all but one were emergency department visits), and 119 inpatient stays (discharge-level data not shown). It is important to note that hospital discharge data does not include non-fatal overdoses that occurred outside of the emergency department or hospital.



For every drug overdose death in TN, there were 13 non-fatal drug overdose discharges from TN hospitals.

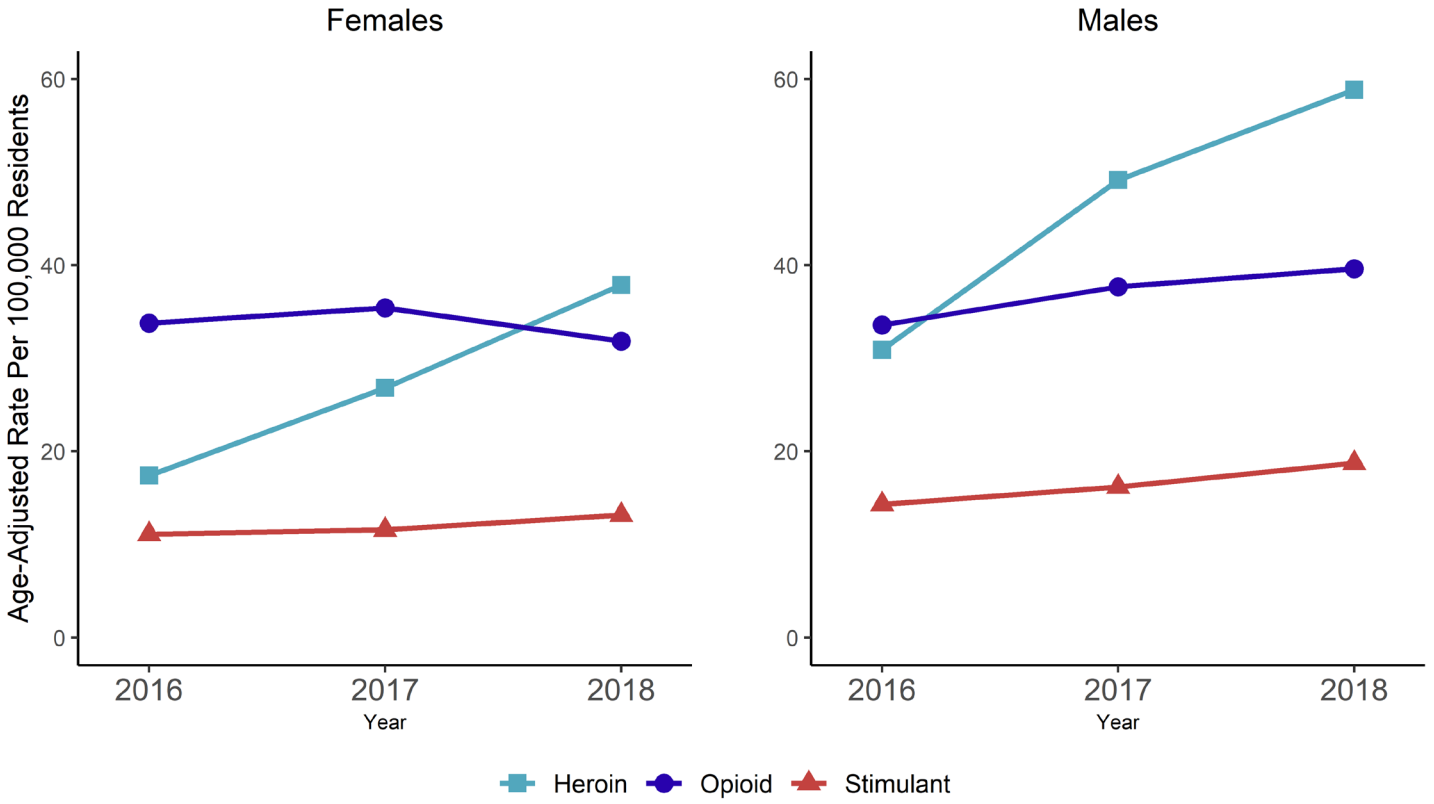
Age-Adjusted Rates for Opioids (excluding heroin), Heroin, and Stimulant (excluding caffeine) Overdose Outpatient Visit and Inpatient Stays in TN, 2016-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

In TN, opioid (excluding heroin), heroin, and stimulant (excluding caffeine) overdose visits continue to increase with a substantial increase observed for heroin overdose outpatient visits ranging from 24.1 per 100,000 in 2016 to 48.3 per 100,000 in 2018. Age-adjusted rate for inpatient stays for opioid overdose decreased from 30.1 per 100,000 in 2016 to 21.8 per 100,000 in 2018, while age-adjusted rates for stimulant (2016: 12.7 per 100,000, 2018: 15.8 per 100,000) and heroin (2016: 4.8 per 100,000, 2018: 5.8 per 100,000) inpatient stays showed a modest increase.

Age-Adjusted Rates for Overdose Outpatient Visits by Sex and Drug Type in TN, 2016-2018



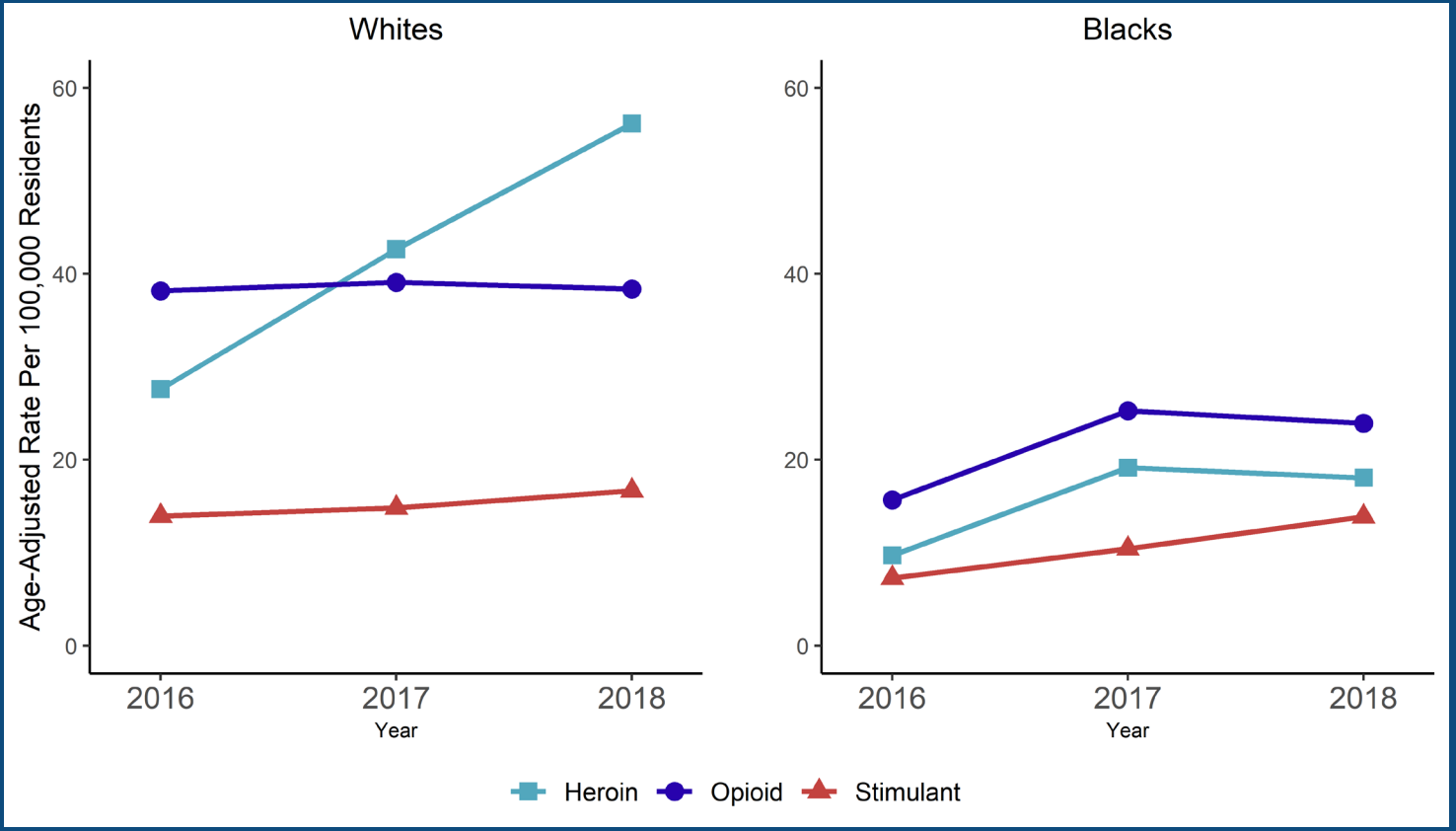
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

Yearly age-adjusted rates for opioid (excluding heroin), heroin and stimulant (excluding cafffeine) overdose outpatient visits by sex are shown above. Independent of the drug type, males had the highest age adjusted rates related to overdose visits compared to females. Outpatient visits for opioid overdoses decreased from 33.8 per 100,000 in 2016 to 31.8 per 100,000 in 2018 in females, while the rates increased in males during the same period and ranged from 33.6 per 100,000 in 2016 to 39.6 per 100,000 in 2018.

Substantial increases in rates for heroin overdose visits were observed both in males and females since 2016. In males, the rate increased from 30.9 per 100,000 in 2016 to 58.9 per 100,000 in 2018, while in females, the rate increased from 17.4 per 100,000 in 2016 to 37.8 per 100,000 in 2018.

Age-adjusted rates for stimulant overdose outpatient visits continue to increase steadily since 2016. In 2018, the age-adjusted rate for stimulant overdose was 18.7 per 100,000 in males compared to 13.1 per 100,000 in females.

Age-Adjusted Rates for Overdose Outpatient Visits by Race and Drug Type in TN, 2016-2018



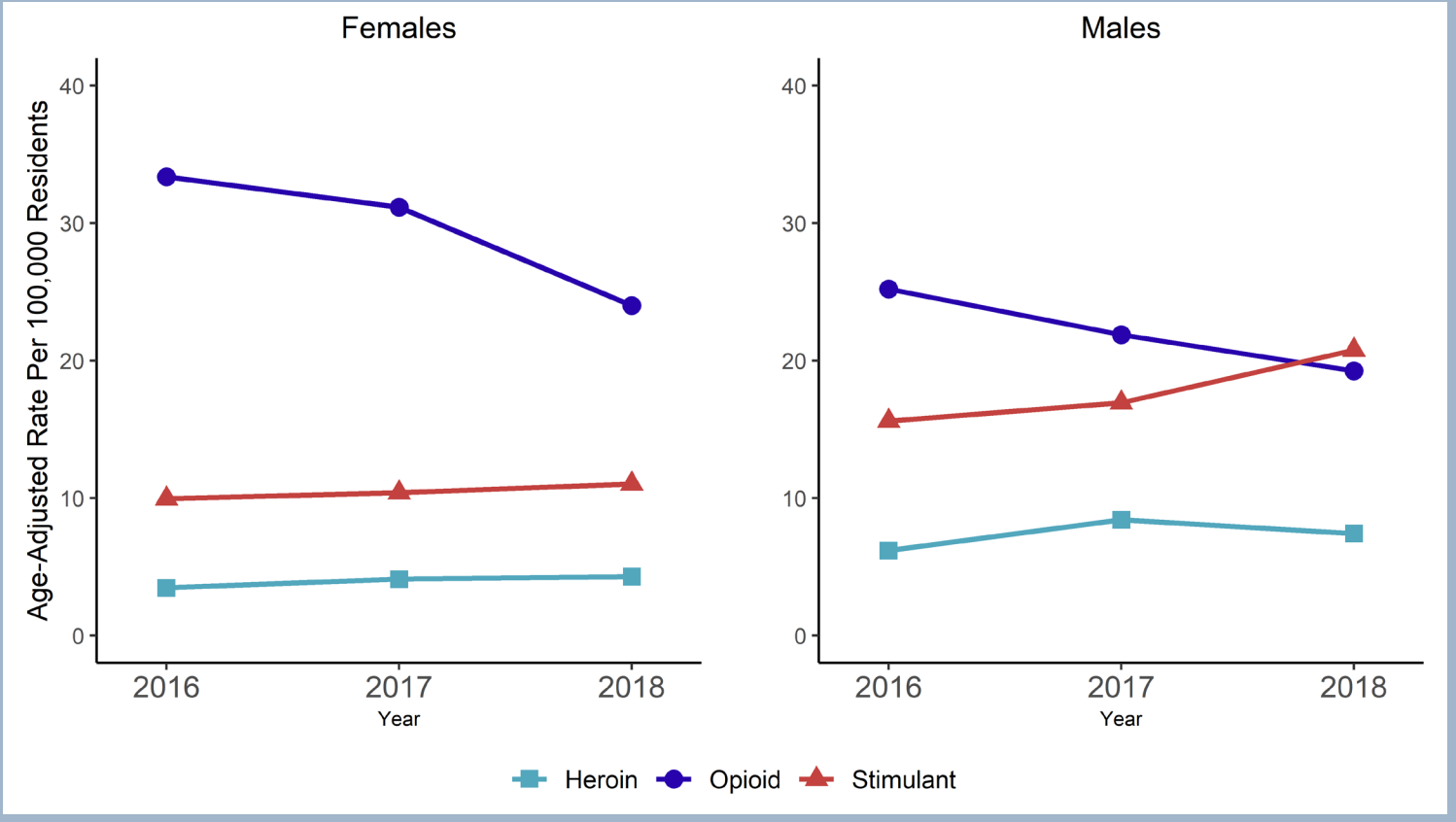
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The age-adjusted rate for opioid overdose (excluding heroin) visits in Whites remained around 38.2 per 100,000 since 2016, while the rates increased in Blacks from 15.7 per 100,000 in 2016 to 25.3 per 100,000 in 2017 and decreased to 23.9 per 100,000 by 2018.

A steep increase in heroin overdose outpatient visits was observed among Whites, ranging from 27.6 per 100,000 in 2016 to 56.2 per 100,000 in 2018, while the stimulant (excluding caffeine) overdose rate increase was modest ranging from 13.9 per 100,000 in 2016 to 16.7 per 100,000 in 2018.

Heroin and stimulant overdose rates doubled among Blacks by 2018 compared to what they had been in 2016.

Age-Adjusted Rates for Overdose Inpatient Stays by Sex and Drug Type in TN, 2016-2018



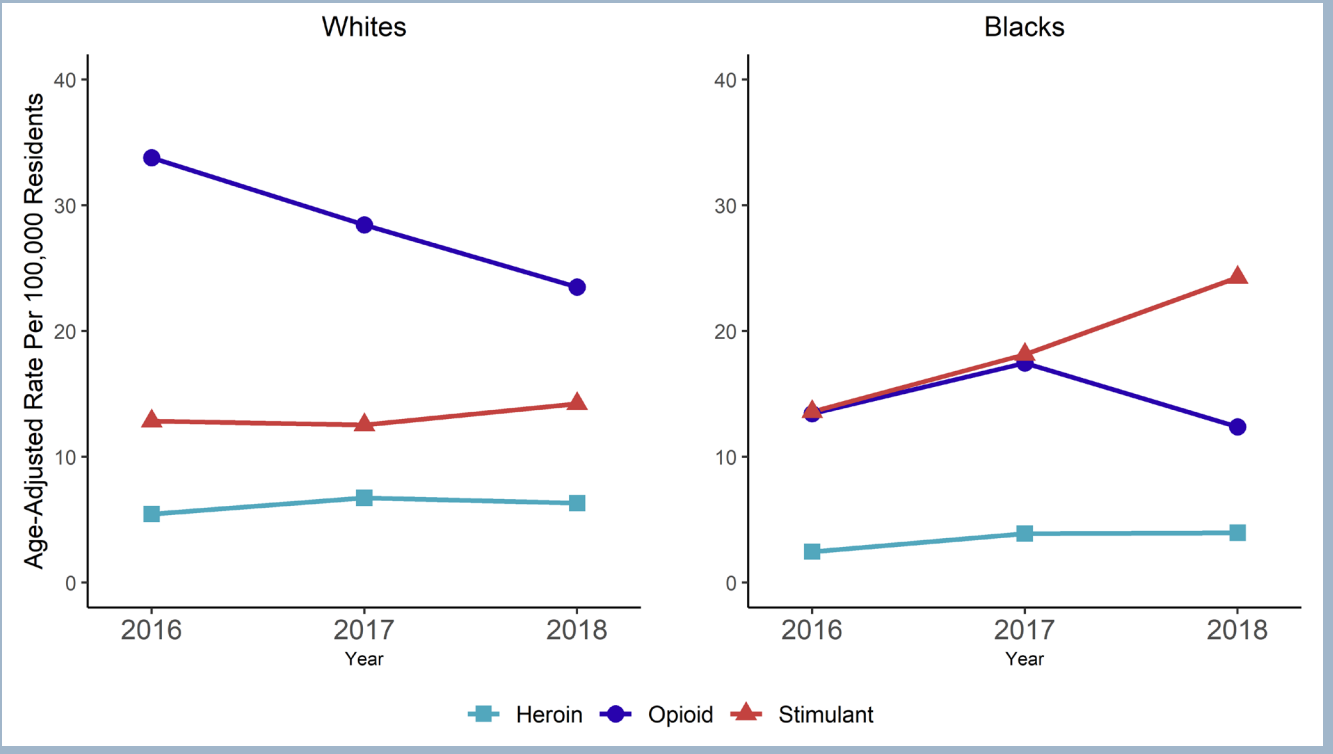
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

Yearly age-adjusted rates for opioid (excluding heroin), heroin and stimulant overdose (excluding caffeine) inpatient stays by sex are shown above. In both males and females the age-adjusted rate for opioid overdose inpatient stays decreased from 2016 to 2018 with females showing higher rates than males for opioid overdose inpatient stays.

Males had higher rates of inpatient stays for stimulant overdoses than females and rates in males increased from 15.6 per 100,000 in 2016 to 20.8 per 100,000 in 2018, while rates for females increased from 9.95 per 100,000 in 2016 to 11.0 per 100,000 in 2018.

Compared to females, age-adjusted rates of inpatient stays for heroin overdoses were higher in males with rates ranging from 6.2 per 100,000 in 2016 to 7.4 per 100,000 in 2018.

Age-Adjusted Rates for Overdose Inpatient Stays by Race and Drug Type in TN, 2016-2018

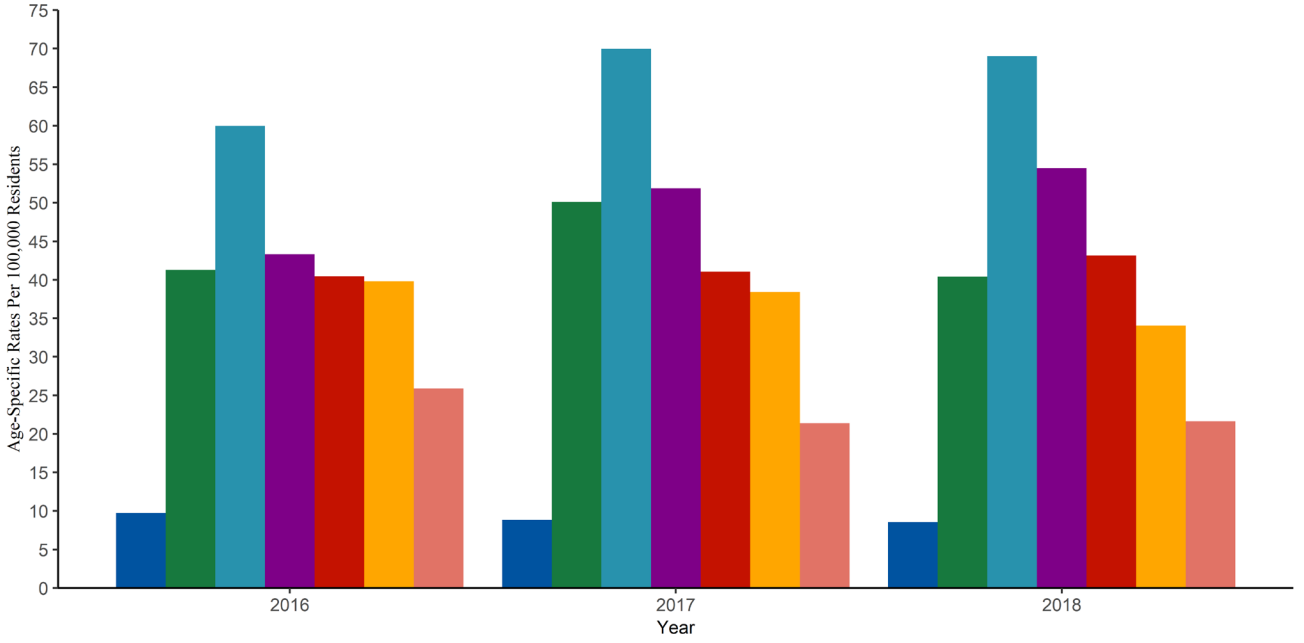


Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The above graph shows the age-adjusted rates for inpatient stays related to different drug overdose types by race. The rates for opioid overdose (excluding heroin) inpatient stays showed a decline from 2016 to 2018 among both Whites and Blacks. There was a marked increase in stimulant overdose (excluding caffeine) inpatient stays among Blacks (13.6 per 100,000 in 2016 to 24.3 per 100,000 in 2018) compared to Whites (12.8 per 100,000 in 2016 to 14.2 per 100,000 in 2018) while the rates for heroin overdoses continued to increase in both races.

There is a marked increase in the stimulant overdose (excluding caffeine) inpatient stays among Blacks compared to Whites.

Age-Specific Rates for Opioid Overdose (excluding Heroin) Outpatient Visits in TN, 2016-2018



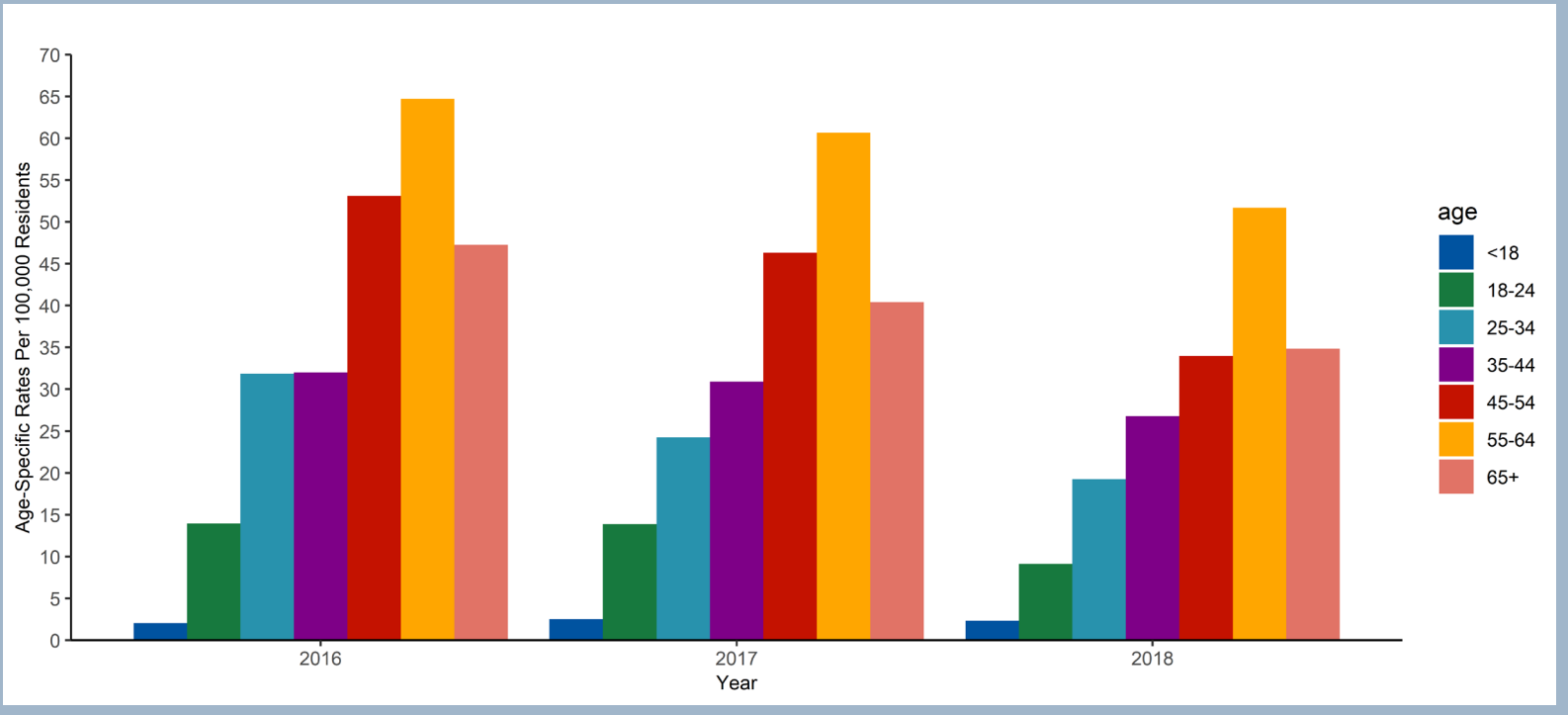
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The graph above displays age-specific rates for opioid overdose (excluding heroin) outpatient visits in TN during 2016 to 2018. Persons aged 25-34 years and 35-44 years had the highest rates of outpatient overdose visits. The rates of outpatient opioid visits increased from 2016 to 2017 and then decreased from 2017 to 2018 among those aged <25 years, while it decreased from 2016 to 2018 among those aged 55 years or older.

Legend

- <18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

Age-Specific Rates for Opioid Overdose (excluding Heroin) Inpatient Stays in TN, 2016-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The highest decrease in age-specific rates for opioid overdose (excluding heroin) was observed among those aged 45-54 years.

The age-specific rates for inpatient opioid overdose (excluding heroin) stays decreased in general from 2016 to 2018 with the highest drop observed among those aged 45-54 years (53.1 per 100,000 in 2016 to 34.0 per 100,000 in 2018). The exception was for those aged <18 years who showed an increase (2.1 per 100,000 in 2016 to 2.3 per 100,000 in 2018).

2017-2018 Non-Fatal Opioid Overdose Outpatient Visits

Change in Number of Opioid Overdose (excluding heroin) Outpatient Visits by TN County of Residence, 2017-2018

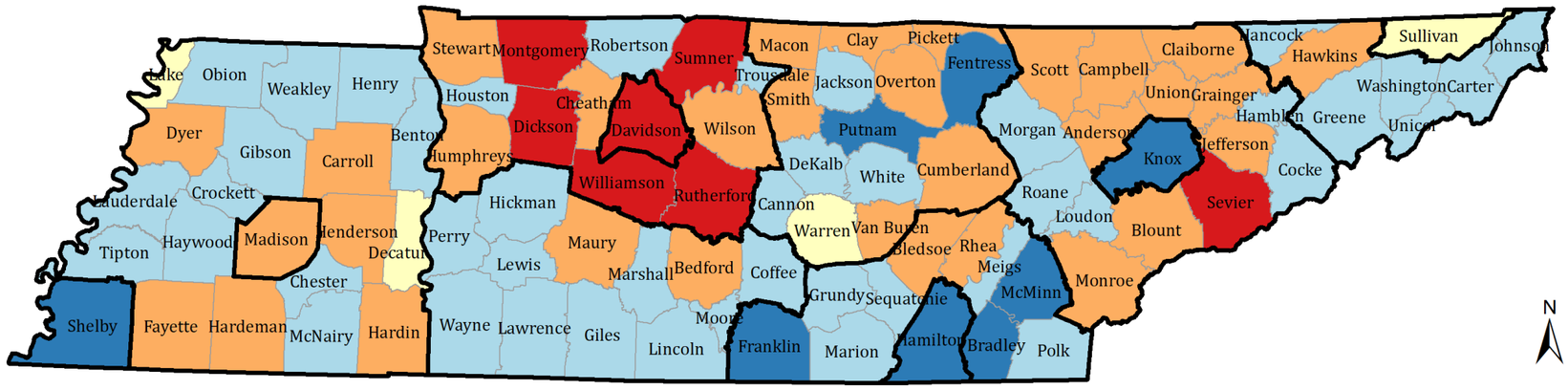
The map to the right displays the change in the number of opioid overdose (excluding heroin) outpatient visits from 2017 to 2018 by TN county of residence. The largest decrease in opioid overdose outpatient visits was observed in Shelby County (297 visits in 2017 to 260 visits in 2018) while the largest increase was observed in Montgomery county (78 visits in 2017 to 120 visits in 2018). Four counties (Decatur, Lake, Sullivan and Warren) reported no change in outpatient opioid overdose visits from 2017 to 2018.

Counties with an increase of ≥10 opioid overdose (excluding heroin) visits in 2018 were:

- Davidson County
- Dickson County
- Montgomery County
- Rutherford County
- Sevier County
- Sumner County
- Williamson County

Counties with a decrease of ≥10 opioid overdose (excluding heroin) visits in 2018 were:

- Bradley County
- Fentress County
- Franklin County
- Hamilton County
- Knox County
- McMinn County
- Putnam County
- Shelby County



Change in Opioid Overdose* Outpatient Visits by TN County of Residence

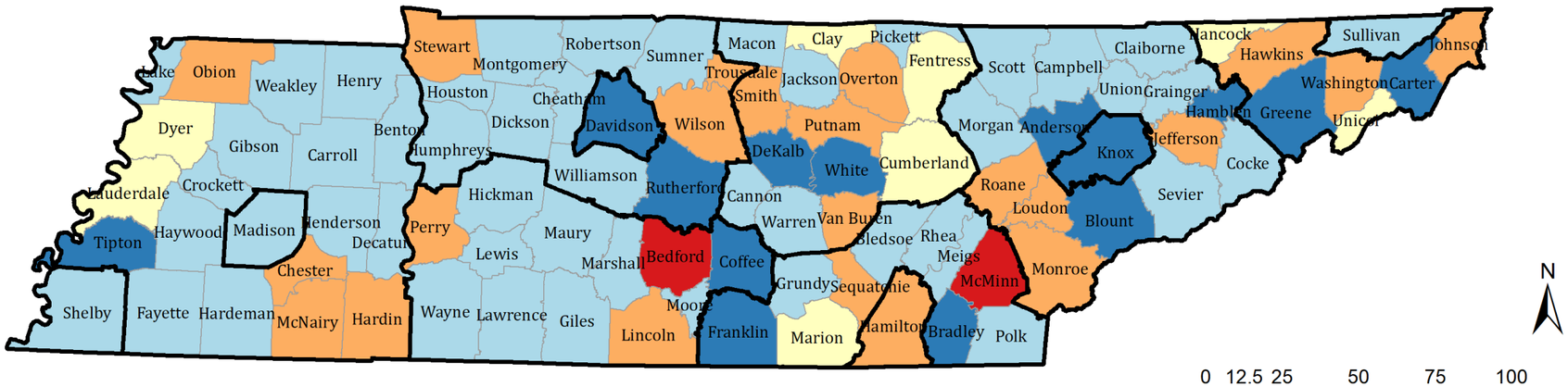
- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- Health Regions

***Excluding Heroin**

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

Total drug overdose outpatient visits in TN involving an opioid decreased by 1.9% between 2017 and 2018.

Change in Number of Opioid Overdose (excluding heroin) Inpatient Stays by TN County of Residence, 2017-2018



Change in Opioid Overdose* Inpatient Stays by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- Health Regions

***Excluding Heroin**

Total drug overdose inpatient stays in TN involving an opioid decreased by 17.3% between 2017 and 2018.

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

The map to the left displays the change in the number of opioid overdose (excluding heroin) inpatient stays from 2017 to 2018 by TN county of residence. Among inpatient stays for opioid overdoses, McMinn County reported the highest increase in the number of stays in 2018 (12 stays in 2017 to 23 stays in 2018), followed by Bedford County (11 stays in 2017 to 22 stays in 2018), while Davidson, Knox and Rutherford counties reported a decrease of more than 20 stays in 2018. Eight counties (Clay, Cumberland, Dyer, Fentress, Hancock, Lauderdale, Marion and Unicoi) reported no change in the number of inpatient stays for opioid overdoses.

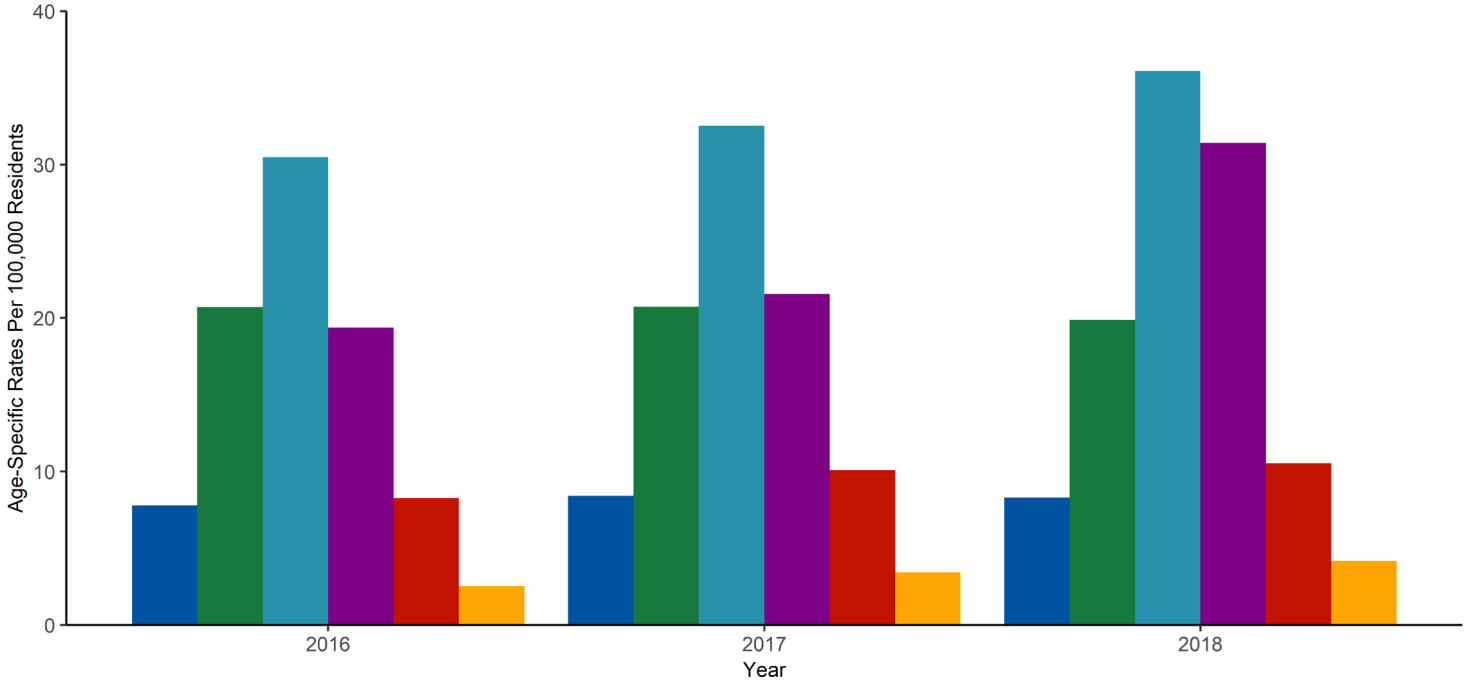
Counties with an increase of ≥10 opioid overdose (excluding heroin) visits in 2018 were:

- **Bedford County**
- **McMinn County**

Counties with a decrease of ≥10 opioid overdose (excluding heroin) visits in 2018 were:

- **Anderson County**
- **Blount County**
- **Bradley County**
- **Carter County**
- **Coffee County**
- **Davidson County**
- **Dekalb County**
- **Franklin County**
- **Greene County**
- **Hamblen County**
- **Knox County**
- **Rutherford County**
- **Tipton County**
- **White County**

Age-Specific Rates for Stimulant Overdose (excluding caffeine) Outpatient Visits in TN, 2016-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System. Graphs excludes outpatient data on individuals 65 years or older as counts were too small to calculate reliable rates.

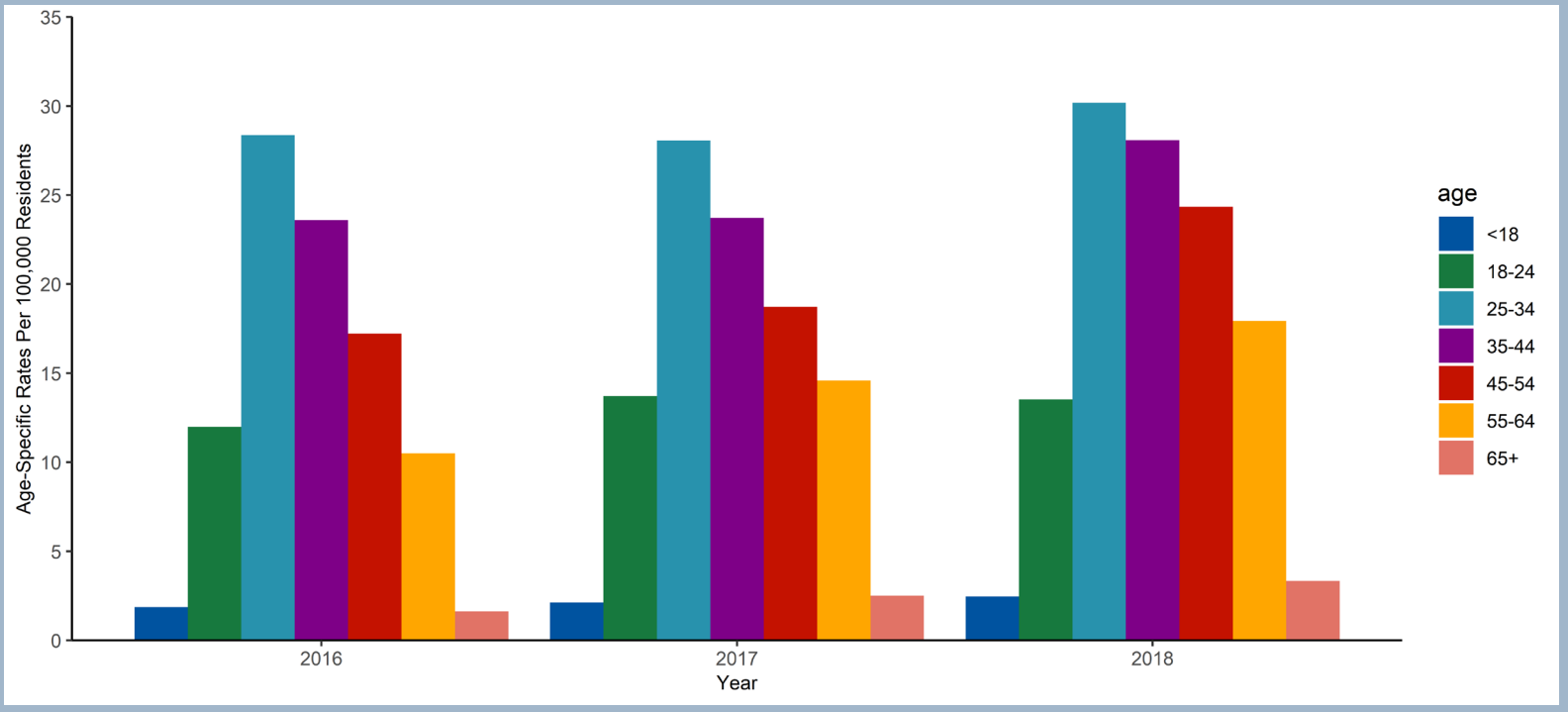
Legend

age

- <18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64

The above graph shows age-specific rates for stimulant (excluding caffeine) overdose outpatient visits in TN during 2016 to 2018. Persons aged 25-34 years (30.5 per 100,000 in 2016 to 36.1 per 100,000 in 2018) and 35-44 years (19.4 per 100,000 to 31.4 per 100,000 in 2018) had the highest rates for outpatient overdose visits in 2018.

Age-Specific Rates for Stimulant Overdose (excluding caffeine) Inpatient Stays in TN, 2016-2018



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Hospital Discharge Data System.

The age-specific rates for inpatient stimulant overdose (excluding caffeine) stays increased across all age groups from 2016 to 2018 with the highest increase observed among those aged 55-64 years (10.5 per 100,000 in 2016 to 17.9 per 100,000 in 2018) and 45-54 years (17.2 per 100,000 in 2016 to 24.4 per 100,000 in 2018).

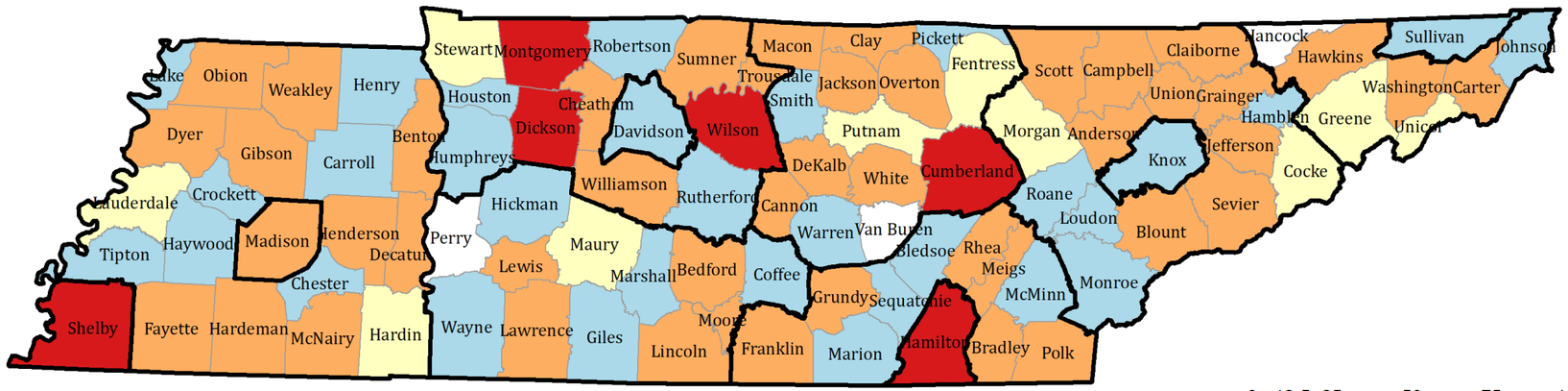
The age-specific rates for inpatient stimulant overdose stays increased across all age groups from 2016 to 2018.

The map to the right displays the change in the number of stimulant overdoses (excluding caffeine) outpatient visits from 2017 to 2018 by TN county of residence. The largest decrease in stimulant overdose outpatient visits was observed in Rutherford (43 visits in 2017 to 34 visits in 2018) county, while the largest increase was observed in Montgomery county (25 visits in 2017 to 63 visits in 2018) followed by Shelby county (61 visits in 2017 to 78 visits in 2018). Ten counties (Cocke, Fentress, Greene, Hardin, Lauderdale, Maury, Morgan, Putnam, Stewart and Unicoi) reported no change in outpatient stimulant overdose visits from 2017 to 2018.

Counties with an increase of ≥10 stimulant overdose (excluding caffeine) outpatient visits in 2018 were:

- Cumberland County
- Dickson County
- Hamilton County
- Montgomery County
- Shelby County
- Wilson County

Change in Number of Stimulant Overdose (excluding caffeine) Outpatient Visits by TN County of Residence, 2017-2018



Change in Stimulant Overdose*Outpatient Visits by TN County of Residence

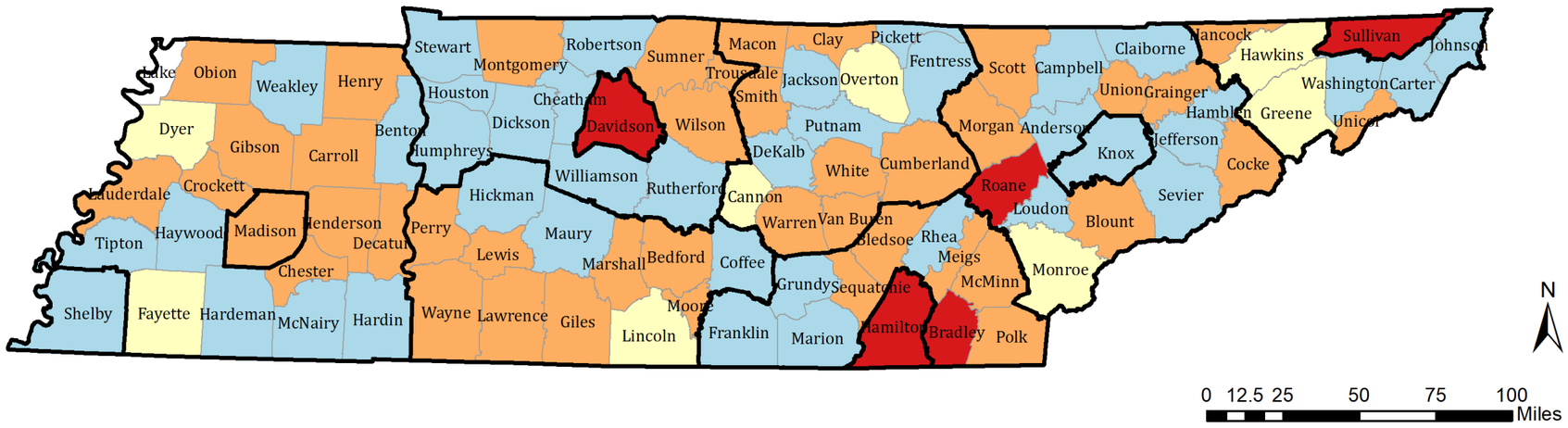
- Decrease <10
- No change
- Increase <10
- Increase >= 10
- No stimulant overdose visit
- Health Regions

***Excludes Caffeine**

Total drug overdose outpatient visits in TN involving a stimulant increased by 14.2% between 2017 and 2018.

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

Change in Number of Stimulant Overdose (excluding caffeine) Inpatient Stays by TN County of Residence, 2017-2018



Change in Stimulant Overdose* Inpatient Stays by TN County of Residence

- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No stimulant overdose stay
- Health Regions

*Excludes Caffeine

Total drug overdose inpatient stays in TN involving a stimulant increased by 17.4% between 2017 and 2018.

The map to the left displays the change in the number of stimulant overdose (excluding caffeine) inpatient stays from 2017 to 2018 by TN county of residence. Among inpatient stays for stimulant overdoses, Davidson County reported the highest increase in the number of stays in 2018 (113 stays in 2017 to 195 stays in 2018) followed by Hamilton (53 stays in 2017 to 67 stays in 2018) and Sullivan (31 stays in 2017 to 43 stays in 2018). Three counties Carter, Jackson, and Shelby reported a decrease of more than five stays in 2018. Eight counties (Cannon, Dyer, Fayette, Greene, Hawkins, Lincoln, Monroe and Overton) reported no change in the number of inpatient stays for stimulant overdoses.

Counties with an increase of ≥10 stimulant overdose (excluding caffeine) inpatient stays in 2018 were:

- Bradley County
- Davidson County
- Hamilton County
- Roane County
- Sullivan County

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

2017-2018 Non-Fatal Heroin Overdose Outpatient Visits

Change in Number of Heroin Overdose Outpatient Visits by TN County of Residence, 2017-2018

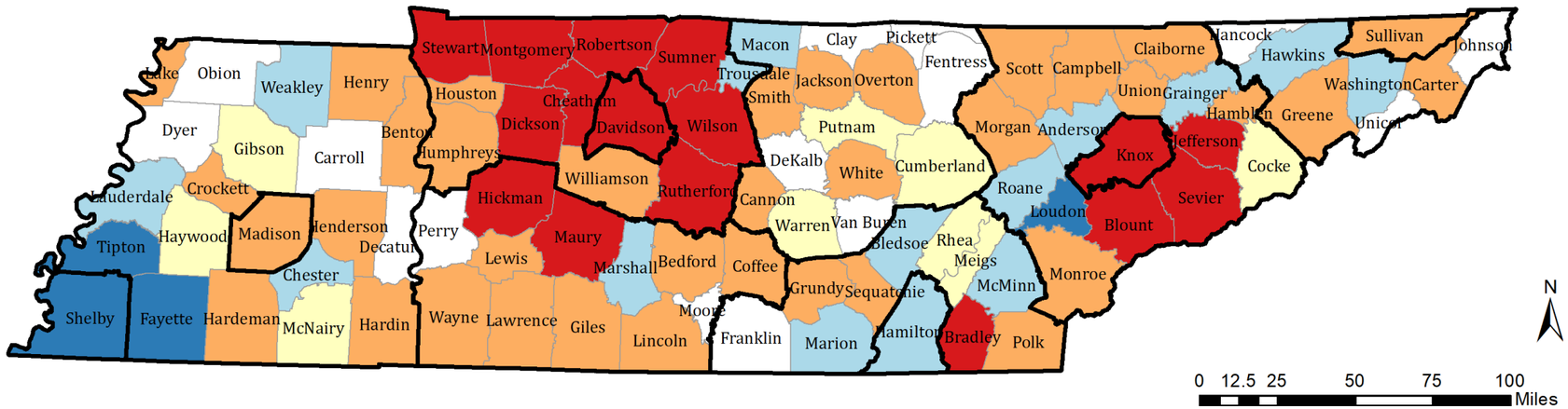
The map to the right shows the change in the number of heroin overdose outpatient visits from 2017 to 2018 by TN County of residence. Sixteen counties reported an increase of ≥10 heroin overdose visits from 2017 to 2018 with Davidson (452 in 2017 to 657 in 2018) and Knox (470 in 2017 to 613 in 2018) counties reporting the highest increase in the number of outpatient heroin overdose visits, while Shelby reported the highest drop in heroin overdose visits in 2018 (478 in 2017 to 315 in 2018).

Counties with an increase of ≥10 heroin overdose outpatient visits in 2018 were:

- Blount County
- Bradley County
- Cheatham County
- Davidson County
- Dickson County
- Hickman County
- Knox County
- Jefferson County
- Maury County
- Montgomery County
- Robertson County
- Rutherford County
- Sevier County
- Stewart County
- Sumner County
- Wilson County

Counties with a decrease of ≥10 heroin overdose outpatient visits in 2018 were:

- Fayette County
- Loudon County
- Sullivan County
- Tipton County



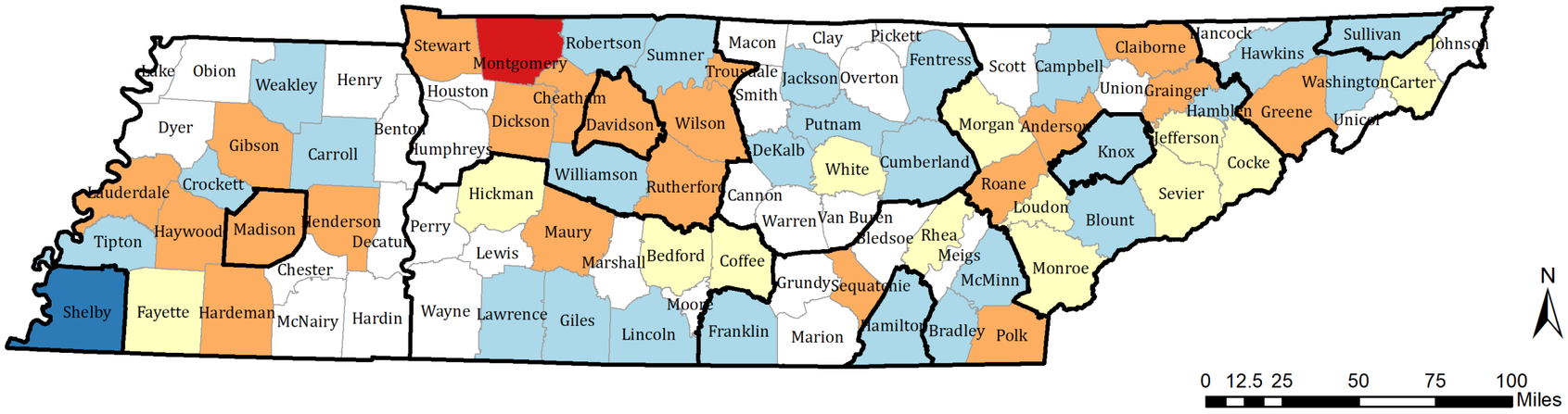
Change in Heroin Overdose Outpatient Visits by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No heroin overdose visit
- Health Regions

Total drug overdose outpatient visits in TN involving heroin increased by 27.2 % between 2017 and 2018.

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

Change in Number of Heroin Overdose Inpatient Stays by TN County of Residence, 2017-2018



Change in Heroin Overdose Inpatient Stays by TN County of Residence

- Decrease >= 10
- Decrease < 10
- No change
- Increase < 10
- Increase >= 10
- No heroin overdose stay
- Health Regions

Total drug overdose inpatient stays in TN involving heroin decreased by 7.2 % between 2017 and 2018.

The map to the left shows the change in the number of heroin overdose inpatient stays from 2017 to 2018 by TN county of residence. The county reporting the highest increase of ≥10 inpatient stays for heroin overdoses in 2018 was Montgomery, while Shelby reported the greatest drop (69 stays in 2017 to 46 stays in 2018) in heroin overdose inpatient stays.

Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Hospital Discharge Data System.

Drug Overdose Reporting (DOR)

In 2016, the TN State Legislature passed amendments to Tennessee Code Annotated (TCA), Title 68, Chapter 11, Part 314 authorizing TDH to collect health records maintained by any facility to facilitate investigations regarding opioid misuse, overdose, and death. All TN hospitals licensed under TCA, Title 68, Chapter 11, Part 314 are required by law to report patient-level health information to TDH, including emergency room departments, acute care hospitals, rehabilitation facilities, and free-standing ambulatory surgical treatment centers that are a part of a hospital. However, it does not include psychiatric hospitals/units or substance abuse treatment facilities within a hospital.

In 2017, TDH implemented the DOR system to collect and summarize patient data concerning non-fatal drug overdoses reported from licensed TN facilities, as described above, dating back to October 2016. In addition to the 2016 legislative mandate, opioid drug overdose was added to the 2019 List of Reportable Diseases in Tennessee for Healthcare Providers, requiring all healthcare providers and other persons knowing of or suspecting an opioid drug overdose event to report that occurrence to TDH. In January 2020, the 2020 List of Reportable Diseases in Tennessee for Healthcare Providers was expanded to include drug overdoses involving stimulants, benzodiazepines, and muscle relaxants.

How are DOR data submitted to TDH?

TN facilities report drug overdoses to TDH weekly based on identified poisoning discharge diagnosis codes from the ICD-10-CM that are associated with an opioid overdose. After discharge, the drug overdose records are only triggered within the facility's system and sent to TDH if the record was determined complete and well coded during the preceding week by that facility. Opioid drug overdoses are reported by facilities to TDH regardless of intent which include attempted suicide, assault (intentional), undetermined, or an accidental overdose (unintentional). In addition to ICD-10-CM diagnosis codes, DOR contains admission and discharge dates, patient demographics, patient and facility addresses, and discharge disposition.

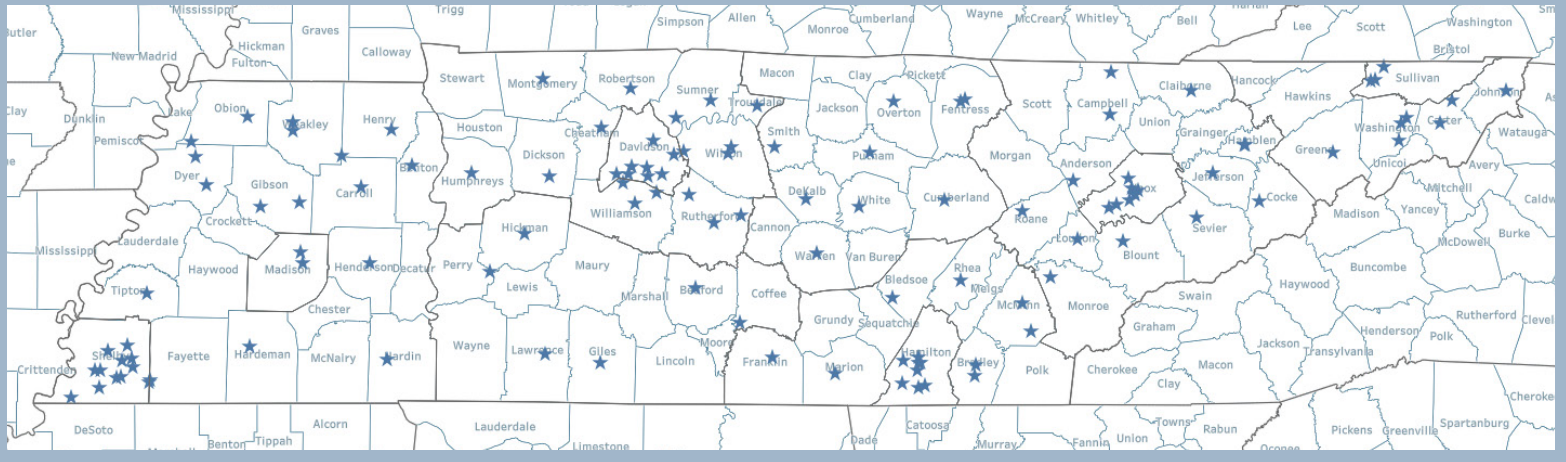
Upcoming 2020 Changes and Future Directions for DOR

Beginning in 2020, TN facilities were able to report chief complaint, additional race values, and timestamps for admission and discharge dates. In addition to reporting ICD-10-CM diagnosis codes, facilities were also able to report based on identified drug overdose codes from the Systematized Nomenclature of Medicine - Clinical Terms (SNOMED CT) that are associated with an opioid, stimulant, benzodiazepine, or muscle relaxant overdose. DOR includes opioid drug overdoses of initial and subsequent encounters, excluding opioid drug overdose sequela. DOR does not collect ICD-10-CM diagnosis codes associated with mental and behavioral disorders due to psychoactive substance use (F10-F19). DOR does not collect events related to adverse effects or underdosing of opioids. Once drug overdoses are reported to the DOR system, data are loaded into TDH's **Integrated Data System (IDS)** where geocoding of patient and facility addresses occur. Indicators are created for opioids, opioids involving heroin, stimulants, benzodiazepines, and muscle relaxants. The drug overdose data are also linked to other data sources in the IDS to support public health surveillance, data analysis, and visualization.

Current Success of the DOR System

Since 2017, 115 healthcare facilities across TN have successfully submitted drug overdose data to TDH's DOR system. DOR provides more timely patient-level drug overdose data compared to other data sources such as HDDS data which can have up to an 18-month lag before release.

Drug Overdose Reporting Facilities in TN, 2017-2020



Locations of facilities reporting to the DOR are depicted by blue stars. DOR captures opioid overdoses reported from emergency room departments, acute care hospitals, rehabilitation facilities, and free-standing ambulatory surgical treatment centers that are a part of a hospital. DOR does not collect ICD-10-CM diagnosis codes associated with mental and behavioral disorders due to psychoactive substance use (F10-F19).

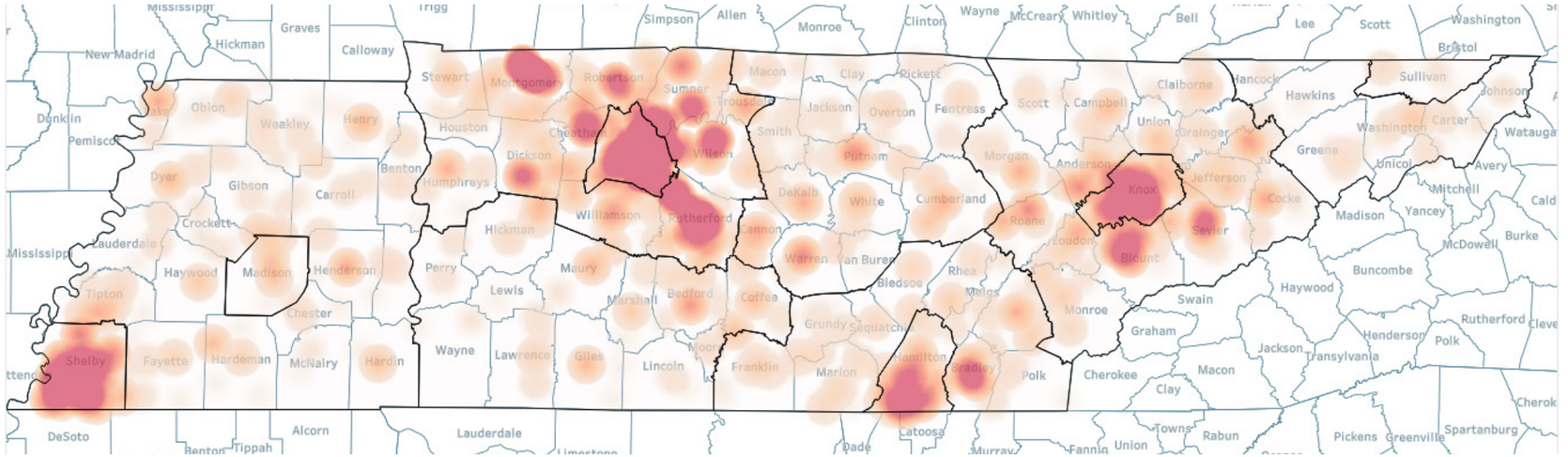
2017-2019 Drug Overdose Reporting (DOR) System

The number of ICD-10-CM non-fatal opioid overdoses (including heroin) has continued to increase from 2017 to 2019. In 2017, 2018, and 2019 there were 6,520, 6,747, and 7,496 non-fatal opioid overdoses (including heroin), respectively. From 2017 to 2018, there were 3.5% more overdoses and from 2018 to 2019, there were 11% more overdoses than the previous year.

The number of opioid overdoses in TN is concentrated in metro areas, including Shelby, Davidson, Hamilton, and Kox counties. Hot spots are also emerging outside of metro areas in counties such as Montgomery, Bradley, and Sevier. Rural areas in TN also experience overdoses-- counties in the West region and Upper Cumberland region also have areas where overdoses are occurring.

Even with 115 hospitals across TN eporting to DOR, there remain areas where key facilities are still being onboarded to DOR, and those facilities have not yet begun to submit data. Thus, when interpreting this map, an absence of "hot spots" does not necessarily signify an absence of overdoses in that area.

Hospital Reported Opioid Overdoses from DOR System in TN, 2019



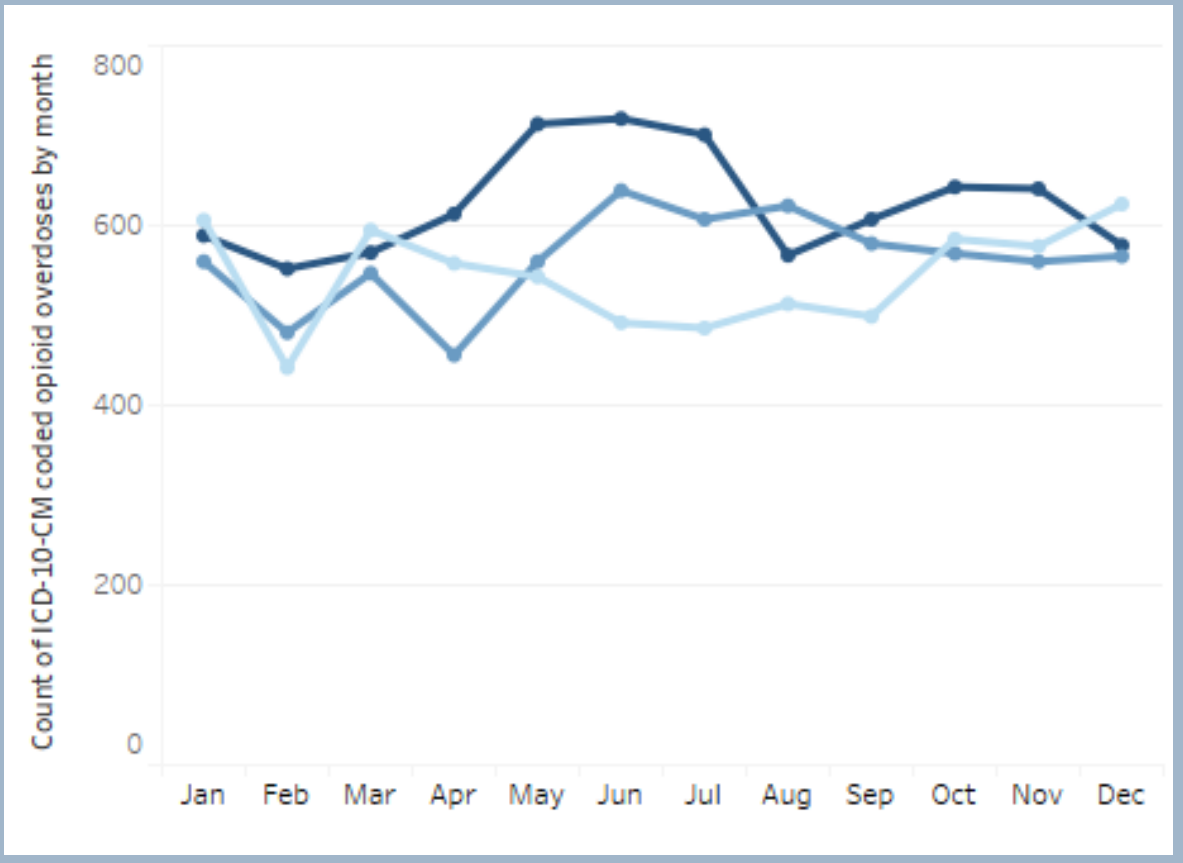
Spatial pattern of hospital reported ICD-10-CM non-fatal opioid overdoses (including heroin) in TN for 2019.

SPECIAL NOTE:

Even with 115 hospitals across TN reporting to DOR, there remain areas where key facilities are still being onboarded to DOR, and those facilities have not yet begun to submit data. Thus, when interpreting this map, an absence of "hot spots" does not necessarily signify an absence of overdoses.

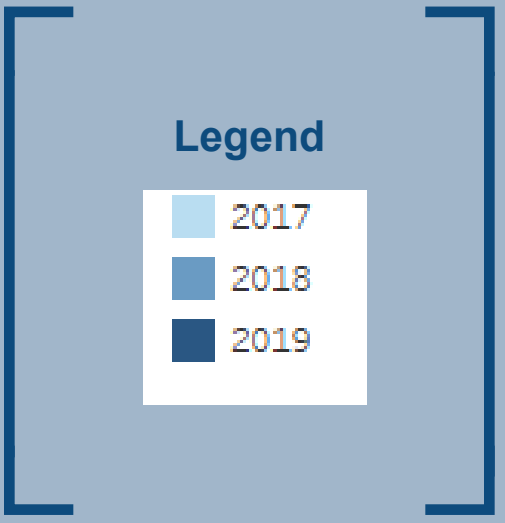
Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Drug Overdose Reporting (DOR) System.

Monthly Hospital Reported ICD-10-CM Non-Fatal Opioid Overdoses (including heroin) in TN, 2017-2019

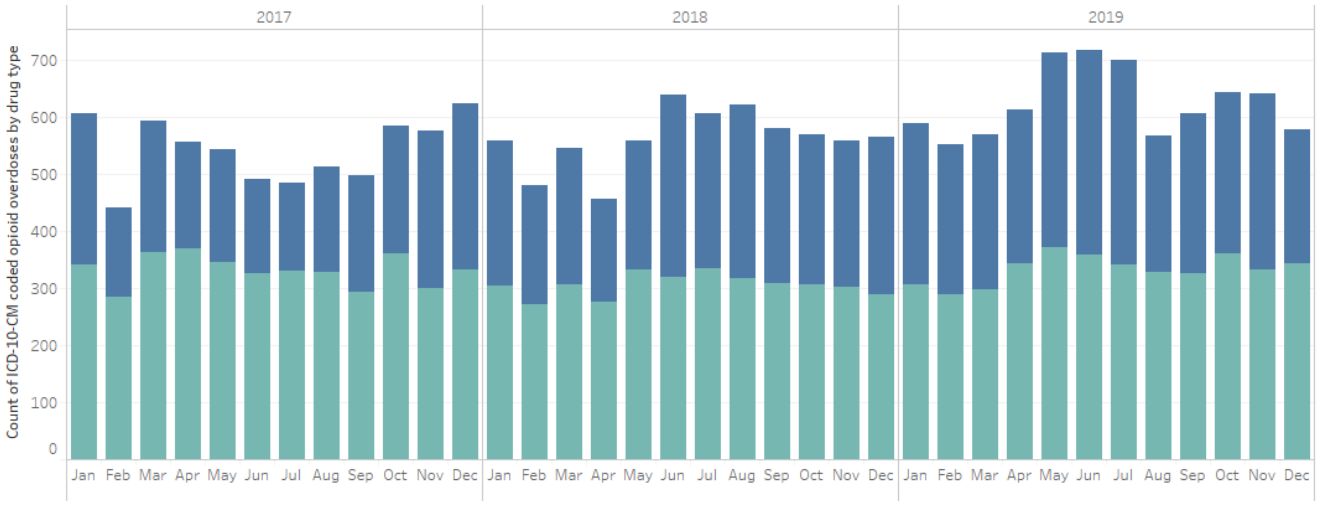


Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Drug Overdose Reporting (DOR) System.

The average number of hospital reported ICD-10-CM non-fatal opioid overdoses (including heroin) per month increased from 2017 to 2019 by 13%. The months of May, June, and July of 2019 experienced the most overdoses of the three years with monthly counts of 713, 719 and 701. The average number of opioid overdoses (including heroin) per month in 2017 was 543 overdoses. This increased in 2018 to an average of 562 per month, and in 2019, increased to an average of 624 per month. These increases represent a 3.5% increase in overdoses from 2017 to 2018, and an 11% increase from 2018 to 2019.



Hospital Reported ICD-10-CM Non-Fatal Opioid Overdoses by Drug Classes in TN, 2017-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Drug Overdose Reporting (DOR) System.

Non-fatal opioid overdoses attributed to ICD-10-CM coded heroin overdoses increased from 2017 to 2019. The months of May, June, and July in 2019 were the highest months of heroin overdoses out of the three year period.

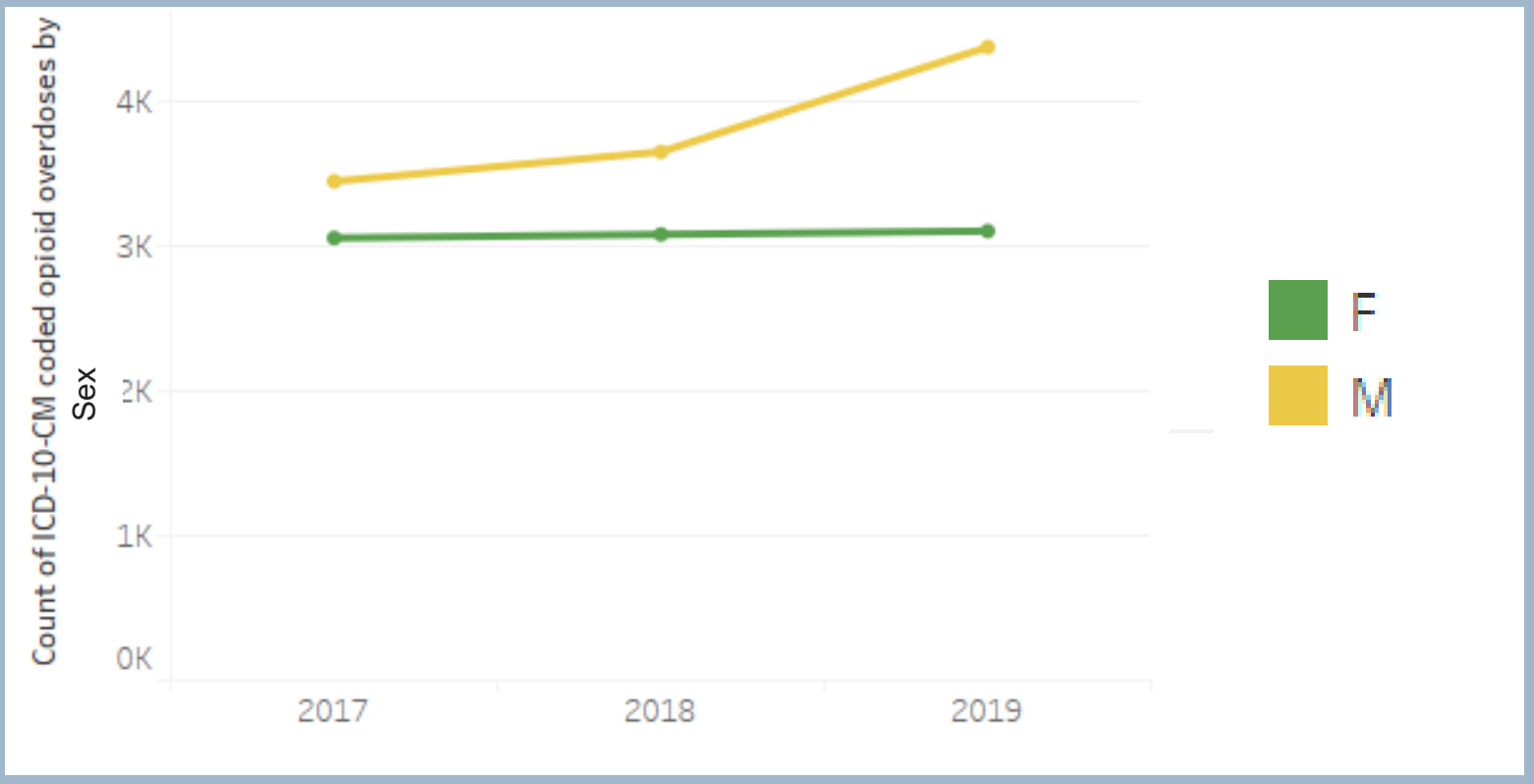
Legend

- Heroin
- Opioid (excluding heroin)

MAY 2019 **JUNE 2019** **JULY 2019**

May, June, and July of 2019 were the three highest months of heroin overdoses out of the three year period.

Hospital Reported ICD-10-CM Non-Fatal Opioid Overdose (including heroin) by Sex in TN, 2017-2019

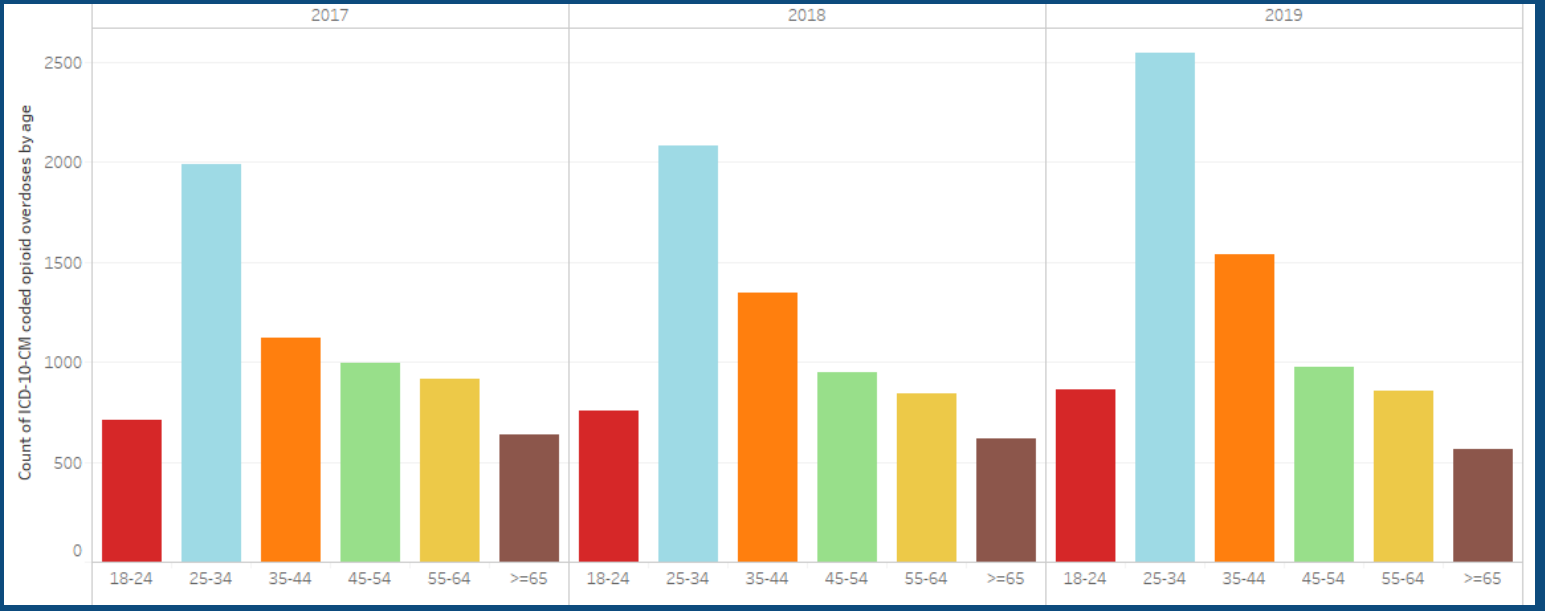


Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents. Data Source: Drug Overdose Reporting (DOR) System.

Hospital reported ICD-10-CM non-fatal opioid overdoses (including heroin) increased for males from 2017 to 2019 by 27%. Non-fatal opioid overdose (including heroin) counts for females remained similar over the three years.

Non-fatal opioid overdoses (including heroin) increased for males from 2017 to 2019 by 27%

Hospital Reported ICD-10-CM Non-Fatal Opioid Overdoses (including heroin) by Age in TN, 2017-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated February 14, 2020). Limited to TN residents.
Data Source: Drug Overdose Reporting (DOR) System.

Counts of non-fatal opioid overdose (including heroin) increased for all age groups from 2017 to 2019 except for the age group 65 years or older, which decreased by 12% from 2017 to 2019. Persons aged 25-34 years consistently had the highest counts of non-fatal opioid overdoses (including heroin). Overdoses for this age group increased 28% from 2017 to 2019. Persons aged 35-44 years of age were the second highest age group to experience non-fatal opioid overdoses (including heroin). This age group increased in non-fatal opioid overdoses (including heroin) by 37% from 2017 to 2019. Counts for persons under age 18 have been suppressed.

Legend

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- >=65

Section Spotlight

Drug Overdose Surveillance and Epidemiology (DOSE) System

The Tennessee (TN) Department of Health was recently awarded the Overdose Data to Action (OD2A) Grant from the Centers for Disease Control and Prevention (CDC). Funding started September 1, 2019. CDC's National Center for Injury Prevention and Control has initiated a collaborative data sharing project with state health departments using CDC's BioSense platform maintained by CDC's National Syndromic Surveillance Program (NSSP) to develop and evaluate case definitions and share case-level data to capture counts and rates of suspected drug overdoses including all drugs, all opioid, heroin, and all stimulants. Identification of overdose cases relies on a CDC-developed algorithm that searches discharge diagnosis codes or SNOMED (Systematized Nomenclature of Medicine) and chief complaint text.

The State is required to submit Emergency Department (ED) syndromic metadata received from over 90 hospitals in TN on a monthly basis to CDC, including percent of visits missing chief complaint text data or ICD-10-CM discharge diagnosis codes and number of facilities providing ED data during a specific month. After retrieving the data, CDC sends within two days, a site report with estimates of suspected drug overdose ED visits generated based on the aggregate data from NSSP via Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE). This aggregate data includes total number of ED visits for the state of Tennessee along with the number of ED visits suspected to involve all drug, all opioid, heroin and all stimulant overdoses stratified by month, age, sex and county. The state validates these estimates within 5 business days from the receipt of this report, along with the report on percent change estimates between months in the rates of ED visits suspected to involve overdoses. We also submit syndromic metadata associated with historical ED visits from NSSP/ESSENCE to CDC and validate the estimates in the historical site report generated by the CDC.

Tennessee state provides CDC access to syndromic case-level data to inform and develop new overdose case definitions, improve data quality and monitor drug overdose outbreaks, and implement site-specific prevention activities.

Learn more about the success stories from TDH's Syndromic Surveillance team!

PRESCRIPTION TRENDS IN TN

From 2018 to 2019, the rate of opioid prescriptions for pain decreased in every Tennessee (TN) county. The number of patients filling opioids for pain has also fallen about 33.3% since 2015. This signals a shift from an epidemic largely driven by prescription pain relievers to one that now includes illicit opioids and stimulants. In this section, prescription trends for opioids for pain, benzodiazepines, and gabapentin will be highlighted. Additionally, this section will introduce the ongoing projects and future work of the Controlled Substance Monitoring Database (CSMD) and TDH's Integrated Data System (IDS).

5,368,852

the total number of Opioid Prescriptions for Pain in Tennessee in 2019.

Introduction

In this section of 2020 Drug Overdose Annual Report, we describe prescription trends in TN from 2015-2019 based on the data available in TN's CSMD. The CSMD, Tennessee's prescription drug monitoring program, provides information about controlled substance prescribing patterns for patients, dispensers, and healthcare providers.[28] Schedule II, III, IV, and V controlled substance[29,30] prescriptions filled in TN are required to be reported to the CSMD. Dispensers are required to report all controlled substances dispensed within one business day, with the exception of veterinary dispensers who report within 14 days. Healthcare providers in TN are required to use the CSMD to query a patient's prescription history prior to beginning a new course of treatment and every six months thereafter or when they have concerns. Dispensation data are transmitted by dispensers to Appriss, the state vendor that maintains the CSMD. Daily updates are provided to TDH's Office of Informatics & Analytics (OIA). TDH uses these data for analytic and public health surveillance purposes, and the data are an integral part of OIA's Integrated Data System (IDS), described in the **Integrated Data System** section in the **Project & Partnerships** section of this report.

What is a Controlled Substance?

A controlled substance is a medication, drug, or substance that can cause physical or mental dependence, and have restrictions on how they are filled and refilled[31]. The Drug Enforcement Agency (DEA) classifies these drugs into Schedules (I-V) based on their abuse potential[32].

Highest Abuse and Dependence Potential → **Lowest Abuse & Dependence Potential**

Schedule I	Schedule II	Schedule III	Schedule IV	Schedule V
• Schedule I drugs are substances with no currently accepted medical use and high potential for abuse • An example is Cocaine or Methamphetamine	• Schedule II drugs are substances with high potential for abuse, as they have high potential for mental and/or physical dependence • An example is Hydrocodone or Oxycodone	• Schedule III drugs are substances with moderate to low potential for dependence • An example is prescribed Tylenol with Codeine	• Schedule IV drugs are substances with low abuse potential and dependence. • The top benzodiazepine prescriptions like Xanax and Valium are Schedule IV prescriptions.	• Schedule V drugs are substances with abuse potential lower than Schedule IV drugs. • An example is prescription cough syrup, Robitussin AC.

28 CSMD FAQ: https://www.tn.gov/health/health-program-areas/health-professional-boards/csmd-board/csmd-board/faq.html

29 Tennessee Drug Control Act, T.C.A. § 39-17-401

30 Shye, R. (2016). What are Controlled Substances?. Retrieved from: https://www.goodrx.com/blog/what-are-controlled-substances/

31 Drug Enforcement Agency. Drug Scheduling. Retrieved from: https://www.dea.gov/drug-scheduling

What is in the CSMD?

CSMD data contains information about each filled prescription for a controlled substance, including quantity, and days supply as well as the National Drug Code number which encodes information about the specific drug prescribed and its strength[32]. In order to monitor the prescription histories of individuals, the data include identifying information about patients including full name, date of birth, gender, and street address. Additional information includes the prescriber's and dispenser's Drug Enforcement Agency (DEA) number and address as registered with the DEA.

How is the CSMD used to determine prescription trends?

OIA uses the CSMD to create indicators of TN prescribing patterns at the prescription, patient, prescriber, and dispenser levels. OIA uses a number of data quality measures to ensure accurate reporting of prescription indicators. For example, out of state prescriptions and prescriptions with implausible values are removed[33]. Additional drug information is added to the existing data by joining it to drug classification tables provided by the Centers for Disease Control and Prevention (CDC), including major classes of drugs in the CSMD (i.e., opioids, benzodiazepines, stimulants, muscle relaxants), type of drugs (e.g., hydrocodone, oxycodone), strength, and oral morphine milligram equivalent conversion factors[34]. Due to the nature of data collection, a single individual may have a number of separate patient records in the CSMD–each of which may be associated with one or more prescriptions–that must be resolved into a single entity in a process referred to as "entity management" or "entity resolution." Our current approach to patient entity management in the IDS utilizes full names and dates of birth for primary matches. Likewise, healthcare providers may have multiple records in the CSMD as a result of having multiple DEA numbers, among other factors. The provider entity management process involves cross-referencing multiple sources of information including DEA registrations, National Provider Identifier (NPI) information, and state licensing data to ensure that a single provider's prescriptions are adequately identified. OIA is constantly monitoring and improving these processes, and additional information and updates on our entity management processes can be found at the end of this section of the report (see the Section Spotlight).

After implementing measures to assure data quality, prescription-based indicators are calculated according to CDC guidelines[35] and TDH departmental needs (see Appendix A for list of available indicators and Appendix B for technical notes about indicator calculations). Prescription indicators that are frequently used are incorporated into the IDS to aid in quick analytics and visualization for public health surveillance. CSMD data and indicators also enhance and inform many of OIA's analytic reports and papers (see **Data Dissemination** and **Dashboards** in the **Projects & Partnerships** section of this report). OIA has also worked closely with other state agencies, such as the TN Department of Mental Health and Substance Abuse Services (TDMHSAS), to provide CSMD data where appropriate and allowed by law (see **Grant-Funding: BJA** and **ROPS** sections for additional information on these partnerships). For instance, OIA has worked closely with TDMHSAS to provide a biannual report of patient and prescription trends for physicians with DATA 2000 Waivers[36] that allow them to prescribe buprenorphine for medication-assisted treatment (MAT) to patients with opioid use disorder (OUD).

32 CSMD Data Collection Manual: https://www.tn.gov/content/dam/tn/health/healthprofboards/csmd-committee/TN-DataCollectionManual.pdf
33 See Technical Notes in Appendix B (pg 142) for additional methods details for prescription-related risk measures.
34 CDC Opioid Overdose Data Resources: https://www.cdc.gov/drugoverdose/resources/data.html
35 CDC's Opioid Overdose Indicator Support Toolkit. Version 3.0. Release Date: 3/23/2018.
36 DATA 2000: https://www.deadiversion.usdoj.gov/pubs/docs/dwp_buprenorphine.htm

What are the limitations of CSMD data?

There are a few limitations inherent with the CSMD data. First, information on indication of use or medical history is not included in the CSMD. Although 2018's TN Together[37] legislation does require the submission of diagnosis codes for some prescriptions, this data has limited usefulness for describing population-level trends. Thus, when calculating opioid indicators used for pain or medication-assisted treatment, we must rely on the FDA-label indication. Additionally, drug information is only as complete as the information available in CDC classification tables which exclude many schedule V drugs and opioids primarily given in inpatient settings. We have done extensive work to provide additional information for drugs not included in the current CDC tables, but some information remains missing (see important note below). Finally, the CSMD only tracks prescriptions that have been filled by a dispenser, not those written but never filled, and it is not a reliable indicator of drug use. Patients may fill prescriptions and never use them, or they may acquire prescription medications through illicit means. Despite these limitations, the CSMD provides important information on prescribing practices and provides a good estimate of the overall amount of controlled substances available in TN which is valuable in the department's overdose prevention and licensure efforts.

In This Section

The following section provides a snapshot of quarterly and yearly trends identified in commonly used indicators calculated from CSMD data. Because they are of great concern in the current overdose epidemic, many of the indicators focus on opioids that are typically prescribed for the treatment of pain. Due to the heightened risk associated with concurrent opioid and benzodiazepine use, this section also includes a number of indicators of benzodiazepine prescribing trends. A brief snapshot of gabapentin prescribing is included as well. Gabapentin was recently classified as a controlled substance in TN and required to be reported to the CSMD beginning on July 1, 2018. The first part of the prescribing section reports on prescription-level trends, broadly. This is followed by a section on prescription and patient-level trends for opioids for pain followed by benzodiazepines and, finally, gabapentin.

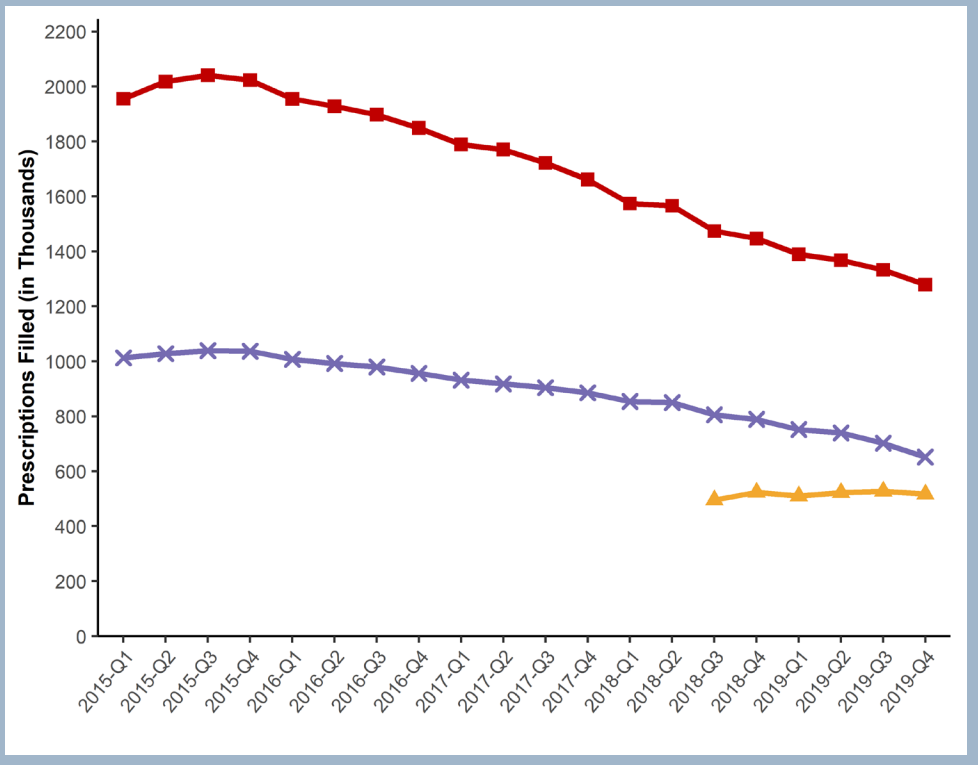
Important Note for 2019 Prescription Trends

We advise the reader to interpret any trends involving drug class and morphine milligram equivalents (MME) in 2019 with caution. Due to a delay in the CDC's reporting of drug information, drug class and MME information for some prescriptions may not have been available when this report was compiled. Some prescription counts and MME totals in 2019 are likely to be higher when updated drug information becomes available. OIA's epidemiologists have determined that the impact of this data issue primarily affects counts of buprenorphine prescriptions and has minimal impacts on other classes of drugs presented here. Because of this, prescription trends for buprenorphine for medication assisted treatment have not been included in this year's report.

37 TN Together: https://www.tn.gov/opioids/about-tn-together.html

Statewide Prescription Trends

Number of Opioid, Benzodiazepine, and Gabapentin Prescriptions in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 16, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

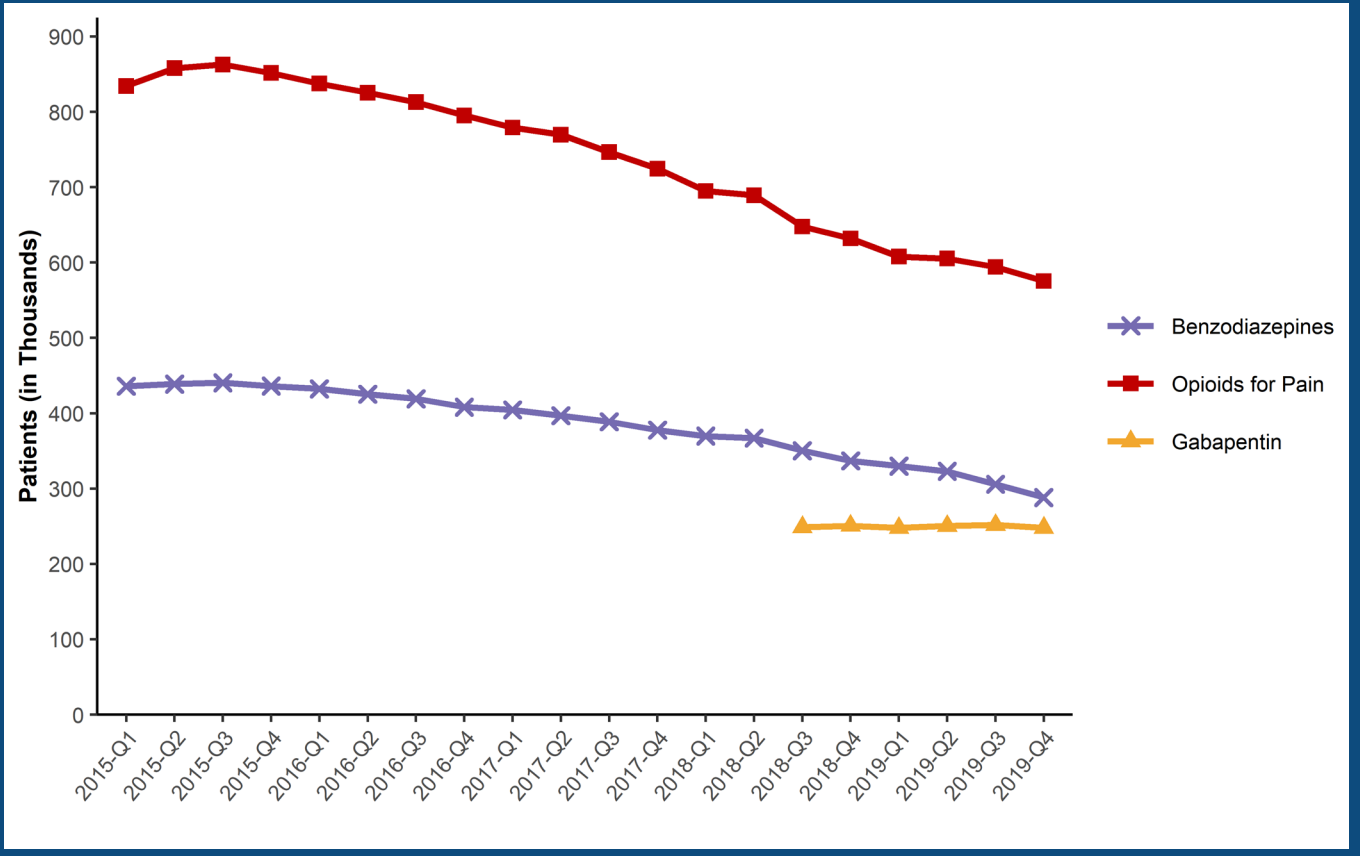
The above graph represents the number of opioid prescriptions for pain which has declined between 2015 and 2019. At the highest in Q3 2015, 2.04 million prescriptions of opioids for pain were filled (representing a rate of 309 prescriptions per 1,000 residents[38]). Since this peak, opioid prescriptions for pain have fallen to 1.28 million filled prescriptions in Q4 2019 (a rate of 189 per 1,000 residents), representing a decrease of 37.3%.

Benzodiazepines are prescribed about half as often as opioids for pain and have followed a trend similar to opioids. Benzodiazepine prescriptions peaked in Q3 2015 at 1.04 million prescriptions filled (157 per 1,000 residents) and have decreased to 652,000 filled prescriptions in Q4 2019 (96 per 1,000 residents), a 37.5% decrease.

Gabapentin prescriptions were first required to be reported to the CSMD on July 1, 2018, and gabapentin data are only presented from Q3 2018 forward. Over this period, around 500,000 gabapentin prescriptions were filled in each quarter. In Q4 2019, there were 517,000 gabapentin prescriptions filled (78 per 1,000 residents).

38 Rates not otherwise indicated as “age-adjusted” are calculated as crude rates.

Patients Receving Opioid, Benzodiazepine, and Gabapentin Prescriptions in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 16, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

As seen in the graph above, the rate of patients who have filled prescriptions for opioids for pain and benzodiazepines has decreased from 2015 to 2019. The number of patients filling opioid prescriptions for pain has fallen from a peak of 863,000 in Q3 2015 to 575,000 in Q4 2019, a reduction of 33.3%.

Likewise, patients filling benzodiazepine prescriptions have also declined, from a high of 440,000 in Q3 2015 to 288,000 in Q4 2019, a reduction of 34.6%.

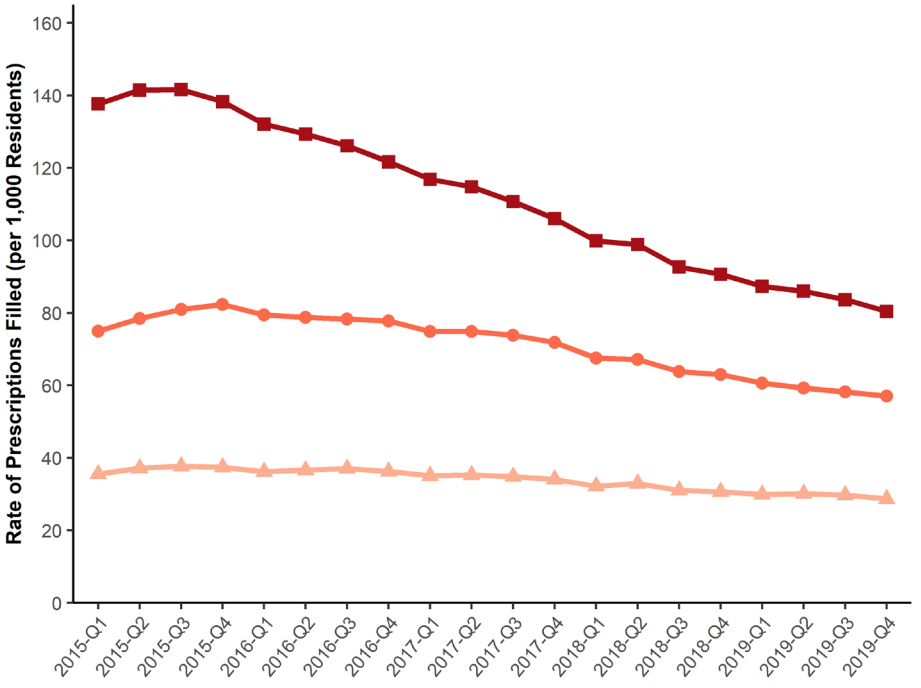
The number of patients filling gabapentin prescriptions has remained steady at around 250,000 patients since reporting began in Q3 2018. In Q4 2019, the number of patients filling gabapentin prescriptions was 248,000.

Both the number of prescriptions and number of patients filling opioids for pain have decreased in TN in 2019.

Opioids for Pain-Prescription Trends

The three most commonly prescribed short-acting (SA) opioids for pain in TN are hydrocodone, oxycodone, and tramadol, respectively. These three types of opioids accounted for about 87% of all opioid prescriptions for pain in 2019.

Prescription Rate of Top 3 Most Prescribed Short-acting Opioids for Pain, 2015-2019



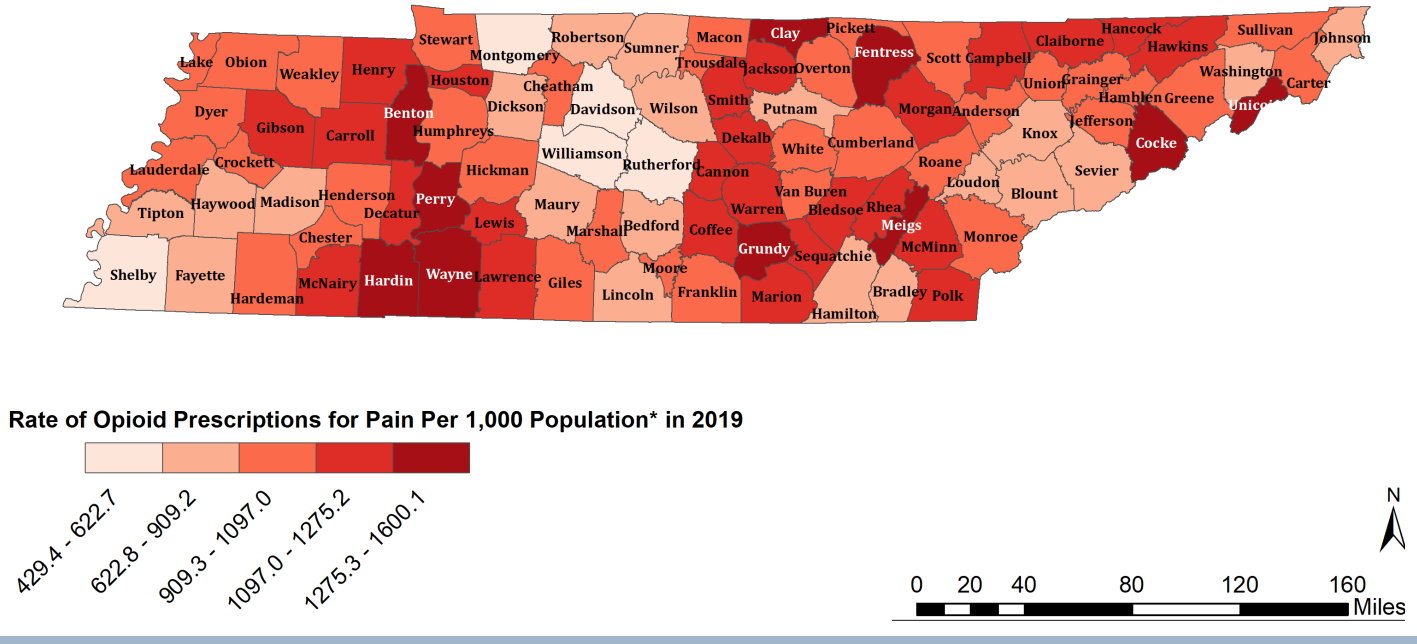
Analysis by the Office of Informatics and Analytics, TDH (last updated January 16, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

Legend

- Hydrocodone SA
- Oxycodone SA
- Tramadol SA

Hydrocodone prescribing rates have dropped steadily for most of the period from a high of 142 per 1,000 residents in Q3 2015 to a low of 80 per 1,000 residents in Q4 2019. Prescription rates for oxycodone increased from 75 per 1,000 residents in Q1 2015 to a high of 82 per 1,000 residents in Q4 2015 before declining to 57 per 1,000 residents in Q4 2019. Tramadol followed a similar pattern, increasing from 36 per 1,000 residents in Q1 2015 to a high of 38 per 1,000 residents in Q3 2015 before declining to 29 per 1,000 residents in Q4 2019.

Rate of Opioid for Pain Prescription Filled by Tennessee County of Residence for 2019



Rate of Opioid Prescriptions for Pain Per 1,000 Population* in 2019

429.4 - 622.7
622.8 - 909.2
909.3 - 1097.0
1097.0 - 1275.2
1275.3 - 1600.1

N

0 20 40 80 120 160 Miles

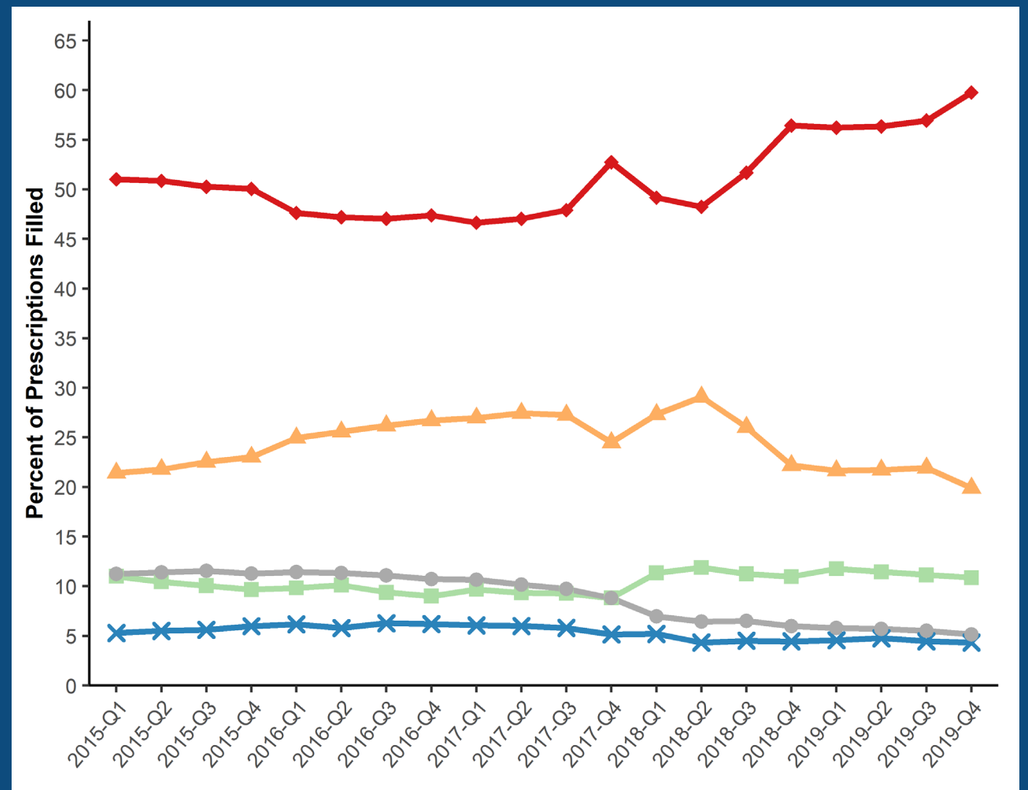
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

The map above shows the number of prescriptions dispensed for opioids for pain per 1,000 residents in each county in 2019. Rates were lower in 2019 compared to 2018 (not shown) across all counties. Despite reductions in the number of prescriptions filled, over 60 of TN's 95 counties have a rate higher than 1,000 prescriptions per 1,000 residents (equivalent to 1 prescription filled per resident). This is much higher than the statewide rate of 793 per 1,000 residents. Prescription rates for opioids for pain tend to be low in the most populous counties in the state and highest in rural areas.

Opioid prescriptions for pain rates were lower in 2019 compared to 2018 across ALL counties in TN.

Payment Type for Opioid Prescriptions for Pain

From 2015 through 2019, the most common payment type for opioid prescriptions for pain in TN was commercial insurance, followed by Medicare. From 2015 through 2017, the percent of opioid prescriptions paid through cash and Medicaid were roughly equal, but the number of prescriptions paid for by Medicaid shrank in 2018 and 2019[39]. Likewise, the percent paid by Medicare decreased as well. Across all of 2019, commercial insurance accounted for about 57.3% of all opioid prescriptions for pain, followed by Medicare (21.3%), cash (11.3%), Medicaid (5.5%), and finally other payment types (4.5%).

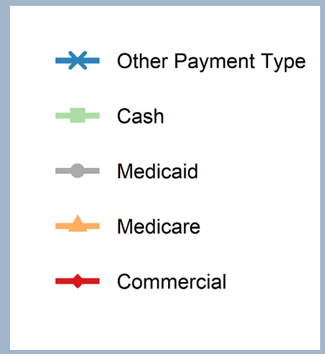


Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

39 This shift aligns with new policies for opioid prescriptions enacted by TennCare that began in 2018: https://www.tn.gov/tenncare/tenncare-s-opioid-strategy.html

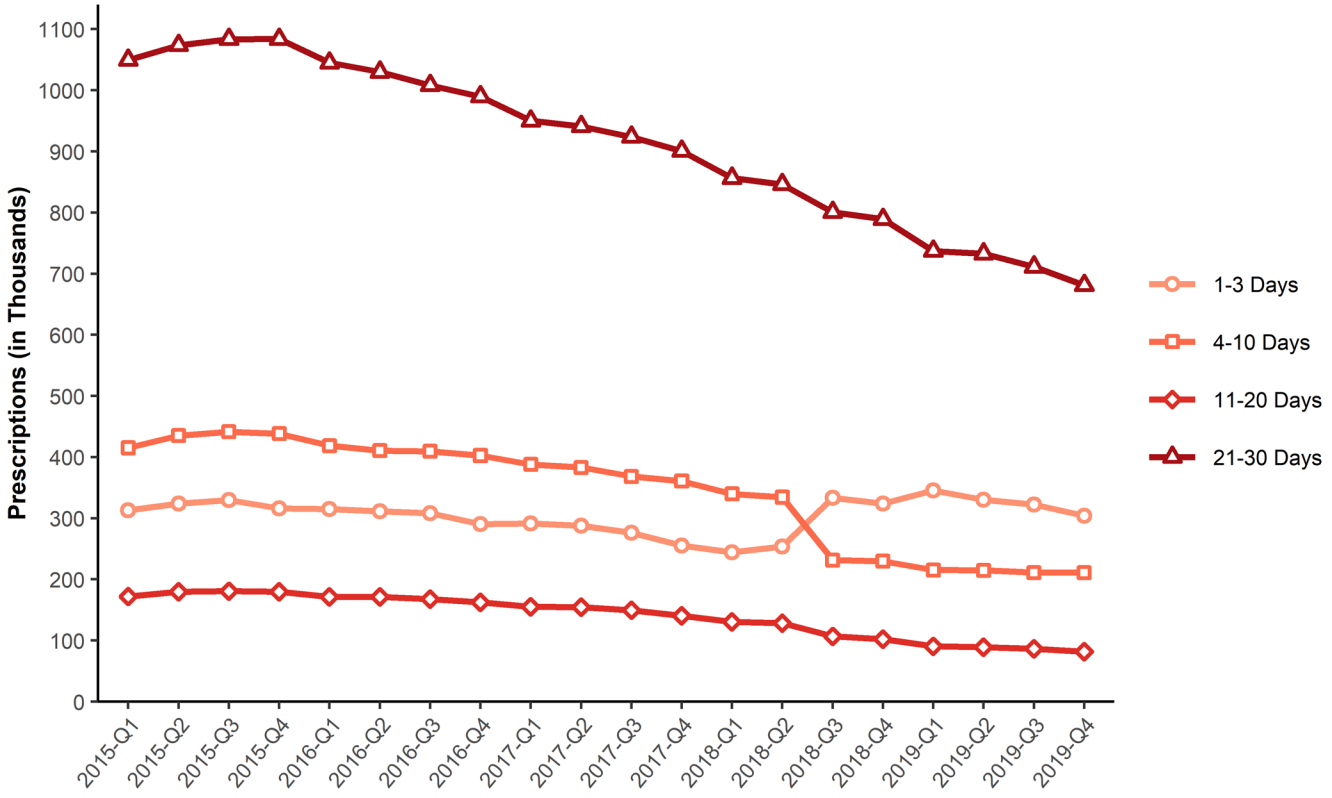
Understanding Payment Information for Prescriptions in Tennessee

Payment information for each prescription filled is provided as one of several categories, including commercial insurance, Medicare, Medicaid, cash, and other payment types[40]. In the plot to the left, we show the percentage of prescriptions filled for opioids for pain in each of these payment categories. Because these lines represent percentages of the total and are mutually exclusive, when the line for one payment type decreases, one or more other lines must necessarily increase, even though the absolute number of prescriptions may not have changed. For example, in the plot to the left, although the percentage of opioid prescriptions for pain that were paid for through commercial insurance increased in 2018 and 2019, the total number of prescriptions paid for through commercial insurance did not change appreciably.



40 Other payment types include military/VA, workers compensation, and discount cards

Number of Opioid Prescriptions for Pain by Days' Supply in TN, 2015-2019



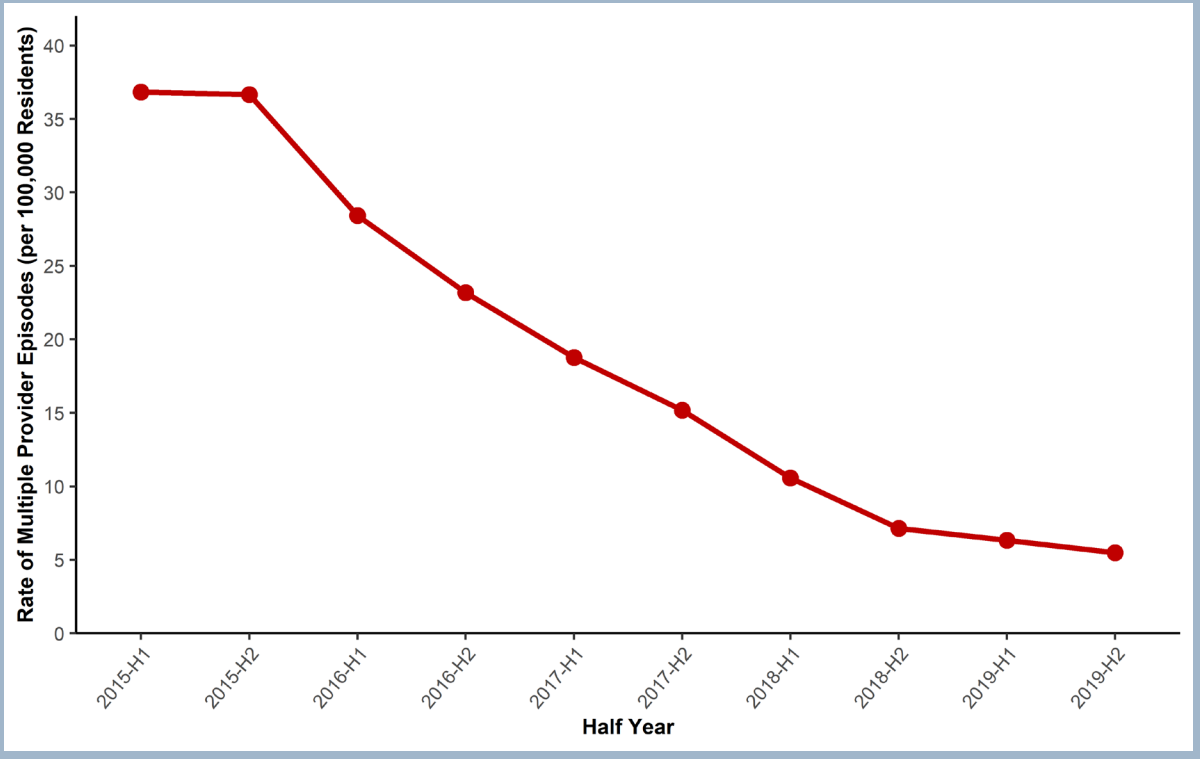
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

During the period from 2015 to 2019, the most common length of opioid prescriptions for pain was 21-30 days. On July 1, 2018, new opioid prescribing laws went into effect as part of the TN Together legislation[41]. These laws limit the length of prescriptions for patients on new opioid prescriptions. Prior to this date, 4-10 day prescriptions were more common than 1-3 day prescriptions. After the legislation went into effect, 1-3 day prescriptions became more common than 4-10 day prescriptions. The least common length for opioid prescriptions is 11-20 days.

In Q4 2019, 681,000 opioid prescriptions for pain were filled with a 21 to 30 days' supply (53.3% of all opioid prescriptions for pain filled that quarter). In the same quarter, 304,000 1-3 day opioid prescriptions for pain were filled (23.8%), 211,000 4-10 day opioid prescriptions for pain were filled (16.5%), and 82,000 11-20 day opioid prescriptions for pain were filled (6.4%).

41 TN Together Infographic: https://www.tn.gov/content/dam/tn/governorsoffice-documents/governorsoffice-documents/OpioidInfographic.pdf

Rate of Multiple Provider Episodes for Opioid Prescriptions for Pain by Half-Year in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

According to the CDC definition[43], a multiple provider episode (MPE) occurs when a patient fills prescriptions from at least 5 prescribers and at least 5 dispensers in a 6 month period[44].

In TN, the rate of MPEs[42] for opioid prescriptions for pain has declined rapidly over the last five years, from 36.8 per 100,000 residents in the first half of 2015 to 5.5 per 100,000 residents in the last half[43] of 2019.

42 CDC's Opioid Overdose Indicator Support Toolkit. Version 3.0. Release Date: 3/23/2018.
43 Defined as the first or second half of the calendar year (i.e., Half 1 is January 1-June 30 and Half 2 is July 1-December 31)

Sex and Age Demographics for Prescriptions for Pain

Understanding Sex and Age Demographics for Prescriptions for Pain in Tennessee

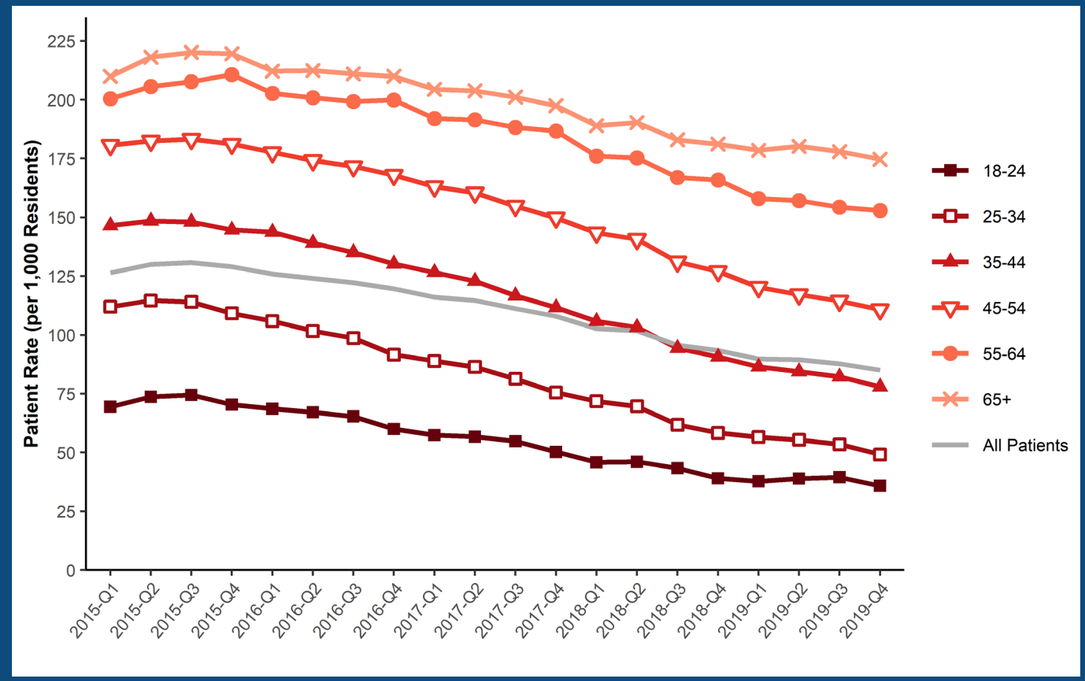
The plot to the right (top) presents the rate of patients filling opioid prescriptions for pain per 1,000 TN residents by age group[44]. The rate for all patients is included for comparison. Across the entire time period, from 2015 to 2019, older age groups filled opioid prescriptions for pain at a higher rate than younger age groups. The oldest age group (patients 65 years and older) filled opioid prescriptions for pain at a much higher rate (175 per 1,000 residents in Q4 2019) than the rate for all patients (85 per 1,000 residents in Q4 2019). All age groups experienced decreasing rates across this time period, but the age groups between 25-54 had the sharpest rate decrease while oldest and youngest groups had more modest declines.

The plot on the right (bottom) presents the rate of patients filling opioid prescriptions for pain per 1,000 TN residents by sex. The rate for all patients is included for comparison. Across the entire period, from 2015 to 2019, female filled opioid prescriptions for pain at a higher rate than male. Both groups have experienced declining rates at roughly the same pace. Rates for females decreased from a high of 147 per 1,000 residents in Q3 2015 (a total of 497,000 females) to 97 per 1,000 residents in Q4 2019 (337,000 females). Rates for males decreased from a high of 113 per 1,000 residents in Q3 2015 (a total of 365,000 males) to 72 per 1,000 residents in Q4 2019 (238,000 males).

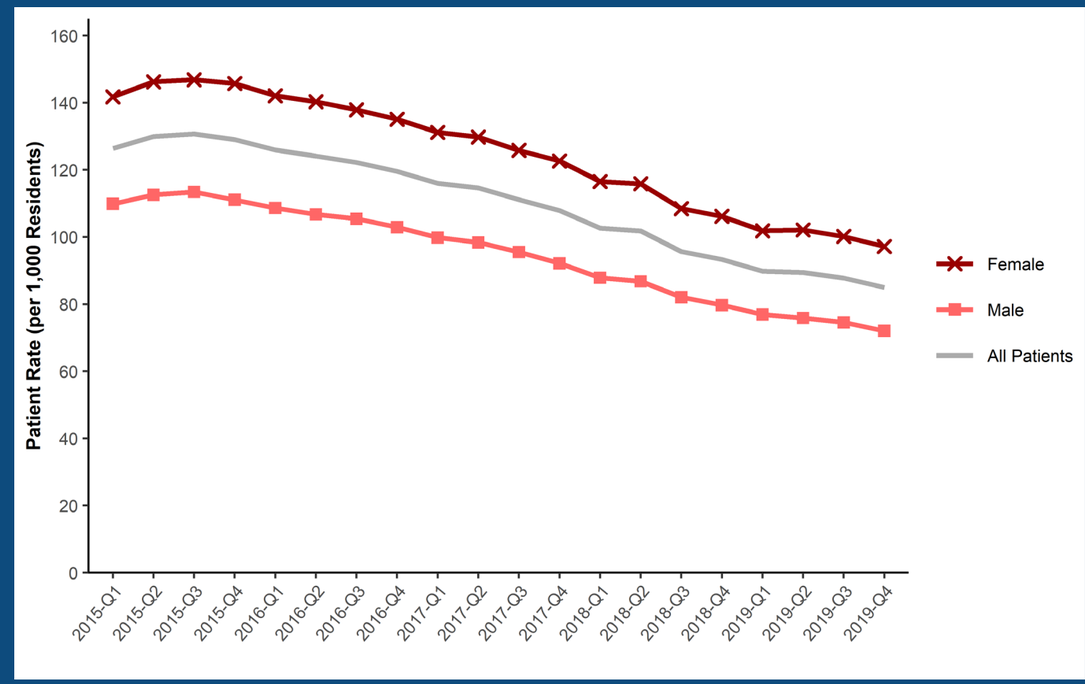
44 Prescriptions for patients less than 18 years of age are not included.

Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

Rate of Patients Recieving Opioids for Pain by Age



Rate of Patients Recieving Opioids for Pain by Sex



Active Prescription Days & High Risk Prescriptions

Active Prescription Days for Patients Filling Opioid for Pain Prescriptions

The table below shows the percent of patients who filled prescriptions of opioids for pain by the amount of their total prescription days throughout the year[45]. Unlike the Days' Supply plot shown earlier in this section, which is a count of the number of prescriptions written for a certain lengths, active days is a measure of patient behavior. This measure counts all of the days on which a patient was believed to have had a prescription throughout the year and sums them for each patient. Patients are then categorized based on the total number of days, and the percentage of patients in each group for each year is presented below.

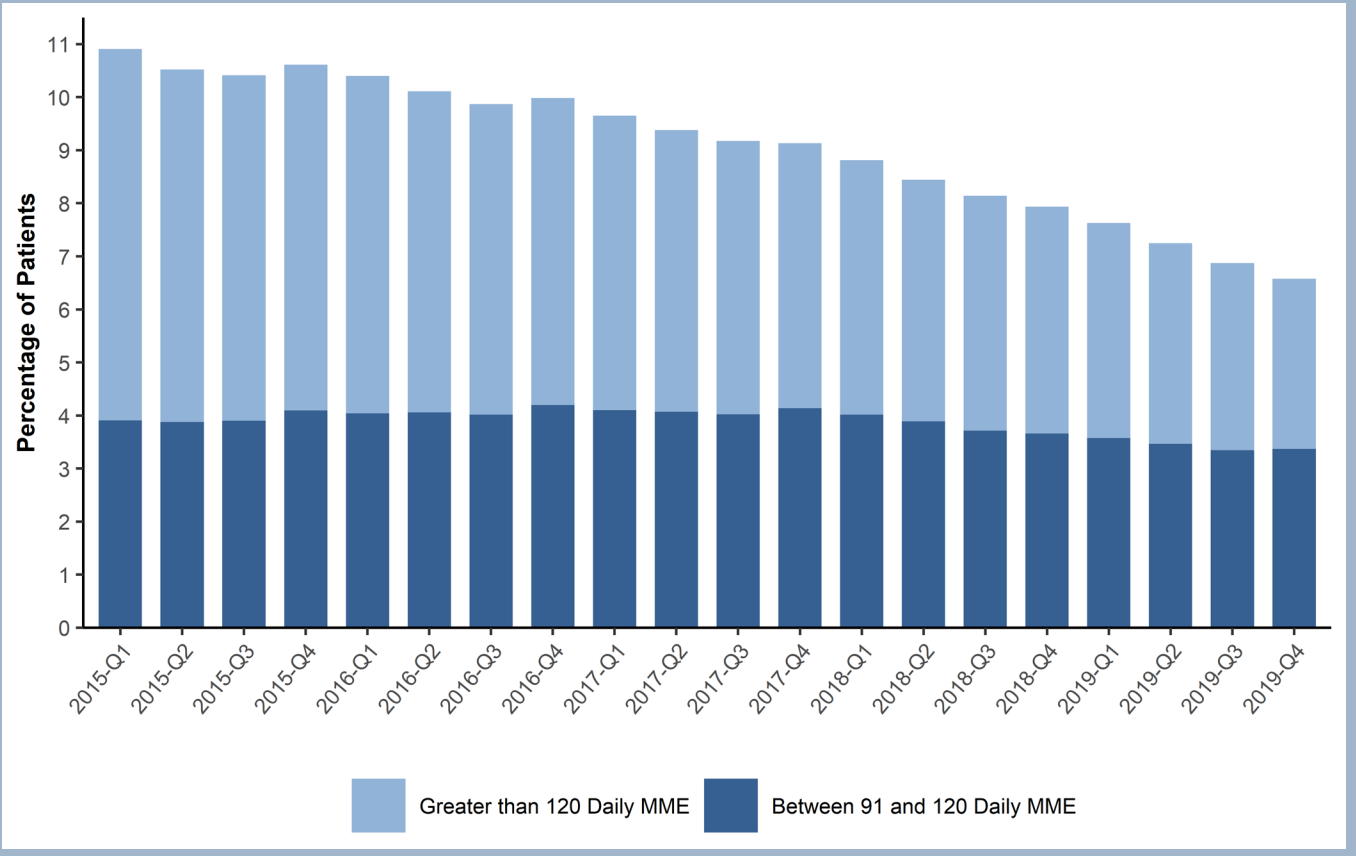
Percentage of Patients Filling Opioids for Pain by Number of Active Prescription Days

Prescription Days	2015	2016	2017	2018	2019
1-7 days	46.8	47.7	49.0	52.7	57.7
8-30 days	22.1	21.6	21.0	18.4	15.5
31-90 days	9.2	8.9	8.5	7.5	6.3
91-180 days	5.5	5.4	5.1	4.8	4.3
181-270 days	4.1	4.0	3.9	3.9	3.6
> 270 days	12.3	12.4	12.6	12.7	12.6

The majority of opioid for pain patients generally filled short term prescriptions amounting to no more than a month for the entire year. In 2019, 57.7% of opioid for pain patients received prescriptions for a week or less during the entire year, while 15.5% received between a week and a month's worth of opioids for pain. Fewer than 20% had prescriptions for opioids between one to nine months (31-270 days) in 2019. From 2015 to 2019, the percent of patients receiving a week or less of opioids for pain increased while the percent decreased for most other active prescription days categories. Over the same period, however, the percentage of opioid for pain patients who filled more than 270 days of opioids in a year has slightly increased, from 12.3% in 2015 to 12.6% in 2019.

45 Inclusive of all prescriptions in the drug class for each patient during the year. This measure assumes patients take their entire prescription as directed. See Appendix B (pg 142) for more information.

Percentage of Patients Dispensed More than 90 Daily MME for Opioids for Pain in TN, 2015-2019



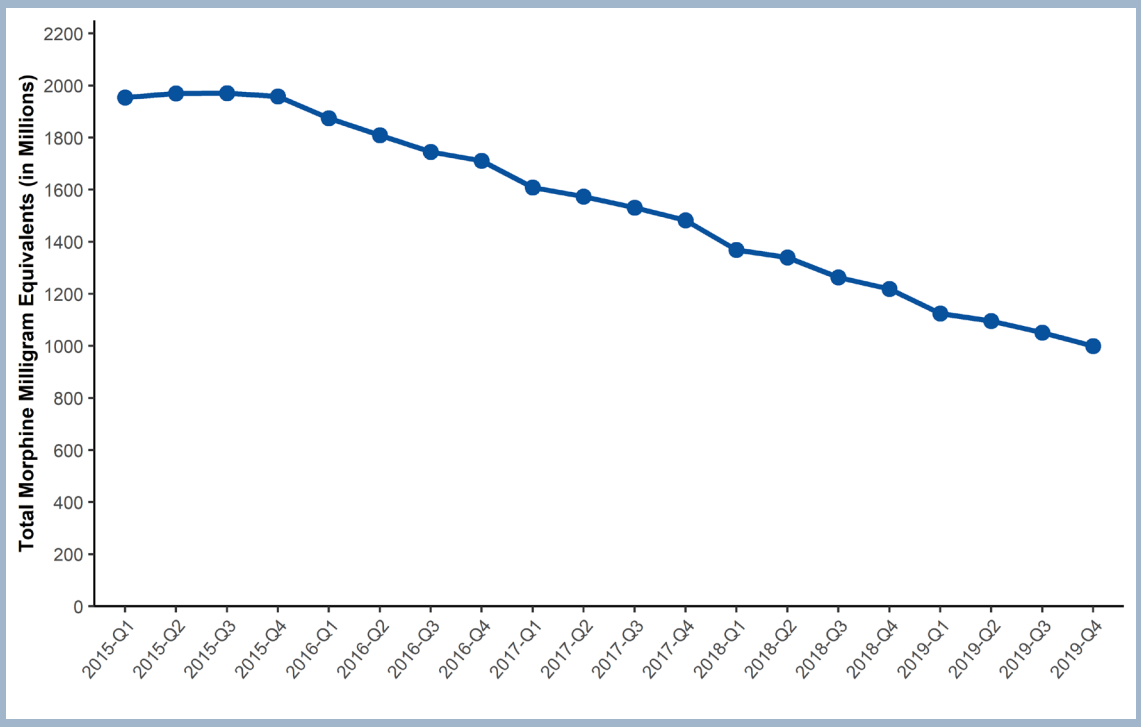
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

MME is defined as the amount of milligrams of morphine an opioid dose is equal to. MME is a way to calculate the total amount of opioids, accounting for differences in drug type and strength[47]. The CDC urges extra precautions with > 50 MME per day.

The percentage of patients who received opioid prescriptions for pain that exceed 90 morphine milligram equivalents[46] (MME) per day has declined from 2015 to 2019. In Q1 2015, 10.9% of all opioid for pain patients received an opioid for pain with a daily MME greater than 90 (the total height of the bar) but only 3.9% of all patients were between 91 to 120 MME (the height of the dark blue portion) while the other 7% were above 120 MME (the height of the light blue portion). In Q4 2019, 6.6% of patients received a prescription of more than 90 daily MME. As the lighter shaded bars show above, however, the decline in patients receiving high daily MME opioids was mostly confined to those filling prescriptions of greater than 120 daily MME. Among this group, the percentage declined from 7% in Q1 2015 to 3.2% in Q4 2019. The percent of patients receiving 91 to 120 daily MME hovered around 4% across the entire period.

46 Centers for Disease Control (2018). Calculating Total Daily Dose. Retrieved from: https://www.cdc.gov/drugoverdose/pdf/calculating%20_total_daily_dose-a.pdf

Total MME of Opioid Prescriptions for Pain by Quarter in TN, 2015-2019



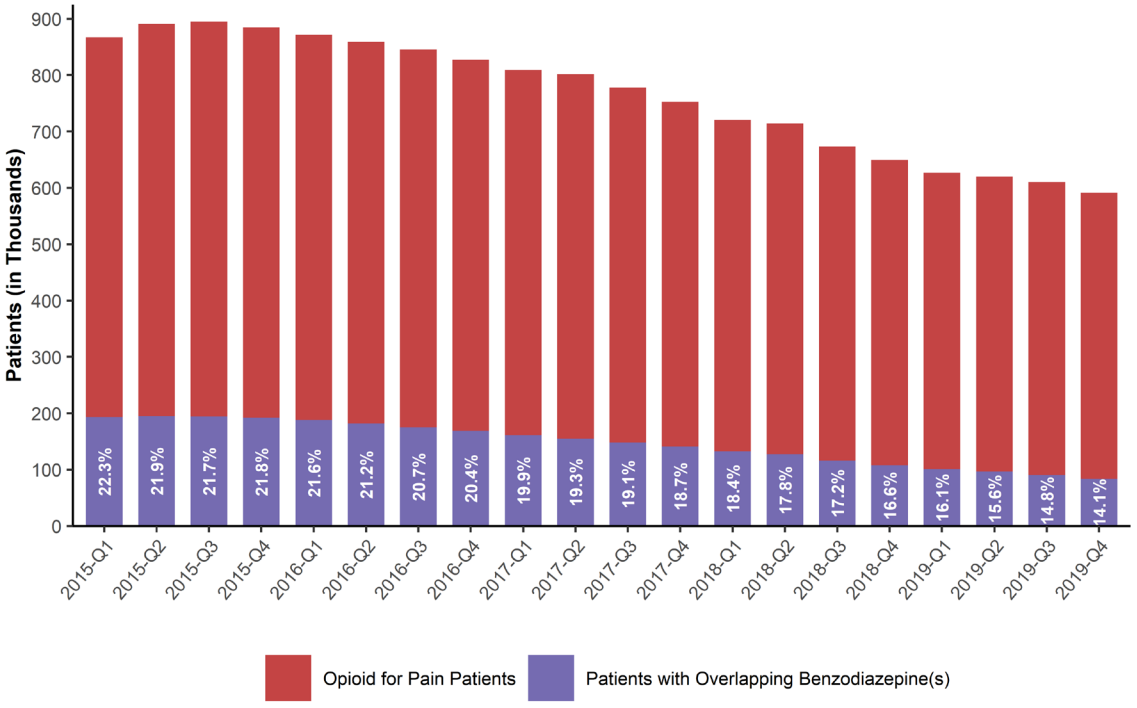
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

Morphine Milligram Equivalents (MME) is a measure of the strength of opioids for pain that accounts for differences in opioid drug type and strength. In 2019, over 4.2 billion MME were dispensed in TN, a rate of 627 MME per resident. This is roughly equivalent to every resident of TN receiving a prescription for 63 10mg hydrocodone pills.

The total MME of opioid prescriptions for pain has fallen every quarter from Q4 2015 to the present. From 2015-2019, at its highest point in Q4 2015, MME has dropped from 1.97 billion to 1 billion in Q4 2019, a decrease of 49%.

In 2019, over 4.2 billion MME were dispensed in TN. This is roughly equivalent to every resident of TN receiving a prescription for 63 10mg hydrocodone pills.

Number of Opioid Prescriptions for Pain by Days' Supply in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

In the plot above, the total height of the bars represents counts of patients filling opioid for pain prescriptions. The height of the overlapping purple bar represents the number of patients with overlapping opioid and benzodiazepine prescriptions. The percentage displayed is the percent of patients in each quarter with overlapping prescriptions[47].

The percentage of patients filling opioid prescriptions for pain who have overlapping benzodiazepine prescriptions in each quarter has decreased steadily during this period, from 22.3% in Q1 2015 to 14.1% in Q4 2019.

The percentage of patients filling opioid prescriptions for pain who have overlapping benzodiazepine prescriptions has declined steadily since 2015.

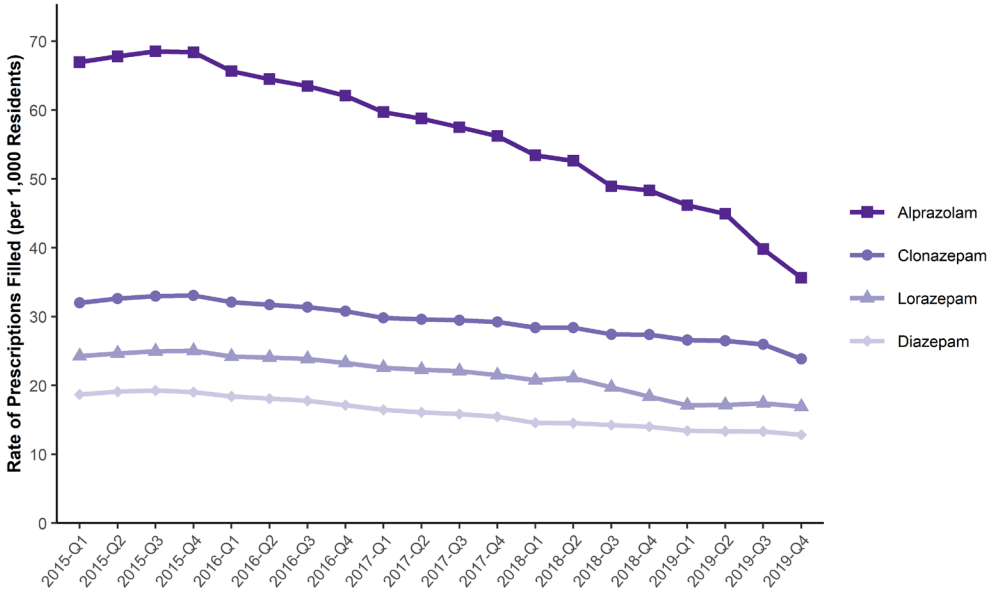
47 Overlapping for more than a single day

Benzodiazepine Trends

What is a benzodiazepine?

Benzodiazepines are a class of psychoactive drugs commonly prescribed to treat anxiety or insomnia. The brand names of commonly prescribed benzodiazepines include Xanax, Valium, and Klonopin. These drugs provide a sedative effect and although they have abuse potential alone, they are especially dangerous when co-prescribed with an opioid for pain. The combination of these two prescriptions has an increased risk of overdose, as both types of drugs suppress breathing and sedate users.

Prescription Rate of Top 4 Most Prescribed Benzodiazepines in TN , 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

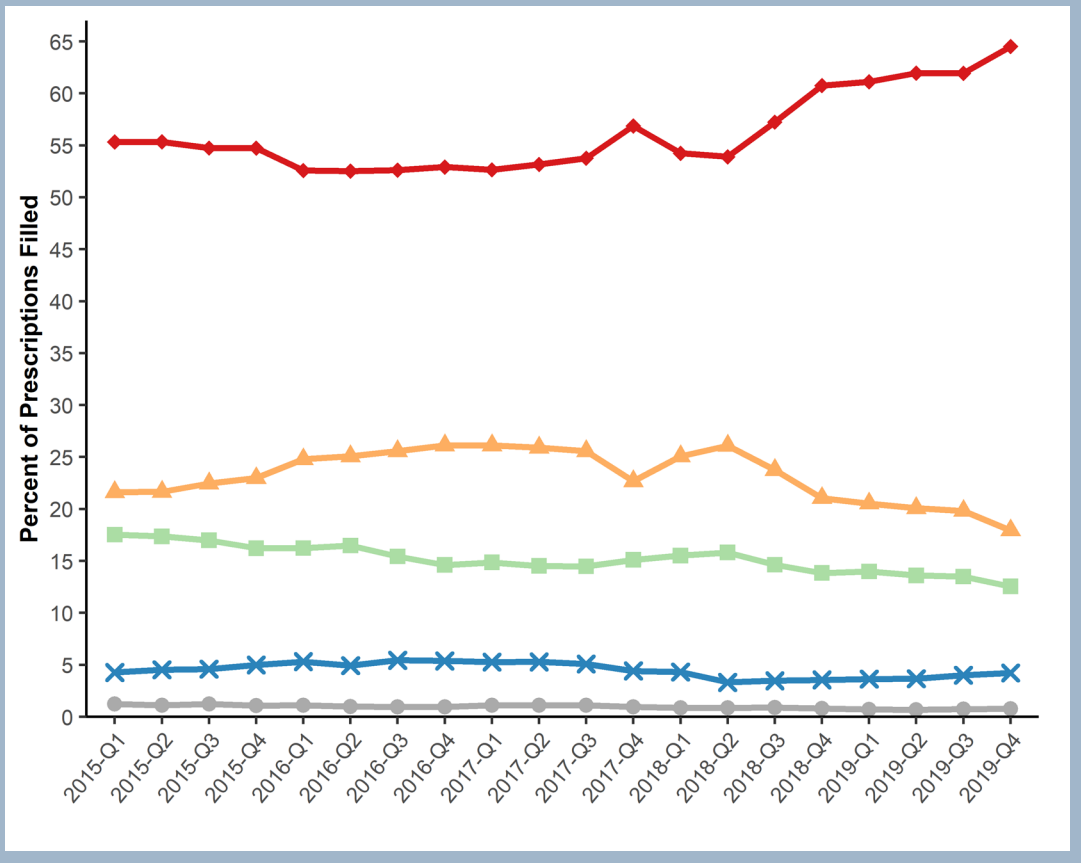
The four most commonly prescribed benzodiazepines[48] in TN are alprazolam, clonazepam, lorazepam, and diazepam, respectively, and they accounted for about 93% of all benzodiazepine prescriptions in 2019.

Alprazolam is prescribed at nearly 2 to 3 times the rate of the other most common benzodiazepines. Alprazolam prescribing rates have dropped for most of the period from a high of 69 per 1,000 residents in Q3 2015 to a low of 36 per 1,000 residents in Q4 2019.

Prescription rates for Clonazepam decreased from a high of 33 per 1,000 residents in Q4 2015 to a low of 24 per 1,000 residents in Q4 2019. Lorazepam followed a similar pattern, decreasing from a high of 25 per 1,000 residents in Q4 2015 to 17 per 1,000 residents in Q4 2019. Diazepam likewise decreased from a high of 19 per 1,000 residents in Q3 2015 to 13 per 1,000 residents in Q4 2019.

48 Common brand names for top prescribed benzodiazepines: Xanax (alprazolam), Klonopin (clonazepam), Ativan (lorazepam), and Valium (diazepam).

Payment Type for Benzodiazepine Prescriptions



Legend

- Other Payment Type
- Cash
- Medicaid
- Medicare
- Commercial

Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

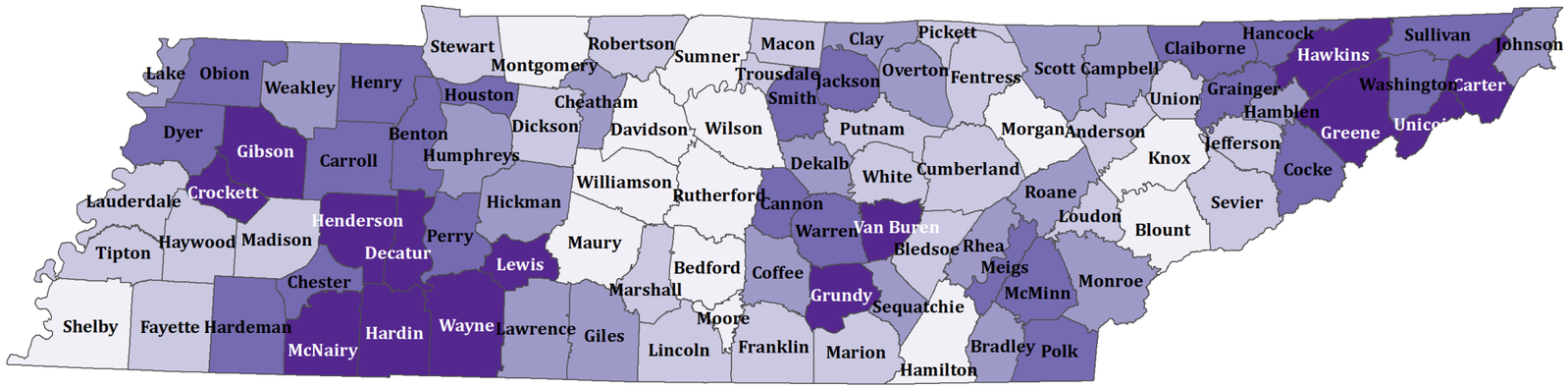
The most common payment type for benzodiazepine prescriptions in TN was commerical insurance, followed by Medicare, Cash, other payment types, then Medicaid.

During most of the period from 2015 to 2018, the distribution of payment types remained somewhat steady. Beginning in late 2018, the percentage of benzodiazepine prescriptions paid through commercial insurance increased as the share paid through Medicare decreased. In 2019, commercial insurance accounted for about 62.3% of all benzodiazepine prescriptions, followed by Medicare (19.6%), cash (13.4%), other payment types (3.9%), and finally Medicaid (0.7%).

2019 Benzodiazepine Prescriptons Trends in Tennessee

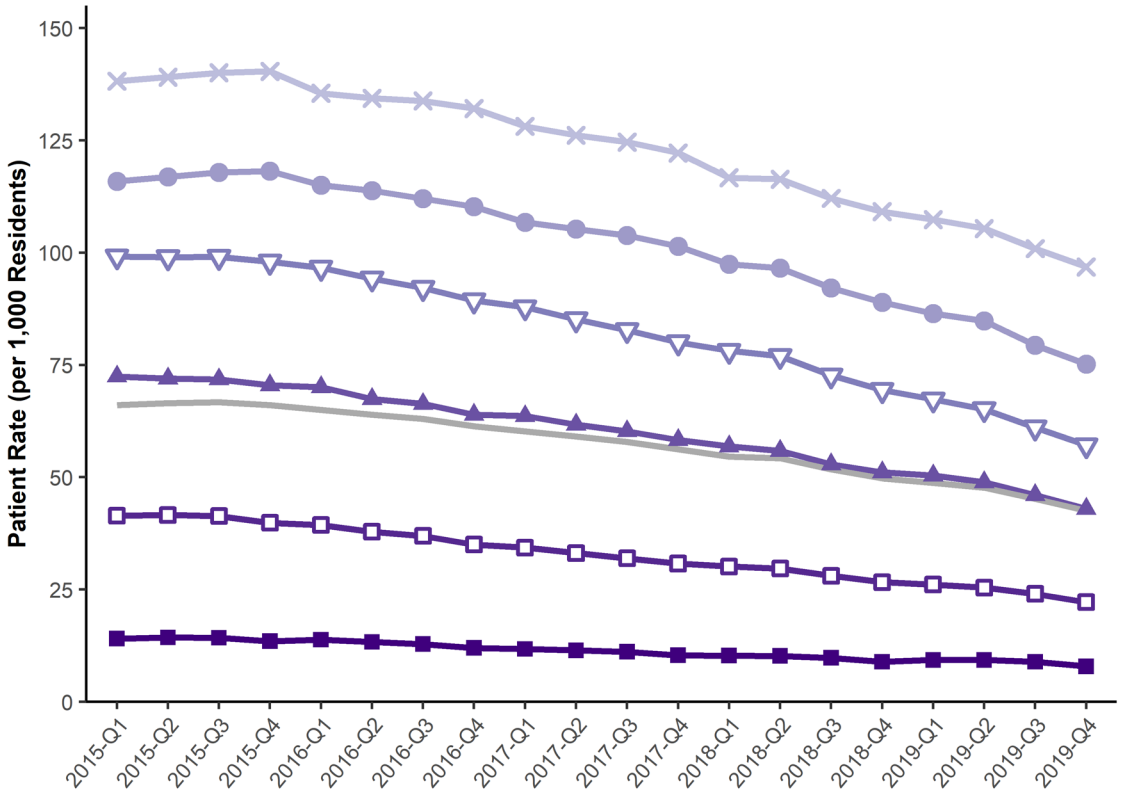
The map to the right shows the number of prescriptions dispensed for benzodiazepines per 1,000 residents in each county in 2019. The rates for benzodiazepine prescriptions were lower in 2019 compared to 2018 in all counties. Similar to the trend for opioids, the rate of benzodiazepine prescriptions dispensed tends to be lower in counties with higher populations and highest in rural areas. Large portions of West TN and Northeast TN have some of the highest benzodiazepine rates in the state.

Rate of Benzodiazepine Prescriptions Filled by TN County of Residence, 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

Rate of Patients Receiving Benzodiazepines by Age in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

Legend

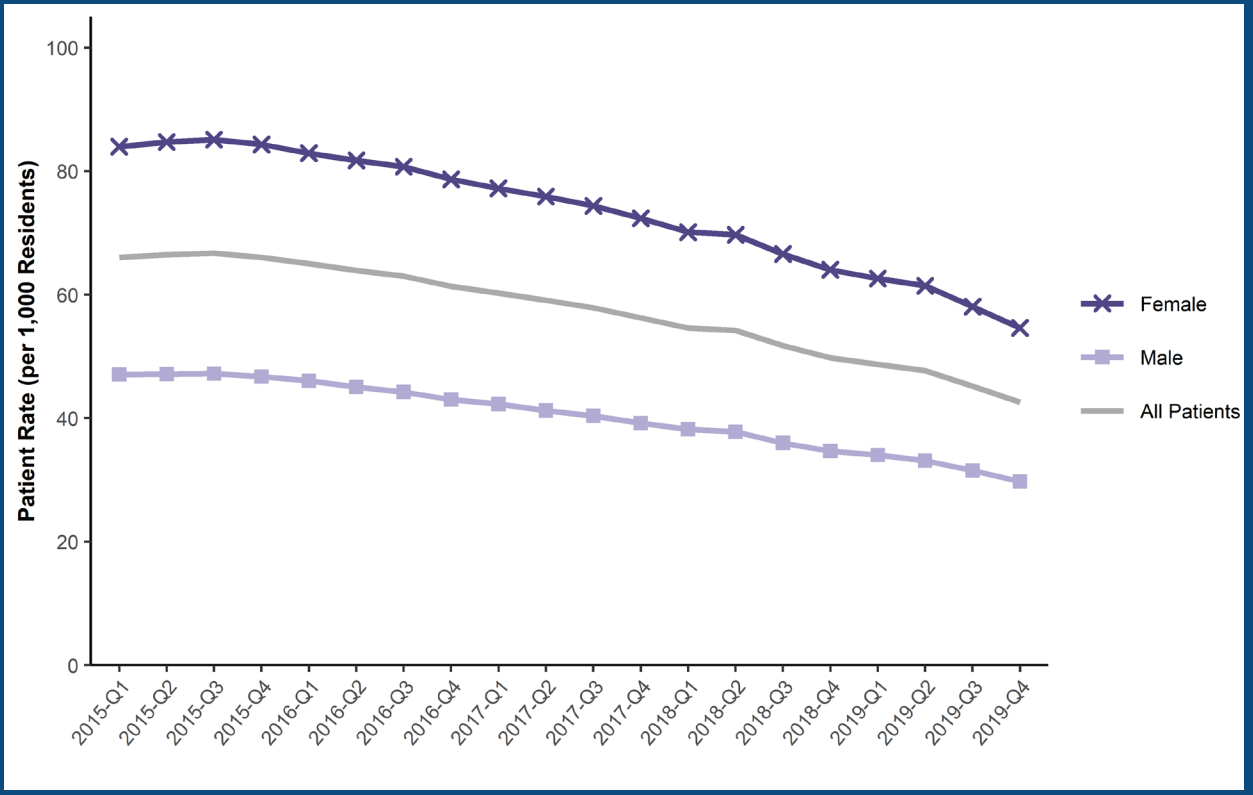
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+
- All Patients

The plot above presents the rate of patients filling benzodiazepine prescriptions per 1,000 TN residents by age group[49]. The rate for all patients is included for comparison.

Across the entire time period, from 2015 to 2019, older age groups filled benzodiazepine prescriptions at a higher rate than younger age groups. The oldest age group (patients 65 years and older) filled benzodiazepine prescriptions at a much higher rate (97 per 1,000 residents in Q4 2019) than the rate for all patients (43 per 1,000 residents in Q4 2019). All age groups experienced decreasing rates across this time period, but older age groups decreased somewhat faster than younger groups.

49 Prescriptions for patients less than 18 years of age are not included.

Rate of Patients Receiving Benzodiazepines by Sex in TN, 2015-2019



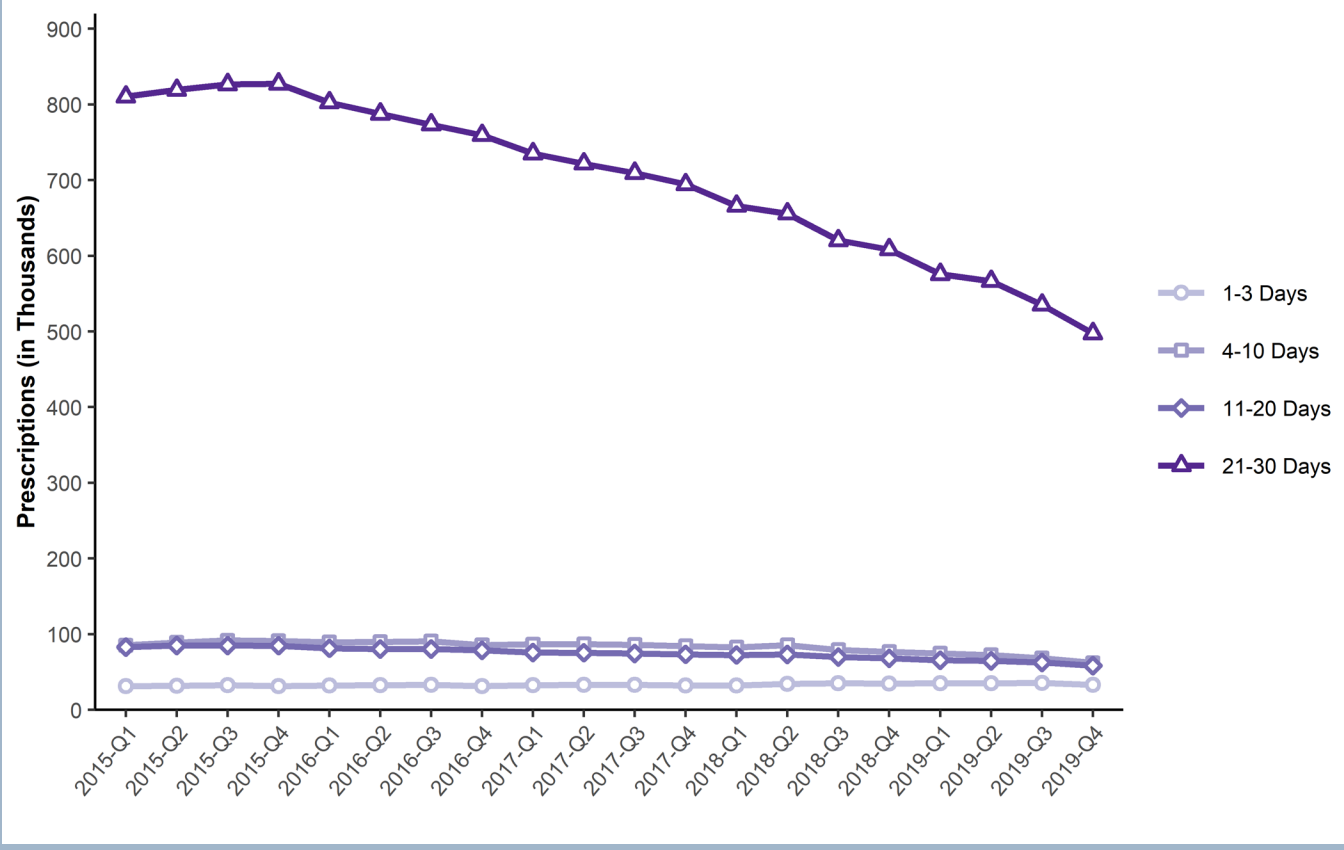
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

The plot above presents the rate of patients filling benzodiazepine prescriptions per 1,000 TN residents by sex. The rate for all patients is included for comparison.

Across the entire period, from 2015 to 2019, females filled benzodiazepine prescriptions at a higher rate than males. Both groups have experienced declining rates at roughly the same pace. Rates for females decreased from a high of 85 per 1,000 residents in Q3 2015 (a total of 288,000 females) to 55 per 1,000 residents in Q4 2019 per 1,000 residents (189,000 females). Rates for males decreased from a high of 47 per 1,000 residents in Q3 2015 (a total of 152,000 males) to 30 per 1,000 residents in Q4 2019 per 1,000 residents (98,000 males).

From 2015 to 2019 females filled benzodiazepine prescriptions at a higher rate than males.

Number of Benzodiazepine Prescriptions by Days' Supply in TN, 2015-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

During the period from 2015 to 2019, the most common length of benzodiazepine prescriptions was 30 days.

During the period from 2015 to 2019, the most common length of benzodiazepine prescriptions was 21-30 days. In Q4 2019, 497,000 benzodiazepine prescriptions were filled with a 21-30 days' supply (76.3% of all benzodiazepine prescriptions filled that quarter). By contrast, benzodiazepine prescriptions for shorter lengths were filled in much lower numbers. For example, in Q4 2019, only 33,000 1-3 day benzodiazepine prescriptions were filled, accounting for just 5% of all benzodiazepine prescriptions filled that quarter.

Active Prescription Days for Patients Filling Benzodiazepine Prescriptions

The table below shows the percent of patients who filled prescriptions of benzodiazepines by the amount of their total prescription days throughout the year[50]. Unlike the Days' Supply plot shown earlier in this section, which is a count of the number of prescriptions written for a certain lengths, active days is a measure of patient behavior. This measure counts all of the days on which a patient was believed to have had a prescription throughout the year and sums them for each patient. Patients are then categorized based on the total number of days, and the percentage of patients in each group for each year is presented below.

Percentage of Patients Filling Benzodiazepine by Number of Active Prescription Days

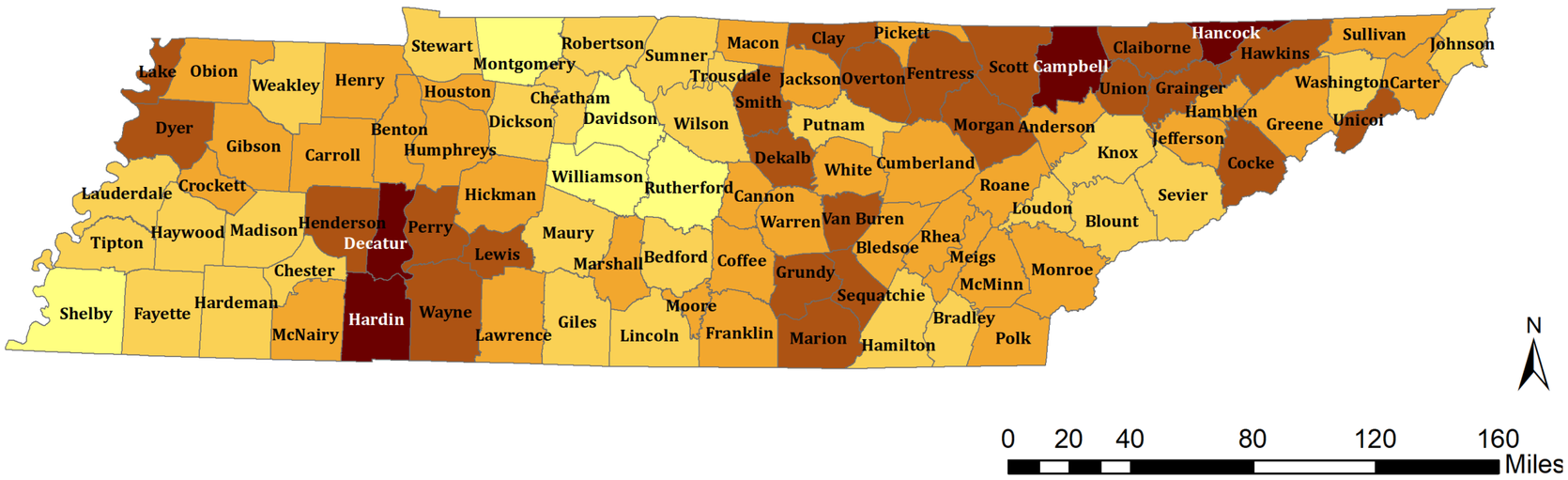
Prescription Days	2015	2016	2017	2018	2019
1-7 days	14.2	15.0	15.8	17.1	18.9
8-30 days	20.5	20.5	20.5	20.5	20.6
31-90 days	15.8	15.7	15.5	15.2	15.2
91-180 days	13.5	13.4	13.2	13.3	13.2
181-270 days	11.6	11.5	11.2	11.2	10.9
> 270 days	24.5	24.1	23.9	22.5	21.1

In 2019, 18.9% of benzodiazepine patients received prescriptions for a week or less during the entire year, while 20.6% received between a week and a month's worth of benzodiazepines. There were generally fewer people who filled in each of the longer periods of time. However, 21.1% of benzodiazepine patients filled prescriptions over 9 months in the year. About 15% had prescriptions for benzodiazepines between a month and 9 months (31-270 days) in 2019.

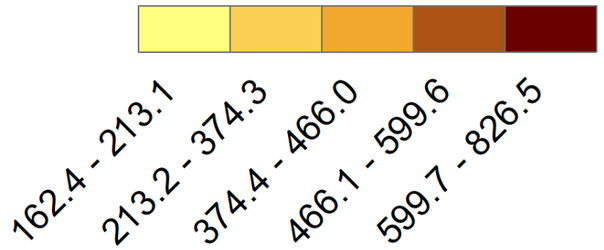
From 2015 to 2019, the percent of patients receiving a week or less of benzodiazepines increased while the percent remained largely unchanged for those receiving over a week to a month. The percentage decreased for all periods longer than a month. The percentage of benzodiazepine patients who filled more than 270 days of benzodiazepines in a year has decreased somewhat from 24.5% in 2015 to 21.1% in 2019.

50 Inclusive of all prescriptions in the drug class for each patient during the year. This measure assumes patients take their entire prescription as directed. See Appendix B (pg 142) for more information.

Rate of Gabapentin Prescriptions Filled by TN County of Residence, 2019



Rate of Gabapentin Prescriptions Per 1,000 Population in 2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

Gabapentin Trends

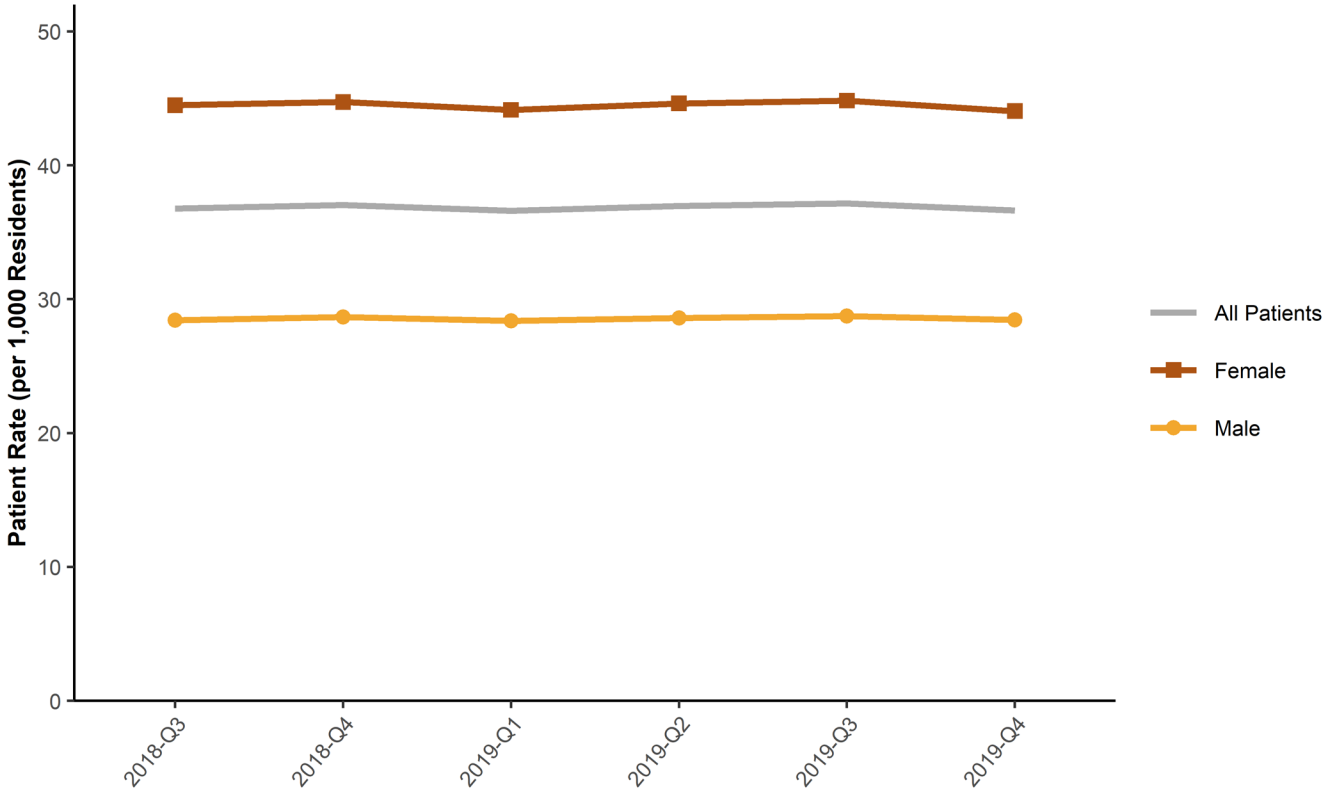
In 2018, gabapentin was added to the list of Schedule V controlled substances in TN[51] and required to be reported to the CSMD beginning on July 1, 2018. Gabapentin, an anticonvulsant drug, can also be used to treat neuropathic pain and has been used as an alternative to opioids for pain management. Although often believed to be safe, gabapentin can be misused, and the rate of gabapentin misuse in the U.S. has increased in recent years[52].

As seen in the map on the left, gabapentin prescription rates are highest in the areas around Campbell and Hancock counties in the northern part of East TN and Decatur and Hardin in West TN. Much like opioid and benzodiazepine rates, gabapentin prescription rates tend to be lower in the more populous counties and higher in rural areas.

51 Controlled substances in Schedule V, T.C.A. § 39-17-414

52 Reynolds, K., Kaufman, R., Korenoski, A., Fennimore, L., Shulman, J. and Lynch, M. (2019). Trends in gabapentin and baclofen exposures reported to U.S. poison centers. Clinical Toxicology. DOI: 10.1080/15563650.2019.1687902

Rate of Patients Filling Gabapentin Prescriptions by Sex in TN, 2018-2019



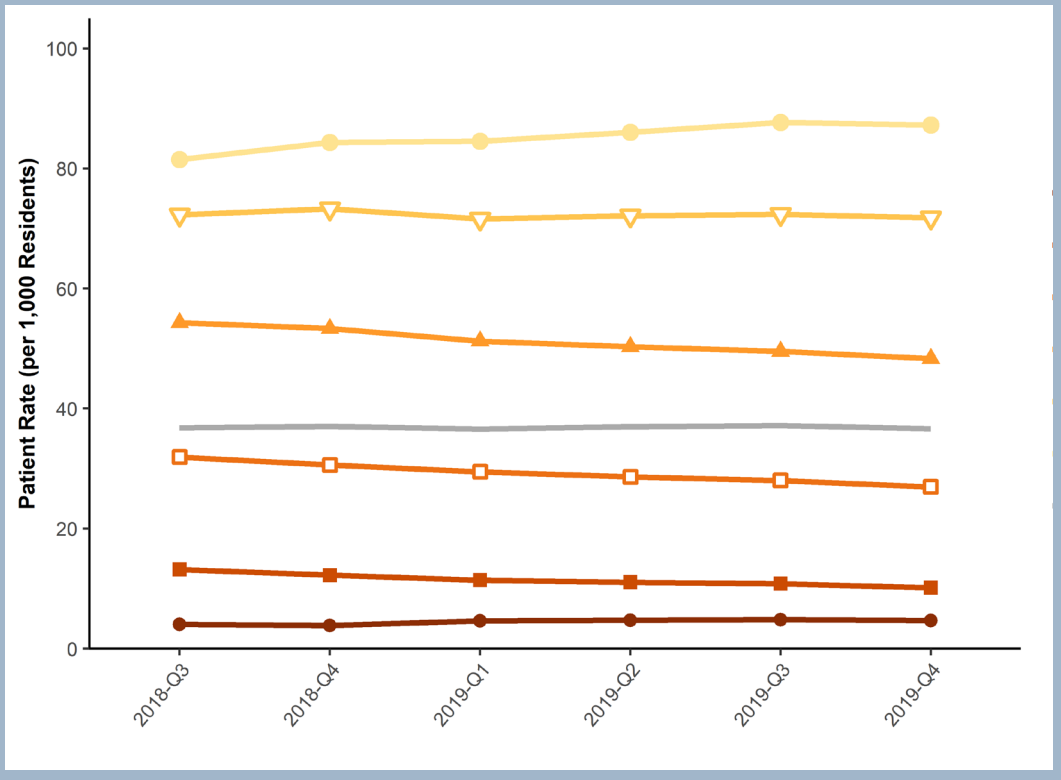
Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents. Data Source: Controlled Substance Monitoring Database.

The plot above presents the rate of patients filling gabapentin prescriptions per 1,000 TN residents by sex. The rate for all patients is included for comparison.

Across the entire period, from Q3 2018 through 2019, females filled gabapentin prescriptions at a higher rate than males. The rates for both groups have held relatively steady across this period. Rates for females have averaged around 44 per 1,000 residents per quarter (about 154,000 women per quarter). Rates for males have averaged around 29 per 1,000 residents per quarter (about 94,000 males per quarter).

Rates of gabapentin prescriptions for both males and females have held relatively steady from 2018 to 2019.

Rate of Patients Filling Gabapentin Prescriptions by Age in TN, 2018-2019



Analysis by the Office of Informatics and Analytics, TDH (last updated January 23, 2020). Limited to TN residents.
Data Source: Controlled Substance Monitoring Database.

The plot above presents the rate of patients filling gabapentin prescriptions per 1,000 TN residents by age group[53]. The rate for all patients is included for comparison.

Across the period from Q3 2018 to 2019, older age groups have had higher rates of gabapentin patients than younger age groups. There is stark difference between the patient rate for the oldest and youngest groups. In Q4 2019, there were 87 patients age 65+ who filled gabapentin prescriptions per 1,000 residents compared to just 5 per 1,000 residents aged 18 to 24.

The rate of patients filling gabapentin prescriptions has remained steady or decreased slightly for age groups under 55. Rates for the oldest age groups, those aged 55-64 and 65 and older, have slightly increased.

53 Prescriptions for patients less than 18 years of age are not included

Section Spotlight

Ongoing and Future Work

The Office of Informatics & Analytics (OIA) continues its efforts to maximize the use of the Controlled Substance Monitoring Database (CSMD) data to promote and improve the health of Tennesseans. The CSMD is one of the core data sources in OIA's Integrated Data System (IDS) and we are able to quickly link CSMD patients to their death certificate records, hospital discharges, and overdoses reported to the drug overdose reporting system, among other data. The ability to use these linked datasets has allowed TDH to rapidly respond to changes in the opioid epidemic. Although we are confident in our linkage strategies to support epidemiological surveillance activities, we continually strive to improve the accuracy of our methods. To that end, OIA's methods team has spent a great deal of time investigating the use of advanced entity resolution software, such as SAS's Data Management Studio (DataFlux), to provide better linkages between datasets. More advanced patient entity management techniques improve our ability to capture a patient's complete record of prescriptions and other health outcomes to better inform TDH's response to the opioid epidemic.

Learn More about the Controlled Substance Monitoring Database please visit their website:

https://tinyurl.com/y5ecu7x5

In addition to patient entity resolution, we have been hard at work developing a system for provider entity resolution. A single provider may have a number of distinct identifiers across our available datasets. When producing reports about provider level metrics, such as prescriber report cards or high risk prescriber lists (see below), we aim to fully capture all of a provider's prescriptions. The provider entity management process being developed in the IDS uses data from the Drug Enforcement Agency, the Centers for Medicare and Medicaid Services, and Tennessee's Licensing and Regulatory System (LARS) to ensure that a single provider can be identified regardless of the identifier associated with each record. Identifiers associated with a single provider will be assigned a unique identification number which is included in all relevant datasets throughout the IDS for fast, consistent linkage.

Work is currently underway to develop prescribing "report cards" for Tennessee's opioid prescribers. These report cards will show a provider, at a glance, how their opioid prescribing compares to peers in their specialty. We have worked with a team of researchers at Vanderbilt University to pilot test these report cards and receive feedback from practicing physicians about the ease of understanding the data provided. This year, we will be working on refining the look and utility of the report cards and identifying a user-friendly way to receive and view them.

OIA maintains a close relationship with the TDH Office of General Counsel (OGC) to assist with over-prescribing investigations. We provide the legislatively mandated top prescribing lists, and we continue

to work with OGC to develop useful measures of high risk prescribing. High risk prescribing can be defined many ways, and OIA works with investigators and prescribing experts at TDH to determine the most relevant for successful provider education and investigation efforts. Over the next year, we will be continuing to develop measures of risky prescribing practices and making them available for investigations and OGC use (see **Maximizing the Use of the CSMD Data**).

We are currently at work on a number of other projects that rely on CSMD data as well. A grant from the Bureau of Justice Assistance (BJA) is supporting investigation of prescribing patterns for other controlled substances, including gabapentin which recently became a controlled substance in Tennessee. This same grant is also funding work being conducted by Vanderbilt University Medical Center to develop statistical models to identify patients at high risk of overdose (see **Predictive Modeling for Patients at High Risk of Overdose** in the **Projects & Partnerships** section.) This work will greatly expand the scope of data available for planning and investigations and help TDH better assess the controlled substance prescribing landscape statewide.

PROJECTS & PARTNERSHIPS

Introduction

Timely information reporting, sharing of resources, and developing relationships both internal and external to TDH have been, and remain, important priorities for OIA. During 2019, OIA worked to further this mission, creating a strong data and analytic infrastructure for several projects and programs to support the Department of Health in addressing drug use, misuse, and abuse in Tennessee. This data infrastructure has been built to support the data lifecycle -- from acquiring, curating, linking, editing, and managing the data, to analysis and visualization of the data, and perhaps most importantly, data and information dissemination. Because OIA has expertise in reliable surveillance, high-quality analysis, and rapid response, we have been steady partners with TDH regional and metro health departments working to provide reliable drug overdose surveillance data, the TDH Opioid Response Coordinating Office (ORCO) to support efforts using data and drive High Impact Area (HIA) program planning and coordination, and multidisciplinary collaboration groups with Tennessee Bureau of Investigation (TBI)-Dangerous Drugs Task Force and the Department of Mental Health and Substance Abuse Services (DMHSAS) aimed at curbing drug overdose in the state. The information in this section provides a more in-depth review of the projects and partnerships that OIA is a part of.

Project & Partnerships included this section:

- **Current Grant Funding**
- **OIA's Partnership with DMHSAS**
- **Partnerships with ORCO**
- **Datapalooza!**
- **Integrated Data System (IDS)**
- **Maximizing the Use of CSMD Data**
- **Data Dissemination**

Grant Funding

Department of Justice, Bureau of Justice Assistance (BJA)

Tennessee Department of Health's response to the drug overdose epidemic has been strongly data-driven with emphasis on building a robust data infrastructure. The Office of Informatics & Analytics (OIA) has been awarded three BJA grants within the last four years, beginning in 2016 with a Harold "Hal" Rogers Prescription Drug Monitoring Program, and in 2018 with two Comprehensive Opioid Abuse Site-based Programs (COAP) (Categories 5 and 6) grants.

The shift in the overdose epidemic from prescription to illicit drugs has required analysis and surveillance from new and timelier data sources—and through BJA funding, OIA has been able to enhance surveillance in overdose with more rapid analysis that identify changing trends in the epidemic to provide information to key stakeholders.

Harold "Hal" Rogers Prescription Drug Monitoring Program

One of the important lessons OIA has learned over the past four years is that substantial effort towards an overdose response has occurred both within and outside of the Department of Health. In 2016, we started a multidisciplinary working group with the primary purpose of building a collaborative relationship with agencies and departments that may not be working together. Though this collaboration, OIA has shared drug overdose data and information with partners though enhanced data visualizations, data briefs, and dashboards. These analytics and visualizations help communicate timely and relevant trends seen in the data regarding drug overdose. Data which are currently utilized for analytics and visualizations include hospital reported opioid overdoses, suspected all-drug fatal overdoses, opioid related arrests, opioid prescribing, and viral hepatitis trends. By utilizing these various data sources and sharing key data, we have formed a truly synergistic relationship through bi-weekly team meetings, exchange of data briefs and monthly reports, and collaboration on response to drug overdose spikes seen within the state.

Sanura Latham presenting at the International Society of Disease Surveillance (ISDS) 2019 conference about OIA's work with the "Hal" Rogers Grant.

Through Hal Rogers funding, OIA has also been able to deliver important information to offices within TDH (e.g. infectious disease programs including viral hepatitis and HIV) and overdose prevention teams (within the Department Mental Health and Substance Abuse Services) who have been able to connect with individuals at risk of overdose. One example of how these data are being used was the decision to use hot spot maps of opioid overdose to place and scale Regional Overdose Prevention Specialists (ROPS) in regions in Tennessee. ROPS provide overdose prevention education and naloxone administration training to communities. Additionally, OIA is working with a team at Vanderbilt University Medical Center (VUMC) who are evaluating the relationship between socioeconomic factors and health to develop a predictive model using machine learning that assigns probability of risk of overdose. This will support enhanced public health surveillance activities. The Hal Rogers grant has also provided funding to allow for law enforcement to access the CSMD electronically for opioid case investigations.

August: 531
2019 YTD: 4,904
2018 YTD: 4,377

Hospital Reported Opioid Overdoses as Reported to the Tennessee Department of Health: August 2019

Figure 1.

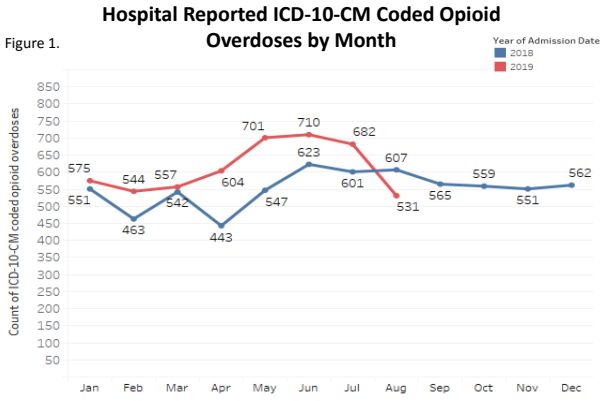


Figure 2.

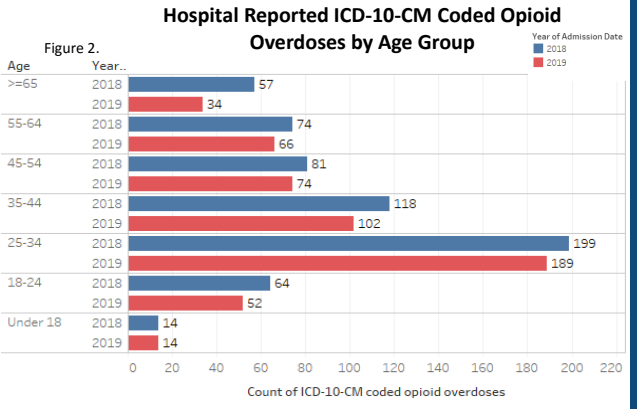
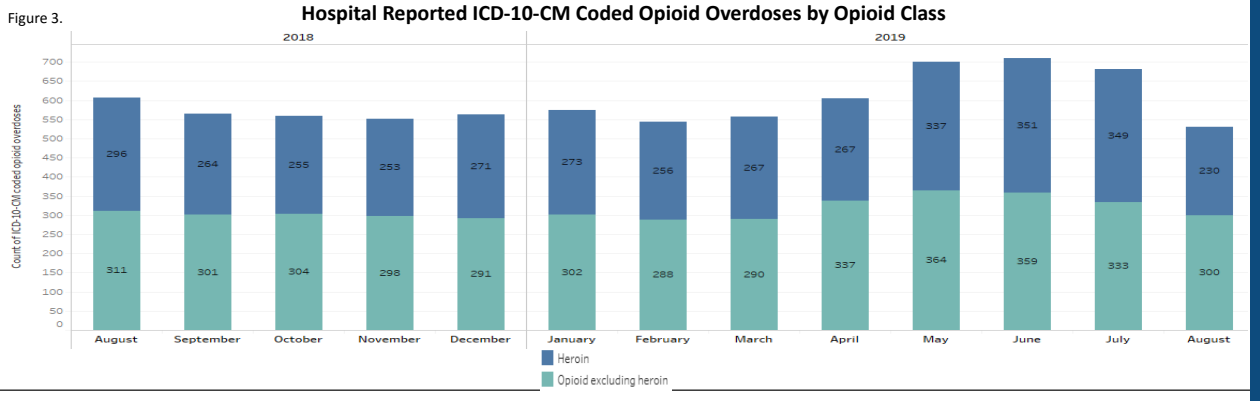


Figure 3.



Source: Tennessee Department of Health, Office of Informatics and Analytics, Drug Overdose Reporting system. **Not for public distribution.**

Harold Rogers Prescription Drug Monitoring Program Implementation and Enhancements (COAP Category 5)

RxCheck

Tennessee's Controlled Substance Monitoring Database (CSMD) continues to be critical in monitoring and tracking controlled substance prescribing and dispensing in the state. With BJA funding, the Department of Health will provide an additional future option for PDMP interstate data sharing. This option, though RxCheck, allows states to securely and efficiently share PMDP data across state lines. RxCheck is free for states and CSMD users, and is governed in combination with Integrated Justice Information Systems Institute (IJIS), BJA, and a board of PDMP users. RxCheck also provides the capability for electronic health records (EHR) integration. TDH supports PMP Interconnect (PMPi), and as part of this grant, is exploring EHR integration options using RxCheck with a pilot partner. The Prescription Drug Monitoring Program- Training and Technical Assistance Center (PDMP-TTAC) website (https://www.pdmpassist.org/content/events) contains more information about RxCheck capabilities.

TDH values that RxCheck emphasizes state ownership of its data, is standards-based, and secure. We appreciate the support of BJA developing and managing the RxCheck Hub and supporting states in joining this effort. Funding from this COAP grant is supporting internal TDH IT needs, onboarding, and management of RxCheck.

Multidisciplinary Collaboration and Data Infrastructure to Fight the Opioid Epidemic (COAP Category 6)

COAP funding continues to support the infrastructure OIA has built to date originally from the foundation of "Hal" Rogers PMDP funding in 2016. Continuing to build the multidisciplinary action group is a main objective—current members include representatives from the TDH Overdose Response Coordinating Office (ORCO), Communicable and Environmental Disease and Emergency Preparedness (Viral Hepatitis Program; HIV Prevention and Surveillance Program), CSMD Program, Tennessee Bureau of Investigation Dangerous Drugs Task Force, and the Tennessee Department of Mental Health and Substance Abuse Services Office of Prevention. In 2019, this working group added representatives from TDH Emergency Medical Services (EMS) and the Tennessee Department of Children's Services Office of Child Safety. Further enhancements of the multidisciplinary collaboration group also include providing technical and analytic support for data sharing and data integration. Dynamic reports and data dashboards have been created and are shown biweekly to the working group to enhance understanding of data trends and inform and drive working group programmatic planning.

Above is Charlotte Cherry, MS, MPH, presenting at the COAP 2019 National Meeting in Arlington, Virginia, about OIA's work with the COAP grants.

Another vital activity under the COAP Multidisciplinary Collaboration and Data Infrastructure grant is working to establish and implement robust data standards and documentation for EMS data. EMS data are essential for tracking drug overdose, and for initiating timely and effective response. THD's Office of EMS oversees more than 200 EMS agencies across the state, including more than 1,500 ambulances-- and it's estimated that transport occurs for more than 1,000,000 patients annually in Tennessee.

Different stakeholders have various needs and data agility--providing concise and timely data and information is one of the main activities that COAP funding supports. OIA provides not just the services for data informatics and integration into the TDH Integrated Data System (IDS), but the analysis and presentation of complex data in ways that can be understood and acted upon by people and departments internal to TDH as well external partners and the public.

Centers for Disease Control and Prevention (CDC)- Overdose Data to Action Cooperative Agreement (OD2A Grant)

In September 2019, TDH was awarded $6.7 million through a cooperative agreement with the Center for Disease Control and Prevention for their Overdose Data to Action program (OD2A). The OD2A grant rolls up the work of prior CDC grants—Prescription Drug Overdose Prevention for States and Enhanced Surveillance of Opioid Overdose in States—that supported OIA's data-driven overdose work into a single source of funding. OD2A also includes expanded funding for prevention activities that are being coordinated through ORCO. CDC's intent for OD2A funds is to support the collection of high quality and timely data on overdoses in TN and to use those data to inform and evaluate prevention activities. Portions of the OD2A funding are specifically earmarked to be used to support improved toxicology testing and local and regional activities.TDH's OD2A activities fall under seven categories:

Surveillance

1) Morbidity Surveillance
    a. Participation in DOSE (see **DOSE spotlight**)
2) Mortality Surveillance
    a. Participation in SUDORS (see **SUDORS spotlight**)
    b. Rapid identification of opioid overdose deaths
3) Innovative Overdose Surveillance
    a. Expansion of data linkages in the IDS (**see IDS spotlight**) to identify injection drug use-associated health outcomes and to better identify risk and protective factors and other social outcomes of overdose
        i. Workers' Compensation data
        ii. Blood-borne infections data
        iii. Child and family welfare data
        iv. Community risk and protective factor data
    b. Incorporation of new data sources into surveillance and visualization tools

Prevention

4) Improved PDMP Functionality
    a. Development of prescriber report cards for clinical decision making support (**see Maximizing CSMD Data Use section**)
    b. Support overprescribing investigations
    c. Analysis of the effects of recent opioid legislation on prescribing trends
5) State and Local Integration
    a. Fund and supervise mini grants to High Impact Areas (**see HIA section**)
6) Linkages to Care
    a. Pilot linkage to care protocols in emergency departments
    b. Fund resource navigators
    c. Develop statewide treatment resource mapping tools
7) Providers & Health Systems Support
    a. Expand and enhance academic detailing throughout the state
    b. Provide continuing education on overdose and treatment to prescribers through a mobile learning application

Partnerships with Opioid Response Coordinating Office

Prevention Activities for OD2A- High Impact Areas

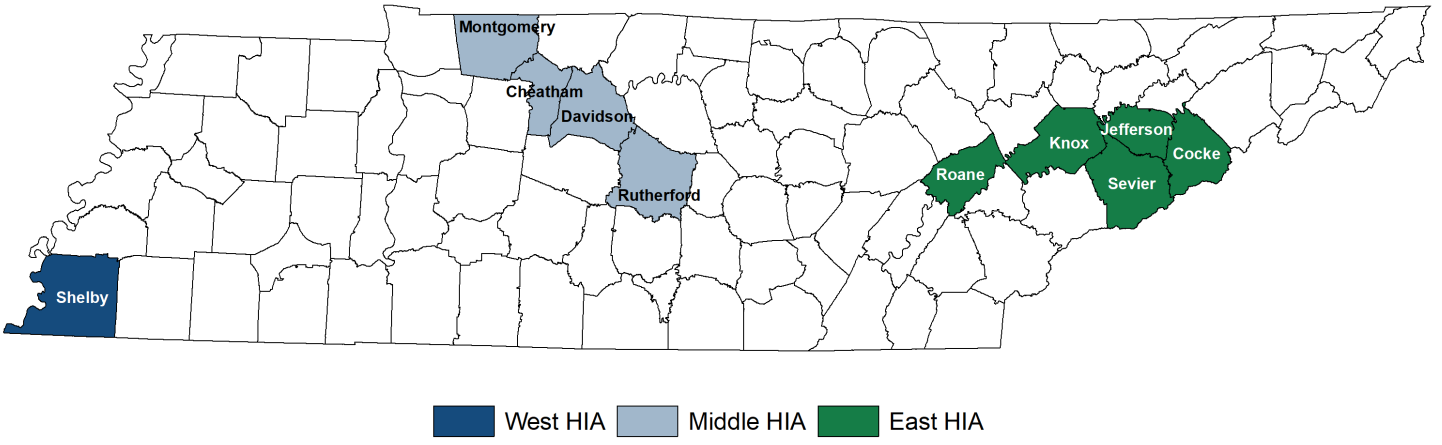
The Tennessee Department of Health Opioid Response Coordinating Office (ORCO) leads the department's response to the drug overdose epidemic in Tennessee. TDH is undertaking several activities aimed at utilizing data to target drug overdose efforts. One main activity lead by ORCO is identifying the areas within Tennessee that have been the most highly impacted by overdose. ORCO and OIA worked together to use 2018 overdose data and information to identify three areas in the state considered "high-impact". The High Impact areas (HIA's) (highlighted below) include 1.) West: Shelby County, 2.) Middle: Davidson, Rutherford, Cheatham and Montgomery counties, and 3.) East: Knox, Roane, Jefferson, Sevier and Cocke counties.

The first workshop for the West HIA multi-sector Task Force held in Memphis, TN (Top), with ORCO's Deputy Director Kristen Zak (Bottom).

Local, regional and metro health departments and other community-based partners within the HIA's have CDC funding to implement interventions aimed at reducing overdose and other adverse consequences of the epidemic in their region. Interventions with the HIAs were selected among CDC approved evidenced-based activities by multi-sector workgroups in each HIA based on issues identified through local data. Each HIA is required to develop a multi-sector Task Force and develop and implement an acute response plan as part of their award. HIA's also choose other interventions for funding. Some examples of interventions that will be implemented include: substance abuse prevention education, establishing connection to MAT treatment and services in correctional settings and upon discharge, expansion of syringe service programs, linkage to care from health departments and through EMS data, establishment of discharge protocols in emergency departments and interviewing individuals with prior overdose to learn more about the population and connect them to treatment.

Interventions will be evaluated over-time to allow for testing and revision during the grant period. Additional HIA's may be added during the grant cycle dependent upon availability of funding and on-going analysis of state overdose data.

High Impact Areas Receiving Funding for Prevention Activities



Predictive Modeling for Patients at High Risk of Overdose

Through funding from the Harold Rogers Prescription Drug Monitoring Program: Data-driven Responses to Prescription Drug Abuse grant, the Tennessee Department of Health (TDH) has partnered with the Vanderbilt University Medical Center (VUMC) Walsh Lab to develop a predictive model that assigns probability of risk of drug overdose. The VUMC Walsh Lab will evaluate the relationship between socioeconomic factors and health, which will lead to the development of a predictive model using a machine learning algorithm that assigns probability of risk of overdose at the zip code and patient level. The Walsh Lab has an established research core that uses unique machine learning and natural language processing methods that can be applied to drug overdose.

Colin Walsh, MD, MA, of Walsh Lab at VUMC discussing the ongoing predictive modeling project with TDH at 2019 Datapalooza.

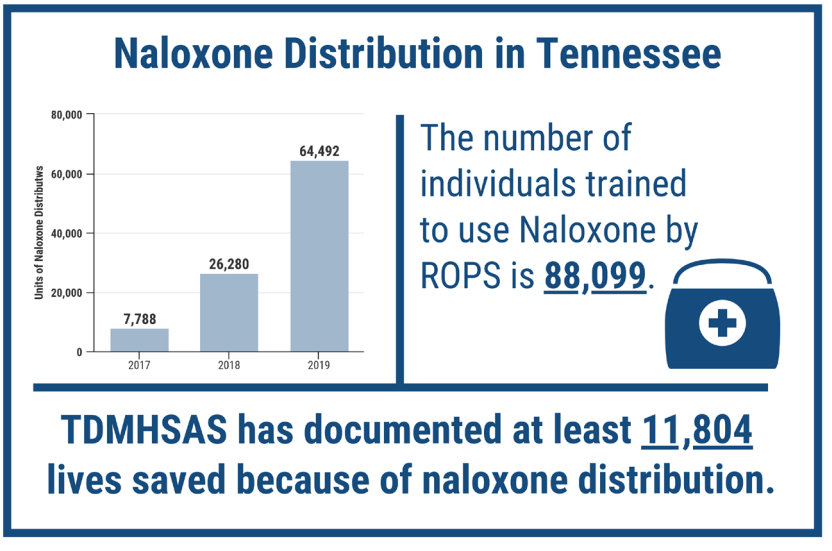
With the ability to develop a predictive model that assigns probability of risk of drug overdose, TDH will be better equipped to prioritize geographies and patients at risk of drug overdose. In addition, this work will contribute to improve public health surveillance of drug overdose, planning activities, and providing information to physicians for enhanced point of care clinical decision making. Also, drug overdose risk modeling can better inform the prioritization of geographic areas for interventions in order to improve care or reduce over-prescribing. At the patient level, patients who might be at higher risk for overdose may have risk information included within the CSMD for use by physicians' clinical decision making.

Partnership with Tennessee DMHSAS

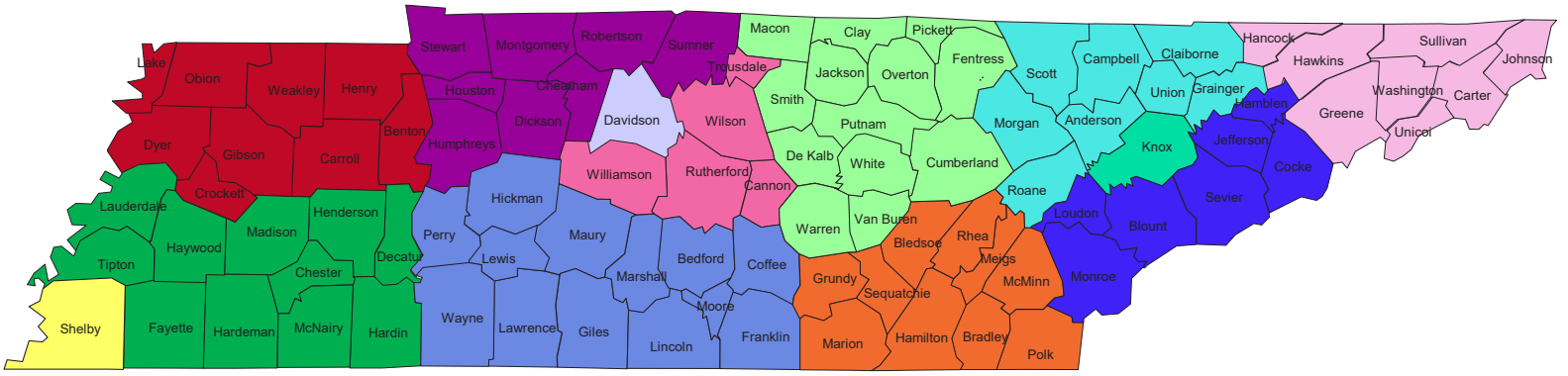
Regional Overdose Prevention Specialists

The Tennessee Department of Health (TDH) Office of Informatics & Analytics (OIA) has continued to build a strong collaborative partnership with the Tennessee Department of Mental Health and Substance Abuse Services -Office of Prevention (DMHSAS). This robust relationship has been possible in part from grant funding from DMHSAS to OIA for an epidemiologist role that is specifically tasked to liaise between the two agencies, and to lead efforts that enhance the rapid turnaround of data analytics related to drug overdose. Specific analytic activities include creating reports and dynamic dashboards that contain pertinent overdose data and information. Having more timely data that feed nimble data analytics helps better inform high need areas to distribute naloxone, or direct where to target education and prevention for regions of the state where drug overdoses continue to increase. Through SAMHSA's State Opioid Response Grant, DMHSAS contracts with community agencies and substance use prevention coalitions to employee a team of regional overdose prevention specialists (ROPS) who are located throughout the state and provide training and education on drug overdose and distribute naloxone to individuals at high risk, first responders, and community agencies serving those at high risk. In a recent DMHSAS state-wide ROPS training, OIA worked with DMHSAS to present data visualizations and maps showing naloxone distribution and locations of education and training events that occurred in the state. This information was layered with where, at a state-wide level, opioid overdoses were occurring. These insights will be used by the DMHSAS program staff and the ROPS to target the highest need zip code areas to provide training and naloxone distribution in 2020. In this collaborative meeting, the ROPS also had the opportunity to provide feedback and express specific data needs that would assist them in better targeting geographies for overdose prevention activities.

OIA also works with DMHSAS to report on trends and statistics for buprenorphine use and outcomes in Tennessee. Buprenorphine is a form of medication-assisted treatment used to aid people in recovering from opioid addiction and dependence. Analyses include prescribing trends of buprenorphine, long-term use, and other indicators. Information from these analyses helps DMHSAS better understand buprenorphine prescribing trends and see where upticks in the utilization of buprenorphine for treatment occur in the state, as well as the trends for long-term use.



REGIONAL OVERDOSE PREVENTION SPECIALIST R.O.P.S.



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Datapalooza!

On Thursday, June 28 and Friday, June 29, 2019, the Tennessee Department of Health' s Office of Informatics & Analytics (OIA) hosted a 1.5 day conference to foster deeper engagement with drug overdose data-- activities included seminars and workshops on data analytics, methods and best practices, creating data visualizations, and approaches to communicating data for public audiences.

Datapalooza highlighted the work and activities of other State agencies and partners, fostered deeper engagement with drug overdose data, and attendees gained insight into ways people are using drug overdose data to drive planning and action.

Datapalooza was proposed as one activity funded under CDC's Prevention for States (PfS) grant. One key pillar of PfS was dissemination of relevant, timely, and usable drug overdose information and data to stakeholders.

Hosting a conference around drug overdose data supported a commitment to collaboration with State agencies and partners to use drug overdose data to drive planning and action in Tennessee.

Target Audience: All data lovers! And all disciplines working within State agencies and their partners (i.e. education, law enforcement, medical (clinical), community, media/communications, and public health).

> ***"We had experts there that were open to answering questions and they showed us how ... we can use [data] it in our everyday lives..."***
>
> **-- Chris Dumas**
> **Doctoral Student at ETSU**

Impacts of Datapalooza:

- Reached over 120 data lovers through the 1.5 day conference!
- Multiple Tennessee agencies were represented, some included:
  - TN Department of Education
  - TN Bureau of Investigation
  - TN Department of Mental Health and Substance Abuse Services
  - TN Regional and County Health Departments
  - University of Tennessee-Knoxville
- People working in the same place were able to network and link with resources

If you would like to learn more about the Datapalooza event or watch the event video , please check out the story map produced by the Office of Informatics & Analytics here:

DATAPALOOZA

Bringing Data 2 Action

Dr. Lisa Piercey (right), Comissioner of Health, welcomed all Datapalooza participants on the final day of the conference.

Roberta Sturm (left), Lead Epidemiologist at Knox County Health Department, discussing Knox County Naloxone Deployment by First Responders.

Integrated Data System (IDS)

The Office of Informatics & Analytics established and maintains the Integrated Data System (IDS) which was created to integrate data from the various divisions within the Tennessee Department of Health (TDH) and provide a definitive source which supports analysis and data visualization across the entire department. This system, which was built originally to support work on the prescription drug overdose epidemic, will also pivot to support addressing other use cases where consistent data linkage and rapid analytics are needed.

The IDS includes data from the Controlled Substance Monitoring Database (CSMD), the Hospital Discharge Data System (HDDS), Vital Records and Statistics (Vital Records Information System Management, Death Statistical File), the Drug Overdose Reporting System (DOR), the Drug Enforcement Administration registry (DEA), the National Provider Identifier Database (NPI), opioid-related arrest data from TBI's Tennessee Incident Based Reporting System (TIBRS), and TDH's Licensing and Regulatory System (LARS) data. Additional data sets being added include the Emergency Management System (EMS) and Birth Certificate data. The IDS supports the work of epidemiologists and statisticians as well as the TDH Office of General Counsel (OGC). The IDS has allowed TDH, for the first time, to have a persistent source of data to link individual patients across various health data systems. This allows epidemiologists from the department to, for example, understand the relationship of prescribing history (from the CSMD) to clinical outcomes (from HDDS, Vital Statistics, and DOR). In addition, the IDS can be directly accessed to obtain data to conduct on demand surveillance, data analyses, and epidemiologic studies as the need arises.

What is in the IDS?

The IDS is comprised of two major components: a repository for all source data, and a data warehouse specifically architected to support efficient and intuitive usability. The full data from each source is permanently stored in a database called the Repository. This server also maintains the entity management process for all sources, to provide unique identifiers for de-duplicated entities. The Warehouse is designed to support fast analytics. It accomplishes this goal by reducing data elements to the minimum needs of each use case, linking disparate data sources via use of entity management techniques, standardizing definitions of common elements across data sources, and providing well defined data hierarchies where possible.

Entity management allows OIA to create a unique key for each individual in a data source. This unique identification number is included in all relevant datasets throughout the IDS and allows OIA to provide fast, consistent linkage.

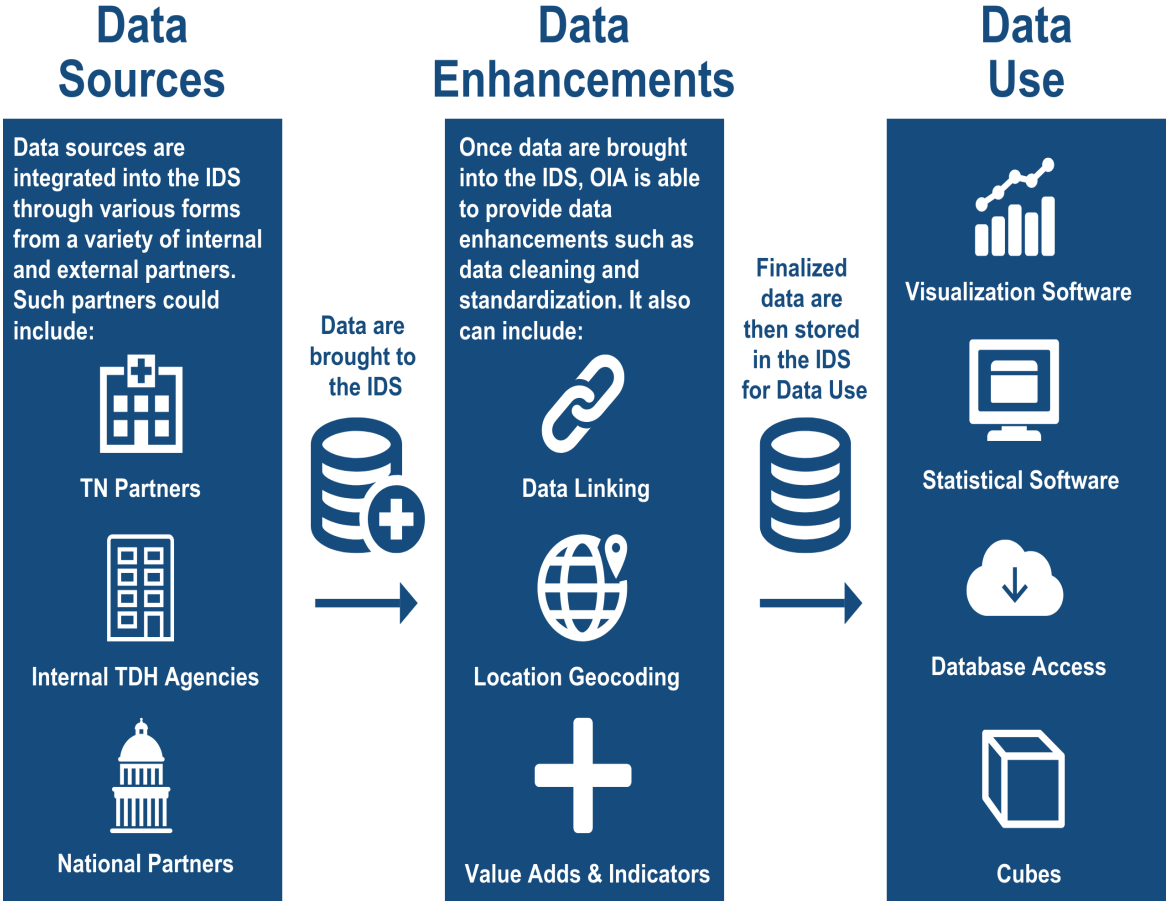
How does the IDS enhance existing data?

Several additional services process the data for analytics and visualization. SQL Server Integrated Services is used to load data from the original sources into SQL Server. SQL Server

Analysis Services will be used to create multidimensional cubes for analysis. ArcGIS provides geocoding information for relevant addresses. SAS Data Management Studio (also known as DataFlux) provides some of our entity management processing services. Tableau is being used to provide visualization through interactive dashboards. OIA's epidemiologists are able to directly connect to the IDS through their statistical programming software of choice such as R, SAS, or STATA.

One of the primary purposes of the IDS is to calculate new variables that serve as indicators in the overdose epidemic that can be recalculated regularly and automatically as needed. These indicators are used to guide public health policy and resource allocation at the department. They also provide helpful information to Tennessee's stakeholders through public facing products such as this report and the TDH Drug Overdose dashboard. These indicators track drug overdose deaths, overdose-related inpatient and outpatient hospital visits, and a variety of prescription trends (See the **Appendix A (pg 140)** for a detailed list of indicators). Another purpose of the IDS is to automate the analysis of high risk patient and prescriber models that will run regularly as appropriate and flag high risk individuals and situations (see **Maximizing the Use of CSMD Data**). Indicators of high-risk prescribing and dispensing undergo continued refinement to best support the work of over-prescribing investigators. The models for high-risk patient behaviors are being developed in collaboration with Vanderbilt University Medical Center (see **Predictive Modeling for Patients at High Risk of Overdose**). Additionally, the IDS has been instrumental in providing data for other emergent public health concerns (for example **Implementation of Prescription-based Surveillance in Response to Pain Clinic Closures** in the 2019 annual report, pg 70).

Understanding the IDS



Maximizing the Use of CSMD Data

One of the important roles that TDH plays in preventing drug overdoses is putting prescribing data to effective use. In addition to tracking key indicators of prescription drug dispensation across TN (see the Prescribing Trends section), CSMD data are used to support overprescribing investigations and will be used to provide enhanced clinical decision support tools to TN's prescribers. Using CSMD data in this way has strong state and federal support, and a number of TN laws and federal funding opportunities have allowed OIA to expand these projects in the past few years. OIA relies on the capabilities of the Integrated Data System (IDS) to quickly and accurately analyze prescribing and overdose data to maximize the use of CSMD data. Below, we describe a few of OIA's ongoing projects that use CSMD data to monitor and prevent inappropriate prescribing.

Overprescribing Investigations

TDH's Office of General Counsel (OGC) brings actions against prescribers who have been identified as overprescribing controlled substances based on investigations that have typically been driven by external complaints. Interventions range from education to disciplinary actions like license revocation. Lawyers in OGC have access to the CSMD, but have typically had to pull records one by one to develop a file that represents the prescribing pattern of a particular prescriber, or the history of a particular patient. Furthermore, they have depended on external complaints to identify prescribers who may be engaging in high risk clinical practices.

Learn more about TN's Office of General Counsel!

OIA has provided a "search and sort" tool out of the IDS that produces an Excel pivot table that can be modified to pull increasingly granular data. This tool increases the efficiency of investigations by allowing investigators to pull CSMD data that has been subjected to our data cleaning protocols, sort and search it in order to identify which charts to pull in an investigation. For example, an investigator may request information on all prescriptions by a certain prescriber in a given timeframe, then modify that request to limit and sort the table by factors including types of drugs, characteristics of patients (e.g. age), prescription factors such as MME or number of prescriptions. They can thus identify within minutes a prescriber's patients with, for example, the highest MME or greatest number of overlapping prescriptions and determine whether the pattern suggests that further investigation is warranted.

Prior to development of the IDS, there was no way to connect to a database in this way that would allow the investigators to use the data quickly and directly without an intermediary pulling records for them. The investigators and lawyers using the tool report that it has significantly increased efficiency and that it bolsters confidence in their understanding of the data patterns. OIA is working on improving the tools available to investigators and lawyers by developing a more intuitive user interface and incorporating additional data.

Top and High Risk Prescribers

TDH is legislatively mandated to use CSMD data to produce a number of lists of prescribers that are identified as having the highest levels of prescribing or are deemed "high risk" to their patients[55].

Top and High Risk Prescribers list includes:
• The top 50 prescribers of opioids, based on morphine milligram equivalents
• The top 10 prescribers in small counties (< 50,000 people) of opioids based on morphine milligram equivalents
• The top 20 prescribers of buprenorphine
• High risk prescribers
• And most recently, statistical outlier prescribers

OIA's epidemiologists compile these lists yearly, using the latest improvements to entity management, data quality, and data linkage available in the IDS to best identify the highest or most anomalous prescribers. The high risk prescriber and statistical outlier lists rely on advanced analyses of prescription and overdose data that have been developed in conversation with key stakeholders and subject matter experts. The high risk prescriber list uses identification of patient overdoses that occur on active prescriptions, high MME prescribing to opioid-naïve patients, high average MME prescribing, and volume of high MME patients to define high risk prescribing.

Once the lists are compiled, OIA provides them to a team in the TDH Bureau of Health Licensure and Regulation who notifies prescribers of their inclusion on the yearly list(s). Prescribers are asked to respond to the department to justify their prescribing behavior. If their response is deemed unacceptable, these prescribers are required to meet certain requirements that include providing patient education materials and attending additional training on the appropriate prescribing of opioids. In some cases, inclusion on these lists prompts more in-depth investigation by the department that may result in further action against the prescriber's license.

Enhanced Clinical Decision Support

OIA is also working to provide meaningful data back to prescribers using linked data and advanced analytics. Currently, providers are able to view some patient risk information and comparative data on prescribing trends in the CSMD. OIA is currently working on a project to provide additional information in the form of prescriber "report cards" using the IDS as a source of high quality data. These report cards will present personal prescribing trends and peer comparisons in an easy to understand format. They will also provide information on patients that is only available through data linkages in the IDS, such as nonfatal overdoses from our Drug Overdose Reporting System and patient risk indicators through our high risk modeling project with Vanderbilt University Medical Center (see **Predictive Modeling for Patients at High Risk of Overdose** in the Projects and Partnerships section of this report). OIA has gathered feedback from physicians on initial drafts of these report cards and will be working to improve and disseminate them in the next year.

55 High Volume Prescribers of Controlled Substanes: T.C.A $ 68-1-128

Data Dissemination

Numbers count. Every number is a story. Every story is a person.

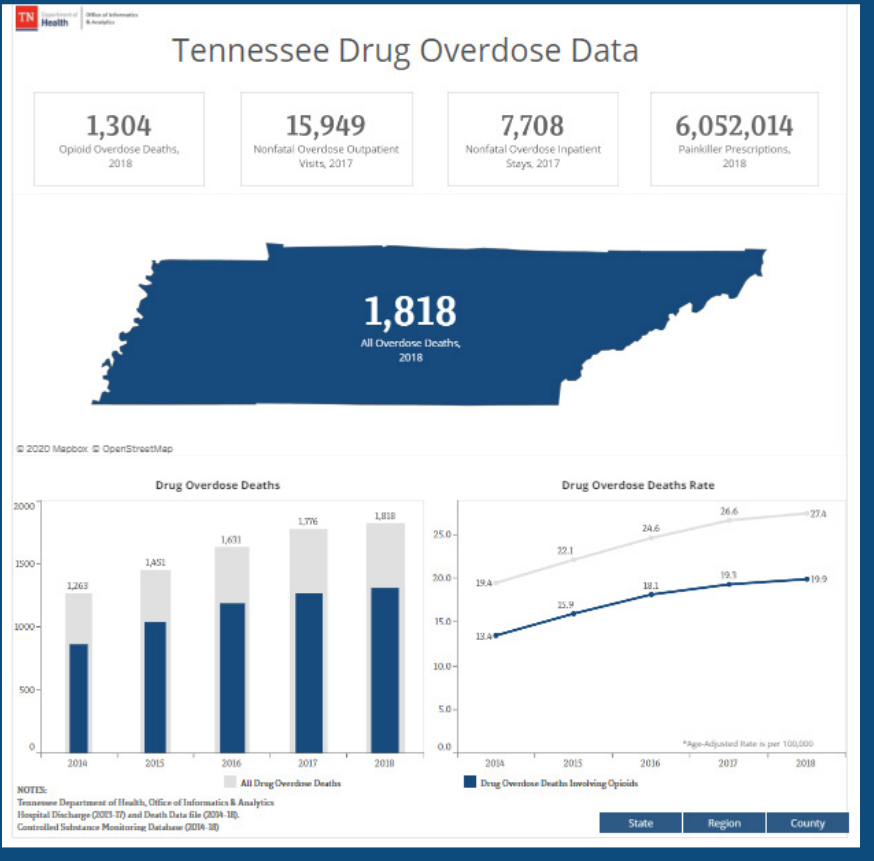
One of the key goals in Office of Informatics & Analytics is to advance data analytics and visualization approaches as well as the translation and dissemination of data and information for a range of audiences that is relevant, timely, and usable. Drug overdose data and information can be accessed via the Tennessee Department of Health (TDH) website https://www.tn.gov/health/health-program-areas/pdo.html with options to access a catalogue of county-level drug overdose data slide sets, a dynamic drug overdose data dashboard, infographics, and various reports and publications about drug overdose, prescription and illicit drug use, misuse, and abuse in Tennessee (TN).

Data Dashboard

Drug Overdose Data Dashboard provides TN county and state level data on fatal and nonfatal drug overdose as well as opioid and benzodiazepine prescribing trends in TN. There have been approximately **14,914** page views of the dashboard's main landing page (January 1, 2019-December 31, 2019).

The Drug Overdose Data Dashboard is a tool that stakeholders use to learn more about drug overdose and prescribing trends in their county, inform grant-writing, policy making, and program planning. Substance Use Prevention Coalitions also receive technical assistance from TDH-OIA to learn how to use data to drive targeted prevention efforts. Expansion of the Drug Overdose Data Dashboard with new indicators and data visualizations are anticipated! Stay tuned for new enhancements expected in 2020!

The Tennessee Drug Overdose Dashboard can be found by clicking here or scanning the QR code below:

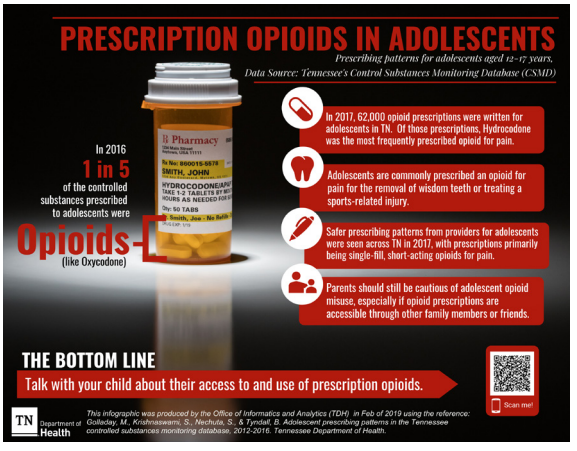


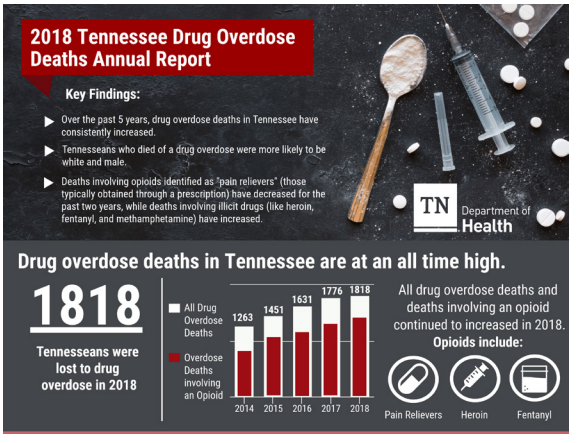
Infographics

Infographics communicate messages, and often breakdown large amounts of data or information in a way that is easy to comprehend. TDH-OIA values developing clear and consumable information for a range of audiences. A new focus has been creating innovative infographics that show and explain data in a concise and easily digestible way. Infographics can be used across content areas to capture the impact of health conditions (e.g. drug overdose).

OIA's infographics have been shared with the TDH Office of Communication & Media Relations and disseminated though the official TDH Facebook feed https://www.facebook.com/TNDeptofHealth/ . It is estimated that the Office of Communication reaches **28,090** people through their various social media platforms. TDH recognizes and values that providing data and information through various outlets helps people better understand public health issues.

Infographics created by the Office of Informatics & Analytics in 2019





Slide Catalogue

In 2019, a slide catalogue was expanded to include updated drug overdose data. A series of slides are publicly available, with a subset available for public health professionals through a Tennessee Department of Health (TDH) SharePoint site. Slide sets for individual counties are developed and have been made available to coalitions and county health directors. Technical assistance for interpreting and using the slides is available from OIA.

Slide sets that include updated drug overdose data are available here.

Media Campaign

In 2018, OIA received supplemental funding to implement the CDC Media Campaign, "It only takes a little to lose a lot"." The goal of the campaign is to increase awareness that prescription opioids can be addictive and dangerous. The campaign also strives to decrease the number of individuals who use opioids recreationally or overuse them.

Twenty-four Prevention Coalitions (Anti-Drug Coalitions) were selected to receive $5,000- $15,000 in grants to implement a local campaign. The Knox County coalition (Metropolitan Drug Commission) received $95,000 to implement a regional campaign. Coalitions targeted a variety of local mechanisms to implement the "It only takes a little to lose a lot" campaign in their counties.

Selection of Advertisements	Number of Coalitions
Radio Ads	21
Television Ads	3
Commercials before Movie in Theater	2
Billboards/Digital Billboards	16
Social Media	15
Local Newspapers	11
Digital Ads	8

Most coalitions used radio ads often selecting radio stations that broadcast local sporting events. A few coalitions used television advertisements. A couple of coalitions teamed up with local theaters to play commercials prior to the start of the movie. Sixteen coalitions used billboard and digital billboards. Another coalition used digital signage and advertised in the emergency room lobby and outpatient lobby a regional medical center. A metropolitan coalition placed ads in local buses. Fifteen coalitions leveraged social media to share the campaign's messages. Eleven coalitions placed advertisements in local newspapers. Eight coalitions used digital advertisements online. Coalitions leveraged their strong local partnerships with several of them receiving additional months of advertising at no cost. A rural coalition ran an advertisement during an event sponsored by the Boys and Girls Club. During this event, the CDC ads were displayed on the Jumbotron. This event was targeted because the number of people reached (8,000) with the ad was greater than the local television stations! The "It only takes a little to lose a lot" Tennessee statewide campaign is estimated to have over 48 million impressions[54]. This number is growing as companies continue to advertise this campaign through in-kind donations.

Learn more about this national campaign here.

54 Coalitions submitted marketing metrics (as available) to the Tennessee Department of Health. Depending on advertising type, metrics included "individuals reached" and/or "impressions." One number was assigned to each advertising type and the numbers totaled for an estimate of over 48 million impressions. Impressions are defined as the number of times the content is displayed.

International Overdose Awareness Day 2019

During the last week of August 2019, DMHSAS and OIA collaborated together to release overdose information and community resources in support of International Overdose Awareness Day (Saturday, August 31, 2019). OIA collaborated with the TDH Overdose Response Coordinating Office (ORCO) and TDH Office of Communications & Media Relations to develop a story map to educate Tennesseans about addiction, recovery, and how to find positive solutions that reduce drug misuse and overdose in their communities. DMHSAS provided information about opportunities to attend events that could empower people to create change and reduce drug overdoses in their communities. International Overdose Awareness week concluded with a mass naloxone administration training led by DMHSAS at the Tennessee Tower in Nashville. This training drew employees from across State agencies and departments, including TDH OIA.

Learn more about the IOAD campaign here.

Check out the OIA Story Map through this link:

In 2019, OIA collaborated with other Tennessee Offices, ORCO and DMHSAS, to recognize International Overdose Awareness Day on August 31st, 2019. OIA produced an ESRI story map to bring awareness to addiction, drug misuse and overdose titled *Being A Neighbor* (very top). OIA staff (left image) also participated in TDMHSAS's statewide Opioid Informational and Overdose Reversal Training (middle) where Regional Overdose Prevention Specialists (ROPS) Stephen Mason and Josh Crews educated employees and community members aboout overdose symptoms and the use of naloxone/narcan (the opioid overdose reversal medication).

APPENDIX

What can you do?

Education and Prevention

Increase education and prevention of substance use disorder.

Reduce Stigma

Help reduce stigma around substance use disorder.

Treatment for Substance Use Disorder

Support treatment for substance use disorder.

Language Matters

Stigmatizing language continues negative perceptions about substance use disorder.

> ***Person with a substance use disorder***

Say "Person with a substance use disorder rather than "Addict"

> ***Person who currently uses substances***

Say "Person who currently uses substances" rather than "Junkie"

> ***Medication-assisted treatment***

Say "Medication-assisted treatment" or "Medication" rather than "Replacement" when referring to the use of any medication approved to treat substance use disorders (in combination with psychosocial support services) or FDA-approved drugs for addiction treatment

> ***Person currently living in recovery***

Say "Person currently living in recovery" rather than "Ex-addict"

For more information about resources : https://www.tn.gov/opioids.html

Appendix A: Data Requests and Available Health Indicators for Overdose Mortality, and Morbidity and Opioid-Related Prescribing

The Office of Informatics and Analytics provides a number of overdose and prescription data resources for official, public, and research use. In addition to this report, we host a number of reports on our facts and figures page at https://www.tn.gov/health/health-program-areas/pdo/pdo/facts-figures.html. Additional data can be found on the TDH Overdose Data Dashboard: https://www.tn.gov/health/health-program-areas/pdo/pdo/facts-figures.html.

If the data you are looking for is not available at one of these locations, click the "Submit a Data Request" button on this page: https://www.tn.gov/health/health-program-areas/statistics.html. This will route you to the TDH data request system, a service of the Data Governance unit of the Office of Informatics and Analytics. Once a request is submitted, it is routed to the appropriate data steward or committee for approval. Once approved, most data requests can be fulfilled within a month, but many requests for preexisting data can be fulfilled faster. The following tables list overdose mortality, overdose morbidity, and prescription indicators that are readily available and can generally be released quickly. Requests for other data will be considered, but may be subject to federal law, state law, or department policy that restricts their use. These requests may also take longer to fulfill.

Mortality Indicators **Data Source: TN Death Statistical File** **Availability: Annually** **Latest Available Data: 2018** **Stratification: Age, Race, Sex** **Geographic Level: TN, Region, County** **Types: Count, Crude and Age-Adjusted Rates per 100,000 TN residents**
Indicator
1. All Drug Overdose Deaths
2. Drug Overdose Deaths Involving Opioids
3. Drug Overdose Deaths Involving Natural, Semi-synthetic and Synthetic Opioids
4. Drug Overdose Deaths Involving Natural and Semi-synthetic Opioids and methadone
5. Drug Overdose Deaths Involving Natural and Semi-synthetic Opioids
6. Drug Overdose Deaths Involving Synthetic Opioids Other than Methadone
7. Drug Overdose Deaths Involving Methadone
8. Drug Overdose Deaths Involving Heroin
9. Overdose Deaths Involving Fentanyl
10. Overdose Deaths Involving Buprenorphine
11. Overdose Deaths Involving Polysubstance Use
12. Overdose Deaths Involving Cocaine
13. Overdose Deaths Involving Stimulants (Other than Cocaine)
14. Overdose Deaths Involving Any Stimulant (Cocaine and other stimulants)
15. Overdose Deaths Involving Benzodiazepines
16. Overdose Deaths Involving Opioids and Benzodiazepines
17. Overdose Deaths Involving Opioids and Stimulants (Other than Cocaine)
18. Overdose Deaths involving Opioids and Cocaine

Morbidity Indicators Data Source: TN Hospital Discharge Data System Availability: Annually Latest Available Data: 2018 Stratification: Age, Race, Sex Geographic Level: TN, Region, County Types: Count, Crude and Age-Adjusted Rates per 100,000 TN residents
Indicator
1. Emergency Department Visits for All Drug Overdoses
2. Emergency Department Visits Involving All Opioid Overdoses Excluding Heroin
3. Emergency Department Visits Involving Heroin Overdose
4. Emergency Department Visits Involving Stimulant Overdoses (Excluding Caffeine)
5. Inpatient Hospitalizations for All Drug Overdose
6. Inpatient Hospitalizations Involving All Opioid Overdoses, Excluding Heroin
7. Inpatient Hospitalizations Involving Heroin Overdose
8. Inpatient Hospitalizations Involving Stimulant Overdoses (Excluding Caffeine)
9. Outpatient Visits for All Drug Overdoses
10. Outpatient Visits Involving All Opioid Overdoses Excluding Heroin
11. Outpatient Visits Involving Heroin Overdose
12. Outpatient Visits Involving Stimulant Overdoses (Excluding Caffeine)

Prescription Indicators Data Source: TN Controlled Substances Monitoring Database Availability: Daily Latest Available Data: 2019 Stratification: Age, Sex Geographic Level: TN, Region, County
Indicator
1. Opioid Prescriptions for Pain Filled Overall and by Drug, number and crude rate per 1,000 TN residents
2. Patients Filling Opioid Prescriptions for Pain, number and crude rate per 1,000 TN residents
3. Buprenorphine Prescriptions for Medication Assisted Treatment, number and crude rate per 1,000 TN residents
4. Patients Filling Buprenorphine Prescriptions for Medication Assisted Treatment, number and crude rate per 1,000 TN residents
5. Benzodiazepine Prescriptions Filled Overall and by Drug, number and crude rate per 1,000 TN residents
6. Patients Filling Benzodiazepine Prescriptions, number and crude rate per 1,000 TN residents
7. Percent of Patients Filling Prescriptions of Opioids for Pain of More than 90 or 120 Daily Morphine Milligram Equivalents (MME)
8. Multiple Provider Episodes, number and rate per 100,000 residents
9. Total MME for Opioids for Pain, number and crude rate per capita
10. Percent of Patients Prescribed Long-Acting/Extended Release Opioids who Were Opioid-Naïve for at Least 60 Days
11. Percent of Patient Prescription Days with Overlapping Opioid Prescriptions
12. Percent of Patient Prescription Days with Overlapping Benzodiazepine Prescriptions
13. Percent of Patients with Concurrent Opioid and Benzodiazepine Prescriptions Overlapping at Least 2 Days

Appendix B: Technical Notes

B1. Technical Notes: Tennessee Drug Overdose Deaths Indicator

Indicators	Drug Overdose Deaths in Tennessee, 2014-2018
Measures	1. [Table] Death Certificate Quality Indicators for Cause of Death Information, 2014-2018, page 14 2. Age-Adjusted Rates for All Drug Overdose Deaths by Sex and Race in TN by Year, page 16 3. Opioids, Benzodiazepines, and Stimulants Present in All Drug Overdoses in TN by Year, page 17 4. [Table] Polydrug Deaths in TN, page 18-19 5. Age-Adjusted Rates for Opioid Overdose Deaths in TN by Year, page 21 6. Age-specific Rates of Opioid Overdose Deaths in TN by Year, page 22 7. Age-specific Rates of Prescription Opioid Overdose Deaths in TN by Year, page 26 8. Age-specific Rates of Heroin Overdose Deaths in TN by Year, page 28 9. Age-specific Rates of Fentanyl Overdose Deaths in TN by Year, page 32 10. Age-Adjusted Rates for Opioid Overdose Deaths by Race and Sex in TN by Year, page 23 11. Age-Adjusted Rates for Prescription Opioid Overdose Deaths by Race and Sex in TN by Year, page 27 12. Age-Adjusted Rates for Heroin Overdose Deaths by Race and Sex in TN by Year, page 29 13. Age-Adjusted Rates for Fentanyl Overdose Deaths by Race and Sex in TN by Year, page 33 14. [Map] Percent Change in Number of Opioid Drug Overdose Deaths by TN County of Residence, 2017-2018, page 24-25 15. [Map] Percent Change in Number of Heroin Overdose Deaths by TN County of Residence, 2017-2018, page 30-31 16. [Map] Percent Change in Number of Fentanyl Overdose Deaths by TN County of Residence, 2017-2018, page 34-35 17. Age-Adjusted Rates for Stimulant Overdose Deaths in TN by Year, page 36 18. Age-Adjusted Rates for Stimulant Overdose Deaths by Race and Sex in TN by Year, page 37 19. [Map] Percent Change in Number of Stimulant Overdose Deaths by TN County of Residence, 2017-2018, page 38-39
Definition of Measures	Overdose deaths are determined by International Classification of Disease, 10th Revision (ICD10) codes listed as the underlying cause of death in the Death Statistical File. These codes are created by the National Center for Health Statistics from the cause of death text fields on death certificates. Contributing substances are generally determined by ICD10 codes in the multiple cause of death fields in the statistical file. Some causes of death cannot be determined by these codes and instead are derived from the cause of death text entered on the death certificate. Relevant ICD10 codes or literal text searches are listed below. All Drug Overdose – underlying cause of death code falls in one of the following ranges: • X40-X44 (Accidental poisoning by drugs) • X60-X64 (Intentional self-poisoning by drugs) • X85 (Assault by drug poisoning) • Y10-Y14 (Drug poisoning of undetermined intent) All Opioid Overdose – Meets all drug overdose criteria *and* contains at least one of the following codes as a contributing cause of death: • T40.0 (Acute poisoning by opium) • T40.1 (Acute poisoning by heroin) • T40.2 (Acute poisoning by natural or semi-synthetic opioids) • T40.3 (Acute poisoning by methadone) • T40.4 (Acute poisoning by synthetic opioids other than methadone) • T40.6 (Acute poisoning by other or unspecified narcotics)

Definition of Measures

Prescription Opioid Overdose – Meets all drug overdose criteria and contains at least one of the following codes as a contributing cause of death

- T40.2 (Acute poisoning by natural or semi-synthetic opioids)
- T40.3 (Acute poisoning by methadone)
- T40.4 (Acute poisoning by synthetic opioids other than methadone)
- Excluding fentanyl (assuming illicit)

Natural, Semi-Synthetic, or Methadone – Meets all drug overdose criteria and contains at least one of the following codes as a contributing cause of death:

- T40.2 (Acute poisoning by natural or semi-synthetic opioids)
- T40.3 (Acute poisoning by methadone)

Natural and Semi-Synthetic – Meets all drug overdose criteria and contains the following code as a contributing cause of death:

- T40.2 (Acute poisoning by natural or semi-synthetic opioids)

Synthetic (other than methadone) – Meets all drug overdose criteria and contains the following code as a contributing cause of death:

- T40.4 (Acute poisoning by synthetic opioids other than methadone)

Methadone – Meets all drug overdose criteria and contains the following code as a contributing cause of death:

- T40.3 (Acute poisoning by methadone)

Heroin – Meets all drug overdose criteria and contains the following code as a contributing cause of death:

- T40.1 (Acute poisoning by heroin)

Fentanyl – Meets all drug overdose criteria and contains text 'FENTAN' in written cause of death on certificate

Buprenorphine – Meets all drug overdose criteria and contains text 'BUPRE' OR 'NORPH' in written cause of death on certificate

Opioids and Benzodiazepines: Meets all opioid overdose criteria and contains the following code as a contributing cause of death

- T42.4 (Acute poisoning by benzodiazepines)

Cocaine: Meets all drug overdose criteria and

- T40.5 (Acute poisoning by cocaine)

Other stimulant: Meets all drug overdose criteria and

- T43.6 (Acute poisoning by psychostimulants)

Polydrug Overdose Deaths: Meets all drug overdose criteria and contains codes in more than one drug overdose class (opioid, benzodiazepine, muscle relaxant, other stimulant including methamphetamine, cocaine).Numbers are mutually exclusive.

Opioid

- T40.0 (Acute poisoning by opium)
- T40.1 (Acute poisoning by heroin)
- T40.2 (Acute poisoning by natural or semi-synthetic opioids)
- T40.3 (Acute poisoning by methadone)
- T40.4 (Acute poisoning by synthetic opioids other than methadone)
- T40.6 (Acute poisoning by other or unspecified narcotics)
- text 'FENTAN' in written cause of death on certificate
- text 'BUPRE' OR 'NORPH' in written cause of death on certificate

	Benzodiazepine • T42.4 (Acute poisoning by benzodiazepines) **Muscle Relaxant** • T48.1 (Acute poisoning by muscle relaxant) **Stimulant** • T43.6 (Acute poisoning by stimulant) **Cocaine** • T40.5 (Acute poisoning by benzodiazepines) Age/Race/Sex stratification • Age is determined according to date of birth and date of death. • Race and sex are reported on the death certificate. • Due to low numbers, decedents of unknown race, Native American, Alaskan Native, Asian or Pacific Islander or listed as unknown are not included in figures. The denominator for all rates is the state or county population in 100,000s. Age-adjustment is used for all fatal overdose rates except for those stratified by age. Age-adjusted rates were calculated using 2000 US 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. Percent change is calculated using the following formula: ((most recent number - earliest number)/earliest number) X 100. Percent change values should be interpreted with the caveat that the absolute change may be small, but the percent change value may be large. For example, a change from 1 death to 2 deaths is an absolute change of 1 overdose death, but a percent change of 100%. Alternatively, a change from 130 overdose deaths to 197 is an absolute change of 67 overdose deaths, but only a percent change of 51.5%.
Geographic Scale	Tennessee — Statewide, County
Time Period	2014 – 2018
Inclusion/ Exclusion Criteria	• Only Tennessee residents were considered • Tennessee residents who died of an overdose out of state are included • Includes only deaths determined to have been caused by acute poisonings
Data Sources	• Tennessee Death Statistical File, 2014-2018 • Population data for 2014-2018 was obtained from CDC Wonder bridged race populations 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	• Any indicator that relies on literal text for calculation is limited in cases where drug types are not reported on the certificate. In particular, death records of TN residents that occur out-of-state do not include cause of death text; literal text indicators cannot be determined for these deaths. • Determination of overdose deaths often requires autopsies and toxicology testing that is dependent on a county's resources and ability to conduct such investigations. Although a drug death may be suspected, it may not be entered as such on the death certificate and therefore cannot be coded with certainty by NCHS. Drug deaths that are coded with ICD10 code R99 (other ill-defined and unspecified causes of mortality) do not contribute to the counts.

B2. Technical Notes: Tennessee Non-Fatal Drug Overdose Hospital Discharge Indicators

Indicators	Drug Overdose Outpatient Visits and Inpatient Stays Rates among Tennessee Residents, 2014-2018
Measures	1. Age-Adjusted Rates for All Drug Overdose Outpatient Visits by Sex and Race in TN during 2016-2018, page 50-51. 2. Age-Adjusted Rates for All Drug Overdose Inpatient Stays by Sex and Race in TN during 2016-2018, page 52-53. 3. Age-Adjusted Rates for Heroin, Opioid Excluding Heroin, and Stimulant Overdose related Out patient Visits and Inpatient Stays in TN, during 2016-2018, page 55. 4. Age-Adjusted rates for Overdose related Outpatient Visits by Sex and Drug in TN, during 2016-2018, page 56. 5. Age-Adjusted Rates of Overdose Related Inpatient Stays by Sex and Drug Type in TN, during 2016-2018, page 58. 6. Age-Adjusted rates of Overdose Related Outpatient visits by Race and Type of Drug in TN, during 2016-2018, page 57. 7. Age-Adjusted Rates of Overdose Related Inpatient Stays by Race and Drug in TN, during 2016-2018, page 59. 8. Age-Specific Rates for Stimulant Overdose Outpatient Visits and Inpatient Stays by Age Groups in TN by Year, 2016-2018, page 66-67. 9. [Map] Change in number of Opioid Overdose Excluding Heroin Outpatient Visits from 2017-2018 by TN County of Residence, page 62-63. 10. [Map] Change in Number of Opioid Overdose Excluding Heroin Inpatient Stays from 2017-2018 by TN County of Residence, page 64-65. 11. [Map] Change in Number of Heroin Overdose Outpatient Visits from 2017-2018 by TN County of Residence, page 72-73. 12. [Map] Change in Number of Heroin Overdose Inpatient Stays from 2017 to 2018 by TN County of Residence, page 74-75. 13. Map] Change in Number of Stimulant Overdose (excluding caffeine) Outpatient Visits from 2017 to 2018 by TN County of Residence, page 68-69. 14. [Map] Change in Number of Simulant Overdose (excluding caffeine) Inpatient Stays from 2017 to 2018 by TN County of Residence, page 70-71.
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 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 (ICD), Clinical 10th revision codes. 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). Relevant codes for each revision are listed for each drug indicator definition below. ***Counts (numerator) or age-adjusted rates (numerator/denominator) definitions 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 o ICD-10-CM any mention of diagnosis codes: • T36-50 (poisoning by drugs, medicaments, and biological substances) with intent codes 1-4 (accidental, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)

- For rates:
  - Denominator – Yearly state/region/county population in 100,000s

Counts (numerator) or age-adjusted rates (numerator/denominator) definitions 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
  - ICD-10-CM
    - Inclusions: Any mention of 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 (accidental, 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.
- For rates:
  - Denominator – Yearly state/region/county population in 100,000s

Counts (numerator) or age-adjusted rates (numerator/denominator) definitions 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.
  - ICD-10-CM any mention of diagnosis codes:
    - T40.1X (poisoning by heroin) with intent codes 1-4 (accidental, intentional, assault, or undetermined) and encounter code A (initial encounter) or missing (not subsequent encounter or a sequela)
- For rates:
  - Denominator – Yearly state/region/county population in 100,000s

Counts (numerator) or age-adjusted rates (numerator/denominator) definitions for Stimulant 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.
  - ICD-10-CM any mention of diagnosis codes:
    T40.5X (Poisoning by cocaine),
    T43.60 (Poisoning by unspecified psychostimulants),
    T43.62 (Poisoning by amphetamines),
    T43.63 (Poisoning by methylphenidate),
    T43.64 (Poisoning by ecstasy),
    T43.69 (Poisoning by other psychostimulants),
    AND the intent is accidental/unintentional, intentional self-harm, assault, or undetermined intent (not adverse effects or underdosing)
    AND it is the initial or missing encounter (not subsequent encounter or sequela)
- For rates:
  - Denominator – Yearly state/region/county 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 Pacific Islander or listed as unknown are not included in figures

Age-adjustment is used for all non-fatal overdose rates except for those stratified by age. Age-adjusted rates were calculated using 2000 US standard population. 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.

Geographic Scale Tennessee — Statewide, County

Time Period	2014-2018
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, and chronic poisonings due the effects of drugs were excluded
Data Sources	• Tennessee Department of Health, Hospital Discharge Data System, 2016 to 2018 (2018 data is provisional). • This report relies on provisional data for 2018 as final data are not yet available. Future releases on hospital discharge overdoses from OIA may have updated indicator counts and rates. • Yearly population data for calculation of rates was obtained from CDC Wonder bridged race population estimates. See (https://wonder.cdc.gov/bridged-race- population.html) for more details.
General Limitations of the Measures	• 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, and chronic poisonings due the effects of drugs were excluded

B3. Technical Notes: Tennessee Opioid Prescription Indicators

Indicator	Opioid and Benzodiazepine Prescription Trends in Tennessee, 2014-2018
Measures	1. Number and Rate of Opioids, Benzodiazepine, and Gabapentin Prescriptions in TN by Quarter, page 90 2. Patients Receiving Opioids, Benzodiazepine, and Gabapentin Prescriptions in TN by Quarter, page 91 3. Prescription Rate (crude)* per 1,000 residents of Top 3 Most Prescribed Short-Acting Opioids for Pain in TN by quarter, page 92 4. [Map] Opioids for Pain Prescription Rate (crude) per 1,000 Residents by TN County of Residence, 2019, page 93 5. Payment Type Percentage for Opioid Prescriptions for Pain in TN by Quarter, page 94-95 6. Number of Opioid Prescriptions for Pain by Days' Supply in TN by Quarter, page 96 7. Patient rate (crude) per 1,000 residents receiving Opioids for Pain by Sex in TN by Quarter, page 98-99 8. Patient rate (crude) per 1,000 residents receiving Opioids for Pain by Age in TN by Quarter, page 98-99 9. [Table] Percentage of Patients Filling Opioids for Pain by Number of Active Prescription Days, page 100 10. Percentage of Patients Dispensed More than 90 Daily MME in TN by Quarter, page 101 11. Rate (crude) of Multiple Provider Episodes (per 100,000) Residents in TN by Half Year, page 97 12. Percent of Patients with Overlapping Opioid and Benzodiazepine Prescriptions in TN by Quarter, page 103 13. Prescription Rate (crude) per 1,000 Residents of Top 4 Most Prescribed Benzodiazepines in TN by Quarter, page 104 14. [Map] Benzodiazepine Prescription Rate (crude) per 1,000 Residents by TN County of Residence, 2019, page 106-107 15. Payment Type Percentage for Benzodiazepine Prescriptions in TN by Quarter, page 105 16. Number of Benzodiazepine Prescriptions by Days' Supply in TN by Quarter, page 110 17. Patient rate (crude) per 1,000 residents receiving Benzodiazepines by Sex in TN by Quarter, page 109 18. Patient rate (crude) per 1,000 residents receiving Benzodiazepines by Age in TN by Quarter, page 108 19. [Table] Percentage of Patients Filling Benzodiazepines by Number of Active Prescription Days, page 111 20. [Map] Gabapentin Prescription Rate (crude) per 1,000 Residents by TN County of Residence, 2019, page 112-113 21. Patient rate (crude) per 1,000 residents receiving Gabapentin by Sex in TN by Quarter, page 114 22. Patient rate (crude) per 1,000 residents receiving Gabapentin by Age in TN by Quarter, page 115
Definition of Measures	Number of opioid for pain, benzodiazepine, and gabapentin prescriptions in TN • After exclusions, a count of all prescriptions filled in each category as identified by the CDC's MME Conversion Table or TDH gabapentin table

Definition of Measures	Number of patients receiving opioid for pain, benzodiazepine, and gabapentin prescriptions in TN • Count of unique patients (after patient entity management) who filled at least one prescription for opioids for pain, benzodiazepines, or gabapentin Prescription rate (crude) per 1,000 residents of top 3 most prescribed short-acting opioids for pain in TN by quarter • *Numerator:* Number of prescriptions filled for top 3 most filled types of short-acting opioid analgesics • *Denominator:* Yearly state population in 1,000s Prescription rate (crude) per 1,000 residents of top 4 most prescribed benzodiazepines in TN by quarter • *Numerator:* Number of prescriptions filled for top 4 most filled types of benzodiazepines • *Denominator:* Yearly state population in 1,000s Rate (crude) per 1,000 residents for opioid for pain, benzodiazepine, and gabapentin prescriptions in TN by county, 2019 • *Numerator:* Number of prescriptions filled • *Denominator*: 2018 county population in 1,000s Percentage of opioid for pain and benzodiazepine prescriptions filled by payment type • *Numerator:* Number of prescriptions filled by specified payment type • *Denominator:* All opioid for pain or benzodiazepine prescriptions filled Number of opioid for pain or benzodiazepine prescriptions filled by days' supply • After exclusions, a count of all prescriptions for opioids for pain or benzodiazepines filled, categorized by the days' supply reported to the CSMD (excluding prescriptions reported as longer than 30 days) Rate of patients receiving opioid for pain, benzodiazepine, and gabapentin prescriptions per 1,000 in TN by sex • *Numerator:* Count of unique patients (after patient entity management) who filled at least one prescription for opioids for pain, benzodiazepines, or gabapentin who were reported to the CSMD as either male or female (excluding those with unknown or missing sex) • *Denominator:* Yearly state population by sex in 1,000s Rate of patients receiving opioid for pain, benzodiazepine, and gabapentin prescriptions per 1,000 in TN by age group • *Numerator:* Count of unique patients (after patient entity management) who filled at least one prescription for opioids for pain, benzodiazepines, or gabapentin, classified into age groups based on age at date filled • *Denominator:* Yearly state population by age group in 1,000s Active opioid and benzodiazepine prescription days by year for patients in the CSMD • For each patient in the CSMD, a count of the days in each year with an active pre scription (based on the date filled and the days' supply), separated into 6 categories of duration. For example, if a patient had two opioid for pain prescriptions of 10 days each but those prescriptions overlapped for a single day, they would be classified as having 19 active days for the year. A patient who had one 10 day opioid for pain prescription in February and one 10 day prescription in April would be classified as having 20 active days for the year. Active days are only counted for the year in which they were expect ed to occur.

	Percent of patients dispensed more than 90 daily morphine milligram equivalents in TN • *Numerator:* Number of unique patients with filled prescriptions for opioid analgesics of more than 90 or 120 daily MME for all days prescribed in a quarter (may include single >90 or >120 prescriptions or multiple overlapping prescriptions) Rate (crude) of multiple provider episodes per 100,000 residents in TN • *Numerator:* Number of unique patients who filled prescriptions from 5 distinct prescribers and at 5 distinct dispensers within one half of the year (Jan 1 – June 30 or July 1 – Dec 31) • *Denominator:* Yearly state population in 100,000s Percent of patients with overlapping opioid and benzodiazepine prescriptions • *Numerator:* Number of unique patients who have a benzodiazepine prescription that overlaps an opioid prescription • *Denominator:* Number of unique patients with filled prescriptions for any opioids for pain Note: Prescription dates, based on date of prescription fill and days' supply, are used to determine which prescriptions overlap
Geographic Scale	Tennessee — Statewide and County
Time Period	2015 –2019
Inclusion/ Exclusion Criteria	• Only Tennessee residents were considered • Only opioids and benzodiazepines in DEA schedules II, III, and IV were included, all gabapentin was included • Only drugs identified in the CDC's 2018 MME Conversion Table or TDH's gabapentin table were considered ▪ Type of opioid or benzodiazepine and short or long acting nature of opioids identified by the CDC's 2018 MME Conversion Table ▪ Opioid prescriptions were separated into two categories: opioids FDA label indicated for pain (analgesics) and opioids FDA label indicated for medication assisted treatment (MAT) ▪ Gabapentin information was collected from IBM Red Book and prepared for analysis • Prescriptions with zero or implausibly high quantities were excluded • Prescriptions with zero or implausibly high days' supply were excluded
Data Sources	• Tennessee Controlled Substance Monitoring Database (CSMD) • CDC's 2018 MME Conversion Table, TDH gabapentin table • Population data for 2015-2018 was obtained from CDC Wonder bridged race populations 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). Estimated rates for 2019 use the 2018 population because 2019 estimates were not available at the time of publication.

General Limitations of the Measures	• Prescriptions that were written but not filled by the patient are not tracked in the CSMD. The CSMD provides a reasonably accurate measure of the amount of controlled substances dispensed in TN, but may not capture the full extent of prescribing practices. • The CSMD does not have information on patient behavior beyond filling prescriptions. Measures are calculated with the assumption patients take their medications as prescribed. Patients may choose not to take their medication or may share medications with others. • The CSMD does not include information about diagnoses or the indicated use for all prescriptions. Measures are calculated with the assumption medications are prescribed for their FDA-label indicated uses (e.g., pain treatment or medication-assisted treatment for opioid use disorders). Off-label use cannot be determined. • Opioid and benzodiazepine prescriptions were identified in the CSMD through the use of the CDC's MME Conversion Table which may not capture all opioid or benzodiazepine prescriptions. The CDC MME table includes most but not all controlled substances dispensed in TN. • The CSMD does not include all controlled substances provided as treatment to patients. Notable exceptions include methadone used for treatment, buprenorphine for medication-assisted treatment provided in office based outpatient treatment settings, and drugs used in inpatient settings which are not monitored by the CSMD. • The CSMD's patient records contain numerous duplicate patients that must be consolidated using a unique patient identifier across records identified as belonging to a single person. Analyses for this report used a simple deterministic approach to identify unique patients that involved matching first name, last name, and date of birth. This simple data linkage approach results in a small overestimate of the number unique patients, and we are continually improving patient identification techniques to improve indicator calculation. • A small proportion of prescriptions reported to the CSMD are for veterinary patients. These patients are not explicitly excluded from calculations and may have small impacts on the data presented here. • TN residence and county of residence were determined by patient address listed in the CSMD's patient records. Patient addresses may not be accurate when pharmacy patient records are not updated or if patients give inaccurate information. If valid street address information was unavailable, counties were assigned according to city and zip code. TN patients whose county could not be identified were given assigned county "Unknown".

Appendix C: List of OIA Journal Publications

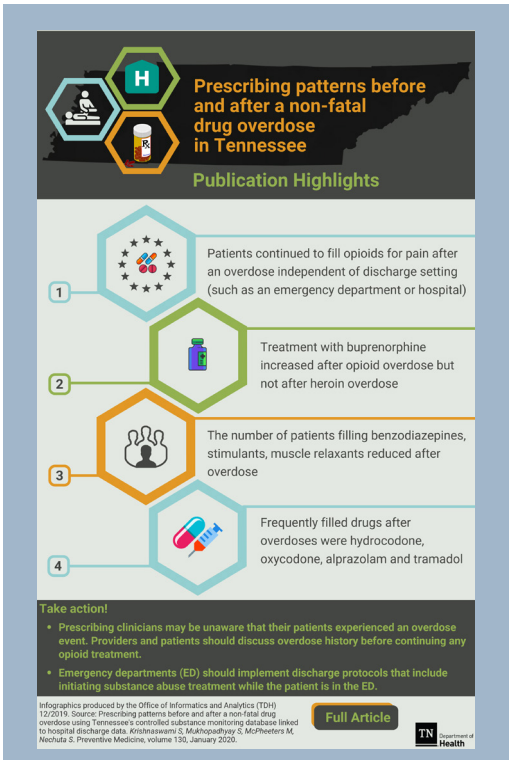
1. Prescribing patterns before and after a non-fatal drug overdose using Tennessee's controlled substance monitoring database linked to hospital discharge data. S. Krishnaswami, Sutapa Mukhopadhyay, Melissa McPheeters, Sarah J. Nechuta, Preventive Medicine 130 (2020) 105883

2. Record linkage approaches using prescription drug monitoring program and mortality data for public health analyses and epidemiologic studies. Nechuta, Sarah; Mukhopadhyay, Sutapa; Krishnaswami, Shanthi; Golladay, Molly; McPheeters, Melissa. Epidemiology, January 2020, volume 31, issue 1, p22-31

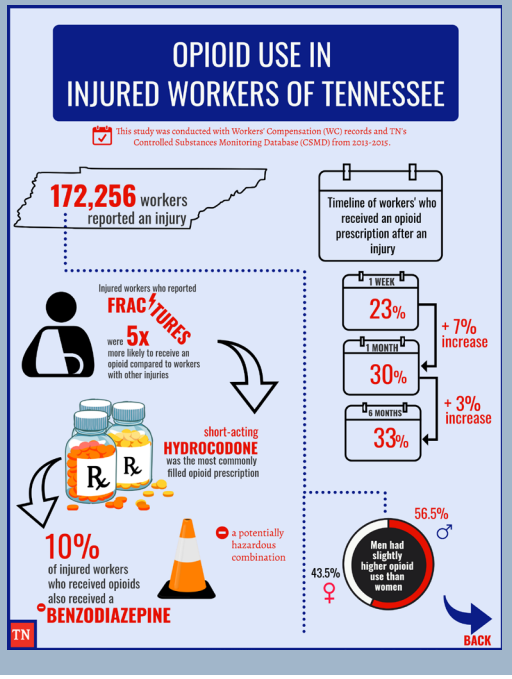
3. Prevalence and Risk Factors Associated with Long-term Opioid Use after Injury among previously Opioid-free Workers. Zoe Durand, Sarah Nechuta, Shanthi Krishnaswami, Eric L. Hurwitz, Melissa McPheeters, JAMA Network Open. 2019; 2(7):e197222. doi:10.1001/jamanetworkopen.2019.7222

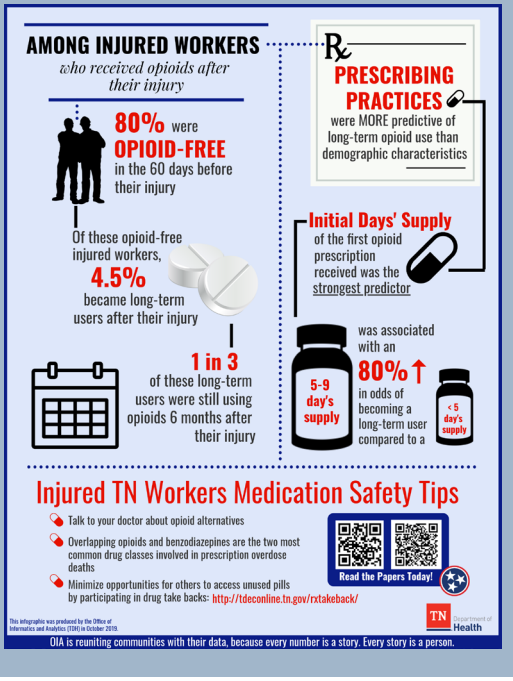
4. Prescription opioid use by injured workers in Tennessee: a descriptive study using linked statewide databases. Zoe Durand, Sarah Nechuta, Shanthi Krishnaswami, Eric L. Hurwitz, Melissa McPheeters, Annals of Epidemiology 32 (2019) 7-13

5. Sociodemographic factors, prescription history and opioid overdose deaths: a statewide analysis using linked PDMP and mortality data. Sarah J. Nechuta, Benjamin D. Tyndall, Sutapa Mukhopadhyay, Melissa L. McPheeters, Drug and Alcohol Dependence 190 (2018) 62-71



Check out the infographic created for the paper (#1) published on the prescribing patterns before and after a non-fatal overdose.



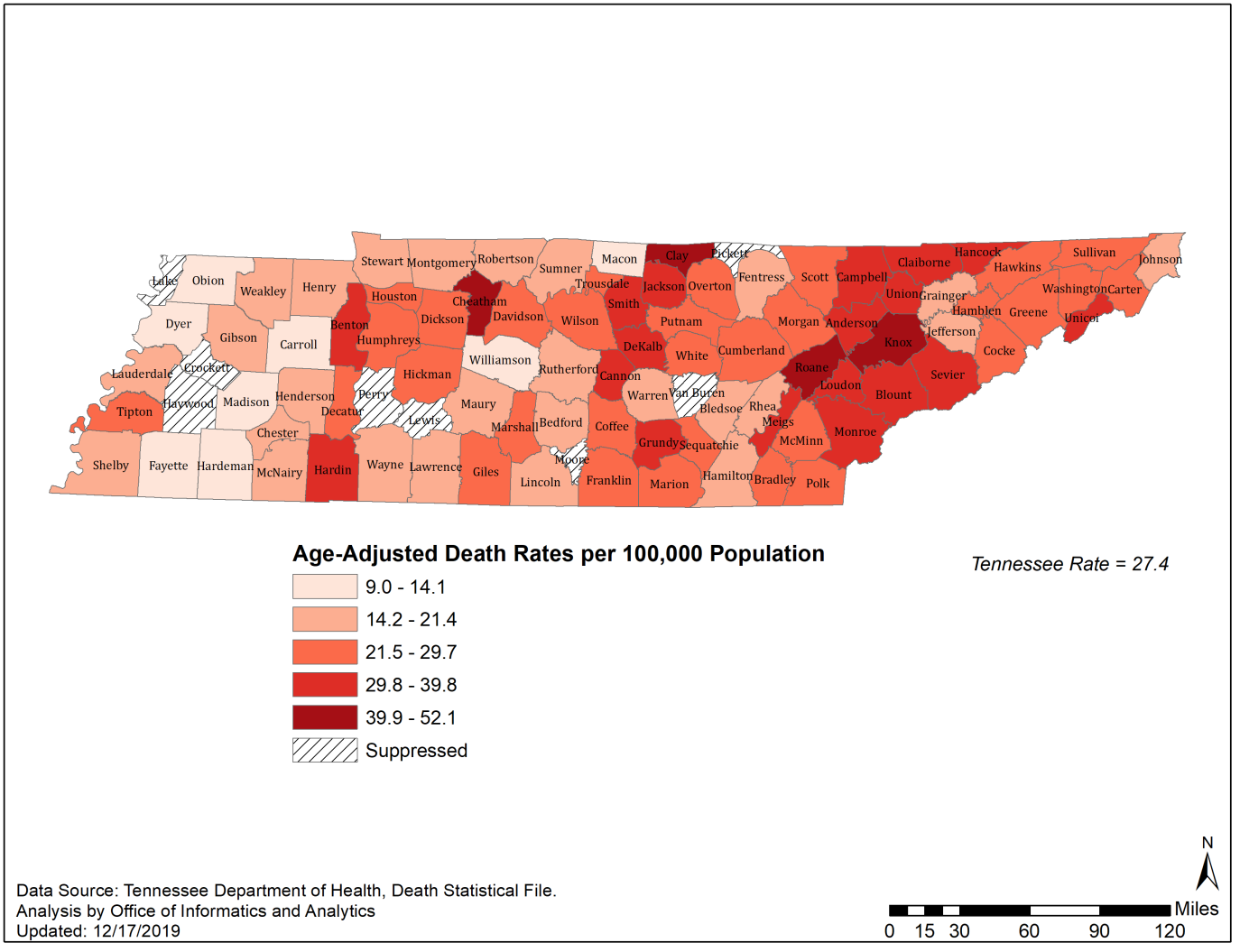


The infographic on the left was created for the two papers published by OIA focusing on opioid use in injured workers of Tennessee (#3 and #4).

Appendix D: Supplemental Materials

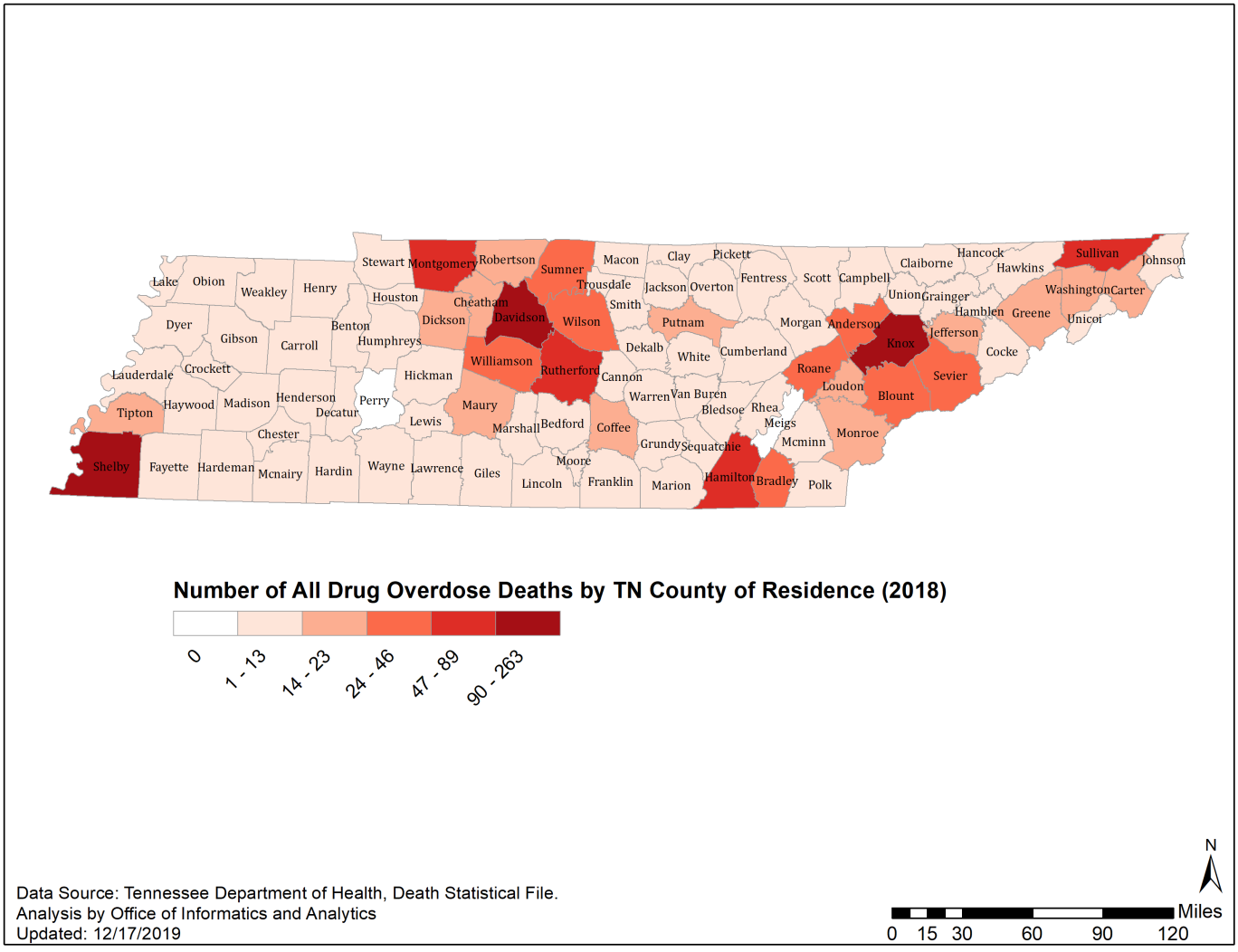
The following are supplemental charts and maps from the Tennessee Drug Overdose Deaths section.

Age-Adjusted Death Rates for All Drug Overdose by TN County of Residence, 2014-2018*



* Counties with fewer than 11 deaths have been suppressed

Number of All Drug Overdose Deaths by TN County of Residence, 2018



Data Source: Tennessee Department of Health, Death Statistical File.
Analysis by Office of Informatics and Analytics
Updated: 12/17/2019

Polydrug Overdose Counts by Drug Type in TN, 2018

Polydrug Overdose Count by Drug Type 2018 (Opioid)	
Drug	**Opioid**
Heroin	367
Fentanyl	740
Benzodiazepine	354
Psychostimulant	281
Cocaine	174

Polydrug Overdose Count by Drug Type 2018 (Heroin)	
Drug	**Heroin**
Opioid	367
Fentanyl	248
Benzodiazepine	83
Psychostimulant	76
Cocaine	68

Polydrug Overdose Count by Drug Type 2018 (Fentanyl)	
Drug	**Fentanyl**
Heroin	248
Opioid	740
Benzodiazepine	137
Psychostimulant	181
Cocaine	130

Polydrug Overdose Count by Drug Type 2018 (Cocaine)	
Drug	**Cocaine**
Heroin	68
Fentanyl	130
Benzodiazepine	39
Psychostimulant	42
Opioid	174

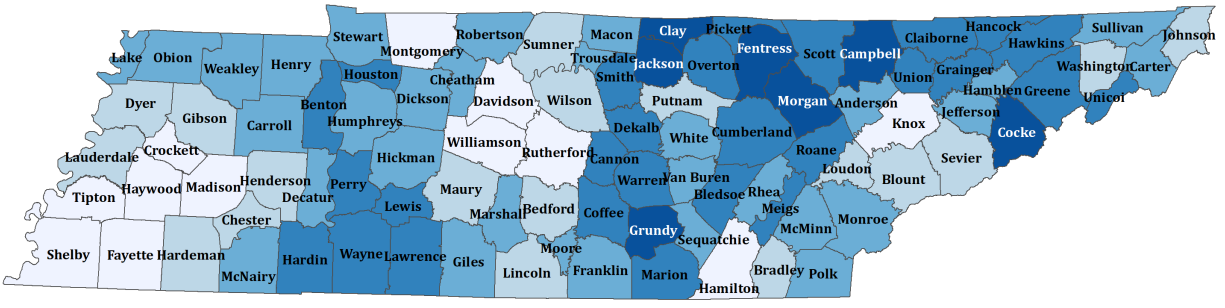
Polydrug Overdose Count by Drug Type 2018 (Benzodiazepine)	
Drug	**Benzodiazepine**
Heroin	83
Fentanyl	137
Opioid	354
Psychostimulant	63
Cocaine	39

Polydrug Overdose Count by Drug Type 2018 (Other Stimulant)	
Drug	**Other Stimulant**
Heroin	76
Fentanyl	181
Benzodiazepine	63
Opioid	281
Cocaine	42

Polydrug counts are given by drug type and are not mutually exclusive.

The following is a supplemental map from the Tennessee Prescription Trends section.

Morphine Milligram Equivalent (MME) of Opioid Prescriptions for Pain Per Capita in TN, 2019



MME of Opioid Prescribed for Pain Per Capita in 2019

243.3 - 553.9
554.0 - 751.0
751.1 - 975.6
975.7 - 1225.2
1225.3 - 1787.1

Data Source: Tennessee Department of Health, Controlled Substance Monitoring Database.
Analysis by Office of Informatics and Analytics.
Updated:1/23/2020

N

0 20 40 80 120 160
Miles

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TENNESSEE'S DRUG OVERDOSE ANNUAL REPORT

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