

Neonatal Abstinence Syndrome Surveillance Annual Report 2019



Nyakeriga AM and McDonald M
Tennessee Department of Health
Division of Family Health and Wellness

A Note to the Reader:

In some cases (particularly in looking at data at the regional level), the counts included in this report are small and therefore may be statistically unreliable. Therefore, readers should interpret all findings with caution. We especially encourage caution in interpreting findings and comparing differences across regions.

If you have questions about particular data points or need assistance in interpreting the data, please contact Alice M. Nyakeriga, PhD, MPH.

Phone: (615) 253-2655

Email: alice.nyakeriga@tn.gov

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Executive Summary

The dramatic increase in maternal opioid use in the US and Tennessee from 2000-2017 paralleled a ten-fold increase in incidence of babies born with Neonatal Abstinence Syndrome (NAS) in Tennessee. NAS is a group of conditions caused when a newborn withdraws from certain drugs, often opioids, used during pregnancy. The Tennessee Department of Health (TDH) established NAS as a reportable condition on January 1, 2013. Since then Tennessee had seen annual increases in the number of cases of NAS until CY2018, which marked the first decrease in the number of cases.

During the CY2019 surveillance period, 808 cases of NAS were reported to the TDH surveillance portal. This marked a decrease in the rate of cases of NAS per 1,000 live births for a second consecutive year. This encouraging observation highlights the statewide collaborative efforts to curb the opioid epidemic and the associated number of cases of NAS. TDH will continue to monitor NAS, with the hope that rates will continue to drop.

Key Findings

- The number of cases of NAS decreased 15.0% from 949 in 2018 to 808 in 2019.
- The rate of cases of NAS per 1,000 live births decreased from 11.7 in 2018 to 10.0 in 2019.
- The proportion of cases of NAS remained higher in males (55.3%) than females (44.7%) in 2019.
- The majority of cases of NAS (65%) involved Medication Assisted Treatment (MAT).
- The geographic distribution of cases of NAS varied across the counties of Tennessee. Counties in the east of Tennessee had the highest rate (68.6 cases of NAS per 1,000 live births).
- Exposure to various substances varied across geographic regions:
 - Exposure to prescription medication was highest in East Tennessee (with 71.9% of NAS cases) being lowest in West Tennessee at 15.1% in Shelby county. On the other hand, over 50% of NAS cases were exposed to illicit substances in Shelby county compared to less than 30% in East Tennessee.
 - There was an increase in NAS cases exposed to illicit substances from 25% in 2018 to 29% in 2019.

The high percentage of infants diagnosed with NAS with exposure to prescribed medications still points to the ongoing need for primary prevention of NAS—preventing substance misuse/abuse among women of childbearing age, and preventing unintended pregnancies among women at risk of misusing/abusing substances. Further, this report underlines the need for continued targeted preventive measures in counties/regions with the highest burden of cases of NAS.

Introduction

Neonatal Abstinence Syndrome (NAS) is a condition in which an infant undergoes withdrawal from a substance to which he or she was exposed in-utero. Different classes of substances, including opioids, antidepressants and barbiturates, may cause NAS when used during pregnancy. The most common substances causing NAS are opioids. This can include legally prescribed opioids (such as pain relievers like morphine and medication assisted treatment opioids such as buprenorphine and methadone) or illegally obtained opioids, e.g., heroin. In addition, a pregnant woman may obtain a substance through drug diversion, i.e. transfer of legally prescribed controlled substance from the individual for whom it was prescribed to another person for any illicit use,

Since the early 2000s, the incidence of NAS in Tennessee increased by 10-fold, far exceeding the national 3-fold increase over the same time period. A sub-cabinet working group focused on NAS and consisting of Commissioner-level representation from the Departments of Health, Children's Services, Mental Health and Substance Abuse Services, Medicaid (TennCare), Safety and the Children's Cabinet convened from 2012 to 2019. This group aligned efforts across state agencies, with a focus on upstream (primary) prevention strategies.

In 2013, Tennessee became the first state in the nation to require reporting of NAS for public health surveillance purposes. Providers are required to report all diagnoses of NAS within 30 days of diagnosis. This report provides an analysis of data reported to TDH during CY2019.

Statewide Data

Highlights: Statewide Reporting

In CY 2019:

- The number of cases decreased from 949 in 2018 to 808.
- More males were diagnosed with NAS than females.
- The rate of cases of NAS decreased from 11.7 in 2018 to 10.0 per 1,000 live births.

Case Reports

During CY2019, providers reported 808 cases of NAS to the surveillance portal. An additional 72 cases of infants with *in-utero* drug exposure but no clinical signs of withdrawal were also reported; these infants are not included in this analysis as clinical withdrawal is the definitive characteristic of NAS.

The majority of cases (94.6%; n=764) were reported by the baby's birth hospital, and 5.4% (n=44) were reported after the baby was transferred to another facility.

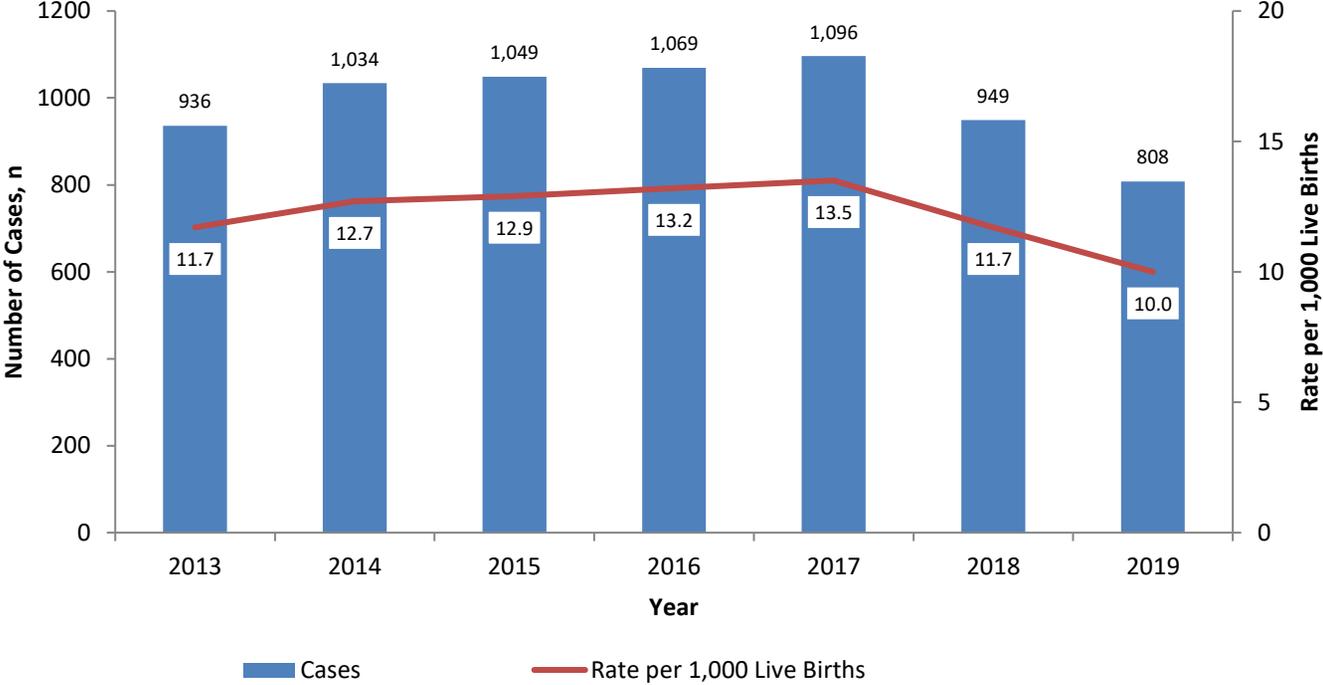
Reported cases of NAS were more likely to be male than female (55.3% versus 44.7%; $p < .01$). This finding is consistent with previous years of NAS Surveillance data, as well as published literature.^{1, 2}

The Tennessee Department of Health (TDH) requires that all cases of NAS be reported within 30 days of diagnosis. In 2019, the average length of time between the date of birth and date of reporting was 30.6 days (range 0-230 days), with 62.0% of cases being reported within 30 days of birth.

Number and Rate of Cases

In 2019, 1.0% (n=808) of live births were diagnosed with NAS, a slight decrease from 1.2% of live births (n=949) in 2018 (*See Technical Note*) (**Figure 1**). This is the second consecutive year with a decrease in the number of cases reported since surveillance began in 2013.

NAS Rate by Year Tennessee, 2013-2019



Source: Neonatal Abstinence Syndrome Surveillance System, Tennessee Department of Health.

Figure 1: Number of Cases of Neonatal Abstinence Syndrome as a Percentage of Live Births, Tennessee 2013-2019.

Source of Exposure for NAS Infants

Highlights: Source of Exposure
In CY 2019: <ul style="list-style-type: none">• 65.0% of infants diagnosed with NAS were exposed to Medication Assisted Treatment (MAT) for treatment of substance use disorder.• 76.7% of infants diagnosed with NAS were exposed to at least one legally prescribed medication.• 94.2% of NAS infants with exposure to only prescription drugs were exposed to MAT.

Source of Exposure

The NAS Surveillance System collects nine categories of substances to which an infant was exposed (**Figure 2**). Individual cases could have been exposed to multiple substances, therefore percentages may sum to greater than 100%. Consistent with previous years' data, the majority of infants were exposed to medications used to treat substance use disorders (medication assisted treatment, MAT; 65.0%). In 2019, 26.5% of infants were exposed to diverted prescription opioid medications, and 11.0% were exposed to diverted prescription non-opioid medications.

When categorized into mutually exclusive categories of exposure (**Table 1**), 76.7% of NAS infants were exposed to at least one prescription medication with 49.4% of cases exposed to prescription medications only, and 20.5% exposed to a mix of prescription and illicit or diverted drugs (**Figure 3**). Another 29.1% were exposed only to illicit or diverted drugs. The remainder (1.0%) had no known exposure, or exposure information was not reported.

Since 2013, there has been a statistically significant increase overall in the percentage of NAS cases exposed only to prescription medications ($p < 0.01$; **Figure 3**), though there was a slight decrease in 2018 and 2019. There was an increase in the proportion of cases exposed to illicit drugs or diverted medications in 2018 and 2019, after two years of decrease. This increase resulted in a non-significant trend over time ($p = 0.10$).

Of those infants with exposure only to prescription medications (**Figure 4**), most (94.2%) were exposed to medication assisted treatment. This percentage was an increase since 2016, though the overall percentage of infants exposed to MAT has decreased (**Figure 2**). There was a slight decrease in the proportion of cases of NAS involving prescription medications only. Another 6.8% of prescription only exposures were to legal non-opioid medications, and 6.5% were to legal opioid medications (**Figure 4**).

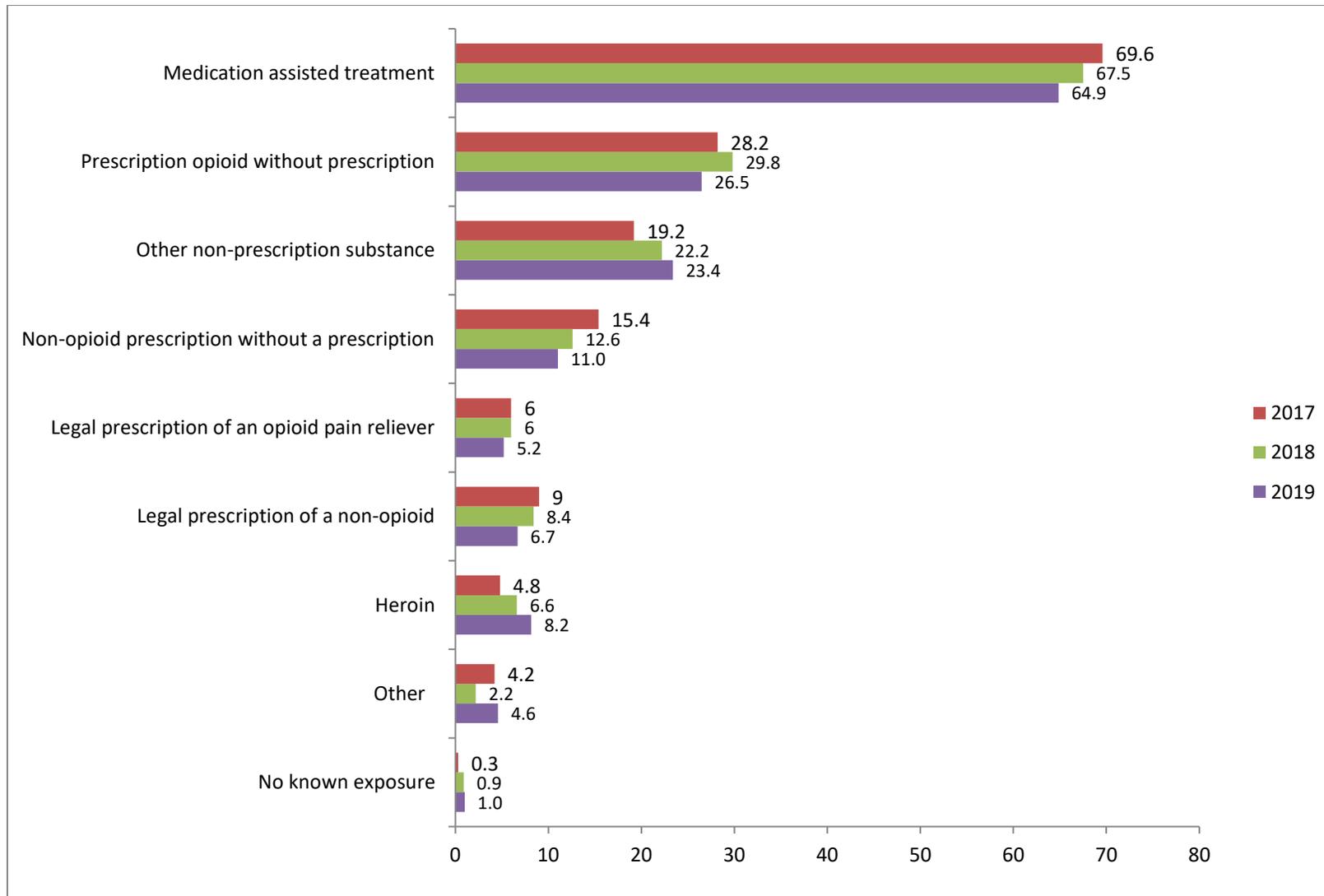


Figure 2: Non-mutually Exclusive Sources of Exposure for NAS Cases, 2017-2019.

Table 1: Derivation of Mutually Exclusive Categories of Exposure from Individual Exposures

Prescription Medications Only	Illicit Drugs or Diverted Medications Only	Combination of Prescription Medications and Illicit Drugs/ Diverted Medications	Unknown
<p>Exposure to one or more of the following ONLY:</p> <ul style="list-style-type: none"> • Medication Assisted Treatment (MAT) • Legal prescription of an opioid pain reliever • Legal prescription of a non-opioid medication 	<p>Exposure to one or more of the following ONLY:</p> <ul style="list-style-type: none"> • Prescription opioid medication obtained without a prescription • Non-opioid prescription medication obtained without a prescription • Heroin • Other non-prescription drug 	<p>At least one medication from “Prescription Medications Only”</p> <p>AND</p> <p>At least one substance from “Illicit Drugs or Diverted Medications Only”</p>	<p>“No known source of exposure but clinical signs consistent with NAS” was selected at time of report</p> <p>OR</p> <p>No exposure options were selected at time of report</p>

Mutually Exclusive Sources of Exposure, NAS 2015-2019

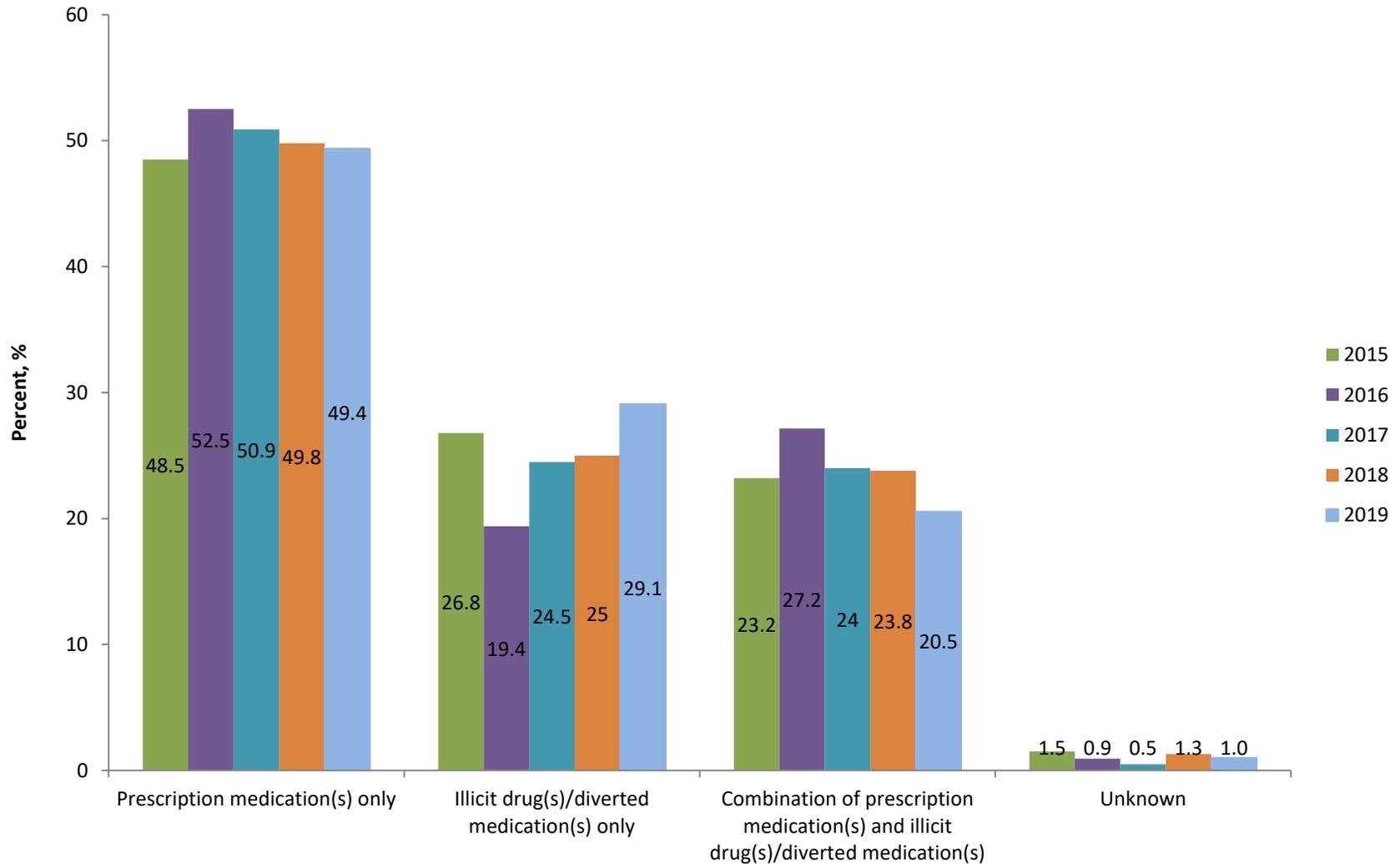


Figure 3: Mutually Exclusive Sources of Exposure for Neonatal Abstinence Syndrome Cases, Tennessee 2015-2019.

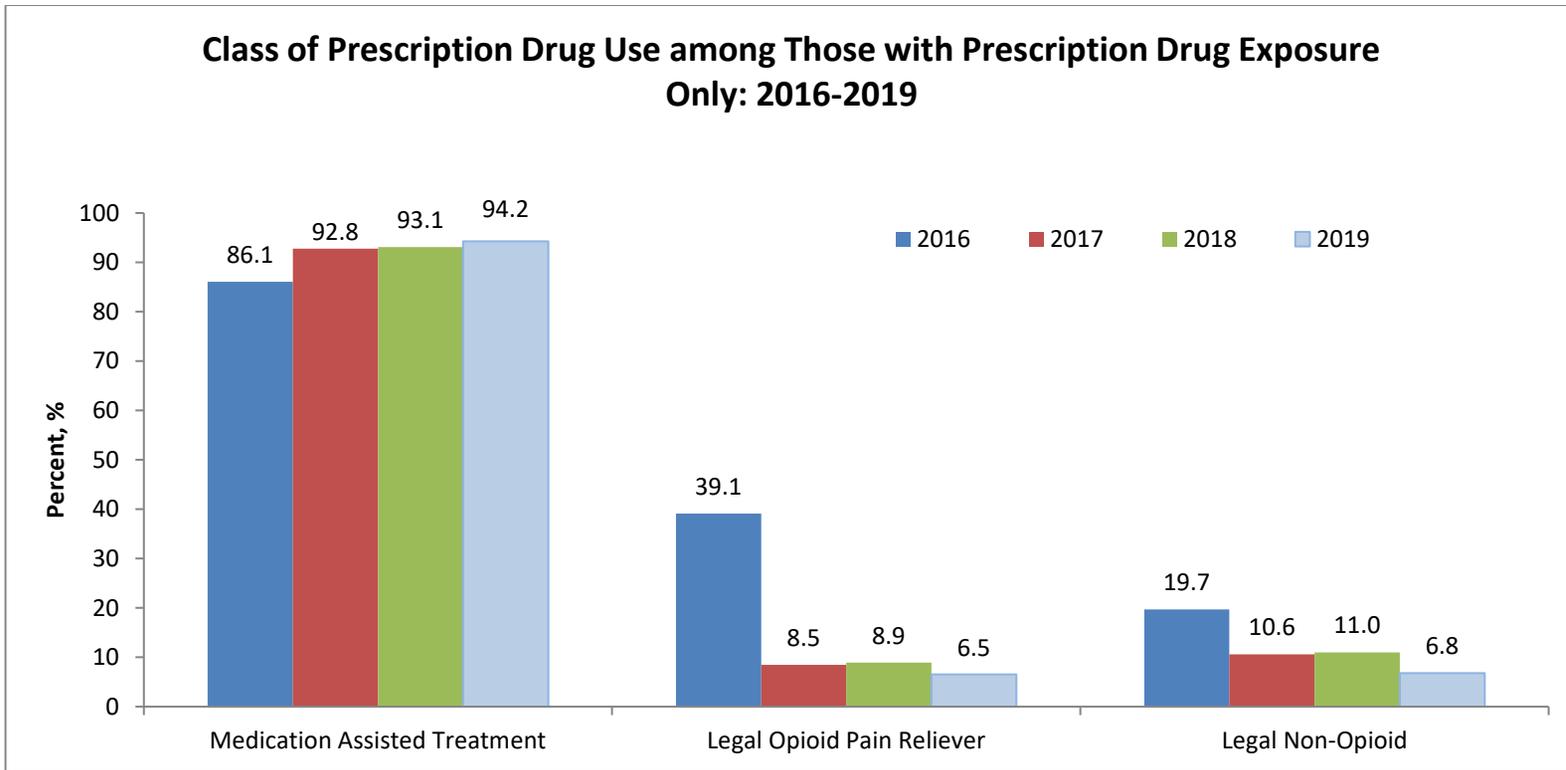


Figure 4: Class of Prescription Drug Use Among Those with Prescription Medication Exposure Only, 2016-2019.

Regional Data

Highlights: Regional Trends for NAS

In CY 2019:

- Overall, rates of cases of NAS increased when moving from west to east across Tennessee.
- Patterns of exposure source varied, with prescription only exposures being most common in East Tennessee, and illicit drug only exposure being most common in West Tennessee.

NAS Incidence by Region

Rates of cases of NAS varied by health region. Rates of NAS cases were lowest in West Tennessee and increased in an easterly fashion (**Figure 5**). Generally, most regions saw a decrease in the rate of cases of NAS in 2019, when compared to 2018 (**Figure 6**). The East Health Region and Upper Cumberland Region showed a statistically significant decrease in the rate of cases of NAS over time ($p < 0.05$ for both). However, South Central Region and Shelby County had an increase in the number and rate of cases of NAS in 2019 from 2018, with an overall significant increase in the rate over time ($p < 0.05$ for both).

Decreases in the rate of cases of NAS were also observed at the county level. In 2019, nineteen counties did not report any cases of NAS. Data were suppressed for 52 counties because of the small number of cases in each county that could lead to concerns about privacy or statistical validity. From 2016-2019 (**Figure 7 - Figure 10**), rates of cases of NAS in the western portion of the state have continued to decrease or remain low (lighter shades or suppressed). Similarly, many counties in West and South Central Health Regions were suppressed. In the eastern part of Tennessee, the rate of cases of NAS remained high, though there were fewer counties in the darkest shade.

Exposure Source by Region

Geographic variation in the substance causing NAS was noted (**Figure 11 & 12 A-D**). Similar to the geographic distribution of the rate of cases of NAS, exposure to prescription medications increased from West Tennessee to East Tennessee (Figure 12A). In East Tennessee, exposure to prescription medications represented 71.9% of cases of NAS in the North East Health Region and 67.1% in Sullivan County, yet only 15.1% and 34.8% in Shelby County and the West Health Region, respectively. Exposure to only illicit drugs is more

common in West Tennessee (over 50% in Shelby County and 40% West Health Region), and least common in East Tennessee (Figure 12C). Overall, the distribution of prescription and illicit/diverted drug combination remained similar from west to east Tennessee (Figure 12B).

Exposure to medication assisted treatment (MAT) varied geographically, ranging from 34% in West Tennessee (Shelby County, West Health Region) to 79.5% in the East Health Region (Figure 13).

In 2019, the use of legally obtained medications was less common statewide (with an average of 5.4%, range of 0-20.3%, for opioid medications and an average of 5.3%, range of 0-12.5% for non-opioid medications), though nearly 20% of cases in the South Central Health Region were exposed to legally obtained opioids (Figure 14). The west to east geographic gradients seen with other exposure categories is less evident with diverted medications. However, exposure to diverted opioid medications was more common than diverted non-opioid medications. The highest proportion of cases of NAS exposed to diverted opioids were observed in Shelby, Davidson and Knox Counties, and the Mid-Cumberland Health and the East Health Regions (Figure 15). Although heroin is the source of exposure for less than 10% of cases of NAS (n=66) overall, 37.4% of cases of NAS in Shelby county were exposed to heroin (Figure 16). Exposure to other illicit substances varied across the state; the prevalence was highest in the South East and West Health Regions and Shelby and Hamilton Counties.

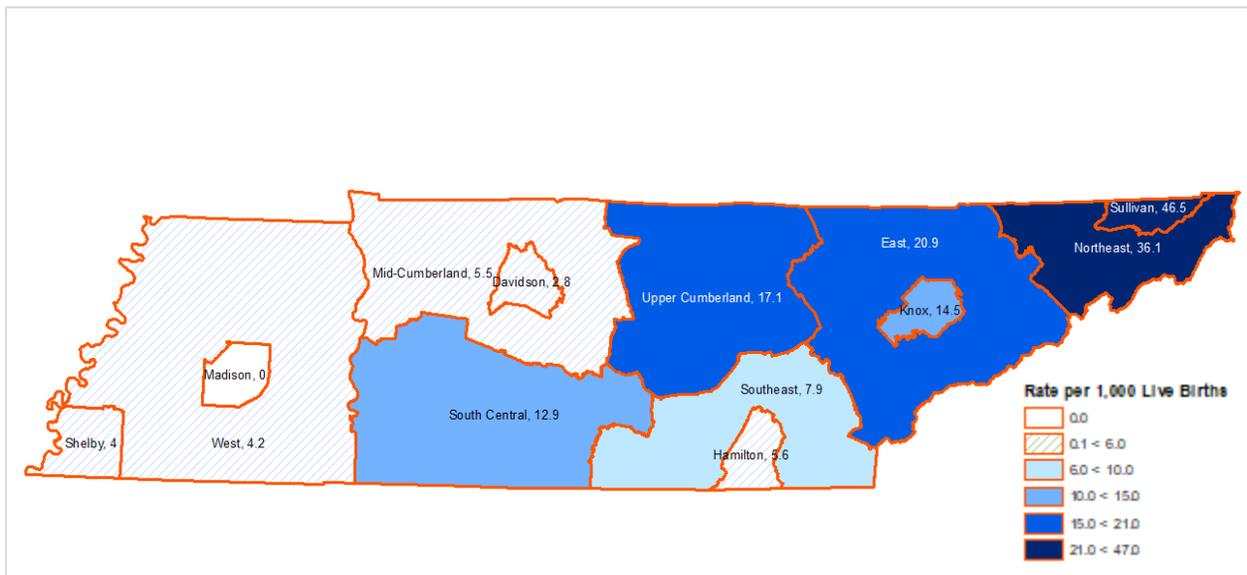


Figure 5: Rate per 1,000 Live Births of NAS Cases by TDH Health, 2019

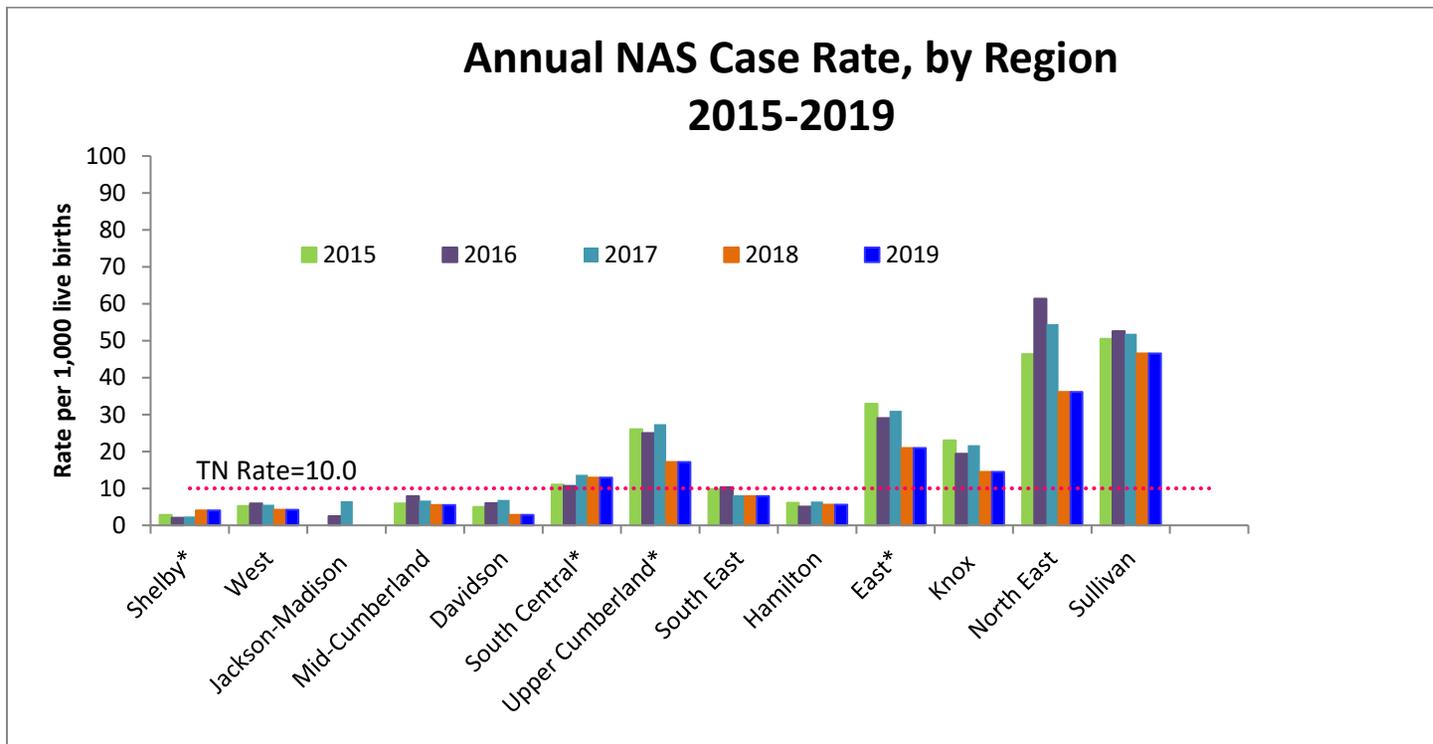


Figure 6: NAS Rates by TDH Health Region, 2015-2019.

*: Regions/counties with statistical significant trends over the years.

Note: Counties with 1-9 cases were suppressed.

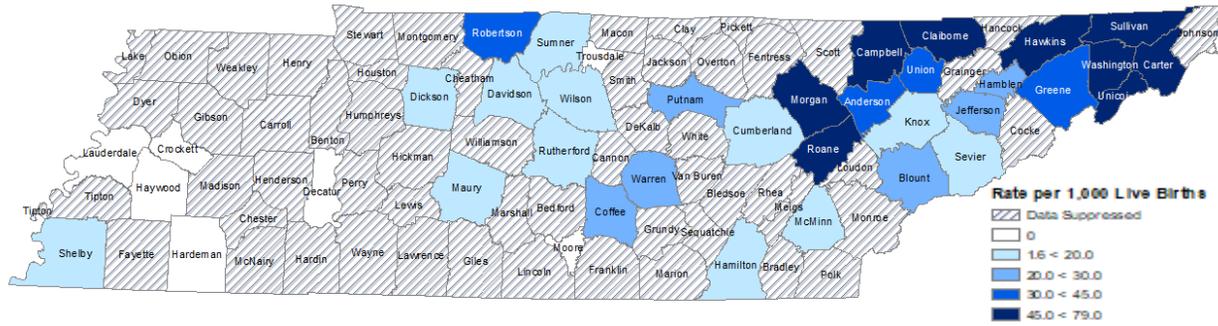


Figure 7: Rate of NAS Cases by County, 2016

Note: Counties with 1-9 cases were suppressed.

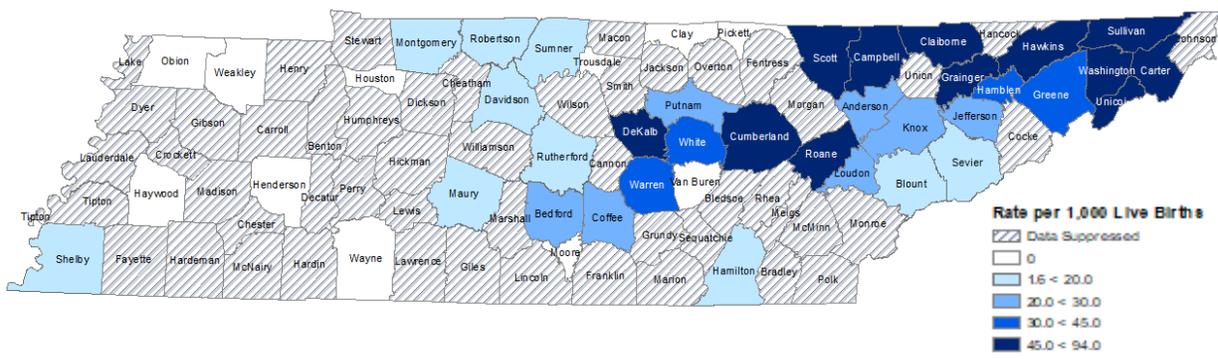


Figure 8: Rate of NAS Cases by County, 2017

Note: Counties with 1-9 cases were suppressed.

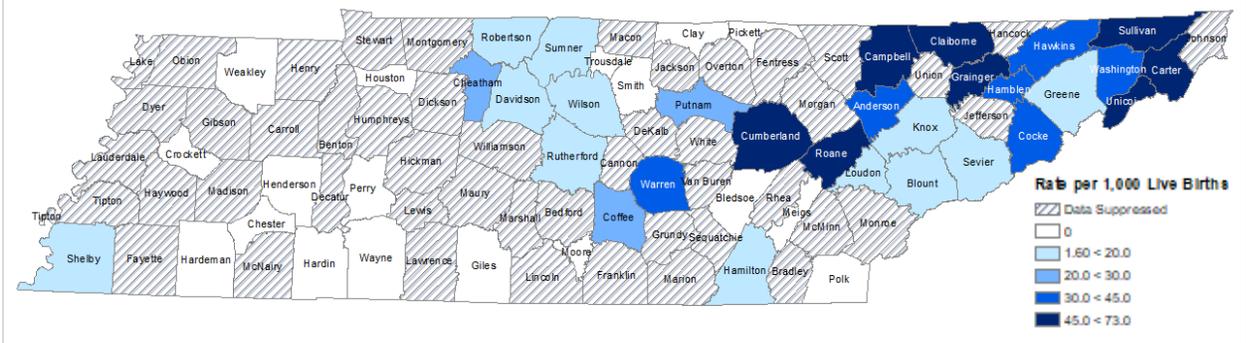


Figure 9: Rate of NAS Cases by County, 2018

Note: Counties with 1-9 cases were suppressed.



Figure 10: Rate of NAS Cases by County, 2019

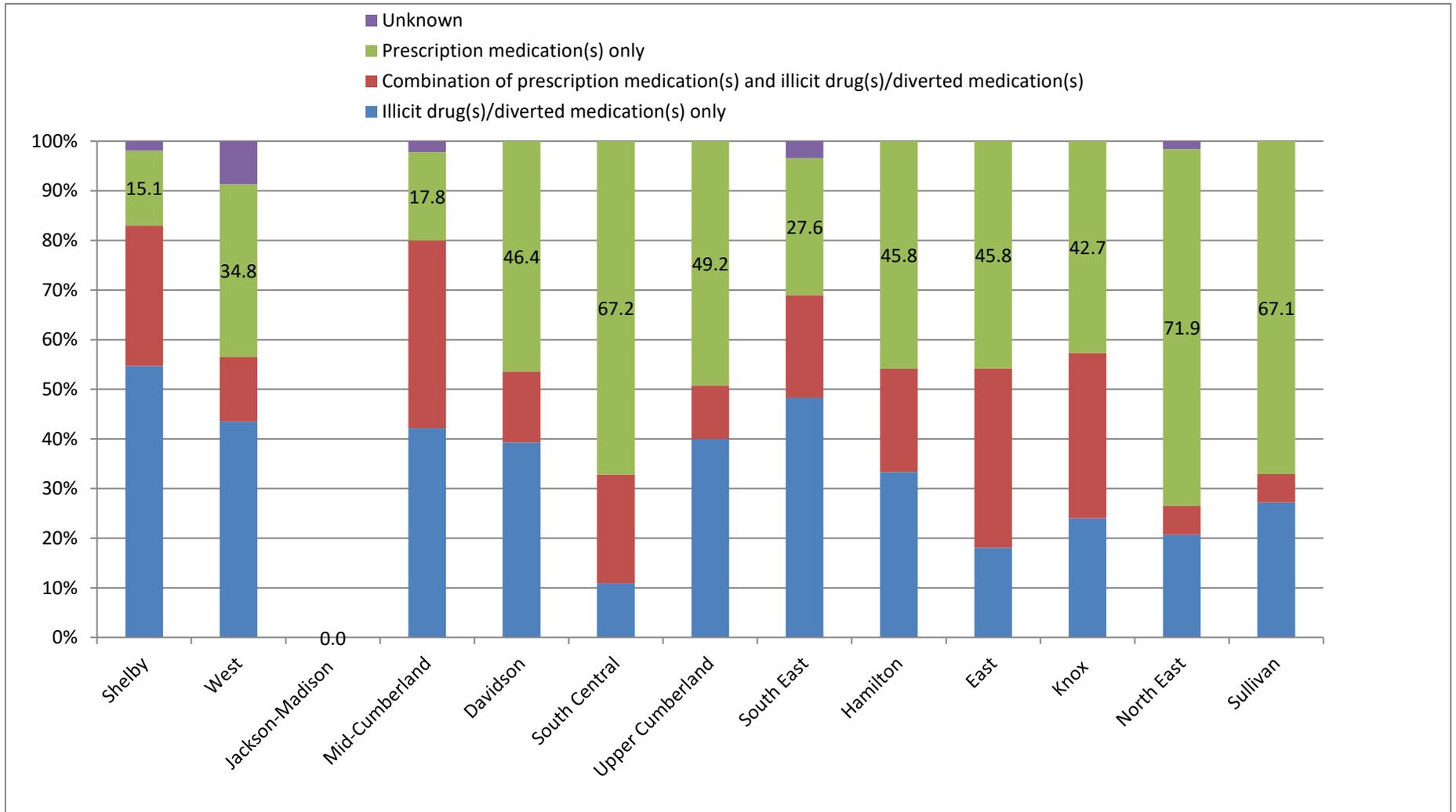


Figure 11: Distribution of Mutually Exclusive Sources of Exposure by Health Region for Neonatal Abstinence Syndrome Cases, 2019

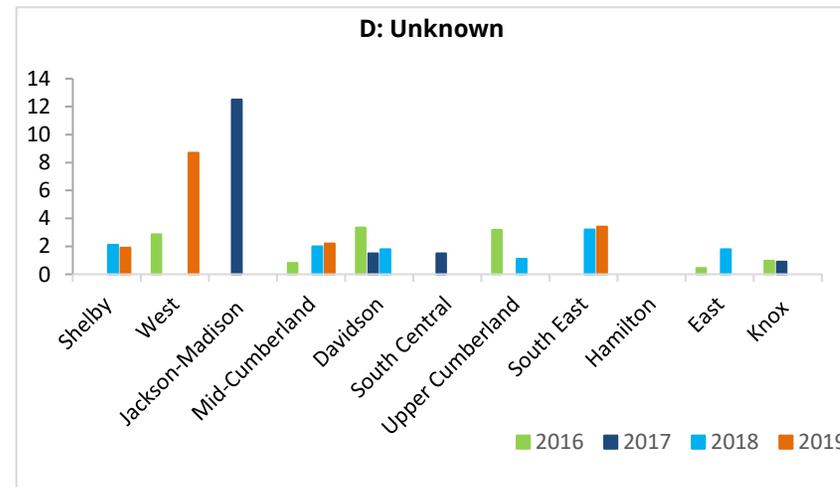
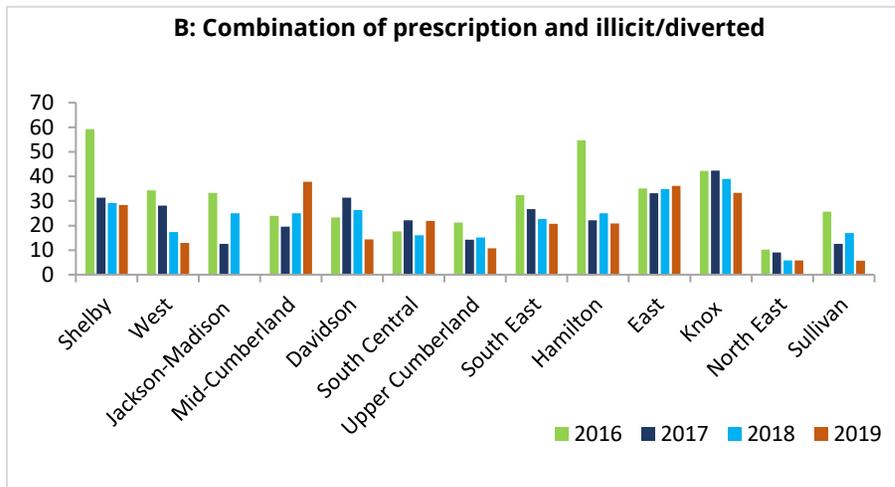
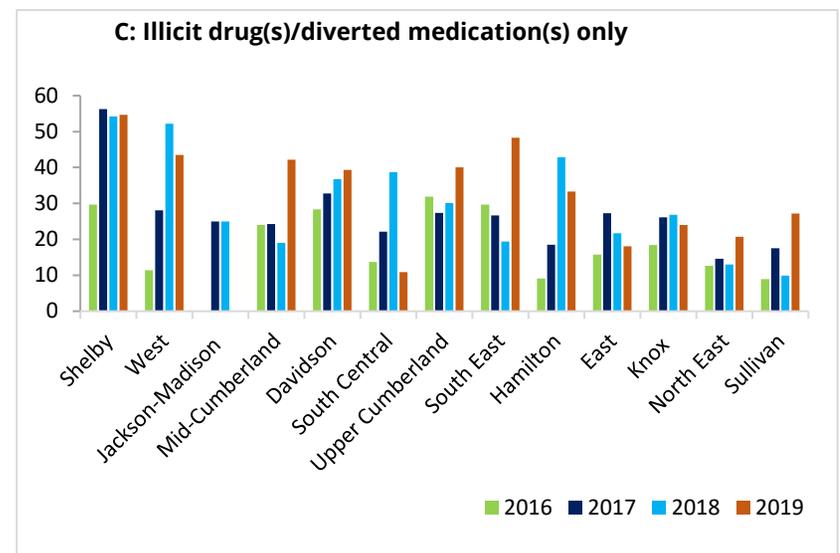
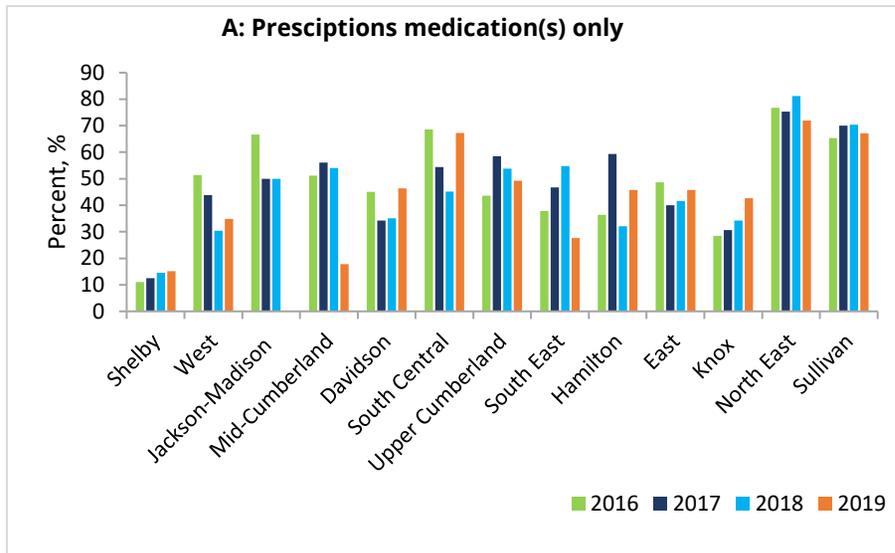


Figure 12 A-D: Prevalence of Exposure to Mutually Exclusive Sources among NAS Cases by Region, 2016-2019

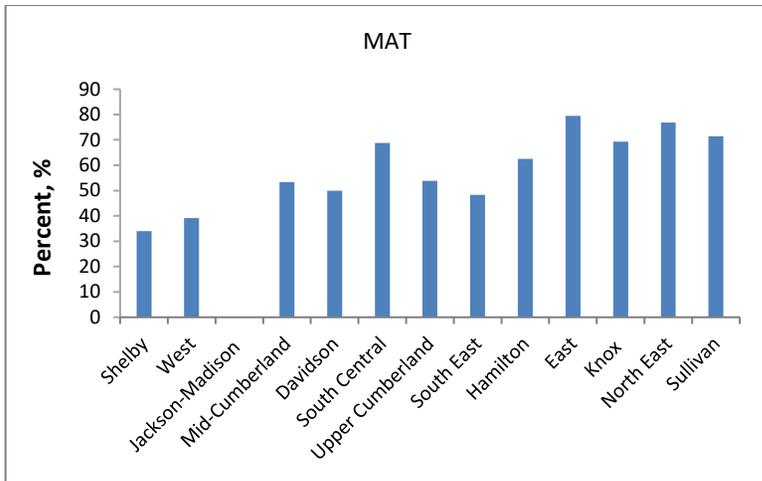


Figure 13: Prevalence of Exposure to Medication Assisted Treatment among NAS Cases by Region, 2019

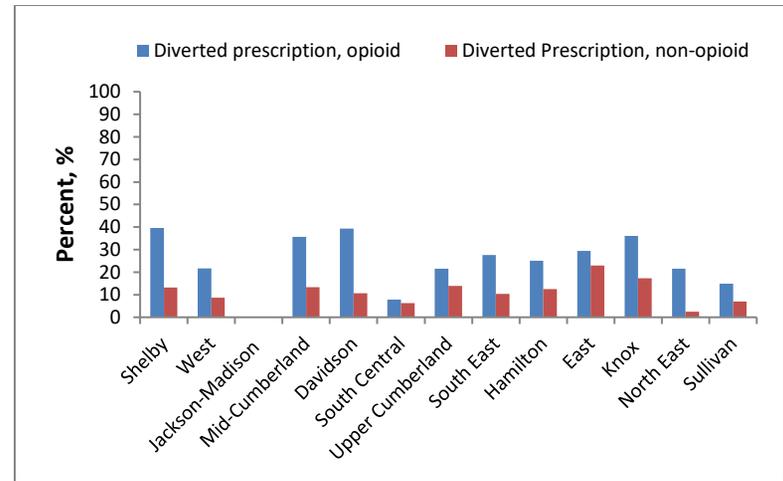


Figure 15: Prevalence of Exposure to Diverted Prescription Medications among NAS Cases by Region, 2019

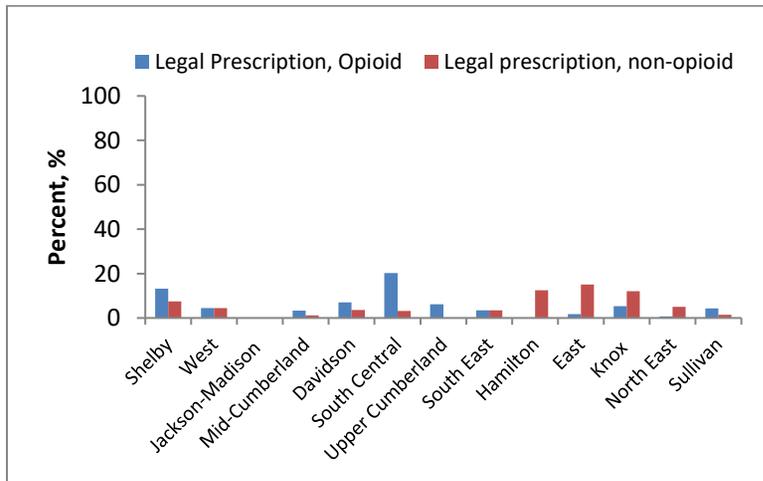


Figure 14: Prevalence of Exposure to Legally Obtained Prescription Medications among NAS Cases by Region, 2019

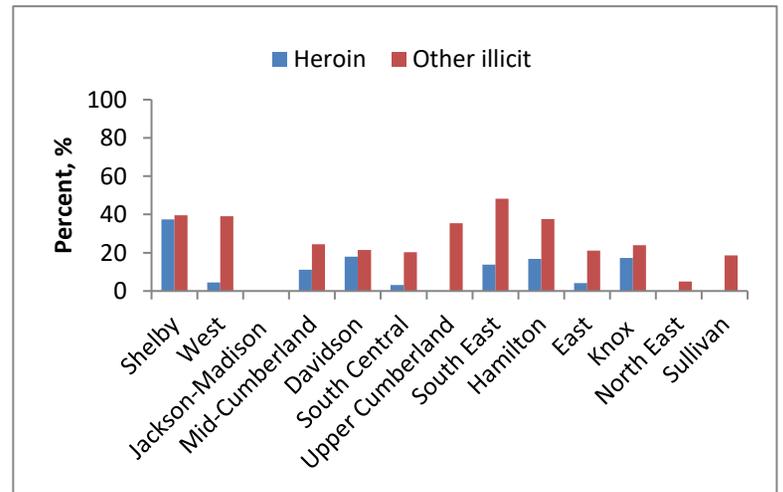


Figure 16: Prevalence of Exposure to Illicit Drugs among NAS Cases by Region, 2019

Non-Residential NAS Cases

Highlights: Non-Residential NAS Cases
In CY2019: <ul style="list-style-type: none">• Tennessee hospitals reported 81 NAS cases in which the infant was from another state.• More than 60% of non-residential NAS cases were from Virginia.

Effective July 1, 2014, reporting hospitals were asked to report cases of NAS treated at Tennessee hospitals that were residents of states that border Tennessee. These states include Alabama, Arkansas, Georgia, Kentucky, Mississippi, Missouri, North Carolina and Virginia.

In 2019, eighty-one cases of NAS from other states were treated in Tennessee. The distribution of out of state cases, by maternal state of residence, is shown in **Table 2**. The majority of non-resident cases are from Virginia (69.14%).

A majority (69.1%, n=56) of out of state NAS cases were born in Tennessee (for example, the baby's mother was from North Carolina but delivered in Tennessee). The remainder (30.9%) were born in out of state hospitals and transferred to a Tennessee hospital for care (for example, the baby was born in Virginia but transferred to Tennessee for care).

Table 2: State of Residence for Non-Resident Cases of Neonatal Abstinence Syndrome Reported in Tennessee, 2019

State	No. of Cases	% of Cases
Georgia	13	16.05
Kentucky	1	1.23
Mississippi	2	2.47
Missouri	1	1.23
North Carolina	6	7.41
Virginia	56	69.14
Other	2	2.47
Total	81	100

Conclusion

Since becoming a reportable condition in 2013, the proportion of births affected by Neonatal Abstinence Syndrome each year increased through 2017, with the first decrease seen in 2018. CY2019 is the second consecutive year that Tennessee saw a decrease in the number of cases. The largest decreases were seen in the East and the Upper Cumberland Health Regions and Davidson County. East and Upper Cumberland Health Regions showed both a decrease in the rate of cases of NAS from 2018 and a statistically significant decrease over time since 2013. On the other hand, the largest increase in the rate of cases of NAS occurred in the South Central Health Region and Shelby County, which had a statistically significant increase in the rate of cases of NAS over time. In addition, geographic differences persist, with less than 40% of infants exposed to MAT in West Tennessee, compared to over 75% in some regions of East Tennessee. Conversely, more than 50% of infants were exposed to illegal substances in West Tennessee vs less than 30% in the East, with an overall statewide increase in exposure to illegal substances.

Since 2013, there has been a shift in the exposure sources associated with NAS, with more mothers of NAS infants taking medications prescribed by a provider. The high proportion of cases of NAS involving medication assisted treatment suggest that women with a history of substance use disorder are becoming more engaged with medical providers during pregnancy. Notably, there was decrease in the percent of infants exposed to MAT from 67.5% in 2018 to 64.9% in 2019.

The patterns of exposure (with nearly 77% of cases being exposed to at least one substance prescribed by a healthcare provider) highlight opportunities for primary prevention. Healthcare providers should be encouraged to explore non-opioid treatment modalities in women of childbearing age and should promote effective contraceptive methods to prevent unintended pregnancies among women who use opioids. Additionally, this report highlights areas that may be targeted to prevent NAS cases in Tennessee.

Acknowledgements

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References

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2. O'Connor AB, O'Brien L, Alto WA. Are there gender related differences in neonatal abstinence syndrome following buprenorphine during pregnancy?. *J Perinat Med* 2013 Sep;41(5):621-3. DOI: 10.1515/jpm-2012-0288.

Technical Notes

1. At publication of the 2018 Neonatal Abstinence Syndrome Surveillance Annual Report, 927 cases with a birth year of 2018 had been reported. After publication of the 2018 report, an additional 22 cases were reported and are included here.

2. All rates for 2019 were calculated using the 2018 Birth Statistical File as the denominator.

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