

# The Burden of Neonatal Abstinence Syndrome (NAS) in Michigan

Michigan FIMR Quarterly Meeting

December 1, 2016

# Outline

- Background
- Methods
- Results
  - State
  - Length of stay & cost
  - Region
  - Maternal characteristics
  - New method for calculating NAS rates
- Conclusion
- Public Health Implications

# Background

- Neonatal Abstinence Syndrome (NAS), sometimes referred to as Neonatal Withdrawal Syndrome (NWS), occurs in a newborn who was exposed to addictive illegal or prescription drugs in utero.
- Two major types are recognized
  - Due to prenatal or maternal use during pregnancy
  - Postnatal NAS secondary to discontinuation of medications such as fentanyl or morphine used for pain therapy in the infant
- The risk is greatest when the mother uses prescription opioid pain relievers or heroin during pregnancy <sup>1-2</sup>

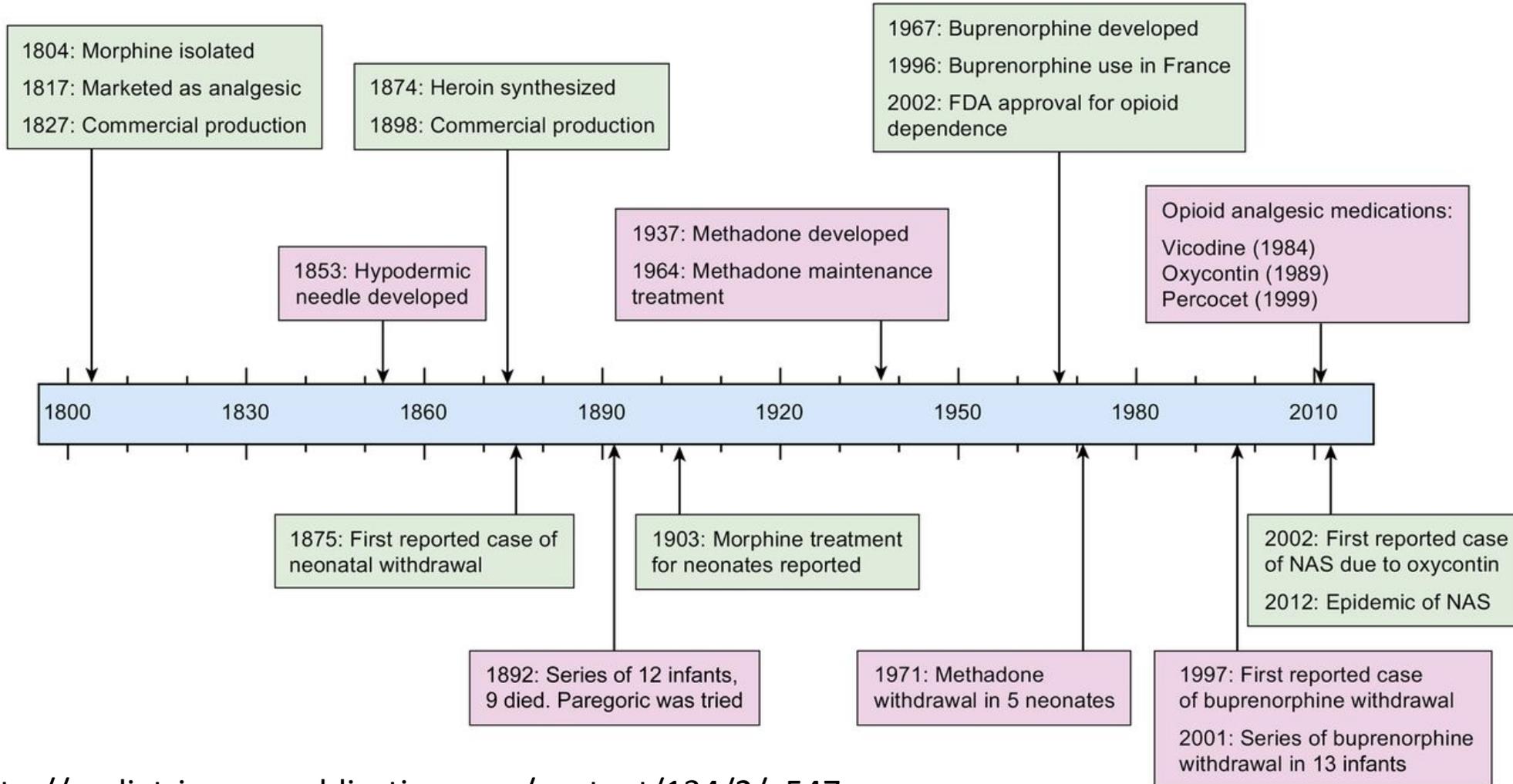
# Background-1

- Maternal substance use is a leading preventable cause of mental, physical and psychological problems in infants and children.
- Infants with NAS are more likely to be born with low birthweight, have breathing and feeding problems, and seizures.
- Signs can include tremors, twitching, fussiness, excessive crying, fever, trouble sleeping, diarrhea, vomiting, and/or stuffiness/sneezing.

# Drugs Associated with NAS

- Opioids:
  - Heroin
  - Methadone
  - Fentanyl
  - Morphine
  - Demerol
  - OxyContin
- Non-opioid CNS Depressants:  
(May mimic NAS)
  - Benzodiazepines
  - SSRI's
  - Barbiturates
  - Anticonvulsants
  - Antipsychotics
  - Alcohol

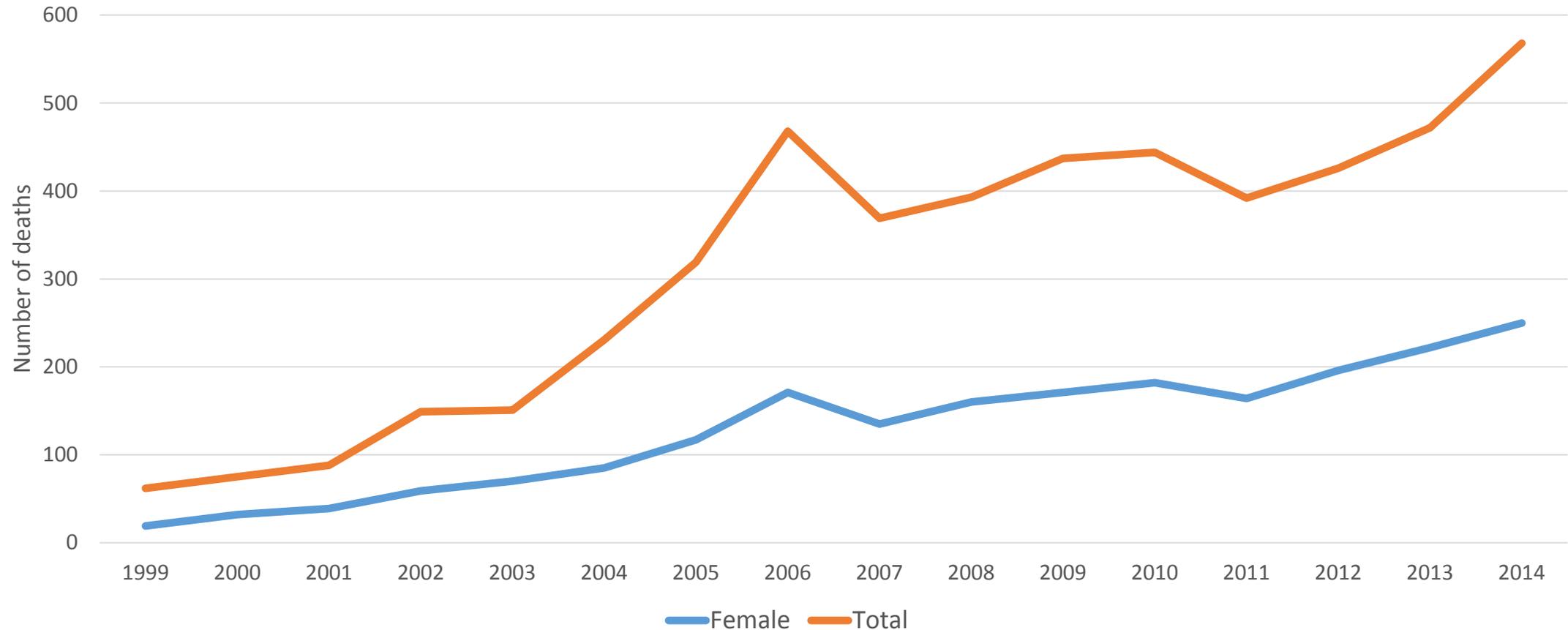
# Background -2



# Background-3

- Prescription drug use is growing
  - Increase in overdoses and deaths associated with non-medical prescription drug use over the past decade

# Number of Opioid-related\* Drug Poisoning Deaths by Female, MI, 1999-2014



Source: Michigan Death Certificate Files, Division for Vital Records and Health Statistics, MDHHS

\*Opioid-related includes opioid w/o heroin or cocaine; opioid w/ heroin, w/o cocaine; opioid w/ cocaine, w/o heroin; opioid with heroin and cocaine

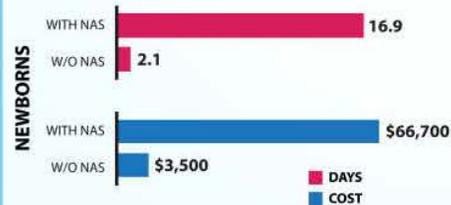
# DRAMATIC INCREASES IN MATERNAL OPIOID USE AND NEONATAL ABSTINENCE SYNDROME

THE USE OF OPIOIDS DURING PREGNANCY CAN RESULT IN A DRUG WITHDRAWAL SYNDROME IN NEWBORNS CALLED **NEONATAL ABSTINENCE SYNDROME (NAS)**, WHICH CAUSES **LENGTHY AND COSTLY** HOSPITAL STAYS. ACCORDING TO A NEW STUDY, AN ESTIMATED **21,732 BABIES** WERE BORN WITH THIS SYNDROME IN THE UNITED STATES IN 2012, A **5-FOLD INCREASE** SINCE 2000.

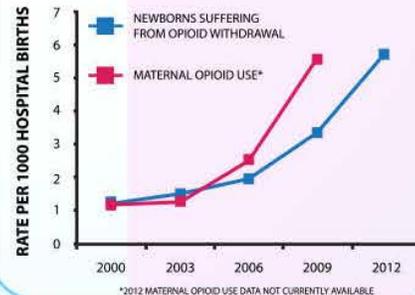


**EVERY 25 MINUTES,  
A BABY IS BORN SUFFERING  
FROM OPIOID WITHDRAWAL.**

## AVERAGE LENGTH OR COST OF HOSPITAL STAY



## NAS AND MATERNAL OPIOID USE ON THE RISE



<https://www.drugabuse.gov/related-topics/trends-statistics/infographics/dramatic-increases-in-maternal-opioid-use-neonatal-abstinence-syndrome>

# Background-5

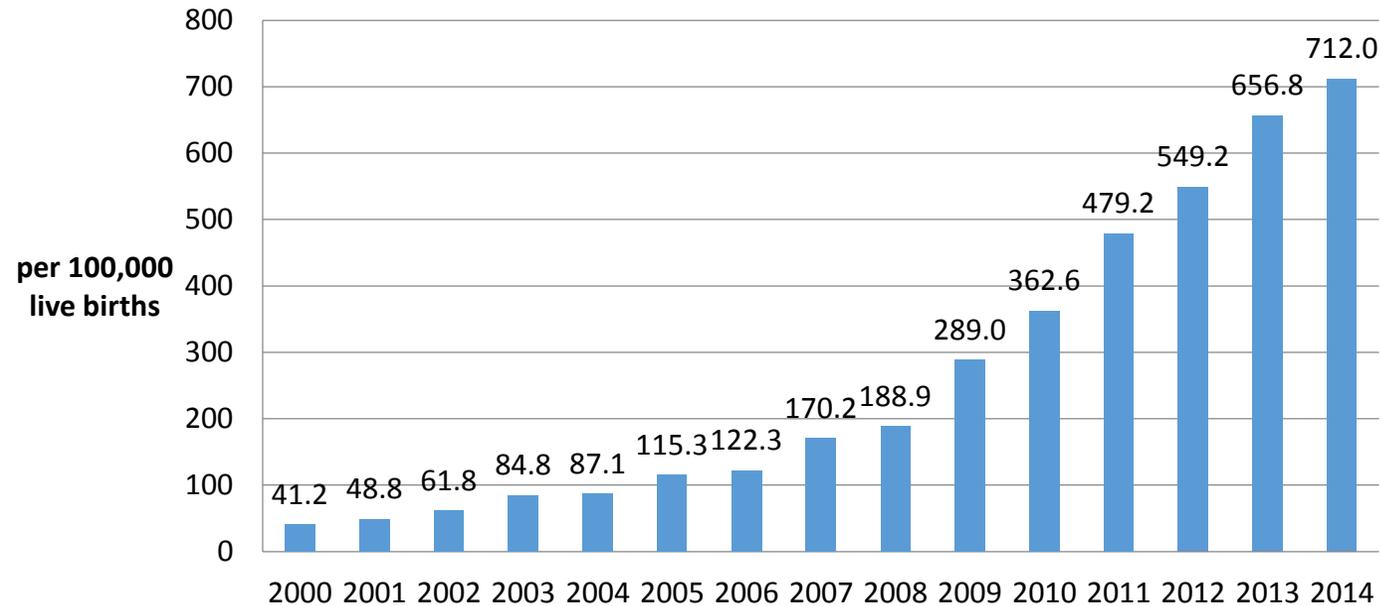
- Treatment may be pharmacologic or non-pharmacologic.
- Michigan is participating in Vermont Oxford Network Quality Improvement initiative to improve NAS care
  - Goal is to improve care, reduce length of stay and costs
  - 18 NICUs participated
  - 20 NICUs and 6 Well Newborn and/or Special Care Nurseries continuing QI efforts as part of collaborative
- Once discharged, infants need a multidisciplinary approach
- Long term effects, beyond the first years of life are unknown.

# Methods

- Data Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation. This file was linked to the Michigan Resident Live Birth File by the Division for Vital Records and Health Statistics, MDHHS).
- Case Definition based on ICD-9 779.5- Neonatal Abstinence Syndrome-pharmacologically treated
  - At the time of analysis this was based on consensus
  - Definition may be broadened to include NAS non-pharmacologically treated
  - Attempted to analyze drug exposure, but codes may be used inconsistently

# Results - Michigan

**Rate of Neonatal Abstinence Syndrome by Year among Michigan Infants,  
2000-2014**



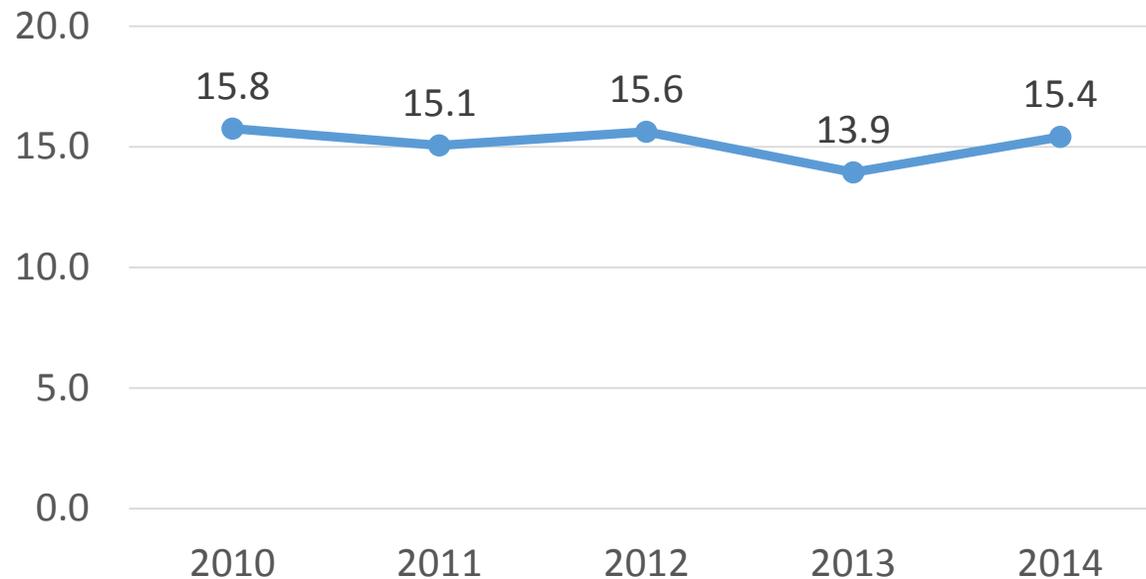
Data Source: Michigan Inpatient Database  
NWS defined by ICD-9-CM diagnosis code 779.5

From 2010 to 2014, the NAS rate nearly doubled statewide

The rate in 2014 was six times the rate 10 years earlier (2005)

# Results - Michigan (Length of Stay and Costs)

Average Hospital Length of Stay for Infants with Treated Neonatal Abstinence Syndrome (779.5), Michigan 2010-2014



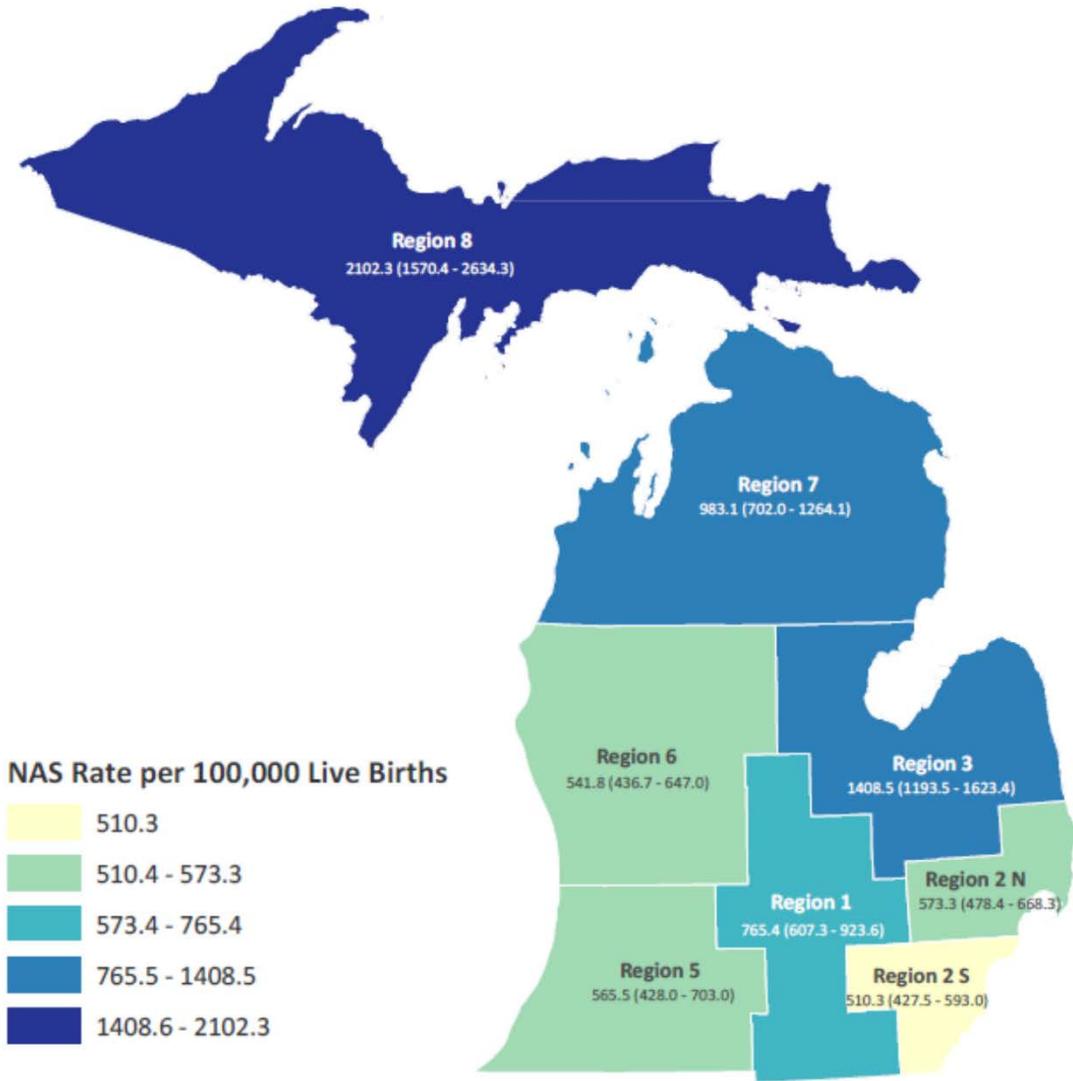
Median Per Child Hospitalization Charges (Treated NAS: 779.5)	
2010	\$24,302
2011	\$25,415
2012	\$28,413

Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Incidence of Neonatal Abstinence Syndrome (NAS)

## by Perinatal Region

Michigan, 2014

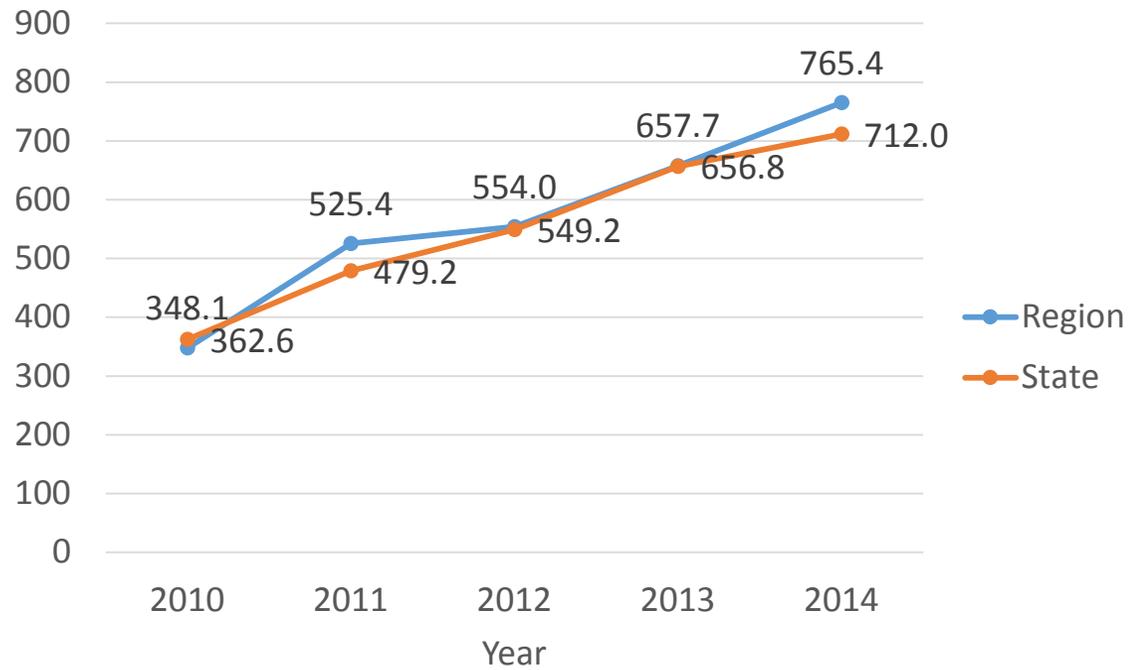


NAS is highest in the Upper Peninsula (Region 8), Region 3 and Region 7

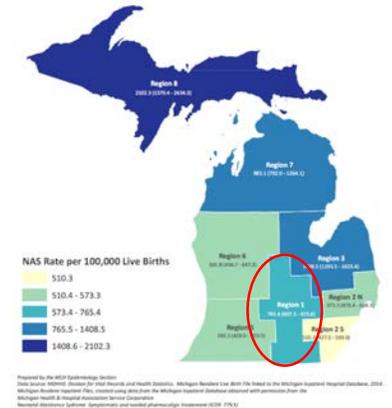
Based on perinatal regions

# Results- Region 1

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 1



Incidence of Neonatal Abstinence Syndrome (NAS)  
by Perinatal Region  
Michigan, 2014



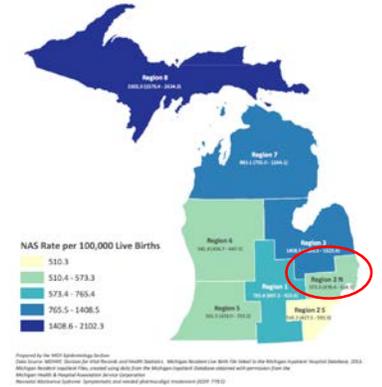
## Perinatal Region 1

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	11,492	40	348.1
2011	11,611	61	525.4
2012	11,372	63	554.0
2013	11,404	75	657.7
2014	11,758	90	765.4

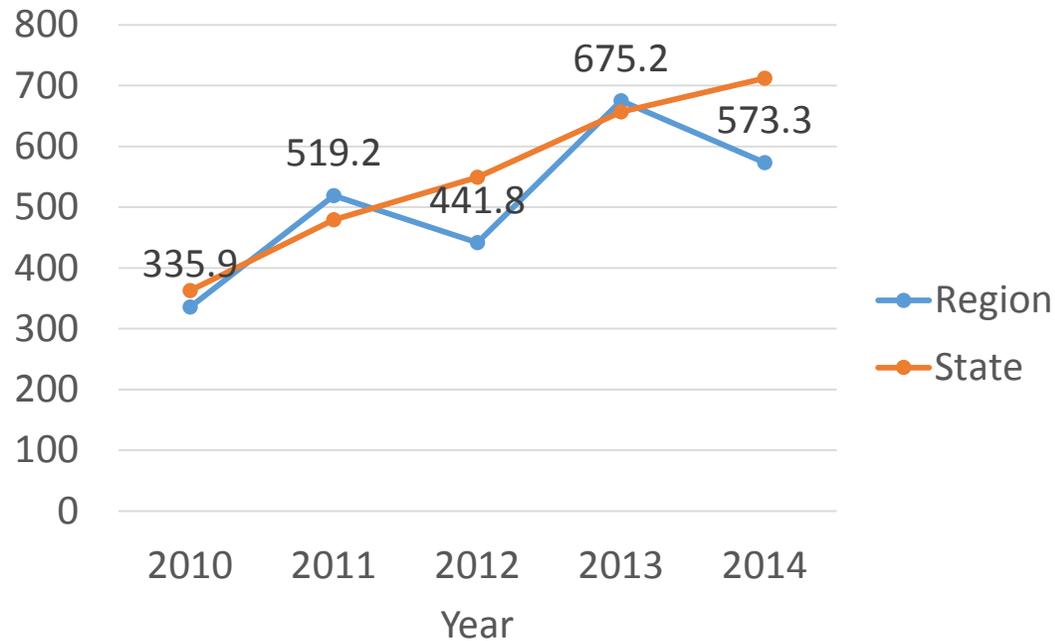
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 2N

Incidence of Neonatal Abstinence Syndrome (NAS) by Perinatal Region Michigan, 2014



Neonatal Abstinence Syndrome Rate per 100,000 Births Michigan - Perinatal Region 2N



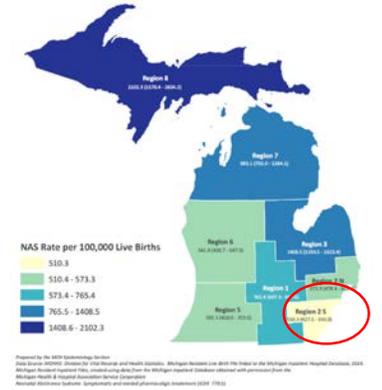
## Perinatal Region 2N

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	23,814	80	335.9
2011	24,077	125	519.2
2012	23,995	106	441.8
2013	24,437	165	675.2
2014	24,419	140	573.3

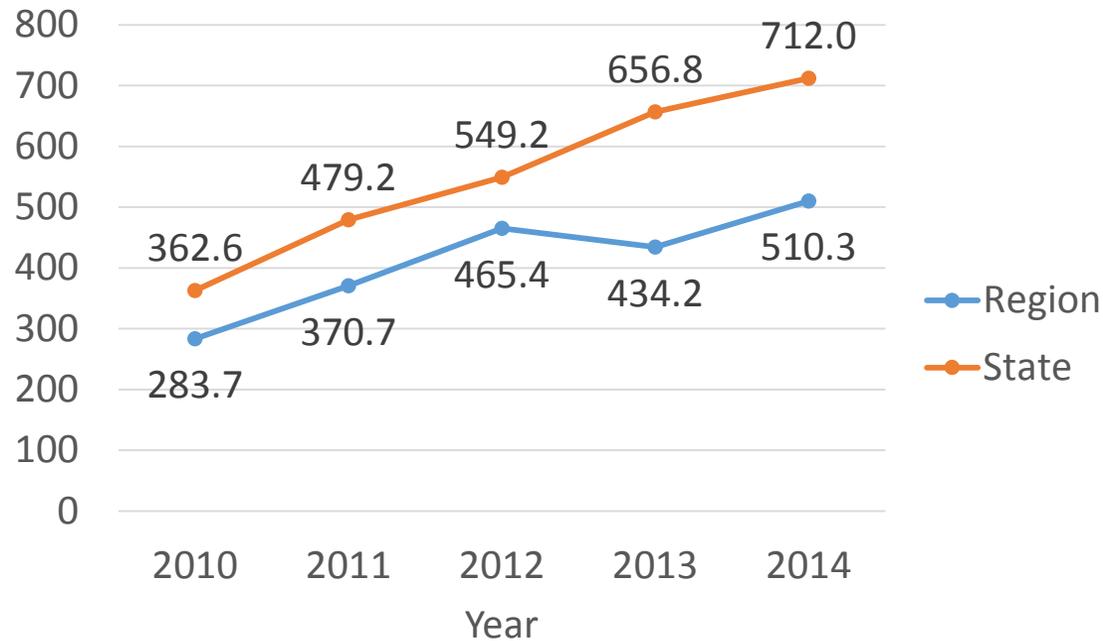
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 2S

Incidence of Neonatal Abstinence Syndrome (NAS) by Perinatal Region Michigan, 2014



Neonatal Abstinence Syndrome Rate per 100,000 Births Michigan - Perinatal Region 2S



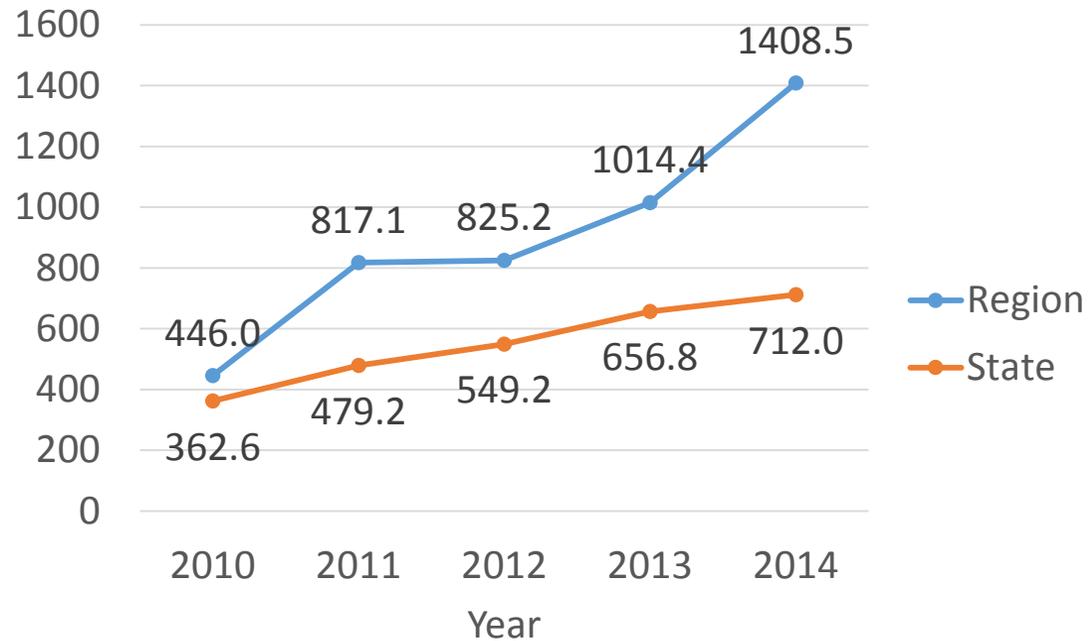
## Perinatal Region 2S

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	29,610	84	283.7
2011	29,135	108	370.7
2012	28,363	132	465.4
2013	28,790	125	434.2
2014	28,612	146	510.3

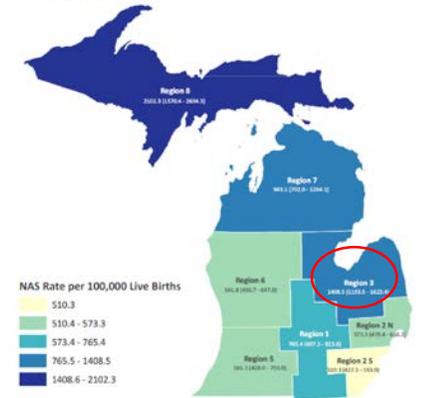
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 3

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 3



Incidence of Neonatal Abstinence Syndrome (NAS)  
by Perinatal Region  
Michigan, 2014



Prepared by the MCH Epidemiology Section  
Data Source: Michigan Resident Inpatient Files, Michigan Resident Live Birth File linked to the Michigan Resident Inpatient Database, 2014  
Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the  
Michigan Health & Hospital Association Service Corporation  
Neonatal Abstinence Syndrome Surveillance and Control (NAS) - Michigan, 2014

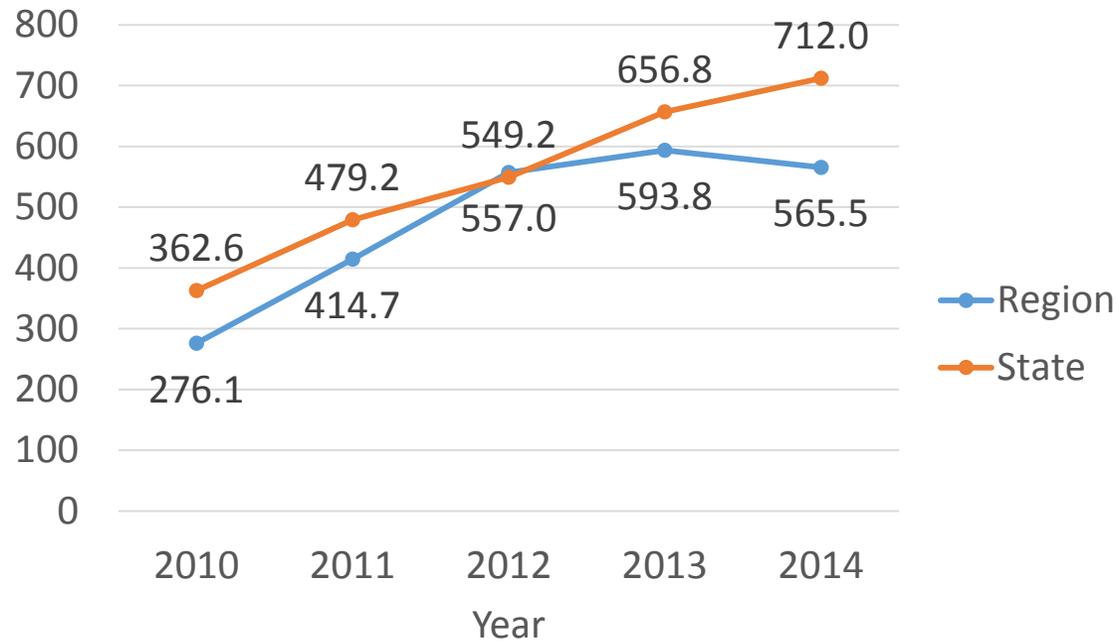
## Perinatal Region 3

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	12,107	54	446.0
2011	11,749	96	817.1
2012	11,633	96	825.2
2013	11,632	118	1014.4
2014	11,715	165	1408.5

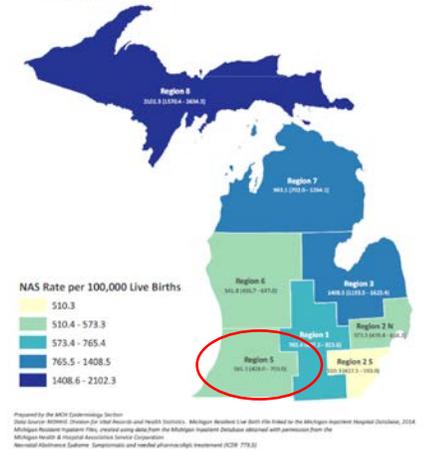
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 5

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 5



Incidence of Neonatal Abstinence Syndrome (NAS)  
by Perinatal Region  
Michigan, 2014



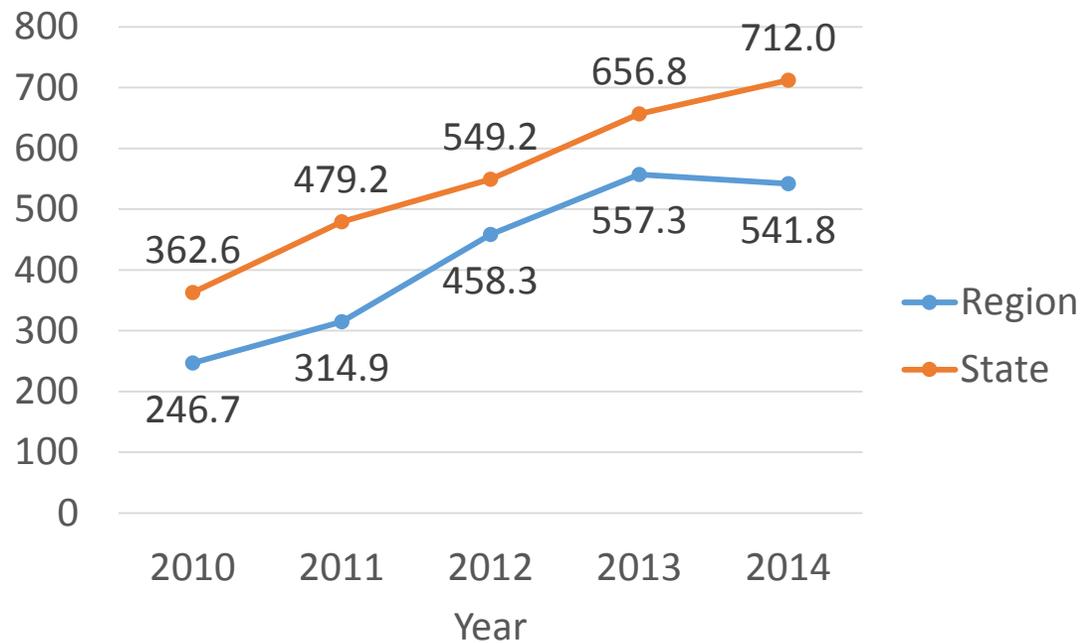
## Perinatal Region 5

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	11,592	32	276.1
2011	11,333	47	414.7
2012	11,132	62	557.0
2013	11,451	68	593.8
2014	11,494	65	565.5

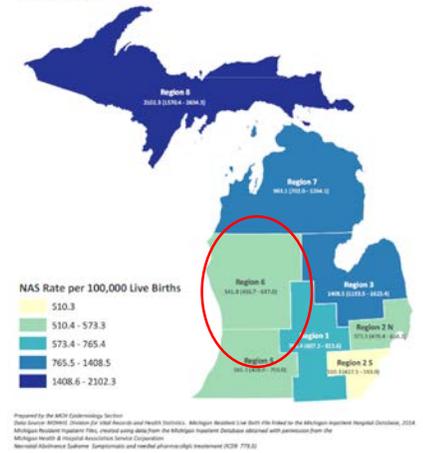
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 6

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 6



Incidence of Neonatal Abstinence Syndrome (NAS)  
by Perinatal Region  
Michigan, 2014



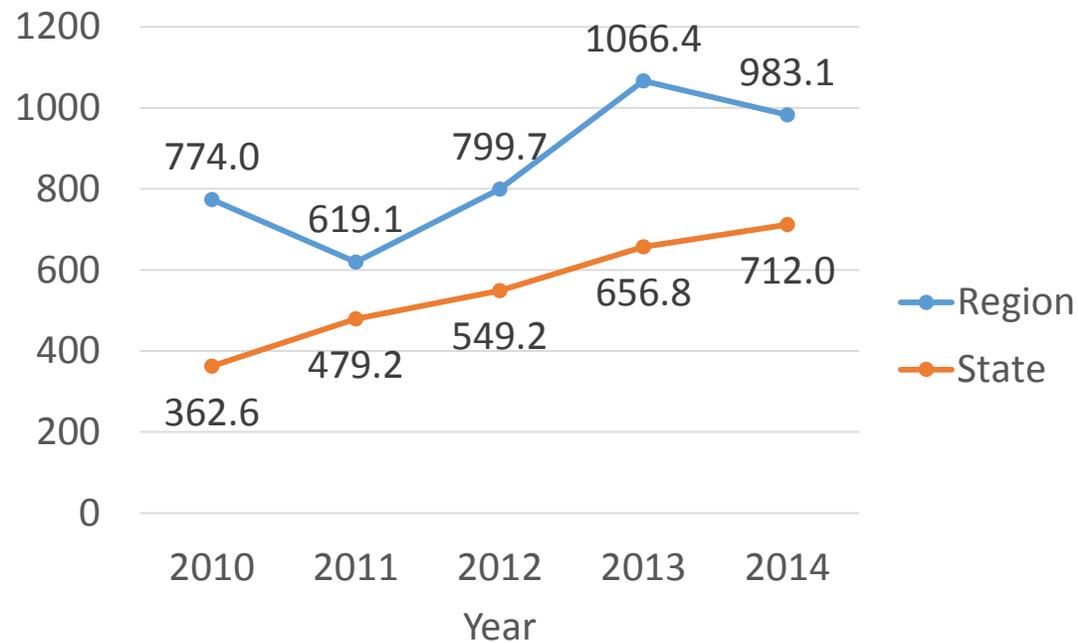
## Perinatal Region 6

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	18,644	46	246.7
2011	18,735	59	314.9
2012	18,765	86	458.3
2013	18,660	104	557.3
2014	18,826	102	541.8

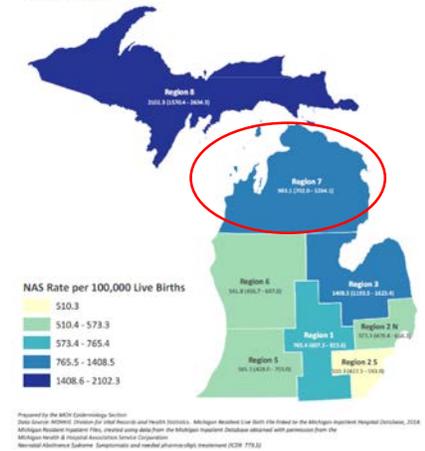
Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 7

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 7



Incidence of Neonatal Abstinence Syndrome (NAS)  
by Perinatal Region  
Michigan, 2014



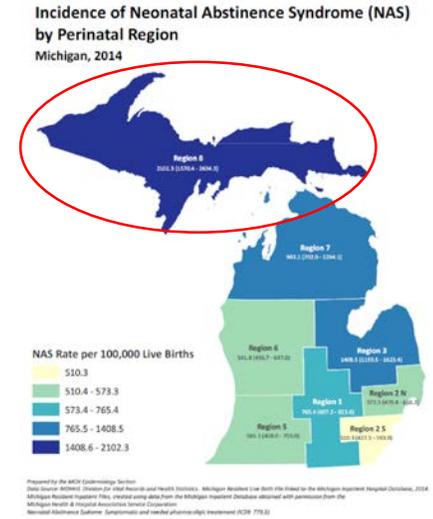
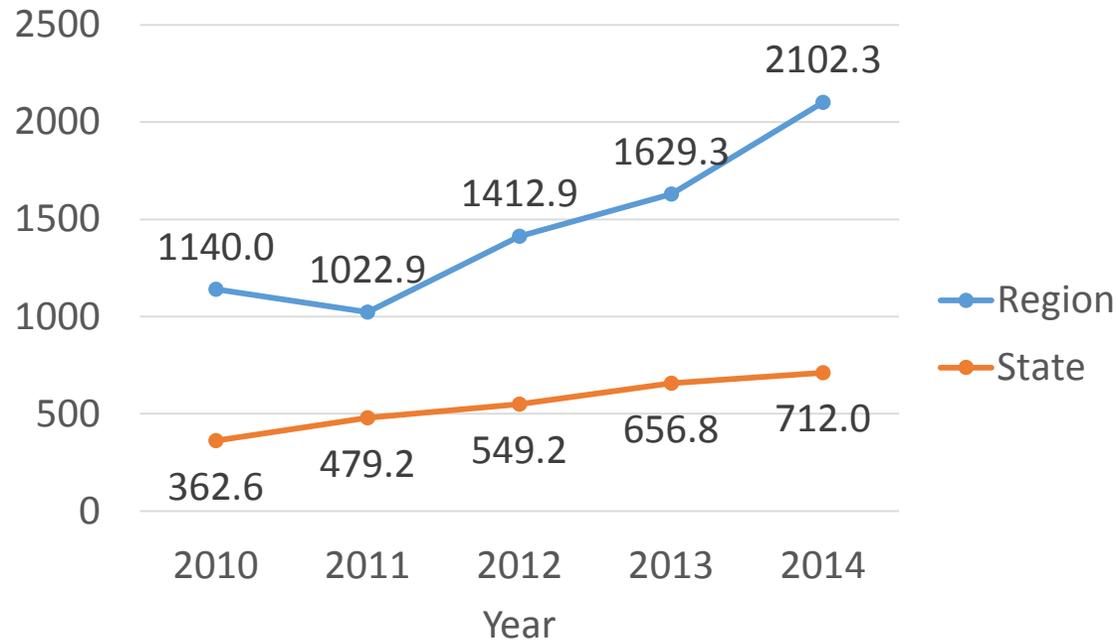
## Perinatal Region 7

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	4,651	36	774.0
2011	4,684	29	619.1
2012	4,627	37	799.7
2013	4,595	49	1066.4
2014	4,781	47	983.1

Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Results- Region 8

Neonatal Abstinence Syndrome  
Rate per 100,000 Births  
Michigan - Perinatal Region 8



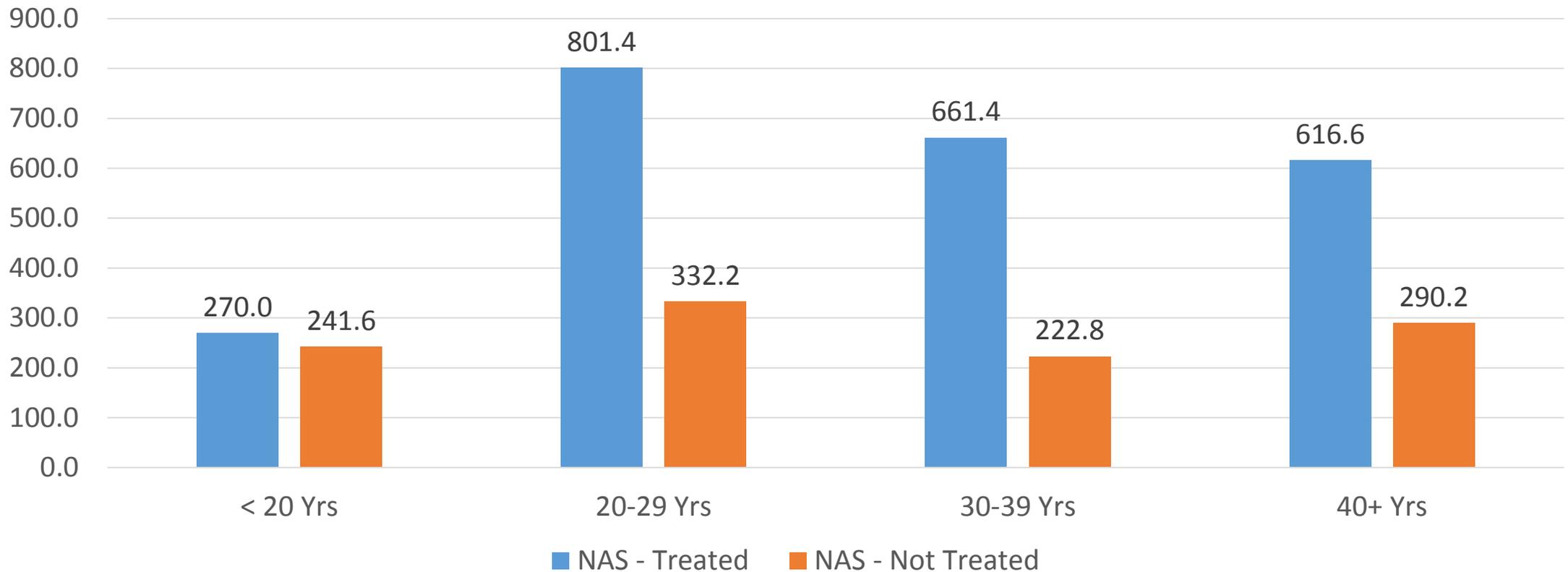
## Perinatal Region 8

	Births	N with Treated NAS (779.5)	Rate per 100,000
2010	2,807	32	1140.0
2011	2,835	29	1022.9
2012	2,831	40	1412.9
2013	2,762	45	1629.3
2014	2,854	60	2102.3

Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Maternal Characteristics NAS treated vs. NAS not pharmacologically treated

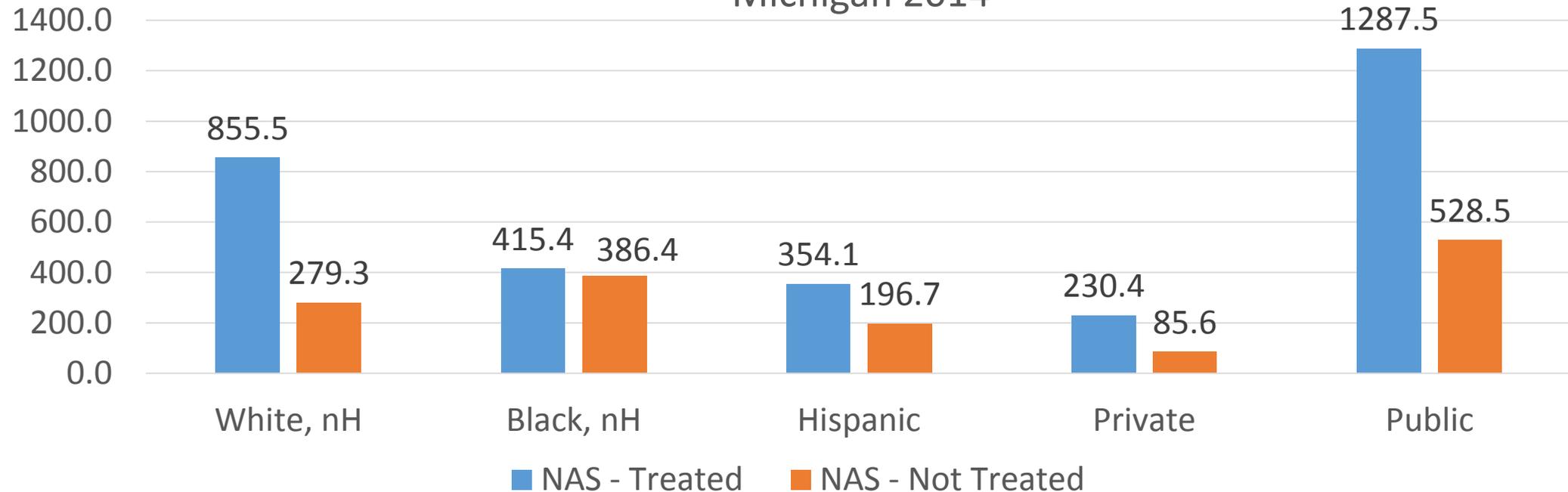
Neonatal Abstinence Syndrome Rates  
(Treated vs. Not Treated)  
by Maternal Age, Michigan 2014



Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# Maternal Characteristics NAS treated vs. NAS not pharmacologically treated, continued

## Neonatal Abstinence Syndrome Rates (Treated vs. Not Treated) by Maternal Race/Ethnicity and Insurance Status, Michigan 2014



Source: Michigan Resident Inpatient Files, created using data from the Michigan Inpatient Database obtained with permission from the Michigan Health & Hospital Association Service Corporation.

# New Method for Calculating NAS Rates

- Previous: Based on number of hospital discharges with ICD-9 779.5 code
  - Some infants have more than one hospital admission for NAS (duplicates)
- New: Based on number of infants with ICD-9 779.5 code
  - Only one occurrence per infant (no duplicates)

Year	Previous Method	New Method
2008	188.9	191.4
2009	289.0	282.1
2010	362.6	352.2
2011	479.2	481.8
2012	549.2	548.3
2013	656.8	653.3
2014	712.0	710.3

# Conclusions

- NAS is increasing in Michigan
- Little change in average length of stay, but costs are increasing
- Rates are highest in the Upper Peninsula and Northern Lower Michigan
- Rates are highest among women 20 years of age and older, especially women 20-29 years
- Rates are highest for White, non-Hispanic and women who intended to pay for delivery using Medicaid Insurance.
- New calculation method doesn't significantly impact NAS rates.

# Public Health Implications

- Access to illicit substances and community response are factors that impact the trend
- Punitive measures are ineffective in reducing drug-use in women. <sup>3-4</sup>
- “Programs tailored for drug-using pregnant women need to address factors contributing to their drug abuse and adverse perinatal outcomes such as women’s reticence to access substance abuse treatment and prenatal care, their lack of medical insurance and social support, and poverty, especially in rural areas.”<sup>5</sup>

# References

1. O'Donnell M, Nassar N, Leonard H, et al. Increasing prevalence of neonatal withdrawal syndrome: population study of maternal factors and child protection involvement. *Pediatrics*. Apr 2009;123(4):e614-621.
2. Wagner CL, Katikaneni LD, Cox TH, Ryan RM. The impact of prenatal drug exposure on the neonate. *Obstet Gynecol Clin North Am*. Mar 1998;25(1):169-194. 3. Hekman K et al. Neonatal withdrawal syndrome, Michigan, 2000-2009. *Am J Prev Med*. 2013; 45(1): 113-117.
3. Armstrong EM. Drug and alcohol use during pregnancy: we need to protect, not punish, women. *Womens Health Issues* 2005;15:45–7.
4. Substance abuse reporting in pregnancy: the role of the obstetrician-gynecologist. ACOG Committee Opinion No. 473. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2011;117:200–1.
5. Creanga, et al Maternal Drug Use and its effect on neonates, a population-based study in Washington State. *Obstet Gynecol* 2012;119:924-933.