

NEONATAL ABSTINENCE SYNDROME (NAS) IN OHIO
2004- 2014 REPORT

Ohio Department of Health

Office of Health Improvement and Wellness

Bureau of Health Services

Violence and Injury Prevention Program

Contact Information:

Ohio Department of Health
Violence and Injury Prevention Program
246 North High St.
Columbus, OH 43215
(614)-466-2144
healthyohio@odh.ohio.gov

Introduction

This report has been prepared by the Ohio Department of Health pursuant to Ohio Revised Code 3711.30.

What is Neonatal Abstinence Syndrome (NAS)?

Neonatal abstinence syndrome (NAS), also known as neonatal withdrawal syndrome, is a set of symptoms associated with the abrupt withdrawal of opioids and other drugs when infants are born to mothers who were taking these substances. The symptoms can range from mild to severe and include:

- Low birth weight
- Breathing problems
- Seizures
- Feeding difficulties
- Tremors (trembling)
- Irritability (excessive crying)
- Sleep problems
- High-pitched crying
- Yawning, stuffy nose, and sneezing
- Vomiting
- Diarrhea
- Dehydration
- Sweating
- Fever or unstable temperature

How is NAS diagnosed?

NAS scoring tools that assess the infant's symptoms may be used to help diagnose and determine the severity of the withdrawal. This scoring may also help in planning treatment for the infant's unique symptoms. An accurate report of the mother's drug usage is also important, including the time of the last drug taken.

Data Summary

Between 2004 and 2014 in Ohio, 9,498 hospitalizations resulted from Neonatal Abstinence Syndrome (NAS) in inpatient settings. In 2014 alone, there were 1,875 admissions, which equates to more than five admissions per day. The rate of NAS grew nearly ten times from 14 per 10,000 live births in 2004 to 134 per 10,000 live births in 2014. The most common conditions associated with NAS were respiratory complications, low birth weight, feeding difficulties and seizures.

NAS has taken a heavy toll on Ohio's healthcare system. Treating newborns with NAS was associated with over \$105 million in charges and nearly 14 days in Ohio's hospitals in 2014. Between 2004 and 2014, the average charge associated with NAS hospitalizations increased from \$26,465 to \$56,111 while the average stay (LOS) fluctuated between 14 and 20 days. The average service charges and average LOS for NAS infants are much greater than for all Ohio infants. In 2014, the average inpatient charge was four times higher for NAS infants, and the average LOS was almost four times greater than for all Ohio infants.

Data on exposure to noxious substances through the placenta or breast milk suggests an increasing number of infants are exposed to opioids (i.e., heroin and prescription pain medication). Nearly 3,900 infants were exposed to opioids between 2004 and 2014. The annual number of inpatient hospitalizations related to opioids increased 1,426 percent during this period, and opioids has surpassed cocaine as the common drug of exposure in 2010 and remained the leading drug of exposure in 2014.

In addition to the rise in NAS, approximately 28,806 hospitalizations resulted from drug abuse or dependence among mothers at time of delivery between 2004 and 2014. Hospitalization rates tripled from 103 per 10,000 in 2004 to 310 per 10,000 discharges in 2014. Opioids surpassed cocaine as the second most common drug abused and continued to be second most common drug after 2014.

Table 1: Ohio Neonatal Abstinence Syndrome Report

Hospitalizations* for Neonatal Abstinence Syndrome											
Setting:	Inpatient (all)										
Location:	Ohio hospitals										
People:	Ohio Residents										
Age:	<1										
Query Codes:	ICD-9 779.5 (NAS-Could be in primary or 18 secondary dx fields.)										
Special:	Please include average cost, total cost, average length of stay, & total length of stay										
Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Inpatient discharge*	199	271	305	369	477	715	953	1182	1461	1691	1875
<i>Medicaid Discharge</i>	152	207	222	288	369	583	811	1005	1307	1475	1703
<i>Non-Medicaid Discharge</i>	47	64	83	81	108	132	142	177	154	216	172
Average length of stay (LOS) in days	15.6	14.6	16	19.5	20.1	19.6	18.9	15.9	14	14.8	13.7
Total LOS (days)	3,103	3,966	4,892	7,200	9,580	14,006	17,965	18,776	20499	24906	25725
Average charge	\$26,465	\$28,610	\$35,456	\$52,415	\$57,027	\$68,821	\$64,911	\$59,574	\$52,119	\$57,898	\$56,111
Total charge	\$5,266,503	\$7,753,207	\$10,814,145	\$19,341,076	\$27,202,102	\$49,207,110	\$61,860,258	\$70,415,888	\$76,145,404	\$97,906,324	\$105,207,950

*May not reflect unique individuals.

In-state Births to Ohio Residents

Setting: Inpatient (all)
 Location: Ohio hospitals
 People: Ohio Residents
 Age: <1
 Query Codes: MSDRG 789-795 (Neonates and Newborns)
 Special: Please include average cost, average length of stay.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Live Births	150,412	149,454	152,740	151,454	148,800	146,226	139,987	137,767	139,479	140,010	140,339
Medicaid Discharge	56,284	58,499	60,976	59,830	61,461	65,062	63,710	62,649	67,330	65,285	66,775
Non-Medicaid Discharge	94,128	90,955	91,764	91,624	87,339	81,164	76,277	75,118	72,149	74,725	73,564
Average LOS (days)	3.3	3.4	3.4	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7
Average charge	\$5,337	\$5,874	\$6,834	\$7,870	\$8,660	\$9,680	\$10,345	\$11,448	\$12,953	\$13,558	\$14,393

Hospitalizations* Associated with Exposure to Noxious Substances through the Placenta or Breast Milk

Setting: Inpatient (all)
 Location: Ohio hospitals
 People: Ohio Residents
 Age: <1
 Query Codes: MSDRG 789-795 (Neonates and Newborns)
 For the following groups:
 Cocaine 760.75 (Could be in primary or 18 secondary dx fields.)
 Opioids 760.72 (Could be in primary or 18 secondary dx fields.)
 Hallucinogens 760.73 (Could be in primary or 18 secondary dx fields.)
 Special:

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cocaine	386	490	459	407	332	234	152	201	163	237	193
Opioid	63	100	118	143	179	188	243	399	601	835	962
Hallucinogen	78	46	69	89	95	67	111	55	89	195	309

Drug Abuse and Dependence Diagnoses at Time of Delivery

Setting: Inpatient (all)
 Location: Ohio hospitals
 People: Ohio Residents
 Age: all
 Query Codes: MSDRGs 765-768 and 774,775 (Vaginal Deliveries and C-Sections)

For the following ICD-9 code groups:
 (Could be in primary or 18 secondary dx fields.)

Cannabis Code group: (304.30 + 304.31 + 304.32 + 304.33 + 305.20 + 305.21 + 305.22 + 305.23)
Opioid Code group: (965.00 + 965.01 + 965.02 + 965.09 + 304.00 + 304.01 + 304.02 + 304.03 + 304.70 + 304.71 + 304.72 + 304.73 + 305.50 + 305.51 + 305.52 + 305.53)
Cocaine Code group: (304.20 + 304.21 + 304.22 + 304.23 + 305.60 + 305.61 + 305.62 + 305.63 + 970.81)
Amphetamine and other psychostimulant Code group: (304.40 + 304.41 + 304.42 + 304.43 + 305.70 + 305.71 + 305.72 + 305.73 + 970.89 + 970.9)
Hallucinogen Code group: (304.50 + 304.51 + 304.52 + 304.53 + 305.30 + 305.31 + 305.32 + 305.33)
Sedative-hypnotics Code group: (304.10 + 304.11 + 304.12 + 304.13 + 305.40 + 305.41 + 305.42 + 305.43 + 967.0 + 967.1 + 967.2 + 967.3 + 967.4 + 967.5 + 967.6 + 967.7 + 967.8 + 967.9)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Marijuana	994	1,153	1,295	1,434	1,422	1,514	1,557	1,559	1,941	2,148	2,447
Opioid	171	246	302	382	455	600	778	1,011	1,303	1,609	1,906
Cocaine	576	681	718	690	544	404	337	359	356	322	343
Other (Amphetamine Psychostimulant, Hallucinogens and Sedatives)	61	94	81	94	99	93	89	100	109	140	131
Total Number Delivering Mothers Diagnosed with Dependence	1,554	1,842	2,068	2,250	2,194	2,301	2,467	2,708	3,298	3,775	4,349

*May not reflect unique individuals.

**Mother may be diagnosed with more than one abuse/dependence condition. *Data source: Ohio Hospital Association*

Table 2: Health outcomes in inpatient settings, NAS infants* vs. all infants, Ohio, 2004-2014**

Infant health complications for all Ohio infants											
NAS Infants											
Setting:	Inpatient (all)										
Location:	Ohio hospitals										
People:	Ohio Residents										
Age:	<1										
Query Codes:	MSDRG 789-795 (Neonates and Newborns)										
	ICD-9 779.5 (NAS) *Could be in primary or 18 secondary dx fields										
With the following ICD-9 code groups: (Could be in primary or 18 secondary dx fields.)	<u>Feeding Difficulties Code Group: (779.3)</u> <u>Low Birth weight Code Group:</u> (All 764.x and all 765.0x and all 765.1x codes including: 764.00 + 764.01 + 764.02 + 764.03 + 764.04 + 764.05 + 764.06 + 764.07 + 764.08 + 764.09 + 764.10 + 764.11 + 764.12 + 764.13 + 764.14 + 764.15 + 764.16 + 764.17 + 764.18 + 764.19 + 764.20 + 764.21 + 764.22 + 764.23 + 764.24 + 764.25 + 764.26 + 764.27 + 764.28 + 764.29 + 764.90 + 764.91 + 764.92 + 764.93 + 764.94 + 764.95 + 764.96 + 764.97 + 764.98 + 764.99 + 765.01 + 765.02 + 765.03 + 765.04 + 765.05 + 765.06 + 765.07 + 765.08 + 765.09 + 765.11 + 765.12 + 765.13 + 765.14 + 765.15 + 765.16 + 765.17 + 765.18 + 765.19) <u>Respiratory Conditions Code Group:</u> (All 770.x codes including: 769 + 770.0 + 770.1 + 770.10 + 770.11 + 770.12 + 770.13 + 770.14 + 770.15 + 770.16 + 770.17 + 770.18 + 770.2 + 770.3 + 770.4 + 770.5 + 770.6 + 770.7 + 770.8 + 770.81 + 770.82 + 770.83 + 770.84 + 770.85 + 770.86 + 770.87 + 770.88 + 770.89 + 770.9) 769 was added to that series on purpose.										
*Divide each group by the total number of NAS infants to get %	<u>Seizures & Convulsions Code Group: (779.0)</u>										
Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Feeding difficulties	X	20.80%	20.60%	23.00%	20.70%	22.00%	20.71%	18.51%	16.55%	15.29%	16.73%
Low birth weight	X	32.00%	28.80%	32.30%	25.60%	29.10%	32.04%	26.85%	26.19%	25.48%	25.31%
Respiratory symptoms	X	36.80%	37.70%	40.30%	35.50%	36.20%	30.31%	29.80%	23.25%	24.76%	22.79%
Seizure & Convulsion	X	3.00%	3.10%	2.70%	2.30%	2.60%	1.83%	1.13%	1.40%	0.90%	1.39%

All Ohio Infants

Setting: Inpatient (all)
 Location: Ohio hospitals
 People: Ohio Residents
 Age: <1
 Query Codes: MSDRG 789-795 (Neonates and Newborns)

For the following ICD-9 code groups: (Could be in primary or 18 secondary dx fields.)
 *Divide each group by the total number of infants to get %

Feeding Difficulties Code Group: (779.3)
 Low Birth weight Code Group: (All 764.x and all 765.0x and all 765.1x codes including: 764.00 + 764.01 + 764.02 + 764.03 + 764.04 + 764.05 + 764.06 + 764.07 + 764.08 + 764.09 + 764.10 + 764.11 + 764.12 + 764.13 + 764.14 + 764.15 + 764.16 + 764.17 + 764.18 + 764.19 + 764.20 + 764.21 + 764.22 + 764.23 + 764.24 + 764.25 + 764.26 + 764.27 + 764.28 + 764.29 + 764.90 + 764.91 + 764.92 + 764.93 + 764.94 + 764.95 + 764.96 + 764.97 + 764.98 + 764.99 + 765.01 + 765.02 + 765.03 + 765.04 + 765.05 + 765.06 + 765.07 + 765.08 + 765.09 + 765.11 + 765.12 + 765.13 + 765.14 + 765.15 + 765.16 + 765.17 + 765.18 + 765.19)

Respiratory Conditions Code Group: (All 770.x codes including: 769 + 770.0 + 770.1 + 770.10 + 770.11 + 770.12 + 770.13 + 770.14 + 770.15 + 770.16 + 770.17 + 770.18 + 770.2 + 770.3 + 770.4 + 770.5 + 770.6 + 770.7 + 770.8 + 770.81 + 770.82 + 770.83 + 770.84 + 770.85 + 770.86 + 770.87 + 770.88 + 770.89 + 770.9) 769 was added to that series on purpose.

Seizures & convulsions Code Group: (779.0)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Feeding difficulties	3.10%	3.30%	3.40%	3.60%	3.70%	4.10%	4.31%	4.44%	4.85%	4.79%	5.12%
Low birth weight	11.10%	11.30%	11.70%	11.50%	11.60%	12.10%	11.90%	12.30%	12.39%	12.74%	13.18%
Respiratory symptoms	10.00%	10.00%	9.90%	9.80%	9.80%	10.10%	9.85%	9.88%	9.81%	10.02%	10.41%
Seizure & Convulsion	0.30%	0.30%	0.30%	0.20%	0.20%	0.20%	0.22%	0.22%	0.22%	0.19%	0.21%

**Children may be diagnosed with more than one condition, so percentages do not add to 100.*

***Data unavailable for NAS infants in 2004. Data source: Ohio Hospital Association*

Key Findings and Comparisons

Key Data Findings:

- The hospitalization rate of NAS has increased rapidly in Ohio between 2004 and 2014. In 2014 alone, there were 1,875 admissions to inpatient settings, which equates to more than five admissions per day.
- Women diagnosed with drug abuse and dependence at time of delivery has increased rapidly. The rise in opioid abuse and dependence has largely driven this rise.
- Health outcomes for NAS infants (feeding difficulties, low birth weight, respiratory distress, and seizures/convulsions) are all significantly worse than for all Ohio infants.
- Treating NAS has placed a significant burden on Ohio's healthcare system with more than \$105 million in hospital charges and nearly 14 days of hospital stay in 2014.
- The number of pregnant women in treatment has risen. Women are disclosing that their primary drug of choice is changing from cocaine and marijuana to opioids.

Comparisons with National Data:

- Ohio's NAS hospitalization rate was higher than the national average of 58 per 10,000 live births in 2012.¹
- As in Ohio, hospitalization rates of NAS have increased rapidly throughout the United States.¹
- The percentage of NAS hospitalizations with respiratory symptoms, feeding difficulties, and seizures were similar in Ohio and the United States; however, the percentage with low birth weight was higher in Ohio than the national average.⁴

Recommendations to Prevent NAS

- All newborns and at-risk breastfeeding children should be screened for NAS symptoms. Standardized instruments like the Neonatal Abstinence Scoring System² should be used to evaluate these groups for NAS. Researchers should develop new instruments for other drug classes if none exist.
- All physicians and nurses who treat women should be educated about the signs of addiction and utilize brief screening tools for at-risk women. Women seeking prenatal care should be screened for substance use and counseled on the impact of such use on their babies. According to the Pregnancy Risk Assessment Monitoring System, 55 percent of mothers reported discussing alcohol, prescription medication, over-the-counter medication, and illegal drug use with the healthcare provider during a prenatal visit.
- Women of childbearing age being treated for substance abuse or dependence should be counseled on the impact of substance use on pregnancy. Women who screen positive for drug abuse and dependence should also be screened for Hepatitis C and HIV because of the high comorbidity.
- Prescribers should carefully consider whether opioid analgesics should be used on a long-term basis during pregnancy.
- Women who deliver drug-addicted babies should be provided with aftercare services, so that mothers can cope with their addiction and learn about the special needs of their infants.
- Alcohol and drug abuse prevention activities should be targeted to women of prime child-bearing age.
- Promising practices in the diagnosis and treatment of NAS should be identified and promoted throughout the state.

Methods

Neonatal Abstinence Syndrome

Hospitalizations for infants with NAS were identified using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Records for infants (age < 1) with a diagnosis code of 779.5 (drug withdrawal syndrome in a newborn) were pulled if they had applicable codes anywhere in discharge fields related to the primary diagnosis or any of the 18 secondary diagnosis fields. The diagnosis of NAS may reflect one or more drugs in the infant's system, but this code does not include a diagnosis of Fetal Alcohol Spectrum Disorder (ICD-9-CM 760.71). Unlike NAS codes in the ICD-10, the ICD-9-CM code does not distinguish between NAS caused by drugs ingested by the mother versus NAS caused by drugs legitimately given by delivering physicians.

The study period for hospitalizations resulting from NAS was from 2004 to 2014 on inpatient settings. The study period was restricted to these years due to trends in reporting by member hospitals. The number of member hospitals reporting inpatient data was consistent between 2004 and 2014.

The annual hospitalization rates of NAS were calculated by dividing the number of infants hospitalized for NAS in Ohio's hospitals by the number of live births in Ohio. Birth records were only pulled for infants being born to women residing in Ohio who gave birth at an Ohio hospital. All data were obtained from the Ohio Hospital Association (OHA).

The burden of NAS on Ohio's healthcare system was estimated by quantifying charges and length of hospital stay (LOS) associated with NAS treatment. Average charges and LOS associated with NAS were compared to all Ohio infants born in Ohio's hospitals for diagnostic related groups 789-795.

Noxious Substances Affecting Infants and Breastfeeding Children

Neonatal abstinence syndrome cannot be broken down by individual drug; however, other ICD-9-CM codes may prove useful when examining drug-specific trends. ICD-9-CM diagnostic codes in the 760.7x series indicate specific noxious influences affecting fetuses or infants via placenta or breast milk (i.e., 760.75 – cocaine; 760.72 – opioids, including heroin and prescription opioids; and 760.73 – hallucinogens). The primary and all 18 secondary diagnostic codes for inpatients were queried independently of 779.5 for infants of any age. As with 779.5, these diagnostic codes are thought to be underutilized by physicians and other medical professionals.

Drug Abuse and Dependence at Time of Delivery

OHA data was used to examine drug-related diagnoses among mothers at time of delivery. Diagnostic related groups 765-768 and 774,775 370-375 were used to identify delivering mothers. ICD-9-CM diagnostic codes indicated drug abuse (305.xx) or drug dependence-related diagnoses (304.xx) for the five most commonly abused drugs including amphetamines, marijuana, cocaine, hallucinogens, opioids (i.e., heroin and prescription opioids) and sedative-hypnotics (i.e., benzodiazepines, barbiturates and muscle relaxants).

Glossary of Terms

Average length of stay – the average number of days in an inpatient setting.

Drug abuse and dependence diagnosis rate – the number of inpatient women diagnosed with drug abuse or dependence divided by the number of live births to Ohio residents, giving birth in Ohio. The rate is presented in units per 10,000 live births.

Drug class – a general category of drugs (e.g., crack cocaine, heroin) that can be used for licit or illicit purposes.

Inpatient setting – a person seen in the context of a hospital inpatient setting or skilled nursing facility.

In utero exposure – exposure to licit or illicit substances in the womb.

Medicaid discharge – a person who terminates medical services and has Medicaid as a payer source.

NAS hospitalization rate – the number of inpatient NAS hospitalizations divided by the number of live births to Ohio residents, giving birth in Ohio. The rate is presented in units per 10,000 live births.

Neonatal abstinence syndrome – a medical condition brought on by the termination of licit or illicit drugs. The condition is also known as neonatal withdrawal syndrome, and it is coded as drug withdrawal syndrome in newborns (779.5) in the ICD-9-CM.

Primary drug of choice – the most preferred licit or illicit drug reported by the client.

Service charge – This definition differs by reporting entity. Service charges for OHA data reflect average or total charges billed on behalf of the hospital. Insurance-negotiated rates may or may not be included in these charges. These charges are an underestimate of total charges because they do not include physician bills that are separate from the hospital billing systems.

References

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