



Neonatal Abstinence Syndrome

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WVU Medicine Children's

Objectives

- Review common terms and definitions and statistics related to neonatal abstinence syndrome
- Review the available assessment tools for withdrawal
- Understand appropriate non-pharmacologic therapies
- Review the pharmacologic agents routinely used for withdrawal
- Discuss the nutritional implications of neonatal abstinence syndrome

Definitions

- **Addiction**

A primary, chronic, neurobiological disease with genetic, psychosocial, and environmental factors that influence its development and manifestation

- **Physical dependence**

A state of adaptation that is manifested by a drug class-specific withdrawal syndrome

- **Tolerance**

A state of adaptation in which exposure to a drug induces changes that lessens one or more of the drugs properties

- **Neonatal abstinence syndrome**

A form of physical dependence resulting from in utero exposure to opioids, anxiolytics, antidepressants, antipsychotics, and other substances

Neonatal Abstinence Syndrome (NAS)

- Clinical diagnosis
- Results from abrupt discontinuation of chronic fetal exposure to substance used by the mother during pregnancy
- Between 2009 and 2011, the diagnosis of NAS has increased from 1.2 to 3.4 per 1000 live births
- Substances involved include:
 - Morphine, heroin, methadone, buprenorphine, prescription opioids, antidepressants, anxiolytics, nicotine, and other substances

How much has the incidence of neonatal abstinence syndrome (NAS) increased in the last decade ?

- a. 100%
- b. 200%
- c. 300%
- d. 400%**

- National inpatient data shows NAS admissions have increased from 1.2 to 5.8 per 1000 hospital births from 2000-2012; an increase of 480%.

Adapted from Patrick SW, Davis MM, Lehmann CU, Cooper WO. Increasing Incidence and Geographic Distribution of Neonatal Abstinence Syndrome: United States 2009-2012. In Press.

How much money did the United States spend on infants with NAS in 2012

- < \$ 500 Million
- b. \$ 750 Million
- c. \$ 1 Billion
- d. > \$ 1.25 Billion

State Medicaid Programs Paying the Majority of the Cost

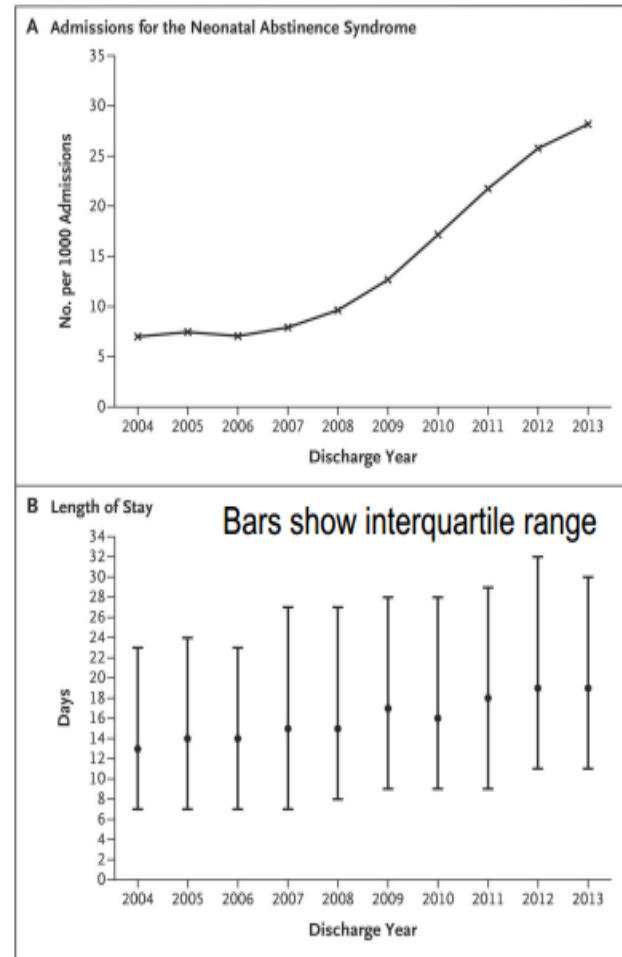
- Cost is 15 to 16 times higher than healthy infants
- Cost is rising –Mean hospital charges for discharges with NAS increased from \$39,400 in 2000 to \$53,400 in 2009

Patrick, S., Schumacher, R., Benneyworth, B., Krans, E., Mcallister, J., & Davis, M. (2013). Neonatal Abstinence Syndrome and Associated Health Care Expenditures. *Obstetric Anesthesia Digest*, 33(2), 86.

Roussos-Ross, K., Reisfield, G., Elliot, I., Dalton, S., & Gold, M. (2015). Opioid Use in Pregnant Women and the Increase in Neonatal Abstinence Syndrome. *Journal of Addiction Medicine*, 9(3), 222-225.

Pediatrix Clinical Data Warehouse

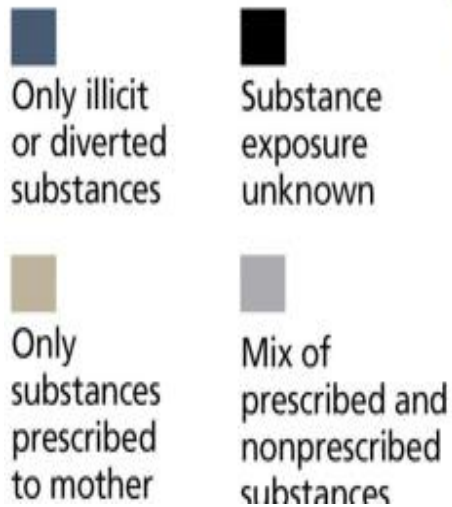
- Large, multicenter, deidentified data set
- Includes ~ 20% of infants admitted to US NICUs
- Queries: NAS, Drug
 - Withdrawal or Drug
 - Withdrawal Syndrome
- 2004-2013
- Among 674,845 infants admitted to 299 NICUs, **10,327 with NAS (1.5%)**



Tolia VN et al. N Engl J Med
2015;372:2118-2126.

Sources of drugs for women with NAS infants

Almost half of mothers whose babies were born dependent on drugs in 2013 were legally prescribed the medication that led to the babies' withdrawal. Here's a breakdown of where the drugs came from.



Source: Tenn. Dept. of Health

The Tennessean: "Born Hurting", by Tony Gonzalez & Shelley DuBois

Prescription Narcotics

Commonly Prescribed:

- Oxycodone (OxyContin)
- Oxycodone + Acetaminophen (Percocet)
- Hydrocodone + Acetaminophen (Vicodin)
- Fentanyl (patch)
- Tramadol (Ultram)
- Methadone
- Buprenorphine (Subutex)

Indications:

- Post-procedural/surgical pain
- Chronic pain
- Sleep disorders
- Drug replacement therapy
- Opioid addiction
- Opioid dependence

Heroin

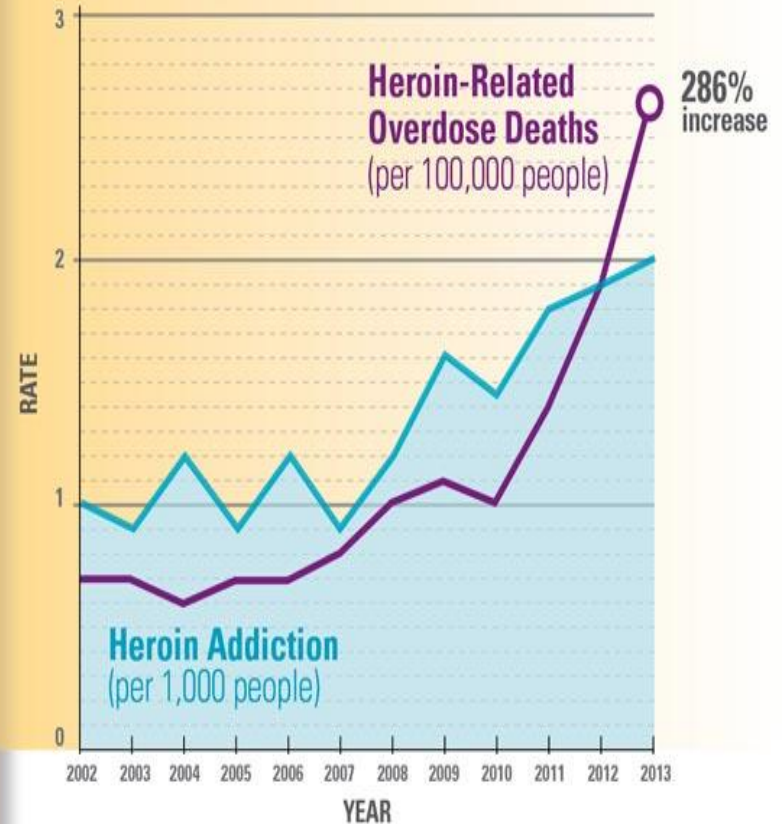
- Heroin use more than doubled among young adults ages 18–25 in the past decade.
- More than 9 in 10 people who used heroin also used at least one other drug.
- 45% of people who used heroin were also addicted to prescription opioid painkillers.

Today's Heroin Epidemic. (2015). Retrieved January 11, 2016, from <http://www.cdc.gov/vitalsigns/heroin/>

Heroin Use Has INCREASED Among Most Demographic Groups

	2002-2004*	2011-2013*	% CHANGE
SEX			
Male	2.4	3.6	50%
Female	0.8	1.6	100%
AGE, YEARS			
12-17	1.8	1.6	--
18-25	3.5	7.3	109%
26 or older	1.2	1.9	58%
RACE/ETHNICITY			
Non-Hispanic white	1.4	3	114%
Other	2	1.7	--
ANNUAL HOUSEHOLD INCOME			
Less than \$20,000	3.4	5.5	62%
\$20,000–\$49,999	1.3	2.3	77%
\$50,000 or more	1	1.6	60%
HEALTH INSURANCE COVERAGE			
None	4.2	6.7	60%
Medicaid	4.3	4.7	--
Private or other	0.8	1.3	63%

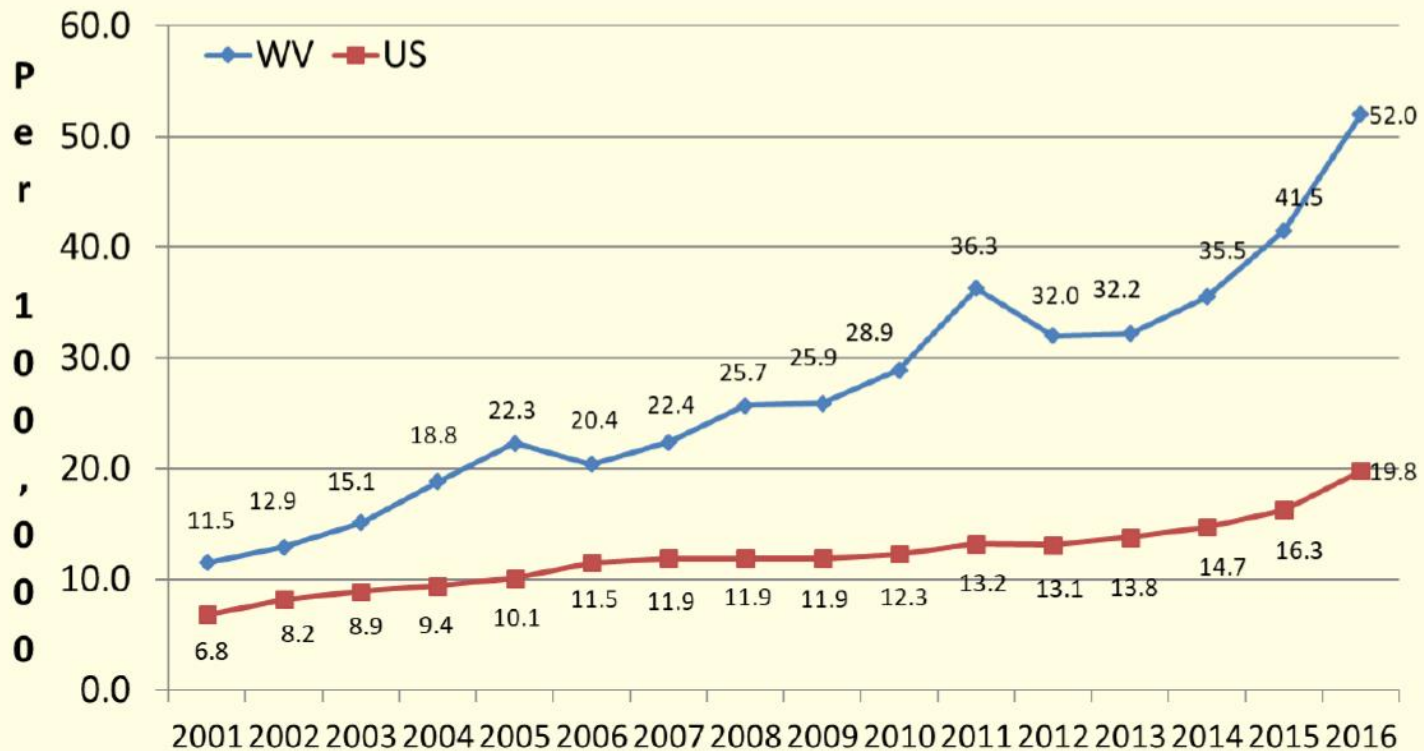
Heroin Addiction and Overdose Deaths are Climbing



SOURCES: National Survey on Drug Use and Health (NSDUH), 2002-2013.
National Vital Statistics System, 2002-2013.

West Virginia versus United States

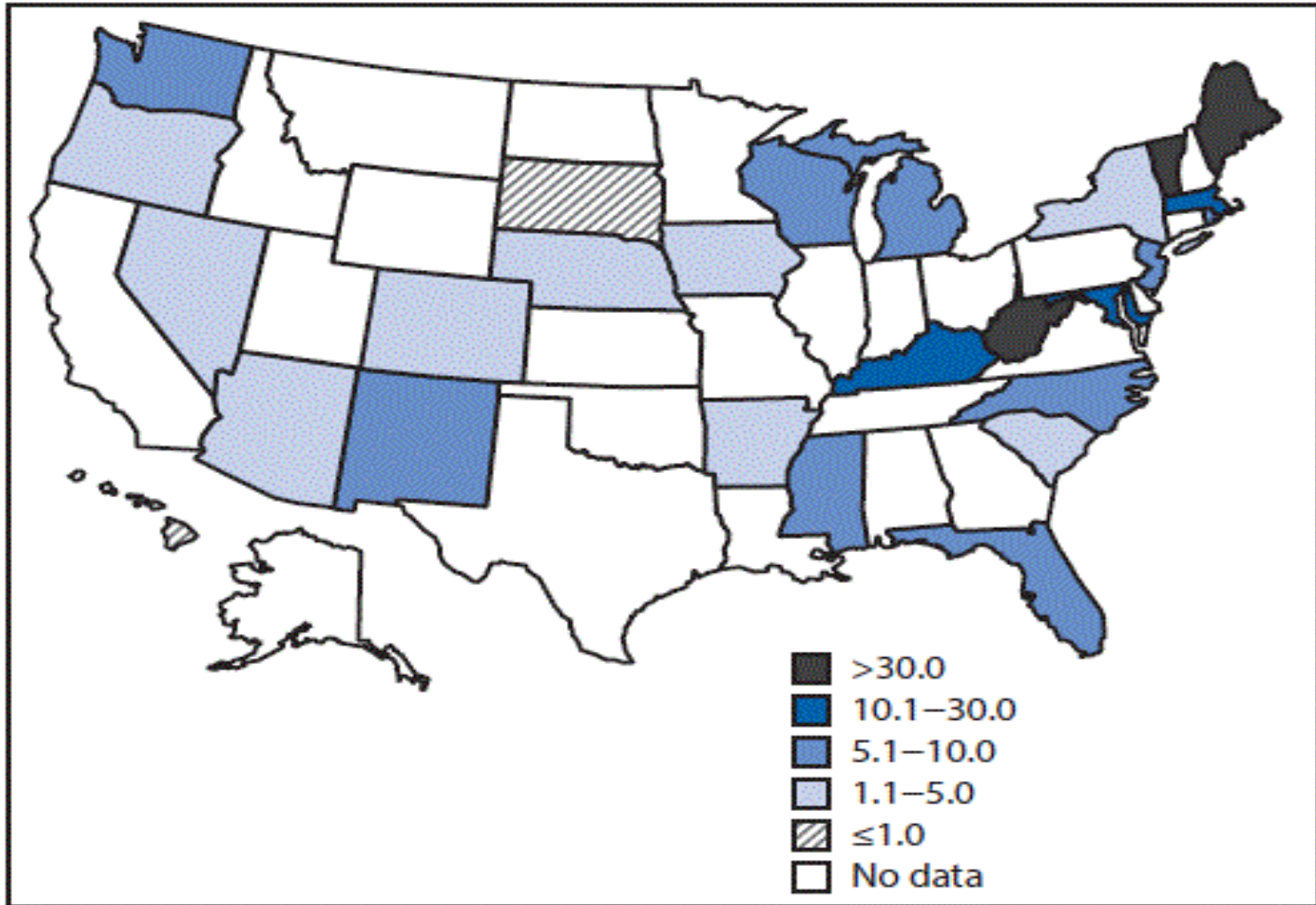
2001-2016 Resident Drug Overdose Mortality Rates West Virginia and United States



Data Source: WV Health Statistics Center, Vital Surveillance System and CDC Wonder
Rates are age-adjusted to the 2000 US Standard Million

NAS in West Virginia

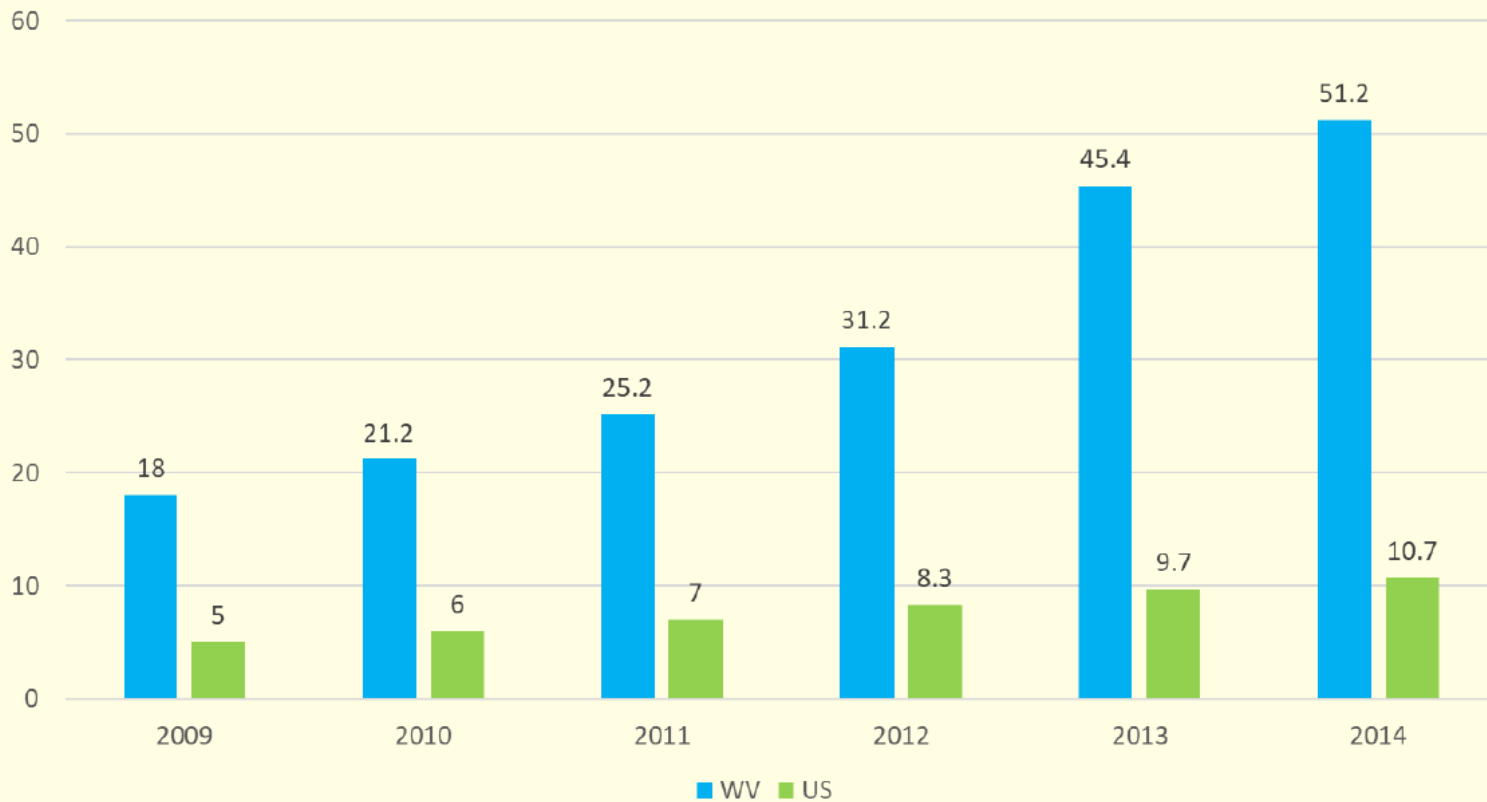
NAS and West Virginia



CDC data from 2012-2013

Other Available Data

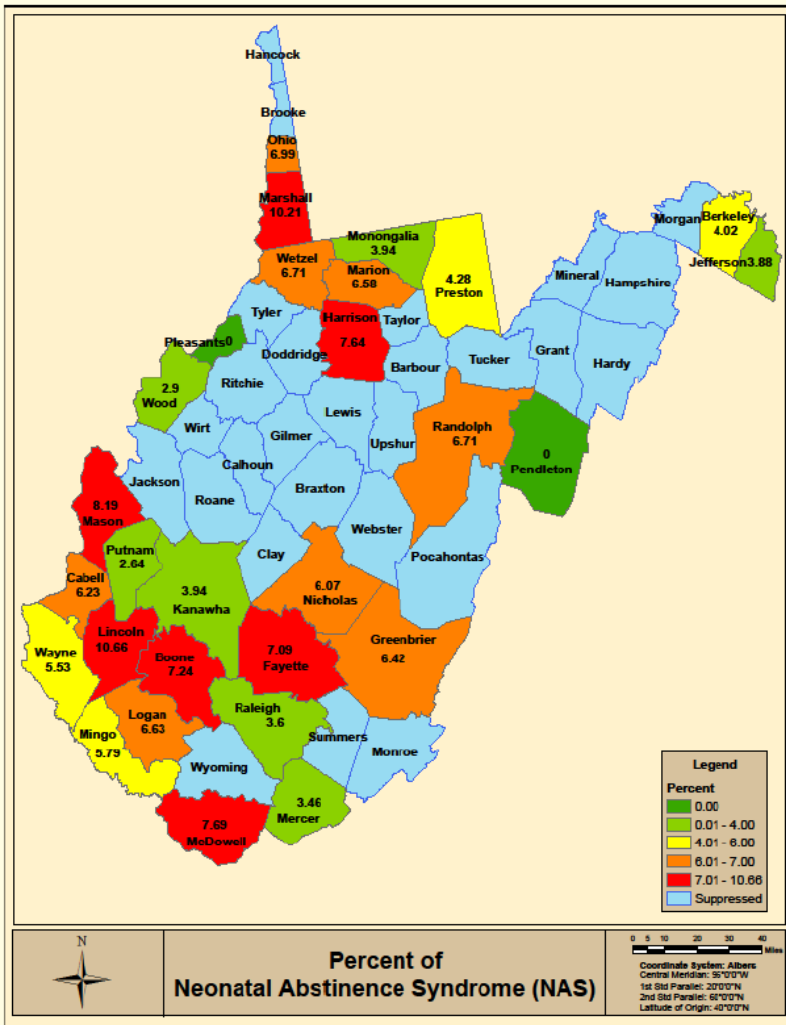
Rate of Infants Born with NAS per 1,000 Delivery Hospitalizations



Source: HCUP – State Inpatient Databases

<https://mchb.tvisdata.hrsa.gov/PrioritiesAndMeasures/NationalOutcomeMeasures>

Results



Statewide Rates:

- Intrauterine Substance Exposure: 143 per 1,000
 - NAS: 50.6 per 1,000
- * Data is for WV residents

How do we identify patients at risk?

SCREENING

Universal vs. High-risk Screening

High-risk

- History of substance use or abuse
- Limited or lacking prenatal care
- Abruption of placenta

Universal

- All mothers admitted to obstetrics unit
- All infants admitted to the newborn or neonatal units
- Regardless of history, suspicion, or level of concern

Maternal Screening

- Questionnaires during routine outpatient visits
 - Substance Use Risk Profile- Pregnancy Scale (SURP-P)
 - 4Ps Plus
 - Pro-Screen, CRAFFT, T-ACE, TWEAK
- Urine toxicological screen
 - Screens for “recent” use
- Confirmatory testing for positive screens
 - False positives can occur due to diet and other medications

Neonatal Screening

- Urine toxicological screen
 - Screens for “recent” exposure
 - Can be a difficult collection
- Meconium screening
 - Screens for exposure over months
 - Can have delayed collection
- Cord tissue screen
 - Screens for exposure over months
 - Readily available for all infants

Screening at WVU Medicine

- Universal urine toxicology screening for mother's at time of admission to labor and delivery
- Universal umbilical cord toxicology screening for all infants born at Children's
- Universal meconium toxicology screening for all infants transferred to Children's

How do we monitor the severity of withdrawal?

SCORING

NAS Scoring Scales

- Finnegan Neonatal Abstinence Scoring Tool
 - 31 items
- Modified Finnegan Scoring System
 - 21 of the original items
 - Reorganized into 3 categories
- Lipsitz Neonatal Drug- Withdrawal Scoring System
 - 11 items
- Neonatal Withdrawal Inventory
- Neonatal Narcotic Withdrawal Index

Modified Finnegan Scoring System

	Time →													
CNS		Score												
Cry	Highpitched, possible to soothe	2												
	Highpitched, not possible to soothe	3												
Sleep	Sleeps < 3 h after feed	1												
	Sleeps < 2 h after feed	2												
	Sleeps < 1 h after feed	3												
Moro-reflex	Over active	2												
	Very over active	3												
Tremor	Moderate tremors disturbed	1												
	Severe tremors disturbed	2												
	Moderate tremors undisturbed	3												
	Severe tremors undisturbed	4												
	Scratch marks	1												
Tone	Increased muscle tone	2												
Seizures	Myoclonic jerks	3												
	Generalised seizures	5												
Respiratory														
Yawning	Frequent yawning >3-4/interval	1												
Nose	Congested nose	1												
Sneezing	>3-4 times/interval	1												
	Nasal flaring	2												
Tachypnea (>60/min)	No retractions	1												
	With retractions	2												
Gastrointestinal														
Sucking behaviour	Excessive sucking	1												
	Poor feeding	2												
Vomiting	Regurgitation	2												
	Projectile vomiting	3												
Stool	Loose	2												
	Watery	3												
Other symptoms														
	Sweating	1												
Fever	37.2-38.2° C	1												
	>38.2° C	2												
Colour	Mottling	1												
TOTAL SCORE														

Scoring

- Infants > 35 weeks gestation
 - MICC- Scoring should begin within 2 hours of birth
 - NICU- Scoring should begin within 6 hours of birth
 - Continued for at least 5 days
- Infants < 35 weeks gestation
 - Scoring initiated only if infant exhibiting some signs of withdrawal
 - Then follows standard guideline

Challenges for Consistency in Scoring

Even though consistent training of staff to utilize assessment tools can increase interrater reliability, scoring with caregivers still remains subjective (Wiles, Ward, & Akinbi, 2014).

Scoring Definitions

Crying:

Healthy, normal infant is usually able to console themselves within 15 seconds by sucking on hands or fingers. If they continue to cry a caregiver can usually quiet them by holding or rocking unless they are very hungry or in pain

Excessive High-pitched

Score 2 & 3

When infant can't stop crying within the 15 second window or continues to cry intermittently/continuously for up to 5 minutes. Greater than 5 minutes, score a 3.

Pitch can vary with infants, so if cry is high-pitched, but doesn't have other symptoms, it should not be scored as a 2 or a 3 (Finnegan, 1991).

Scoring Definitions

Sleep:

Defined as the **longest period of time in a 3 hour period**

Example:

Infant sleeps from 1200-1230, goes back to sleep from 1230-1430 and remains awake until 1500

1200-1230= 30 minutes

1230-1400= 90 minutes

Infant would receive a score of 2 (baby sleeps < 2hours), since longest period of time sleeping was 90 minutes

Scoring Definitions



Moro reflex:

Moro is a normal newborn reflex that evaluates infant's CNS

Hyperactive Moro

Score 2

Infant with pronounced jitteriness of hands during or at end of Moro reflex. Jitteriness is defined as rhythmic tremors that are symmetrical & involuntary (Finnegan, 1991).

** prior to eliciting a Moro reflex, infant should be quiet so jitteriness that may be present is related to withdrawal not agitation (Finnegan, 1991).

Score 3 for infants with both jitteriness & clonus

Clonus is defined as repetitive, rhythmic jerks

Scoring Definitions

Tremors: Rhythmical involuntary movements that occur at a fixed point

Disturbed: Observed during time infant is being handled

Undisturbed: Observed when infant has been undisturbed for at least 2 one-minute periods of time

Mild Tremors: Tremors of hand or feet

Mod-Severe Tremors: Tremors of arms or legs

Tone: Ability of muscles to resist movement, measure when infant is awake and calm.

Increased Muscle Tone score 2

Scoring Definitions

Excoriation: Defined as rub marks on the skin (chin, knees, elbows, toes or nose)

A reddened diaper area does NOT count as excoriation, but as a result of loose or watery stools which is scored separately

Excoriation should continue to be scored until the rub marks on skin are no longer present

Scoring Definitions

Myoclonic Jerks: involuntary spasms or twitching of a muscle. Rarely seen in infants, but would be seen as quick movements of short duration

Convulsions: seizure activity may be present with CNS irritability in 2 % to 11% of opioid exposed infants (Finnegan, 1991).

Seizures typically occur late, when infants were around 10 days old

Scoring Definitions

Sweating: Do not score for sweating if due to overheating (too many blankets or overdressing)

Fever: score a 1 for axillary 37.2-38.3 & score a 2 > 38.4

Frequent yawning: more than 3 times in a testing period

Mottling: Marbled or lacey appearance on the skin

Scoring Definitions

Nasal stuffiness: Noisy respirations related to nasal secretions

Sneezing: more than 3 times within the scoring interval

Nasal flaring: outward spreading of nostril

Respiratory rate: > 60 score 1, > 60 with retractions score 2

Excessive sucking: frantic rooting

Poor feeding: uncoordinated suck/swallow, gulping of formula, or poor intake during feeding

Scoring Definitions

Regurgitation: For regurgitation not associated with burping
score 2

Projectile Vomiting: episodes either during or after feed score 3

Loose Stools: score 2

Watery Stools: any type of stool accompanied by a water ring
score 3

Signs and Symptoms

- **Neurologic Signs**

- Tremors; Jitteriness
- Seizures
- Irritability; Sleeplessness
- High-pitched cry
- Hypertonia; exaggerated Moro
- Yawning; sneezing
- Respiratory pauses/desaturations

- **Autonomic Instability**

- Sweating
- Temperature Instability
- Fever
- Mottling
- Nasal Stuffiness
- Tachypnea

- **GI dysfunction**

- Poor feeding
- Uncoordinated/constant sucking
- “Reflux”/Vomiting
- Diarrhea (leads to diaper rash; pain)
- Dehydration
- Poor weight gain



Diagnosis & Treatment

-Institutions across the state will use consecutive scores to determine the need for pharmacological treatment.

** After Pharmacological treatment is stopped, scoring should continue for 24 hours**

Treatment

- No established optimal treatment
- 2005 Cochrane reviews suggest lack of high-quality evidence for any specific treatment
- Expert opinion suggest opioids as the class of agents with the greatest efficacy



Treatment

- Enable infant to feed and gain weight
 - Frequently need increased caloric density of formula due to high metabolic rate
- Prevent seizures and other morbidities
- Reduce unnecessary hospitalization
- Improve/monitor family interaction/care
- Reduce infant mortality; improve outcomes
- ****Limit additional opioid exposure****

AAP Guidelines NAS (Hudak Pediatr 129:e540, 2012)

- Initiate **non-pharmacologic measures first**
- The optimal threshold ‘score’ for initiating pharmacologic therapy is unknown
- **Breast-feeding** should be encouraged if no illicit drug use
- Oral morphine, methadone—best evidence (but limited); clonidine—emerging evidence
- Observe exposed infants for 4-7 days
- Treatment of drug withdrawal may not alter long-term outcome



Non-Pharmacologic Care

- Should ***always*** be implemented first, and continued as an adjunct to drug treatment
 - Decreased environmental stimulation
 - **Room in** with mother, if feasible
 - Tight swaddling; Kangaroo care
 - Rocking/swinging
 - Non-nutritive/nutritive sucking—Breast is best!
 - Demand and/or frequent, small feedings
 - Butt care – prophylactic to prevent breakdown



Pharmacologic Treatment

- “Withdrawal from opioids...may be life-threatening, but ultimately drug withdrawal is a self-limited process”
- “Unnecessary pharmacologic treatment will prolong drug exposure and the duration of hospitalization”
- “The only clearly defined benefit of pharmacologic treatment is the **short-term** amelioration of clinical signs”
 - Prompt escalation of treatment to control clinical signs

2012 AAP Statement on Neonatal Drug Withdrawal

Non-Pharmacological Management

6 Basic Principles of Caring for an Infant with Neonatal Abstinence Syndrome

Swaddling

Positioning

Motion

Handling

Oral Stimulation

Environment & Stimulation

Other Interventions for NAS Infants

Encourage parents to actively participate in care: holding/cuddling, feeding, settling/console, and changing diaper to promote bonding.

- Infants do better with consistent care.
- Teach parents the 6 Basic Principles and 5 S's of Soothing
- Speak softly & remind those visiting and around to use quiet voices.

Other Interventions for NAS Infants

- Encourage parents to keep surroundings calm.
- Decrease noise and lights.
- Do not overdress infant.
- Protect from scratching/rubbing- use mittens or socks.
- Always practice Safe Sleep for Infants

ADDITIONAL NON-PHARMACOLOGIC TREATMENT

Breast Feeding

- **Benefits:**

- Maternal-infant bonding
- Readily available/cheap food source
- Immune factors/Gut protection
 - Particularly important in preterm infants
- May ease drug withdrawal symptoms

Concerns

- Drug toxicity (all cross into breast milk)
- Maternal inattention, sleepiness
- Risk for infection (specifically, HIV)
- Secondary smoke—increased risk for SIDS

Breast Feeding

- ▶ Growing body of literature supports breastfeeding on methadone maintenance
 - ▶ Jansson LM et.al. *Pediatr* 121: 106, 2008
- ▶ Less need for drug treatment of NAS
 - ▶ Despite low and unpredictable levels of methadone in breast milk and infant serum
 - ▶ And no evidence of significant methadone transfer to infants in breast milk

Breast Feeding

- Recommended for mothers receiving medication assisted treatment (methadone/buprenorphine)
 - Similar benefits to women without SUD
 - Additional benefit of reduced severity of NAS for infants
- Should be avoided for women with active substance use
- Women using marijuana should be educated about eliminating use while breast feeding

The Impact of Breastfeeding on Health Outcomes for Infants Diagnosed with Neonatal Abstinence Syndrome: A Review

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American Academy of Nursing on Policy

Supporting breastfeeding for infants born to opioid dependent mothers June 18, 2018



*Maureen Groer, PhD, MSN, MA, BS, FAAN, Breastfeeding Expert Panel,
Denise Maguire, PhD, RN, CNL, FAAN, Breastfeeding Expert Panel,
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CLINICAL REPORT

The Transfer of Drugs and Therapeutics Into Human Breast Milk: An Update on Selected Topics

abstract

FREE

Many mothers are inappropriately advised to discontinue breastfeeding or avoid taking essential medications because of fears of adverse effects on their infants. This cautious approach may be unnecessary in many cases, because only a small proportion of medications are contraindicated in breastfeeding mothers or associated with adverse effects on their infants. Information to inform physicians about the extent of excretion for a particular drug into human milk is needed but may not be available. Previous statements on this topic from the American Academy of Pediatrics provided physicians with data concerning the known excretion of specific medications into breast milk. More current and comprehensive information is now available on the Internet, as well as an application for mobile devices, at LactMed (<http://toxnet.nlm.nih.gov>). Therefore, with the exception of radioactive compounds requiring temporary cessation of breastfeeding, the reader will be referred to LactMed to obtain the most current data on an individual medication. This report discusses several topics of interest surrounding lactation, such as the use of psychotropic therapies, drugs to treat substance abuse, narcotics, galactagogues, and herbal products, as well as immunization of breastfeeding women. A discussion regarding the global implications of maternal medications and lactation in the developing world is beyond the scope of this report. The World Health Organization offers several programs and resources that address the importance of breastfeeding (see <http://www.who.int/topics/breastfeeding/en/>). *Pediatrics* 2013;132:e796–e809

PHARMACOLOGIC TREATMENT

Morphine

- Drug class: opioid
- Use: most commonly used for neonatal opioid withdrawal or neonatal abstinence syndrome
 - Can be used for iatrogenic withdrawal
- Half-life:
 - Infants < 6 months: ~ 6-7 hours
 - Infants > 6 months: ~ 3 hours

Phenobarbital

- Drug class: Barbiturate
- Use: Adjunctive therapy for neonatal abstinence syndrome
- Half-life:
 - Neonates: 45- 500 hours
 - Infants: 20- 133 hours

Methadone

- Drug class: Opioid
- Use: Most commonly used for opioid iatrogenic withdrawal
 - Can be used for NOWS or NAS
- Half-life: Children: 4-62 hours

Lorazepam

- Drug class: Benzodiazepine
- Use: Treatment of benzodiazepine iatrogenic withdrawal
 - Could be used for benzodiazepine associated NAS
- Half-life:
 - Neonates: ~ 40 hours (18-73 hours)
 - Older children: ~ 10 hours (6-17 hours)

Clonidine

- Drug class: Alpha-adrenergic agonist
- Use: Treatment of dexmedetomidine iatrogenic withdrawal, adjunctive treatment of multi-agent iatrogenic withdrawal and adjunctive treatment of NAS
- Half-life:
 - Neonates: 44- 72 hours
 - Children: 8-12 hours

Pharmacologic Therapy

- Current recommendations are to standardize therapy
- Morphine or methadone have been the mainstays of treatment
- New data emerging on using buprenorphine
- Adjunct treatment uses phenobarbital or clonidine

Nutrition Implications

In Utero Opioid Exposure

- ▶ Lower birth weight
- ▶ Increased preterm birth rate
- ▶ Reduced fetal growth parameters
- ▶ Associated neonatal problems
 - ▶ Hypoglycemia
 - ▶ Anemia
 - ▶ Respiratory distress
 - ▶ Delayed transition

Oral Feeding

- Early: uncoordinated suck/swallow, gulping of formula, or poor intake during feeding leads to excessive weight loss or inadequate weight gain.
- Late: Hyperphagia (High volumes) but may still have inadequate weight gain

Signs and Symptoms

- **Neurologic Signs**

- Tremors; Jitteriness
- Seizures
- Irritability; Sleeplessness
- High-pitched cry
- Hypertonia; exaggerated Moro
- Yawning; sneezing
- Respiratory pauses/desaturations

- **Autonomic Instability**

- Sweating
- Temperature Instability
- Fever
- Mottling
- Nasal Stuffiness
- Tachypnea

- **GI dysfunction**

- Poor feeding
- Uncoordinated/constant sucking
- “Reflux”/Vomiting
- Diarrhea (leads to diaper rash; pain)
- Dehydration
- Poor weight gain

Increased metabolic demand=need for more Calories

- Tremors; Jitteriness
- Seizures
- Irritability;
Sleeplessness
- High-pitched cry
- Hypertonia;
exaggerated
Moro
- Sweating
- Temperature Instability
- Fever
- Tachypnea

Energy Requirements

- Adequate intake to achieve growth.
 - Some infants may require up to 200 kcal/kg/day
 - Healthy Term Infants generally growth with ~100 kcal/kg/day
- Many NAS infants will require formula mixed at a higher caloric density to achieve adequate growth
- Increased caloric demand may be related to in utero exposure (which agent)

High Calorie Formula

- Early initiation of high-calorie formula for infants with prenatal methadone exposure may be beneficial for weight gain
- *Hospital Pediatrics* 2018;8;7 **Methadone-Exposed Infants: A Feasibility Study Randomized Clinical Trial of Standard- Versus High-Calorie Formula for**

GI Symptoms

- “Reflux”/Vomiting
- Diarrhea (leads to diaper rash; pain)
- Dehydration
- Poor weight gain
- Skin breakdown=increased needs
- Malabsorption questions with diarrhea

GI Symptoms


- Gas Pain
 - Minimize frantic hunger
 - Appropriate bottles
 - Frequent burping
 - Minimize crying
 - Infant Massage
- Vomiting/Loose Stools
 - Low osmolality formula
 - Low/no lactose formula

Breastfeeding

- Breast is still best.
- Use of breast milk will vary based on policies of each facility
- Do not discourage mothers from breastfeeding if they are in treatment programs.
- Mothers and Babies are often separated. Please support efforts to pump to provide breast milk.
- Please do not discourage pacifier use in this population.



Growth during the first year in infants affected by neonatal abstinence syndrome

Tammy E. Corr^{1*} , Eric W. Schaefer² and Ian M. Paul^{1,2}

Abstract

Background: Infants with neonatal abstinence syndrome (NAS) initially experience neurologic excitability, poor feeding, and/or hyperphagia in the setting of increased metabolic demand. Because the longitudinal effects of these early symptoms and behaviors on weight trends are unknown, we sought to contrast weight gain patterns through age 1 year for infants diagnosed with NAS with matched controls.

Methods: Retrospective cohort of 70 singletons with a gestational age of ≥ 37 weeks and an ICD-9 or ICD-10 diagnosis of NAS made ≤ 7 days after birth with institutional follow-up matched to patients without NAS. Infants were matched on gestational age (± 2 weeks), birth weight (± 20 g), sex (exact), and insurance type (exact). Quantile regression methods were used to estimate 10th, 25th, 50th, 75th and 90th percentiles of weight over time.

Results: The mean gestational age for an infant with NAS was 38.8 weeks (standard deviation [SD], 1.3). The mean birth weight was 3.141 kg (SD, 0.510). NAS patients had a median of 24 weights recorded between birth and 400 days (inter-quartile range [IQR], 16–32 weights). Patients without NAS had a median of 12 weights recorded (IQR, 10–16). Growth curves were similar over the first 400 days of life. Patients with NAS had non-significantly higher and lower estimated weights for the 90th and 10th percentiles, respectively.

Conclusion: Infants with a diagnosis of NAS grew similarly to controls during their first year. Given the frequently-encountered NAS symptoms of hyperphagia and irritability, future studies may evaluate whether early differences in caregiver feeding exist and whether they have longer-term impacts on growth.

Keywords: Neonatal abstinence syndrome, Neonatal opioid withdrawal syndrome, Infant growth, Infant nutrition, Pediatric obesity, Behavioral feeding, Comfort feeding, Parenting practices

Research

- Current studies:
 - Types of formula
 - Caloric Density
 - Impact on Microbiome
 - Additional Breastfeeding research

Roles for Dietitians

- 1) Screening for malnutrition
- 2) Assess intake and growth in neonatal period
- 3) Follow-up after discharge
- 4) Optimize prenatal nutrition
- 5) Supporting breastfeeding for moms in treatment programs (no street drugs)

We can be a resource. Call If you have questions.

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QUESTIONS??

Thank you

