Neonatal Abstinence Syndrome

Emily Scott, MD FAAP

Riley Hospital for Children
Indiana University Health

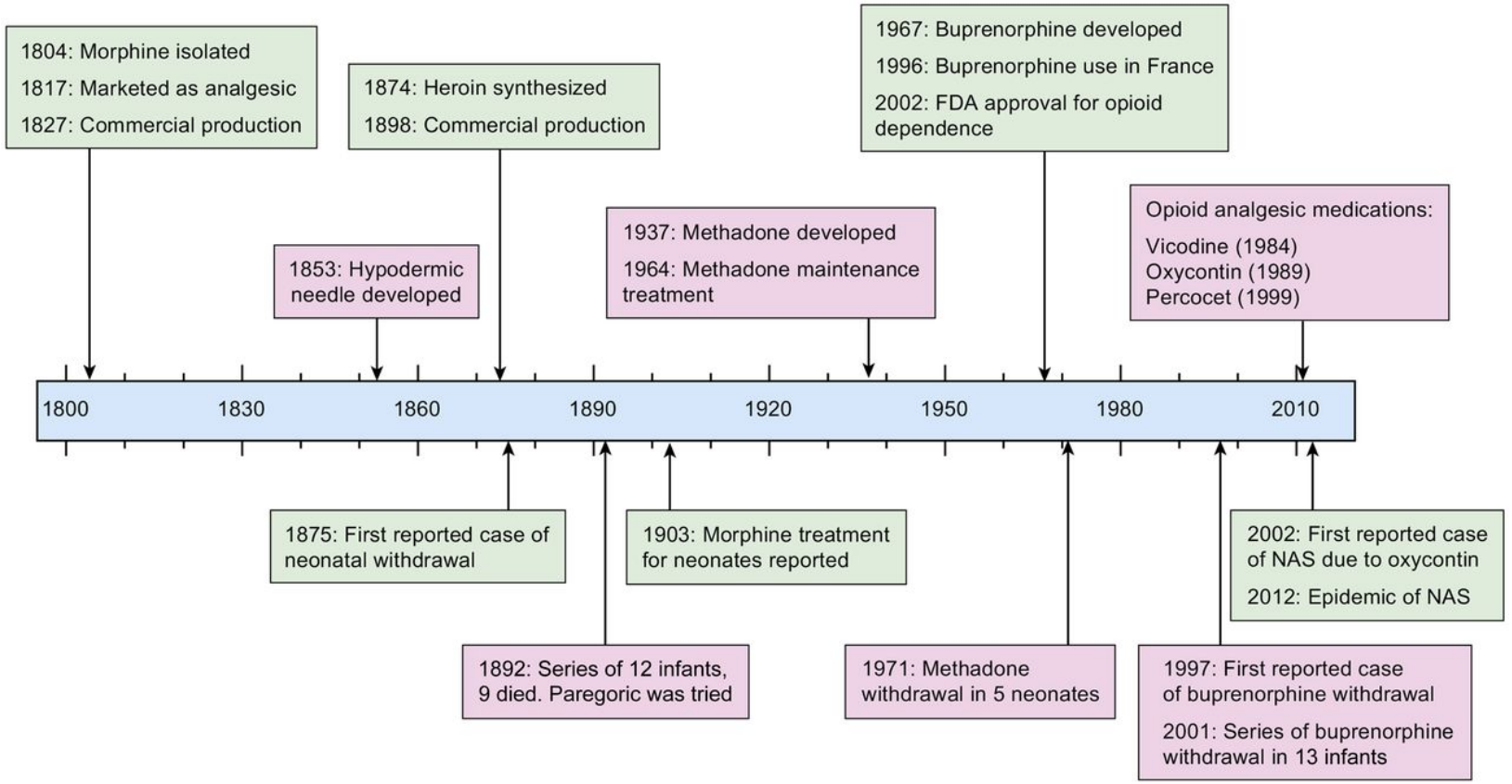
Disclosures

- I have no financial disclosures.

Objectives

- Highlight the growing rates of neonatal abstinence syndrome in our community
- Review the evidence based practices for screening, monitoring and treating neonatal abstinence syndrome
- Discuss the importance of family-centered care for infants affected by opioid use during pregnancy

Historical background

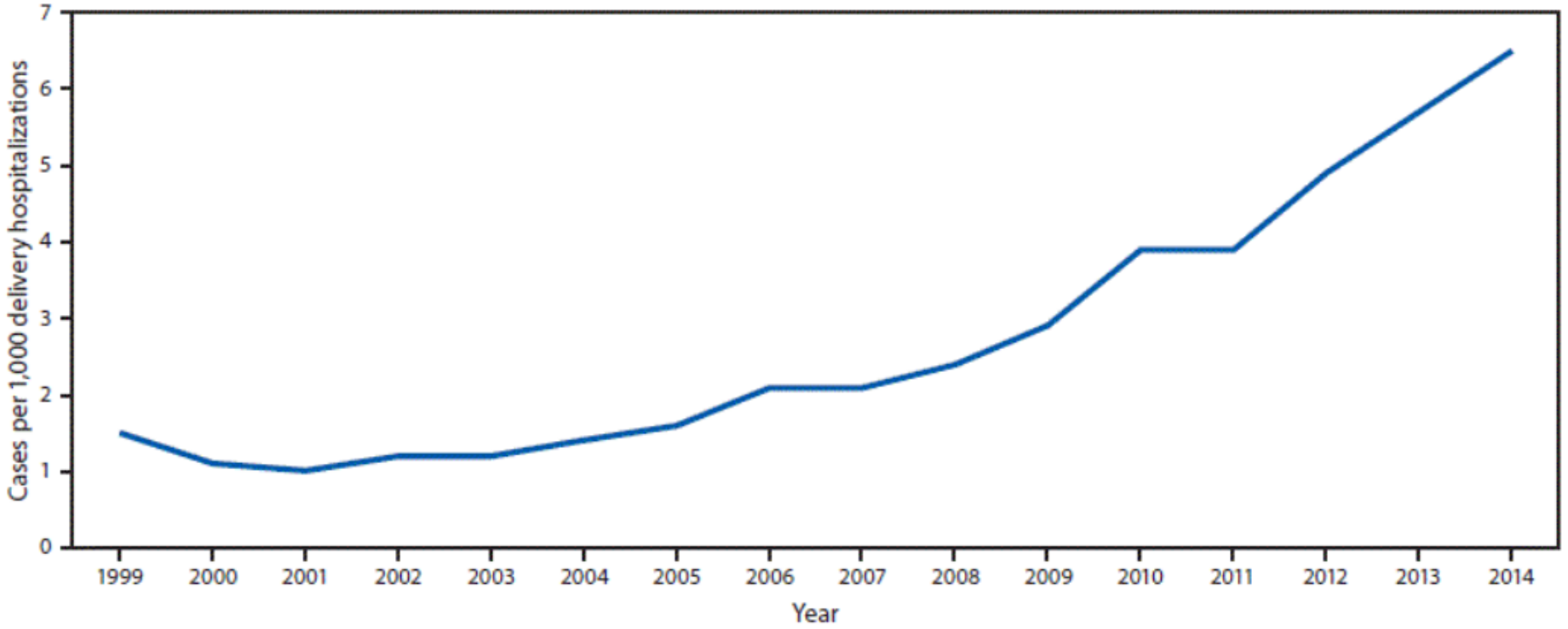


Kocherlakota 2014

Riley Hospital for Children
Indiana University Health

OUD at the time of delivery quadruples in 15 years

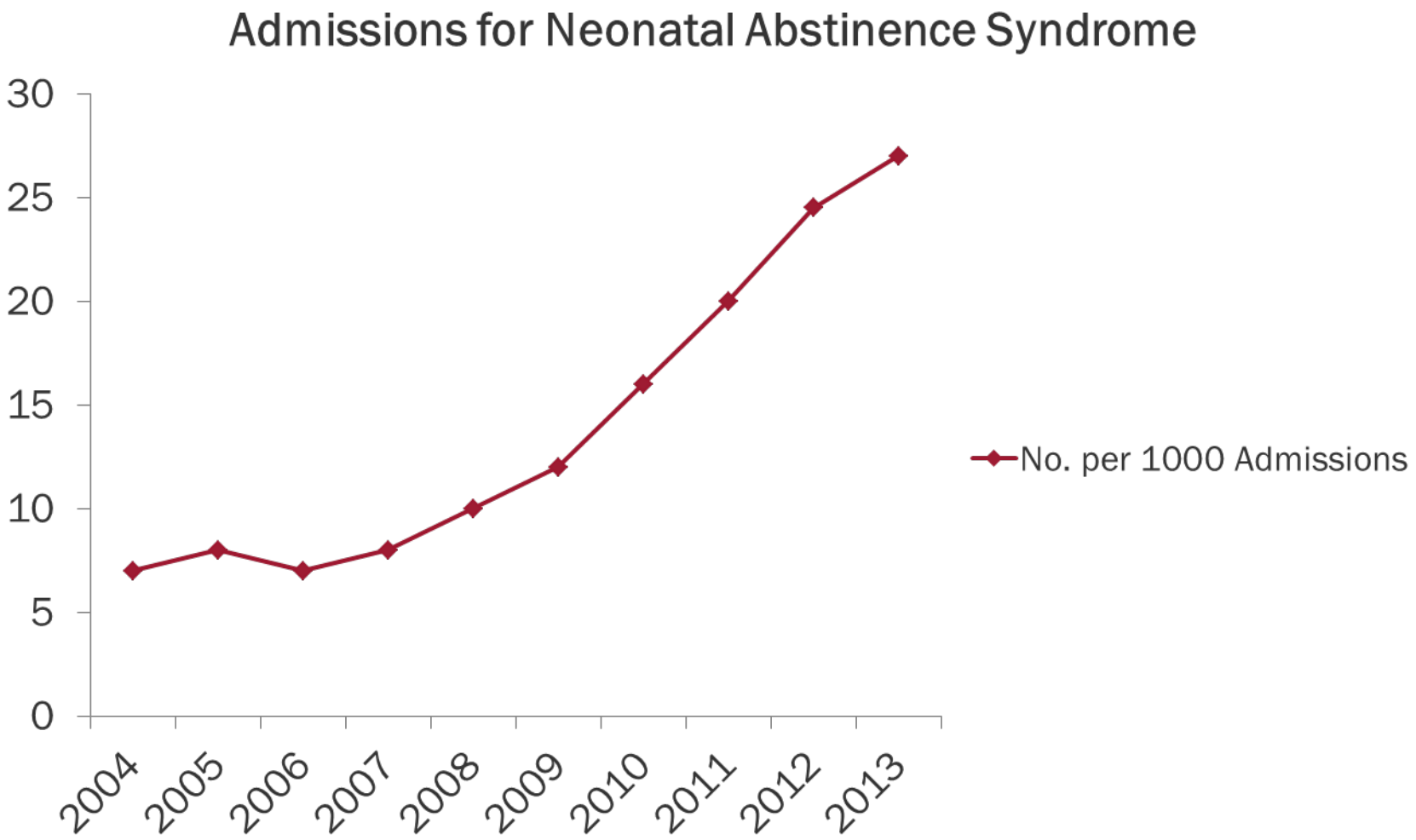
FIGURE 1. National prevalence of opioid use disorder per 1,000 delivery hospitalizations* — National Inpatient Sample (NIS),† Healthcare Cost and Utilization Project (HCUP), United States, 1999–2014



Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. Opioid Use Disorder Documented at Delivery Hospitalization — United States, 1999–2014. MMWR Morb Mortal Wkly Rep 2018;67:845–849.

Riley Hospital for Children
Indiana University Health

Scope of the problem

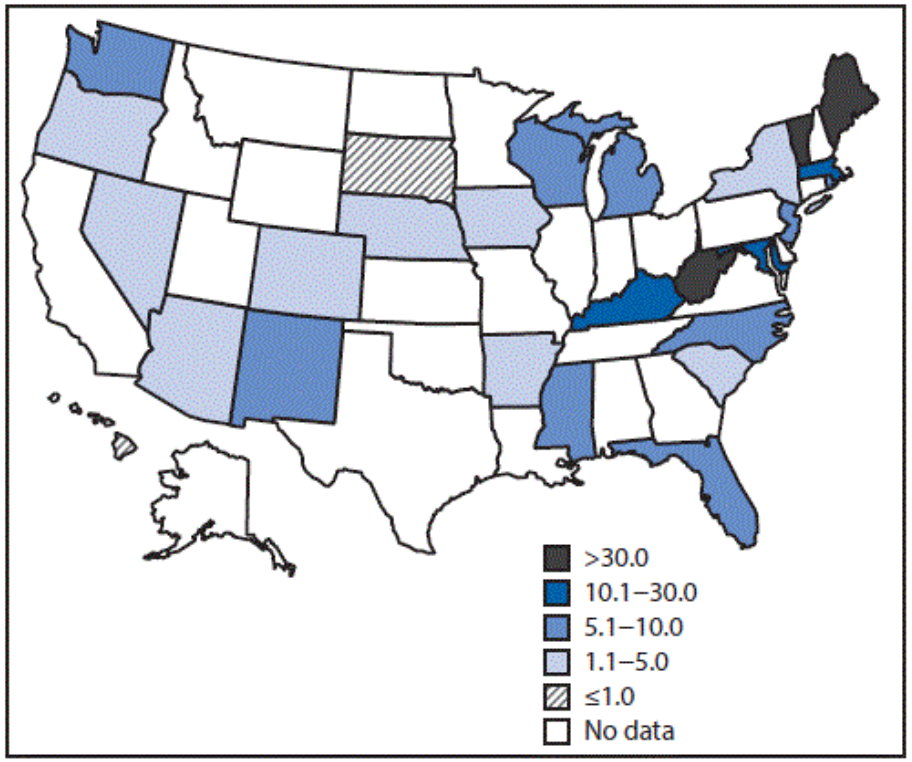


Riley Hospital for Children
Indiana University Health

*

Rate of NAS – CDC MMWR Summer 2016

FIGURE. Neonatal abstinence syndrome (NAS) incidence rates* — 25 states, 2012–2013†



Source: State Inpatient Databases, Healthcare Cost and Utilization Project.

* NAS cases per 1,000 hospital births.

Riley Hospital for Children
Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY
Riley Hospital for Children
Indiana University Health

*

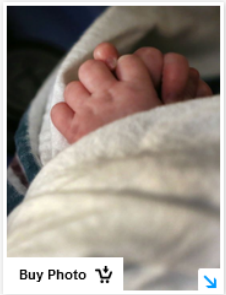
INDYSTAR
PART OF THE USA TODAY NETWORK

newborns opiate

HOME | NEWS | SPORTS | LIFE | THINGS TO DO | TRAVEL | OPINION | OBITUARIES | WEATHER | ARCHIVES | insider | USA TODAY

Data show high rate of opiate-affected newborns

Maureen Groppe, Star Washington Bureau 3:02 p.m. EDT August 13, 2016



(Photo: Kelly Wilkinson/IndyStar 2015 file photo)

WASHINGTON — Doctors and nurses at Community Hospital East in Indianapolis began to suspect in recent years that they were seeing more babies born dependent on opioids and other drugs.

Some infants shook and screamed with the pain of withdrawal. Others were born too small or had trouble breathing.

Now their suspicions are backed up by hard — albeit preliminary — evidence: One in five babies born at Community East in the first six months of 2016 tested positive for drugs. Opiates were the most common substance found in the umbilical cord.

The hospital tested only babies who appeared to be victims of substance abuse. Approximately 60 percent tested positive.

The figures come from a pilot study the Indiana State Department of Health is conducting under a 2014 mandate from the Indiana legislature. The mandate requires state health officials to create a task force to gauge the prevalence in Indiana of neonatal abstinence syndrome (NAS). Babies with the syndrome are exposed to addictive drugs while in the mother's womb and go through withdrawal after being born.

Donetta Gee-Weiler, vice president of women's and children's services with Community Health Network, said the numbers are shocking but not surprising to those dealing with the issue every day.

"We've seen this and are working with the state to help others understand the incidence of substance abuse," she said. "It's a problem in Indiana."

The NAS task force must come up with a standard way to diagnose and track the condition, and must help health care providers figure out how to prevent and treat it.

Riley Hospital for Children
Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

*

Neonatal Abstinence Syndrome (NAS)

- Defined as the constellation of clinical findings associated with drug withdrawal in newborns
  - *Opioids
  - Benzodiazepines
  - Alcohol
  - SSRIs
- Most newborns exposed to opiates in utero will undergo some withdrawal

Symptoms of NAS

- Inconsolable, high pitched cry
- Poor sleep and feeding patterns
- Tremulous and jittery
- Diarrhea and vomiting
- Yawning and sneezing
- Increased tone
- Tachypnea
- Fever
- Seizures
- Failure to thrive
- Dehydration

Riley Hospital for Children
Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

*

Timing of withdrawal

- Symptom onset depends on substance half-life
  - Heroin: 24 hours
  - Prescription short-acting opioids: 36-72 hours
  - Methadone/Buprenorphine: 48-72 hours (*can be delayed to 5-7 days)

Riley Hospital for Children
Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

Scoring systems

- Multiple scoring systems available
  - Modified Finnegan score
- Semi-objective with concerns for interobserver reliability
- Consistent practice is the key!

SYSTEMS	SIGNS AND SYMPTOMS	SCORE	AM 2	4	6	8	10	12	PM 2	4	6	8	10	12	DAILY WT.
CENTRAL NERVOUS SYSTEM DISTURBANCES	High Pitched Cry	2													
	Continuous High Pitched Cry	3													
	Sleeps < 1 Hour After Feeding	3													
	Sleeps < 2 Hours After Feeding	2													
	Hyperactive Moro Reflex	2													
	Markedly Hyperactive Moro Reflex	3													
	Mild Tremors Disturbed	2													
	Moderate Severe Tremors Disturbed	3													
	Mild Tremors Undisturbed	1													
	Moderate Severe Tremors Undisturbed	2													
	Increased Muscle Tone	2													
	Excoriation (specify area): _____	1													
	Myoclonic Jerks	3													
	Generalized Convulsions	3													
METABOLIC VASOMOTOR/ RESPIRATORY DISTURBANCES	Sweating	1													
	Fever < 101°F (39.3°C)	1													
	Fever > 101°F (39.3°C)	2													
	Frequent Yawning (> 3-4 times/interval)	1													
	Mottling	1													
	Nasal Stuffiness	1													
	Sneezing (> 3-4 times/interval)	1													
	Nasal Flaring	2													
	Respiratory Rate > 60/min	1													
	Respiration Rate > 60/min with Retractions	2													
GASTROINTESTINAL DISTURBANCES	Excessive Sucking	1													
	Poor Feeding	2													
	Regurgitation	2													
	Projectile Vomiting	3													
	Loose Stools	2													
	Watery Stools	3													
	TOTAL SCORE														
	SCORER'S INITIALS														
	STATUS OF THERAPY														

negan L. Neonatal abstinence syndrome: assessment and pharmacotherapy. Neonatal Therapy: An update, F. F. Granti, editors. Elsevier Science Publishers B. V. (Biomedical Division). 1986: 122-146

Riley Hospital for Children
Indiana University Health

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

*

Length of monitoring

- Infants exposed to low-dose prescription opiates with short half-life (hydrocodone) can be safely discharged if there are no signs of withdrawal by **3 days** of life
- Infants exposed to methadone/buprenorphine should be observed for minimum of **5-7 days**
- Discharged babies need close follow-up

Hudak 2012

Traditional management

- Medication treatment with morphine (or other opioid replacement) based on Finnegan scores
  - 3 scores of 8 or higher, 2 scores of 12 or higher?
  - 2 scores of 9 or higher, 1 score of 12 or higher?
  - Other?

- When do you start weaning the medication? How often?

- No “best practice” protocol exists

Hudak 2012

Initiating medication therapy

- Morphine (or other opioid)
  - "Capture" baby's symptoms, then slow wean as tolerated
- Phenobarbital/clonidine as adjunctive meds
- Following a protocol makes a difference!
- Prolonged length of stay (weeks)

Paradigm shift

- Families (optimal and intensive supportive care) are the first line therapy for neonatal abstinence syndrome

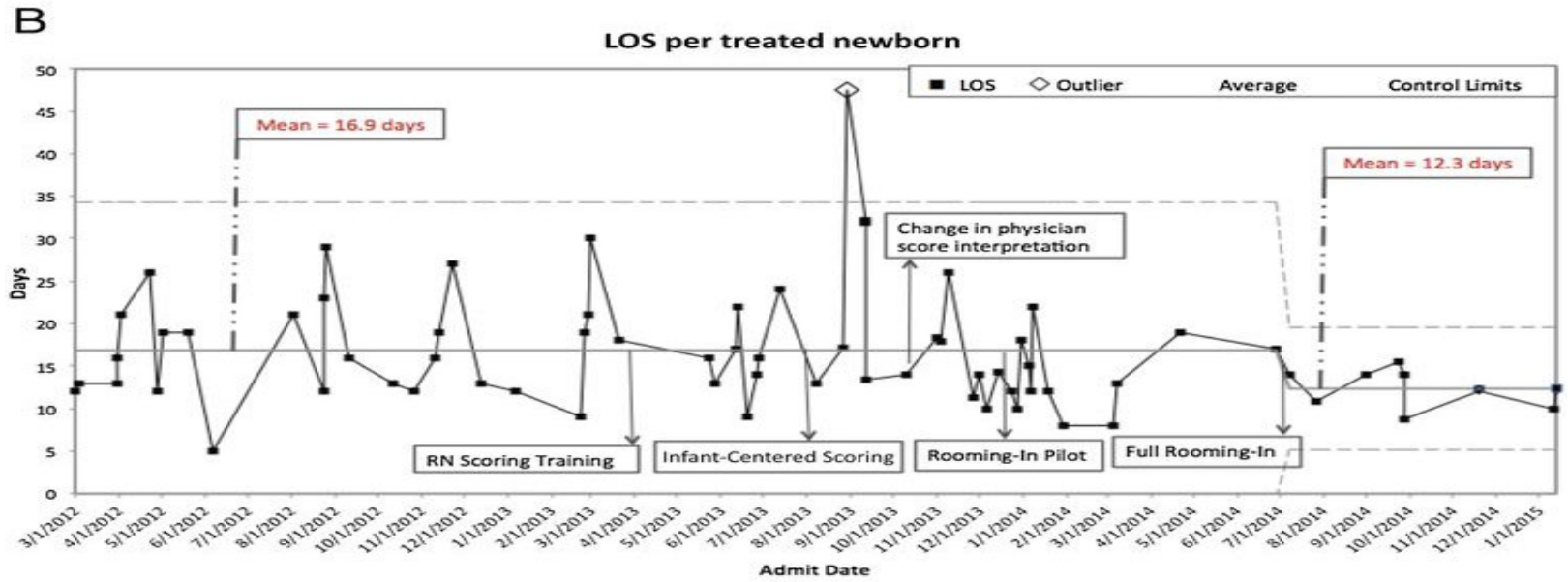
Family-Centered NAS Care – Dartmouth Study

Traditional Model	Family Centered Model
Opioid exposed baby at risk for NAS admitted directly to NICU	Opioid exposed baby at risk for NAS remains with mother on postpartum unit, then transitions to pediatrics floor where family can “room in”
Finnegan score done on an exam table away from family	Finnegan score is done after a feed while being held by parents
Decision to start morphine based on Finnegan scores alone	Decision to start morphine based on overall clinical picture, with Finnegan score being a part of that picture

Holmes 2016

Results of Family Centered NAS Care

- Need morphine to treat
  - ⬇ 46% → 27%
- Adjunctive use of phenobarbital
  - ⬇ 13% → 2%
- Average length of stay for morphine treated
  - ⬇ 16.9 → 12.3 days
- Average hospital costs per at risk infant
  - ⬇ $11,000 → $3,500



Holmes 2016

Original Investigation

ONLINE FIRST

February 5, 2018

Association of Rooming-in With Outcomes for Neonatal Abstinence Syndrome

A Systematic Review and Meta-analysis

Kathryn Dee L. MacMillan, MD[1,2]; Cassandra P. Rendon, BA, BS[2,3]; Kanak Verma, MPH[2,3]; et al

» Author Affiliations

JAMA Pediatr. Published online February 5, 2018. doi:10.1001/jamapediatrics.2017.5195

Key Points

Question Does rooming-in with family reduce the use of medications, length of stay, and costs in the inpatient treatment of neonatal abstinence syndrome?

Findings In this systematic review and meta-analysis of 6 studies comprising 549 patients, rooming-in was associated with a reduction in the need for pharmacologic treatment and a shorter hospital stay when rooming-in was compared with standard neonatal intensive care unit admission for neonatal abstinence syndrome.

Meaning Rooming-in should be considered as the preferred inpatient care model for all opioid-exposed newborns, including those with neonatal abstinence syndrome.

for Children
alth

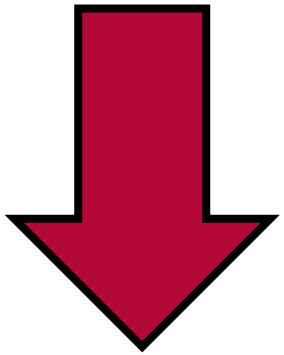
Breastfeeding

Riley Hospital for Children
Indiana University Health

Maternal Substance Abuse

- Any maternal illicit drug abuse is not compatible with breastfeeding
  - **Moms on methadone/buprenorphine should be encouraged to breastfeed if currently abstinent from any drugs of abuse**

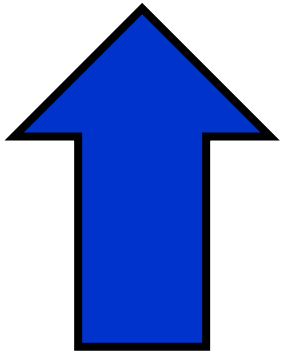
Exclusive breastfeeding and NAS



Finnegan scores

Infants required morphine

Length of stay



Supportive care for infant

Maternal bonding

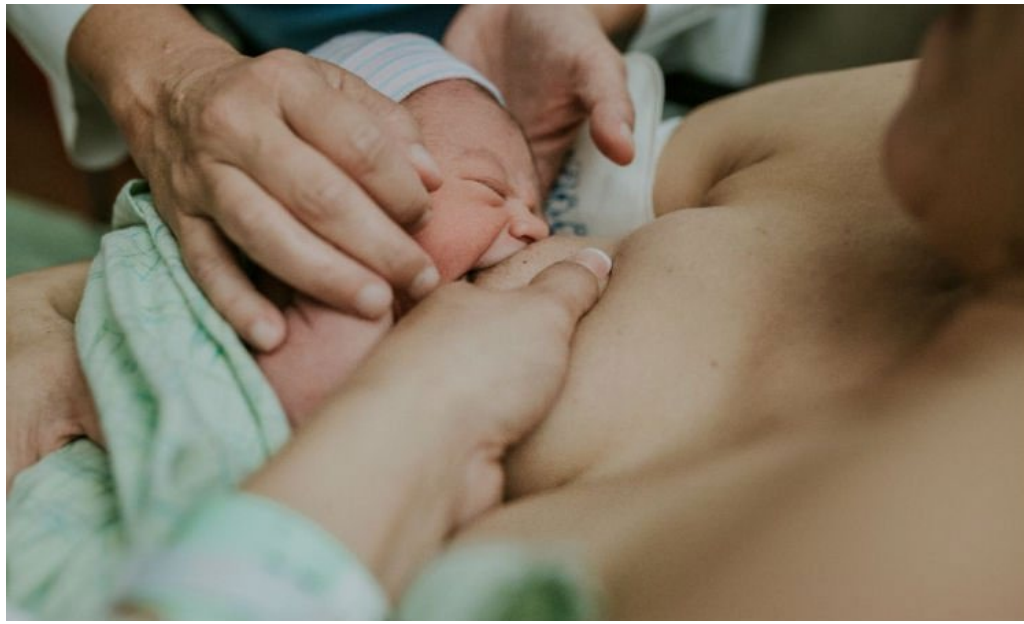
Maternal stress relief

Abdel-Latif 2006

Riley Hospital for Children
Indiana University Health

Breastfeeding support

- It is SAFE for moms on maintenance meds
- Prenatal education/expectations
- Early skin to skin and lactation support
- If baby frantic/disorganized
  - Swaddle arms
  - Get milk flowing (hand expression/pumping)
  - Breast massage to maintain flow
  - Nipple shield
- Counsel moms with Hep C



Bogen 2017

Eat, Sleep, Console?

An Initiative to Improve the Quality of Care of Infants With Neonatal Abstinence Syndrome

Matthew R. Grossman, MD,[a] Adam K. Berkwitt, MD,[a] Rachel R. Osborn, MD,[a] Yaqing Xu, MS,[b]
Denise A. Esserman, PhD,[b] Eugene D. Shapiro, MD,[a,c] Matthew J. Bizzarro, MD[a]

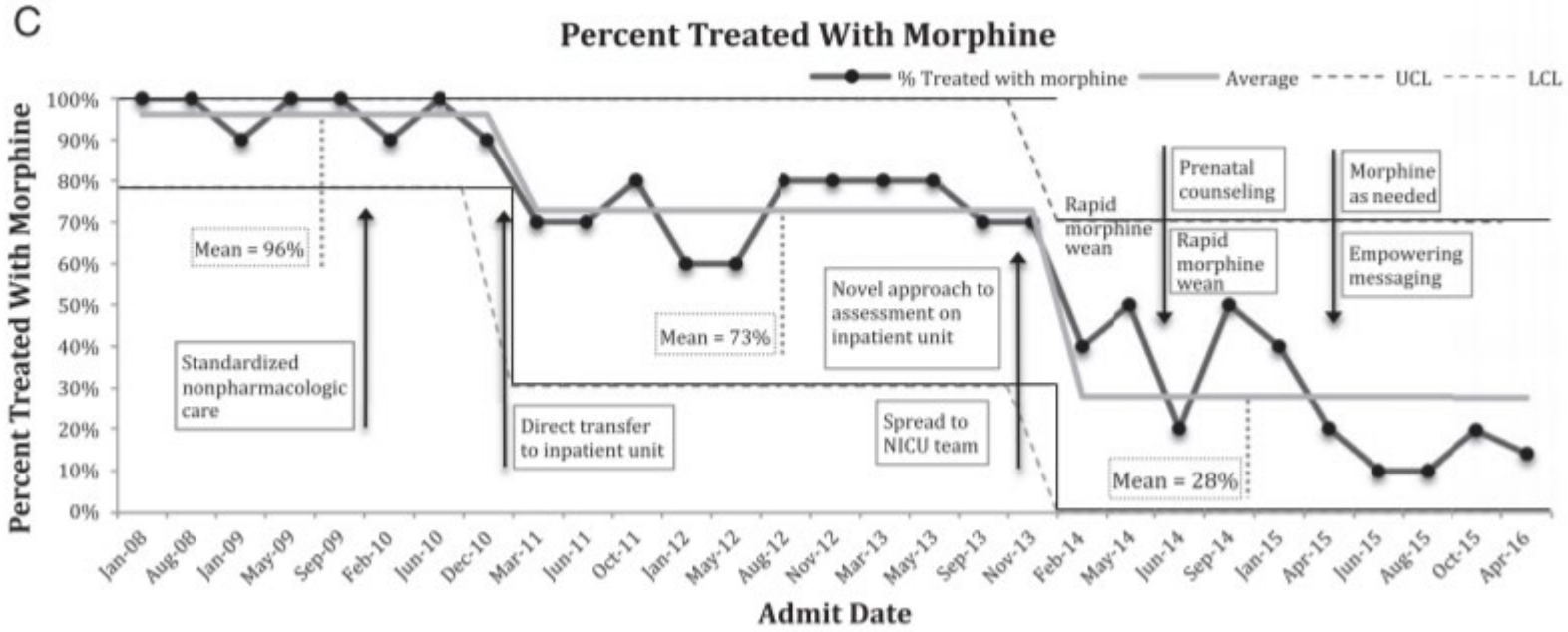
- Can the baby breastfeed effectively or take > 1 oz from the bottle?
- Can the baby sleep for > 1 hour undisturbed?
- Can the baby be consoled within 10 minutes?
- **If yes – no morphine!**

***if morphine started – given PRN**

Riley Hospital for Children
Indiana University Health

Grossman 2017

Eat, Sleep, Console?



- Length of stay – 22.4 to 5.9 days
- Morphine treatment – 98% to 14%
- Average cost - $45,000 to $10,000

Riley Hospital for Children
Indiana University Health

Grossman 2017

Paradigm shift

- Families (optimal and intensive supportive care) are the first line therapy for neonatal abstinence syndrome

Preparing for Hospital Discharge

- Who will be in the home
- Who will be mom's support
- What support services are already in place?
- Is mom going to be weaning off her maintenance medication soon?

Long term outcomes

- Research is mixed
- Infants diagnosed with NAS are likely at risk for many comorbidities throughout childhood including
  - Feeding difficulties
  - Failure to thrive
  - Hypertonicity
  - Developmental delay
  - Strabismus
  - Behavior concerns

Risks to wellness

- Children with opioid exposure in utero are 2.5 times more likely to be readmitted to the hospital in the first month of life.
- Throughout their childhood, more likely to be readmitted for:
  - Assaults
  - Maltreatment
  - Poisoning
  - Mental/behavioral disorders
  - Visual disorders

Patrick 2015
Uebel 2015

After hospital discharge

- Children exposed to substances prenatally require:
  - Close follow-up with a pediatric provider
  - Ongoing assessment of feeding and growth
  - Close monitoring of development, behavior and vision
    - Early referrals to First Steps and subspecialty care if needed
  - Hepatitis C testing *if indicated
  - Frequent and thorough assessments of social determinants of health
    - Referral to community supports

Labor of Love
Helping Indiana Reduce Infant Death

Be aware of biases

Explicit bias

- Aware
- Voluntary
- Intentional

Implicit bias

- Unaware
- Involuntary
- Unintentional

Riley Hospital for Children
Indiana University Health

Source: The Washington Times

"It is time for us to reshape how we view addiction in the US.
It is a medical condition – not a moral failing." - Stephen Patrick, MD

Riley Hospital for Children
Indiana University Health

*

References

- Abdel-Latif ME, Pinner J, Clews S, Cooke F, Lui K, Oei J. Effects of breast milk on the severity and outcome of neonatal abstinence syndrome among infants of drug-dependent mothers. *Pediatrics*. 2006; 117 (6): e1163 – e1169.
- Abrahams, RR, Kelly SA, Payne S, Thiessen P, Mackintosh J, Janssen P. Rooming-in compared with standard care for newborns of mothers using methadone or heroin. *Canadian Family Physician*. 2007; 53: 1722 – 1730.
- Agthe, AG. Kim, GR, Mathias KB, et al. Clonidine as an adjunct therapy to opiods for neonatal abstinence syndrome: a randomized controlled trial.
- Choo RE, Huestis MA, Schroeder JR, et al. Neonatal abstinence syndrome in methadone-exposed infants is altered by level of prenatal tobacco exposure. *Drug and Alcohol Dependence* 75 (2004) 253-260.
- Goyal MK, Kuppermann N, Cleary SD, Teach SJ, Chamberlain JM. Racial Disparities in Pain Management of Children With Appendicitis in Emergency Departments. *JAMA Pediatr.* 2015;169(11):996–1002.
- Gutherz SB, Kulick CV, Soper C, et al. Brief postnatal exposure to phenobarbital impairs passive avoidance learning and sensorimotor gating in rats. *Epilepsy & behavior*. 2014. 37. p265-9.
- Grossman, MR et. al. "An Initiative to Improve Quality of Care of Infants with Neonatal Abstinence Syndrome. Pediatrics Jun 2017, 139 (6) e20163360; **DOI:** 10.1542/peds.2016-3360
- Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. Opioid Use Disorder Documented at Delivery Hospitalization — United States, 1999–2014. MMWR Morb Mortal Wkly Rep 2018;67:845–849.
- Hall ES, Wexelblatt SL, Crowley M, et al. A multicenter cohort study of treatments and hospital outcomes in neonatal abstinence syndrome. *Pediatrics.* 2014. 134:2. p527-34.
- Holmes AV, et al. Rooming-In to Treat Neonatal Abstinence Syndrome: Improved Family-Centered Care at Lower Cost. *Pediatrics.* 2016. 137(6)
- Hu S, Sheng WS, Lokensgard JR, et al. Morphine induces apoptosis of human microglia and neurons. *Neuropharmacology.* 2002. 42. p829-36.
- Hudak ML, Tan RC. Neonatal drug withdrawal , clinical report. *Pediatrics*. 2012. 129. p540-60.
- iNICQ 2013: Recognition and management of the substance-exposed infant. Vermont Oxford Network iNICQ team webinar.
- Fraser JA, Barnes M, Biggs HC, et al. Caring, chaos, and the vulnerable family: Experiences in caring for newborns of drug-dependent parents. International Journal of Nursing Studies. 44 (2007) 1363-1370.
- Hunt RW, Tzioumi D, Collins E, et al. Adverse neurodevelopmental outcome of infants exposed to opiate in-utero. *Early Human Development*. 2008;84:29-35.
- Johnson TJ, Winger DG, Hickey RW, et al. A comparison of physician implicit racial bias towards adults versus children. *Academic pediatrics*. 2017;17(2):120-126.

References

- Kellogg A, Rose CH, Harms RH, Watson WJ. Current trends in narcotic use in pregnancy and neonatal outcomes. *American Journal of Obstetrics and Gynecology*. 2011; 204: 259. e1 – e4.
- Kieviet N, Dolman KM, Honig A. The use of psychotropic medication during pregnancy: how about the newborn? *Neuropsychiatric Disease and Treatment.* 2013; 9: 1257 – 1266.
- Ko, J, et al. Incidence of Neonatal Abstinence Syndrome – 28 States, 1999-2013. *MMWR.* August 12, 2016 / 65(31);799–802
- Kocherlakota P. Neonatal abstinence syndrome. *Pediatrics*. 2014; 134 (2): e547 - e561.
- Kraft WK, Givson E, Dysart K. Sublingual buphrenorphine for treatment of neonatal abstinence syndrome: a randomized trial. *Pediatrics.* 2008. 122. P601-7.
- Lainwala S, Brown ER, Weinschenk NP, et al. A retrospective study of length of hospital stay in infants treated for neonatal abstinence syndrome with methadone versus oral morphine preparations. *Advances in neonatal care*. 2005. 5:5. p265-72.
- Maguire D. Care of the infant with neonatal abstinence syndrome: strength of the evidence. *J Perinat Neonatal Nurs.* 2014 Jul-Sep;28(3):204-11.
- Massaro AN, Hammad TA, Jazzo B, et al. Massage with kinesthetic stimulation improves weight gain in preterm infants. *J. Perinatology.* 2009 May; 29(5):325-7.
- Mazurier E, Cambonie G, Barbotte E., et al. Comparison of chlorpromazine versus morphine hydrochloride for treatment of neonatal abstinence syndrome. *Acta Paediatrica*. 2008. 97. P1358-61.
- Mehta A, Forbes KD, Kuppala VS. Neonatal abstinence syndrome management from prenatal counseling to postdischarge follow-up care: results of a national survey. *Hospital Pediatrics*. 2013; 3: 317 – 323.
- Messinger DS, Bauer CR, Das A, Seifer R, et al. The Maternal Lifestyle Study: Cognitive, Motor, and Behavioral Outcomes of Cocaine-Exposed and Opiate-Exposed Infants Through Three Years of Age. *Pediatrics*. 2004;113;1677-1685.
- Minozzi S, Amato L, Bellisario C, Ferri M, Davoli M. Maintenance agonist treatments for opiate-dependent women. *Cochrane Database Systematic Reviews*. 2013; (12): CD006318.

References

- Osborn DA, Jeffery HE, Cole MJ. Opiate treatment for opiate withdrawal in newborn infants. *Cochrane database of systematic reviews* 2010, Issue 10.
- Patrick SW, Dudley J, Martin PR, Harrell FE, Warren MD, Hartmann KE, Ely EW, Grijalva CF, Cooper WO. Prescription Opioid Epidemic and Infant Outcomes. *Pediatrics*. 2015; 135: 842 – 850.
- Patrick SW, Schumacher RE, Benneyworth BD, Krans EE, McAllister JM, Davis MM. Neonatal abstinence syndrome and associated health care expenditures: United States, 2000 – 2009. *Journal of the American Medical Association*. 2012; 307 (18) 1934 – 1940.
- Saiki T, Lee S, Hannam S, Greenough A. Neonatal abstinence syndrome – postnatal ward versus neonatal unit management. *European Journal of Pediatrics*. 2010; 169: 95-98.
- Section of Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics*. 2012; 129: e827 – e841.
- Sublett J. Neonatal Abstinence Syndrome Therapeutic Interventions. *The American Journal of Maternal /Child Nursing.* 2013;38:2: 102-107.
- Tolia VN, Patrick SW, Bennett MM, et al. Increasing incidence of the neonatal abstinence syndrome in U.S. neonatal ICUs. *New England Journal of Medicine.* 2015. 10:1056.
- Velez M, Jansson LM. The Opioid dependent mother and newborn dyad: non-pharmacologic care. *J Addict Med.* 2008 September 1;2(3): 113-120.
- Wachman EM, Hayes MJ, Brown, MS, et al. Association of OPRM1 and COMT Single-Nucleotide Polymorphisms With Hospital Length of Stay and Treatment of Neonatal Abstinence Syndrome. *JAMA*. 2013;309(17):1821-1827
- Zimmerman-Baer U, Notzli U, Rentsch K, Bucher HU. Finnegan neonatal abstinence scoring system: normal values for first 3 days and weeks 5-6 in non-addicted infants. *Addiction*. 2010; 105 (3): 524- 528.