Caring for Babies and Families Struggling with Neonatal Abstinence Syndrome (NAS) at Nationwide Children's Hospital

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NATIONWIDE CHILDREN'S

When your child needs a hospital, everything matters.℠

Substance Use in Pregnancy

- 15.8 million women (or 12.9 percent) ages 18 or older have used illicit* drugs in the past year. (SAMHSA, 2014)
- Pregnant women under-report drug use
- 55-99% of women in substance abuse treatment have experienced trauma (sexual abuse, domestic violence) (TIP 51, Addressing Specific Needs of Women, 2009)
- Work to change health care providers' attitudes from "what's wrong with her?" to "what happened to her?"

Opioid Effects on Fetus and Newborn

Neonatal Abstinence Syndrome (NAS)

- Irritability
- Tremors
- Seizures
- poor sleep
- High pitched crying
- Diarrhea
- Overeating
- Emesis
- Hypertonic
- Poor suck
- Restlessness
- Sweating

Other effects:

- Poor fetal growth (HC, long bones)
- Prematurity
- Low birth weight
- Neurobehavioral abnormalities
- Urogenital abnormalities
- Cerebral vascular anomalies/ accidents
- Necrotizing Enterocolitis in term newborns
- STD- Hep B and/or C; HIV
  (in Ohio, 26% of moms +HCV)
- Prolonged QTc with methadone

Drug Effects on Fetus and Newborn

Cocaine

- Prematurity
- Microcephaly, neural tube defects
- Vascular accidents

Heroin

- low birth weight

SSRI

- CNS irritability, feeding problems

Amphetamine

- Cardiac anomalies

Drug Effects on Fetus and Newborn

Alcohol

- Birth defects
- Fetal Alcohol Syndrome

Nicotine

Concentrations higher in fetal compartment than maternal serum levels

- Preterm labor
- Poor growth, esp head
- Risk of SIDS
- Childhood asthma
- ADHD

Drug Effects on Fetus and Newborn

Marijuana

Remains in body up to 30 days, increases fetal and neonatal exposure

Infant neurobehavioral effects:

Decreased self-quieting ability

Fine tremors and startles

Sleep pattern changes

Longer term:

Disturbed nocturnal sleep

Behavior problems

- inattention, impulsivity and hyperactivity,
- delinquency and externalizing problems
- self-reported depressive and anxiety symptoms

Long Term ND Outcomes

- Altered arousal regulation at 1 month and visual evoked potentials at 6 months of age
- Auditory event-related potentials and dysregulation abnormalities
- Poor grade school performance (Oei et. al., 2017)
- Documented adverse neurodevelopmental outcomes from nicotine, alcohol, THC exposure
- Direct impact on outcomes- environment and social factors

National Incidence and Cost of NAS

- **1999-2013**
  - Rate of NAS increased 300% from 1.5 to 6 cases per 1000 hospital births (Ko et. al., 2016)
  - Rate of antepartum maternal opiate use increased 500% from 1.19 to 5.63/1000 deliveries
  - Hospital charges per patient related to NAS increased from $39,400 to $53,400 (Patrick et al., 2012)
  - National healthcare costs increased from $200 million in 2000 to $1.5 billion in 2012 (Patrick et al., 2012)

Local Data

- **2015-2017**
  - 160 babies treated for drug withdrawal in NCH NICUs
  - NCH services 33 counties in Ohio
    - Delaware county- n= 4
    - Fairfield county- n=21
    - Franklin- n= 45
    - Marion- n= 6

Neonatal Drug Withdrawal

- 20-90% of drug exposed infants will exhibit withdrawal symptoms, depending on:
  - Type of drug/s- singular or multiple, half life
  - Concomitant SSRI and tobacco use
  - Maternal weight, drug dosage and timing
  - Infant weight, gestation
  - Infant's intrinsic metabolism

Neonatal Drug Withdrawal

- Symptom Onset: 24 hours to days
  - onset of BUP withdrawal later than Methadone
- Symptom Duration: 16 days to months, self limiting
- AAP Monitoring Recommendations:
  - Minimum 2-3 days for any maternal history of drug use
  - 5-7 days if mom on multiple and/or long acting drugs

NAS Assessment Tools

Scale	Finnegan	Neonatal Withdrawal Inventory (NWI)	Neonatal Narcotic Withdrawal Index (NNWI)	Lipsitz	Ostrea
When	1975 1986 mod	1988	1981	1975	1976
N DOL	Term neonates up 28 DOL	80 term neonates	24 hours old, 50 FT methadone exposed vs 40 FT non-exposed	41 neonates 35-40 GA	196 neonates 37 GA
Scored items	31 items Scale 1-5	7 items Scale 0-4	7 items + "other" Scale 0-2	11 items Scored 0-3	6 items Rank order
Withdrawal assessed	Opiates	Opiate (methadone, heroine)	Opiate (Methadone 40-65 mg/day, +/- heroine)	"narcotic addicted mothers"	Opiate (methadone > or < 20 mg/day; heroine)
Comments	Comprehensive Complex Originally developed as clinical research tool	Tx at score of 8 Established inter-rater reliability, sensitivity, specificity	Tx for 2 scores 5+ in 24 hrs Established reliability, inter-rater reliability	Highly subjective (yes/no, normal/abnormal) Compared healthy term and near term to NAS	No guidelines for therapy Not comprehensive

Neonatal Drug Testing

Urine

- Detects recent use of nicotine, opiates, cocaine, amphetamine, TCH
- High rate of false negatives
- Bagged specimen can be difficult to obtain
- Parent, staff stress related to trying to collect sample
- Turnaround time
- Relatively inexpensive

Meconium

- Detects more long-term use of nicotine, alcohol, opiate, cocaine, amphetamine, THC
- ? Effect of urine, transitional stool on sample
- Can be difficult to collect
- May pass in utero/during birth.
- May not be timely -obstruction, short stay, delayed stooling
- Parent, staff stress related to trying to collect sample
- Turnaround time

Neonatal Drug Testing

Hair

- Highly reliable
- Detects long term exposure to nicotine, alcohol, cocaine, amphetamine
- Valid
- Specimen collection difficult for newborns

Umbilical Cord

- Highly reliable and valid
- Expanded panel of drugs
- Chain of custody
- Turnaround time
- Expense
- Ease of collection
- Storage

Nonpharmacologic Care

Dyad care when possible

- Decrease in LOS and NICU admissions

Decrease stimuli

- Cluster care
- Quiet environment
- Containment- then transition to back to sleep
- Pacifier
- ?Kangaroo care
- Slow, smooth rhythmic rocking/swaying

Small, frequent feeds

Skin care

Breastfeeding

Benefits:

- Attachment
- Nutritional benefits
- Other health benefits
- Financial benefits, convenience
- Decreased NAS severity
- Could improve mom's abstinence or treatment adherence

Risks:

-Medical

Drug transfer
Type of drug/s
Maternal infections

- Legal

State Law
Organizational Policies

Pharmacologic Management

- Used to relieve symptoms not controlled with non-pharm (seizures, weight loss)
- Prolongs hospital stay and/or exposure to drugs
- No evidence for improved long term outcomes with drug therapy
- No evidence for short or long duration drug therapy

Pharmacologic Management

Paragoric

Toxic ingredients; high concentration of alcohol (~45%)

Tincture of Opium

Highly concentrated morphine solution- increases possibility of medication errors; contains alcohol

Morphine

Short half life; allows for quicker weans

Given Q3 hours with feeds- interrupts ad lib/breastfeeding

Methadone

Longer half life; given frequently- easier with breastfeeding

Pharmacologic Management

Buprenorphine

Shows promise; clinical trials underway

Phenobarbital

Treatment of seizures, sedation; neuronal toxin with prolonged exposure

Clonidine

Used to help decrease tachycardia, hypertension, diaphoresis, diarrhea; effective as primary or adjunct treatment

Benzodiazepine

Impaired excretion, late onset seizures

Discharge Management

Safe Home Environment:

- States, counties vary related to reporting and disposition
- Work through Social Worker

Family Education

- ? Ongoing scoring
- Nutrition
- Well baby parenting

Follow Up

- Developmental screening
- ? Exposure to HBV, HBC, HIV

The Nationwide Children's Hospital Experience

Nationwide Children's Hospital (NCH) is a large, free-standing academic pediatric facility in Columbus, Ohio with 450 licensed beds

Neonatal Services (NS)
9 Intensive Care Nurseries
254 Neonatal beds
2300+ admissions/year

MAGNET RECOGNIZED
AMERICAN NURSES CREDENTIALING CENTER

NATIONWIDE CHILDREN'S
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Neonatology Service Line

Length of Stay Issues

Background:

In 2009 at NCH

- 7.6% of all NICU/NSCU admits (approx. 120 patients/year)
- Average Length of Stay (ALOS) 35.5 days on the main campus, 78 days in an off-campus unit

Significance:

Long LOS negatively impacts psychosocial situation

Created backlog of NICU/NSCU beds

Caregiver stress

Resource expenditure:

More than $70 million in healthcare expenses, 1,649 admissions – roughly five per day- and nearly 19,000 days in Ohio in 2011 (OPQC, 2014)

NAS Taskforce

Interprofessional Committee: information, education, lessons learned and potentially better practices are shared

Monthly interdisciplinary collaborative meetings:

- Education, awareness of maternal substance use and abuse
- Developed NAS practice guidelines
- Enhanced antenatal professional education, communication, collaboration
- Outreach education and support for providers in the Region.

MOD Grant:

- Improved maternal Methadone treatment retention rate by 25%

Nationwide Children's Hospital and NAS

Developed Volunteer Cuddler Program

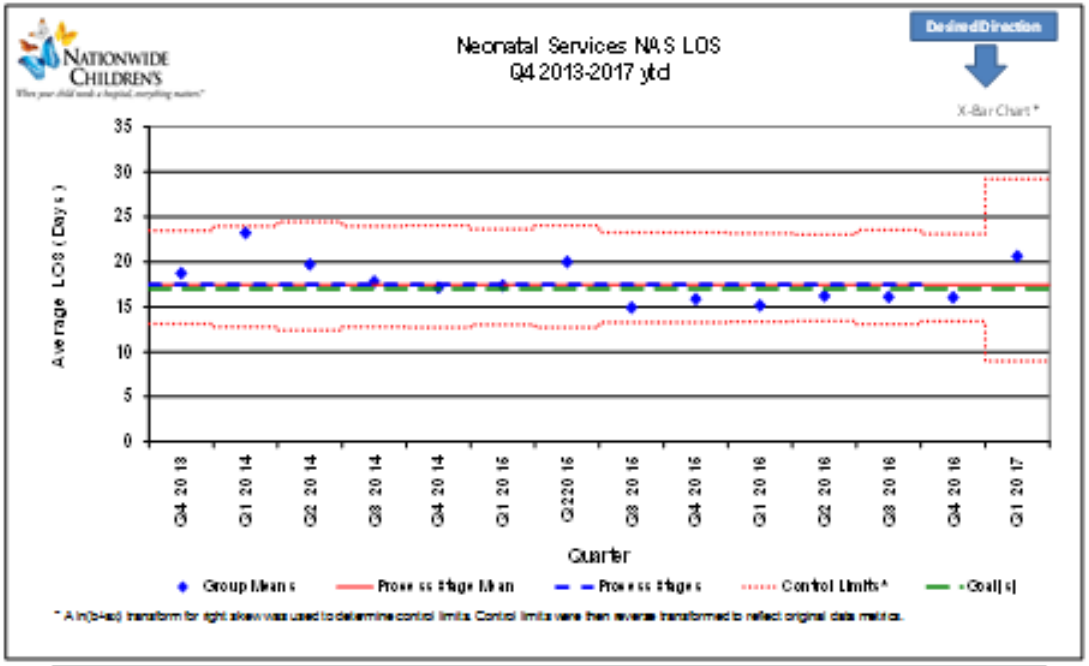
Established NCH NAS Follow up Clinic for ongoing medical management, developmental screens

Ohio Perinatal Quality Collaborative (OPQC)
https://www.opqc.net/projects/NAS

Maternal Opiate Medical Support (M.O.M.S.) Pilot Project Program http://momsohio.org/about/

Vermont Oxford Network iNICQ NAS Collaborative
https://public.vtoxford.org/quality-education/nas-universal-training-program/

Outcomes: Length of Stay



Group Means	18.7	23.2	19.7	17.8	17.1	17.8	20.0	14.9	15.9	15.1	16.2	16.1	16.0	20.6
Group Size	42	39	31	38	35	40	35	45	45	47	49	41	48	11

Less than 5% 30 day readmission rate

Healthcare Savings

Since 2013:

Cared for 541 babies with NAS in the NCH NICUs

In 2016:

Cared for 648 babies

Avoided $1.3 million in NICU expenses

Continued Steps

- Medical and non-pharmacologic infant care
- Family integrated and supported care
- Follow up and early access to services
- Pediatric prevention strategies

In Summary

- Incidence of maternal drug use, NAS is increased
- Profound impact on baby, family, providers, healthcare system
- Each unit should have an NAS protocol:
  - Screening and testing of mom and baby
  - Assessment/scoring
  - Treatment- non pharm and pharm
  - Discharge management and Follow Up
- LOS can shortened by decreasing variability in treatment
- Staff challenged /stressed when caring for NAS patients and families
- Staff attitudes and bias impact collaboration with family
- Much research is needed!

Questions?

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References

- Abrahams, R., MacKay-Dunn, M., Nevmerjitskaia, V., MacRae, G., Payne, S. & Hodgson, Z. (2010). An evaluation of rooming-in among substance-exposed newborns in British Columbia. J *Obstet Gynaecol Can.* 32(9),866–871.
- American College of Obstetricians and Gynecologists. (2012). Committee Opinion: opioid abuse, dependence and addiction in pregnancy. *Obstetrics and Gynecology*. Vol 119, No 5, 1070-1076.
- Behnke, M., Smith, V., & American Academy of Pediatrics (AAP) Committee on Substance Abuse and Committee on Fetus and Newborn. (2013). Prenatal substance abuse: Short and long term effects on the exposed fetus. *Pediatrics*, 131 (3), e1009-e1024.
- Bhatt-Mehta, V., Ng, CM. & Schumacher, RE. (2014). Effectiveness of a clinical pathway with methadone treatment protocol for treatment of neonatal abstinence syndrome following in utero drug exposure to substances of abuse. *Pediatr Crit Care Med*, Feb, 15(2), 162-169.
- Center for Substance Abuse Treatment. (2009). *Substance Abuse Treatment: Addressing the Specific Needs of Women*. Treatment Improvement Protocol (TIP) Series 51. HHS Publication No. (SMA) 09-4426. Rockville, MD: Substance Abuse and Mental Health Services Administration.
- Crocetti. M., Amin, D. & Jansonn, L.(2007). Variability in the evaluation and management of opiate exposed newborns in maryland. *Clinical Pediatrics*, (46) 7, 632-635.
- D'Apolito, K., & Finnegan, L. (2010). *Assessing signs and symptoms of neonatal abstinence using the Finnegan scoring tool: an inter-observer reliability program* (2nd ed.). Ordering information retrieved from http://www.neoadvances.com
- Finnegan, L. (1986). Neonatal abstinence syndrome: assessment and pharmacotherapy. In F. Rubatelli & B. Granadi (Eds.), *Neonatal therapy: An update* (pp. 122-146). New York: Exerpta Medica.
- Finnegan, L., Kron, J., Connaughton, J., & Emich, J. (1975). Neonatal abstinence syndrome: assessment and management. *Addictions and Disease: Inernational Journal,* 2(1), 141-157.
- Franck,L., Harris, S., Soetenga, D., Amling, J., & Curley, M. (2008). The withdrawal assessment tool - version 1 (WAT-1). *Pediatr Crit Care Med*, November, 9(6), 573–580.
- Gaalema, D., Scott, T., Heil, S., Coyle, M., Kaltenbach, K., Badger, G., Arria, A., Stine, S., Martin, P. & Jones H. (2012). Differences in the profile of neonatal abstinence syndrome signs in methadone- versus buprenorphine-exposed neonates. *Addiction*, Nov;107, Suppl 1:53-62.

References

- Green, M. & Suffet, F. (1981). The neonatal narcotic withdrawal index: a device for the improvement of care in the abstinence syndrome. Am J Drug Alcohol Abuse, 8 (2), 203-213.
- Hudak, M., Tan, R. & The Committee on Drugs and The Committee on Fetus and Newborn, American Academy of Pediatrics (2012). Neonatal drug withdrawal. *Pediatrics*, 101 (6), 1079-1088.
- Jansonn, L., Valez, M. & Harrow, C.(2009). The opioid exposed newborn: assessment and pharmacologic management. *J Opioid Manag*. 5(1), 47–55.
- Jansson L., & Academy of Breastfeeding Medicine (2009). Protocol #21: Guidelines for breastfeeding and the drug-dependent woman. *Breastfeeding Medicine*, 4(4):225-228. Retrieved from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2989871/
- Jones H.E., Dengler E., Garrison, A., O'Grady, K.E., Seashore, C., Horton, E., Andringa, K., Jansson, L., & Thorp, J. (2014). Neonatal outcomes and their relationship to maternal buprenorphine dose during pregnancy. *Drug Alcohol Depend*. Jan 1, 134, 414-417.
- Jones, H.E., Jansson, L.M., O'Grady, K.E., & Kaltenbach, K. (2013). The relationship between maternal methadone dose at delivery and neonatal outcome: Methodological and design considerations. *Neurotoxicol Teratol*. Sep-Oct, 39, 110-115.
- Jones, H., Kaltenbach, K., Heil, S., Stine, S., Coyle, M., Arria, A., O'Grady, K., Selby, P., Martin, P., & Fisher, G. (2010). Neonatal abstinence syndrome following methadone or buprenorphine exposure. *New England Journal of Medicine*, 363, 2320-2331.
- Jones, H., O'Grady, K., Malfi, D., & Tuten, M. (2008). Methadone Maintenance vs. Methadone Taper During Pregnancy: Maternal and Neonatal Outcomes. *The American Journal on Addictions*,17, 372-386.
- Kaltenbach, K. (1996). Exposure to opiates: Behavioral outcomes in preschool and school-age children. In *Behavioral Studies of Drug-Exposed Offspring: Methodological Issues in Human and Animal Research*, NIDA Research Monograph Series 164, U.S. Government Printing Office, Washington, DC, 230-241.

References

- Kaltenbach, K., & Jones, H.E. (2011). Maternal and neonatal complications of alcohol and drugs. In P. Ruiz and Eric Strain (Eds.) Lowinson & Ruiz's *Substance Abuse: A Comprehensive Textbook*, Lippincott Williams & Wilkins, 648-662.
- Kraft, W. (2014). Withdrawal vs. toxidromes: How do we make the best treatment decisions? *Vermont Oxford Network iNICQ 2014: Structuring Success! Care of infants and families affected by neonatal abstinence sydrome webinar*, Jan 22, 2014.
- Ko JY, Patrick SW, Tong VT, Patel R, Lind JN, Barfield WD. Incidence of neonatal abstinence syndrome: 28 states, 1999-2013. MMWR Morb Mortal Wkly Rep2016;65:799-802
- Maguire, D., Cline, G.J., Parnell, L., & Tai, C,Y. (2013). Validation of the finnegan neonatal abstinence syndrome tool-short form. *Adv Neonatal Care*, Dec,13(6), 430-7.
- Murphy-Oikonen, J., Brownlee, K., Montelpare, W., & Gerlach, K. (2010). The experiences of NICU nurses in caring for infants with neonatal abstinence syndrome. *Neonatal Network*, Sept/Oct, 29 (5), 307-313.
- Lipsitz, P. (1975). A proposed narcotic withdrawal score for use with newborn infants. *Clinical Pediatrics*, 14(6), 592-594.
- Oei JL, Melhuish E, Uebel H, Azzam N, Breen C, Burns L, Hilder L, Bajuk B, Abdel-Latif ME, Ward M, Feller JM, Falconer J, Clews S, Eastwood J, Li A, Wright IM. Neonatal Abstinence Syndrome and High School Performance. Pediatrics. 2017 Feb;139(2). pii: e20162651. doi: 10.1542/peds.2016-2651
- Ohio Perinatal Quality Collaborative (OPQC). (2014). Retrieved from: https://opqc.net/node/207
- Patrick, S., Schumacher, R., Benneyworth, B., Krans, E., McAllister, J., & Davis, M. (2012). Neonatal abstinence syndrome and associated health care expeditures: United States 2000-2009. JAMA, May 9, 307 (18), 1934-1940.
- Paul, J.A,, Logan, B.A,, Krishnan, R., Heller, N.A., Morrison, D.G., Pritham, U.A., Tisher, P.W., Troese, M., Brown, M.S., & Hayes, M.J. (2013). Development of auditory event-related potentials in infants prenatally exposed to methadone. *Dev Psychobiol*, Sep 6
- Pritham, U.A. (2013). Breastfeeding promotion for management of neonatal abstinence syndrome. *J Obstet Gynecol Neonatal Nurs*, Sep-Oct, 42(5), 517-26
- Substance Abuse and Mental Health Services Administration: (SAMHSA). Retrieved from: http://www.samhsa.gov/data/
- Vermont Oxford Network (VON). (2013)
- Visconti, K., Hennessy, K., Towers, C., Howard, B.(2014). Chronic opiate use in pregnancy and newborn head circumference. *Am J Perinatol*. 2014, May 2. [Epub ahead of print]
- Zahorodny, W, et al. (1998). The neonatal withdrawal inventory: A simplified score of newborn withdrawal. *Developmental and Behavioral Pediatrics*, 19(2):, 89-93.