Neonatal Abstinence Syndrome (NAS)
Birth Through Six Months
Introduction of Co-Presenters

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  - Pediatrician with experience in newborn medicine for 10 years

- Liz Rick, MOT, OTR/L
  - Registered Occupational Therapist with 10 years of experience
  - Employed at CCHMC for 6.5 years
  - A part of the NOWS/NAS Clinic since its start 5 years ago
• Neonatal Opioid Withdrawal Syndrome (NOWS) and Neonatal Abstinence Syndrome (NAS) may be used interchangeably throughout the presentation
Presentation Objectives

• Provide description of NAS Clinic at CCHMC and patients served
• Discuss local trends of the opioid epidemic
• Briefly describe medical management of NAS
• Discuss the most common developmental trends observed in infants with NAS from birth to 6 months old
• Provide assessment and treatment strategies for infants from birth to 6 months with NAS
Cincinnati Region: Exposure to any substance per 1,000 births
Cincinnati Region (852% increase)

Illicit drug use or prescribed opioid per 1,000 births

- 2009: 10.4
- 2010: 15.8
- 2011: 24.5
- 2012: 34.5
- 2013: 53.2
- 2014: 69.0
- 2015: 63.3
- 2016: 87.0
- 2017: 87.4
- 2018*: 88.6
Cincinnati Region: Opioid exposure rate per 1,000 births
Cincinnati Region (677% increase)
Cincinnati Region: NAS rate per 1,000 births (defined as requiring pharmacologic treatment)
Cincinnati Region (262% increase)
NAS cases FY14-FY16
Neonatal Abstinence Syndrome

The clinical findings associated with neonatal opioid withdrawal have been termed the neonatal abstinence syndrome (NAS).

Among neonates exposed to opioids in utero, withdrawal signs will develop in 55% to 94%.

30-80% will require pharmacologic treatment.

- OPQC cohort = 41%

Average onset of symptoms: 44 hours of life.
Symptoms of NAS

- Poor feeding
- Uncoordinated and constant sucking
- Vomiting
- Diarrhea
- Dehydration
- Poor weight gain
- Increased sweating
- Nasal stuffiness
- Fever
- Mottling
- Temperature instability

- Tremors
- Irritability
- Increased wakefulness
- High pitched cry
- Increased muscle tone
- Increased reflexes
- Frequent yawning
- Seizures

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pp. e540 -e560
Infants are typically monitored:

- **72** hours for short acting opioids (heroin, prescription pain medications)
- **96** hours for long acting opioid exposure (methadone, buprenorphine)
Non-Pharmacologic Treatment

• Low stimulus environment
• Swaddling, skin to skin
• Breastfeeding
• Non-nutritive sucking
• High calorie formula if not breastfeeding
• Music therapy and massage therapy
• Rooming in with infant, cuddlers
Pharmacologic Treatment

• **First line opioid**
  – Methadone, buprenorphine, and morphine

• **Adjunct therapy**
  – Phenobarbital, clonidine, gabapentin
  – Infants may be discharged home on these medications

• Standardized treatment protocol has been shown to be most effective at reducing length of stay rather than specific agent used
Pharmacologic Treatment

• Nationally:
  – 60-80% of all exposed receive treatment
  – LOS all opioid exposed is 16 days
  – LOS all treated babies is **23-42 days** (significant variability)

• Southwest Ohio:
  – 30% of all infants exposed to opioids receive treatment
  – 24.3% require adjunct therapy
  – LOS for all opioid exposed is 8.8 days
  – LOS for all treated babies is **16.8 days**
What we know:
Infants with a history of *in utero* opioid exposure are at risk for long-term medical and developmental problems

What we did:
Established a multi-disciplinary follow-up clinic with providers, occupational therapists, social workers, and nurses
Developmental and Medical Problems in Opioid Exposed Children

Exclusions
Gestation ≤34 weeks, N=957
Complex clinical condition or congenital anomaly, N=3,306
Non-opioid substance exposure, N=1,061

County resident birth with Cincinnati Children’s Hospital Medical Center physician encounter at birth hospital, N=20,868

Study Cohort, N=15,544

- Births from January 2014-December 2015

No detected exposure, N=14,933
Opioid exposure without NAS, N=473
Opioid exposure with NAS, N=138
# Developmental and Medical Problems in Opioid Exposed Children

## Comparison of diagnosis rates among opioid exposed infants without NAS, opioid exposed infants with NAS, and infants with no detected exposures.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No Detected Exposure N=14,933</th>
<th>Opioid Exposure without NAS N=473</th>
<th>Opioid Exposure with NAS N=138</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
<th>P-value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral or emotional disorder; N, %</td>
<td>171</td>
<td>1.1</td>
<td>14</td>
<td>3.0</td>
<td>8</td>
</tr>
<tr>
<td>Developmental delay; N, %</td>
<td>1,138</td>
<td>7.6</td>
<td>74</td>
<td>15.6</td>
<td>39</td>
</tr>
<tr>
<td>Hepatitis C exposure; N, %</td>
<td>21</td>
<td>0.1</td>
<td>32</td>
<td>6.8</td>
<td>48</td>
</tr>
<tr>
<td>Motor function developmental disorder; N, %</td>
<td>215</td>
<td>1.4</td>
<td>13</td>
<td>2.7</td>
<td>7</td>
</tr>
<tr>
<td>Otitis media; N, %</td>
<td>4,221</td>
<td>28.3</td>
<td>155</td>
<td>32.8</td>
<td>43</td>
</tr>
<tr>
<td>Plagiocephaly; N, %</td>
<td>270</td>
<td>1.8</td>
<td>5</td>
<td>1.1</td>
<td>14</td>
</tr>
<tr>
<td>Sensory disorder; N, %</td>
<td>1,095</td>
<td>7.3</td>
<td>49</td>
<td>10.4</td>
<td>29</td>
</tr>
<tr>
<td>Speech disorder; N, %</td>
<td>964</td>
<td>6.5</td>
<td>48</td>
<td>10.1</td>
<td>19</td>
</tr>
<tr>
<td>Strabismus; N, %</td>
<td>149</td>
<td>1.0</td>
<td>16</td>
<td>3.4</td>
<td>15</td>
</tr>
<tr>
<td>Torticollis; N, %</td>
<td>322</td>
<td>2.2</td>
<td>6</td>
<td>1.3</td>
<td>12</td>
</tr>
</tbody>
</table>

<sup>a</sup> Comparison of opioid exposure without NAS and no detected exposure

<sup>b</sup> Comparison of opioid exposure without NAS and opioid exposure with NAS

* Statistical significance after Bonferroni-Holm correction for multiple comparisons

NAS=Neonatal abstinence syndrome
NAS/Opioid Exposed Follow-Up Clinic

- Provide care for over 500 new patients per year
- Encounter more than 1000 total patients visits per year
- Standardized screening and testing for the first 2-3 years of life
  - Social emotional problems
  - Development (cognitive, language, motor skills)
  - Sensory processing problems
  - Behavior problems
  - Vision testing
  - Infectious disease testing (Hepatitis C)
NAS Follow-Up Clinic Algorithm

First clinic visit scheduled within 2 weeks of d/c
- OT and SW eval at each new visit
- Refer to Help Me Grow
- Evaluate home formula and caloric concentration

Home on adjunct therapy?
Yes

Suggested Wean:
- No/mild symptoms: cut dose by 50% x 1 week, then d/c
- Moderate symptoms, cut dose by 25% each week until d/c
- Severe symptoms: continue current dose and re-evaluate at next visit

Next visit in 1 month
Follow up wean/continued symptoms

No

Next visit at 3-4 mo
- Refer to Ophthalmology if strabismus present or reported
- Refer to PT if torticollis present
- Consider GMA

Next visit at 6-8 mo
- Vision screening
- ASQ SE

Next visit at 12 mo
- Audiology Screening
- Toddler Sensory Profile

Next visit at 18 mo
- Hep C testing if recommended
- Child Behavior Checklist
- Schedule Bayley

Next visit at 22-26 mo after Bayley
- Assess follow-up transition
- Psychology/DDBP as needed

Cincinnati Children’s
changing the outcome together
Continued Symptoms of NAS

• Symptoms typically appear at day 3-5, but onset may be as late as 1 week of age
• Symptoms may last from days to weeks, sometimes months of life for both treated and non treated babies
  – Periodic fast breathing
  – Nasal stuffiness/congestion
  – Reflux, spitting up
  – Tremors
  – Crying spells, irritability
  – Mottling
  – Hypertonia
New Visits - Medical provider

- Evaluate growth, need for higher calories
- Discuss GI issues:
  - Gas
  - Constipation
  - Reflux
  - Nutrition/formula choice
- Visual problems
  - nystagmus, strabismus
- Muscle tone, development, sensory processing in conjunction with OT
New Visits – Role of therapist

- Patients typically range from ~2 weeks old – 2 months old at their clinic evaluation
- Screening for the following factors:
  - Muscle tone
  - Torticollis and plagiocephaly
  - Sensory processing abilities
  - Participation in ADL’s
  - Vision
Muscle Tone

• Most often at the first visit, babies with NAS exhibit some degree of increased muscle tone, or muscle tightness
• Usually, the muscles relax with repetitive movement and gentle stretching
• Families often report that their baby is "so strong" when there is a degree of increased muscle tone
Hypertonia

- Commonly affected areas of the body:
  - Cervical area (torticollis or shoulder elevation)
    - Redness, creasing, or build up in neck creases
  - Shoulders
    - Noted when trying to raise baby's arms overhead
    - Can contribute to early rolling
  - Hips
    - Noted when trying straighten baby's legs
    - Can contribute to poor tolerance for tummy time, or result from minimal exposure to tummy time
Stretching for tight muscles

• Range of motion exercises can help stretch your baby’s muscles that are tight. Stretching will help to increase your baby’s flexibility and movement.

• Here are some things to keep in mind while doing the stretches with your baby:
  – To get the best results it is important to be consistent.
  – **Do these stretches 4-5 times per day.**
  – Lightly hold your baby’s hands and be gentle with all the movements you do with your baby.
  – **Hold each stretch 20-30 seconds.**
  – Do these stretches when your baby is relaxed. Make the exercises enjoyable by talking or singing to your baby while you do the stretches. If your baby is fussy or hungry, avoid doing these exercises. If your baby is resisting the stretches, stop and try again later.
Scapular depression stretch

Starting position: While baby’s arms are at their side, position your hands underneath their shoulder blades with your fingers resting on top of their shoulders.

Scapular depression: Gently move shoulders down away from baby’s ears.
Shoulder flexion stretch - "So Big"

**Shoulder**

Flexion & Extension:

- Starting position: With arm raised toward the ceiling, make sure your baby’s palm is facing their body. Place one hand at their shoulder. Grasp the palm with your other hand.

- Flexion: Gently raise your baby’s arm up toward the ear.
Hip extension stretch

Extension

- Starting Position: Lay your baby on their belly with their leg straight. Place one hand on their bottom. Grasp the lower leg with your other hand.

- Extension: While keeping the knee straight, gently lift your baby’s leg off the surface.
Frog stretch

Starting position: With their hips and knees bent toward chest, grasp your baby’s lower leg.

Abduction: While keeping your baby’s knees bent, gently move your baby’s legs out to the side.
Positioners

- Advise families against the use of standing positioners (jumperoos, exersaucers, walkers, etc.)
- Before a baby has the core strength to sit independently (usually around 6 months), they often fix or extend through their legs
- Can increase or contribute to hypertonicity through the legs
Hypotonia

- Some infants may present with muscle tone on the low end of normal (hypotonia)
- Their muscles appear extra loose or floppy
  - Baby may feel like they are going to slip through your grip when you pick them up
- May demonstrate a more persistent head lag or have a hard time tolerating tummy time
Hypotonia Interventions

• Interventions focus on strengthening and positioning
• Tummy time!
  – Towel roll
  – Inclined surface
Hypotonia Interventions (continued…)

• Reaching
  – Towel rolls under shoulders to support reaching against gravity
  – Sidelying to support reaching in a more neutral position
Congenital Muscular Torticollis (CMT)

- CMT is a condition in which one or more neck muscles are short or tight.
- Children with CMT most often tilt the head in one direction and turn it to the other.
- Children with CMT may have difficulty turning their head, struggle with nursing or feeding, have a flat spot on one side of their head and/or prefer one hand more.
- CMT is often found at birth or when a child is very young.
- The cause of CMT has not been identified, but risk factors include positioning during pregnancy, trauma during birth and reflux.
Incidence of CMT in NAS Population

• In a retrospective review of infants seen in NAS clinic, 11.1% of infants had a diagnosis of torticollis
  – This is nearly 6x greater than the general population
  – 66.7% of these infants also had a co-diagnosis of plagiocephaly (McAllister et al., 2018)

• A recent study out of Tennessee reported an incidence of CMT in the NAS population as high as 25% (Towers et al., 2020)
Intervention for Torticollis

- Educate caregivers on exercises to perform daily
- Provide tummy time opportunities
- Limit time in infant car seats/carriers and positioning devices
- Refer for PT– EI or Outpatient after discussing with family
Stretches for torticollis

• To be performed under the direction of an occupational or physical therapist
  – If you suspect a torticollis and patient is not already followed by PT, ask your OT or PT to consult or refer for outpatient PT
Plagiocephaly

- Plagiocephaly means slanted or flattening of the head.
- An infant’s skull is very soft to allow the brain to grow during the first year of life. If the head stays in the same position, a flat spot may develop because of the baby’s soft skull.
- Plagiocephaly is when the side or back of the head becomes flattened, often due to lying in one position too long.
Interventions for Plagiocephaly

- **Family Education**
  - Change your baby’s position often when awake.
  - Limit the amount of time your baby rests in baby furniture – car seats, infant carriers, and strollers.
  - Put your baby on his tummy when he is awake and being watched.
Sensory Processing

• Refers to how an individual processes and responds to incoming sensory input, including smells, sights, sounds, touch, and movement.

• Often, infants with NAS present as over-responsive to sensory input.
Sensory Over-Responsivity (SOR)

• Responds too much, too frequently, or for too long to sensory stimuli
• Upset by transitions and unexpected changes
• Irritable and at times inconsolable
• Often labeled a “fussy baby”
• Poor self-calming abilities, needs a lot of support/intervention to calm

STAR Institute
Principles for Intervention for SOR

• "Empty the cup"
• Provide notice in advance—predictability is key!
  – Do not surprise them with the sensation
• Use gentle stimulation
• Use calming (inhibitory) activities:
  – Linear swinging
  – Deep touch pressure
  – Proprioceptive input

STAR Institute
Participation in ADL's

- Infants with NAS may have decreased tolerance for:
  - Bathing
  - Dressing
  - Grooming/hygiene, such as applying lotion or having face or nose wiped
  - Toileting, including diaper changes and wiping
  - Car rides
Participation in ADL's (continued...)

- Infants with NAS may also experience:
  - Poor sleep hygiene
    - Hyperactive startle
    - Need for additional calming strategies and/or environmental modifications
  - Poor feeding abilities
    - Nasal congestion affecting suck-swallow-breathe coordination
    - State of arousal
    - Messy eater or taking a long time to feed (>30 minutes)
Strategies to support ADL’s

• Bathing
  – Washing baby with your hands vs washcloth
  – Modifying water or room temperature

• Dressing/diaper changes
  – Singing a song helps the child become aware of when the task will be over

• Applying lotion
  – Use of firm pressure and predictable touch. Always apply in the same order
Sleep Strategies

- Establish a consistent bedtime routine
- White noise
- Blackout curtains for naps and early risers
- Whenever possible, laying baby down alert, but drowsy
- 5 S’s
5 S’s

- Swaddle
- Side or stomach position
- Shush
- Swing
- Suck

https://www.happiestbaby.com/blogs/baby/the-5-s-s-for-soothing-babies
Feeding strategies

• Environmental modifications

• External pacing
  – Used to support an infant’s coordination;
  – Can improve an infant’s ability to manage fluid, coordinate breathing, and maintain vital sign stability

• Cue-based feeding
  – Focuses on infant factors to guide progression of feeding (versus focusing on volume)
  – Infant behaviors tell the feeder when to start, continue, or stop oral feeding
Cue based feeding

**Good Experience**
- Relaxed body & face
- Opening mouth to bottle
- Regular breathing
- Easy, calm sucking
- Bringing hands toward chin or mouth

**Uncomfortable Experience**
- Looking/turning away
- Pushing/arching back
- Facial grimacing
- Crying
- Coughing or gagging
- Faster breathing rate
Vision

• Are their eyes aligned?
  – Some intermittent deviation of the eyes (one or both) is normal in the first few months of life
  – Eye deviation should not be constant
  – As high as 8% in this population, compared to 3% in the general population (Merhar et al., 2018)

• Is there involuntary movement of the eyes present?
  – Nystagmus

• Does the child seem to intentionally avoid eye contact with caregiver?
  – May be an early sign of sensory over-responsivity
Vision (continued...)

• 2 months old
  – Baby begins to track objects from side to side across midline
  – Eyes should be able to focus on an object about 6” away

• 4 months old
  – Smiles when baby sees you
  – Sees objects from farther away
  – Eyes should no longer cross inward or drift outward
Among infants, 77% were referred to EI and 48% were enrolled in services. Of infants discharged to biological parents, 81% were referred to EI versus 66% of infants discharged to foster care (p ≤ 0.05). This difference persisted in multivariable analysis.
Importance of Early Intervention

- After being referred for EI, need ongoing monitoring even though they might be hitting their milestones on time and appear to be on target.
- Help caregivers follow through with stretches.
- Help provide families with sensory strategies to support daily activities that are challenging.
- Monitoring for progression or emergence of head preference, plagiocephaly, or suspected torticollis in a baby who has not yet been referred for therapy services (either outpatient or EI).
Considerations for EI providers

• Periodic (1x/month or every other month) model of intervention when a child appears to be on target during these first 6 months

• If discharged from EI, families may not know what to look for or know when to be concerned
  – May miss critical windows for referring for treatment for time sensitive conditions

• You have the rapport with family that will allow you to discuss concerns that arise while working with the child
Research indicates that both treated and non-treated infants are at high risk for a variety of developmental concerns.

At first assessment, these infants may look like they are meeting their milestones for their age, but ongoing monitoring for the preceding factors is recommended.

Caregiver education and support can prevent some of these issues, as well as resulting co-morbidities (e.g. plagiocephaly, torticollis)
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