Neonatal Abstinence Syndrome (NAS)

Birth Through Six Months

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Introduction of Co-Presenters

- Jennifer McAllister, MD, IBCLC
  - Medical Director, West Chester Hospital Special Care Nursery, University of Cincinnati Newborn Nursery, NOWS/NAS Follow-up Clinic
- 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

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NOWS/NAS

- Neonatal Opioid Withdrawal Syndrome (NOWS) and Neonatal Abstinence Syndrome (NAS) will be used interchangeably throughout the presentation

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Presentation Objectives

- Provide description of NAS Clinic at CCHMC and patients served
- 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

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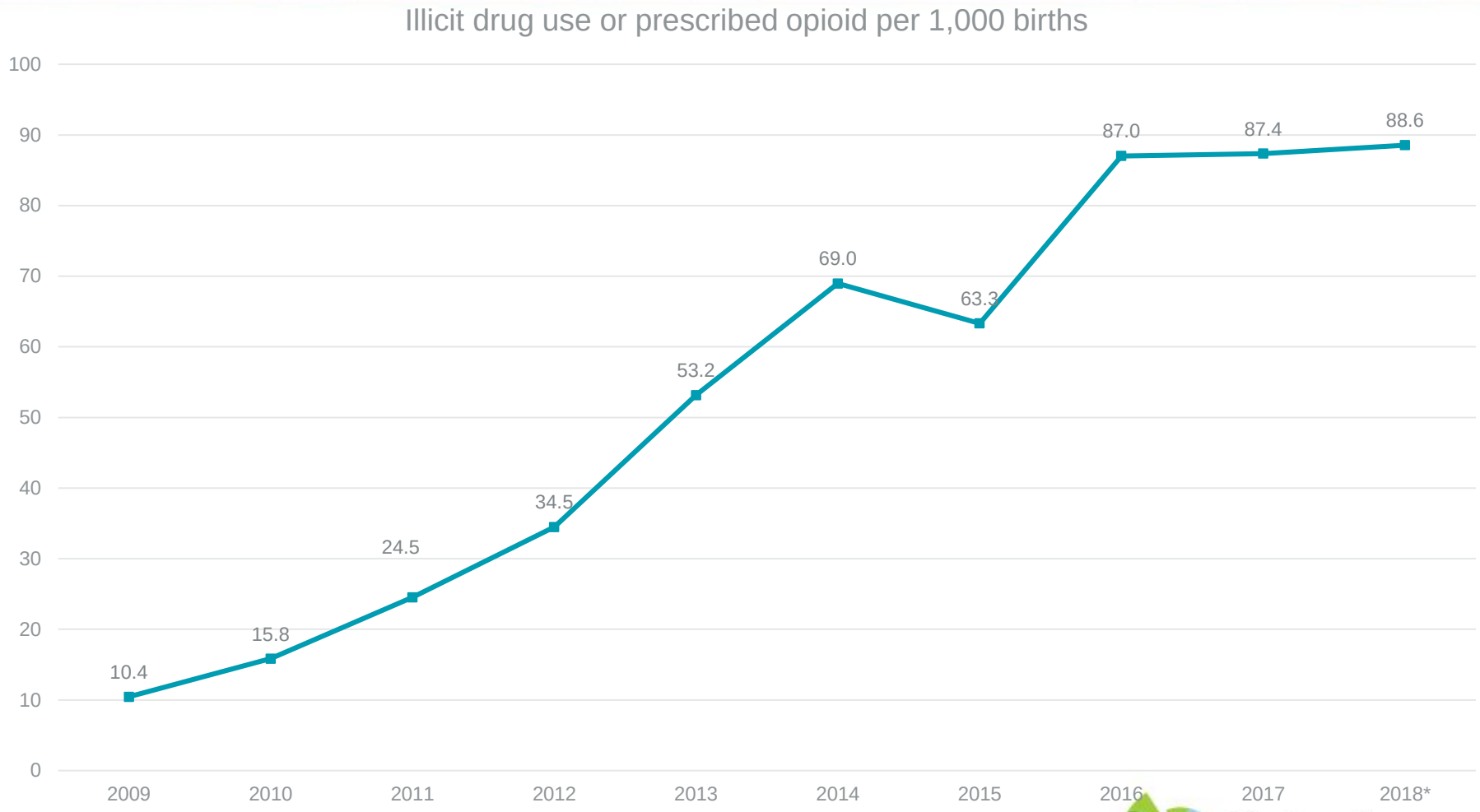
Cincinnati Region: Exposure to any substance per 1,000 births
Cincinnati Region (852% increase)



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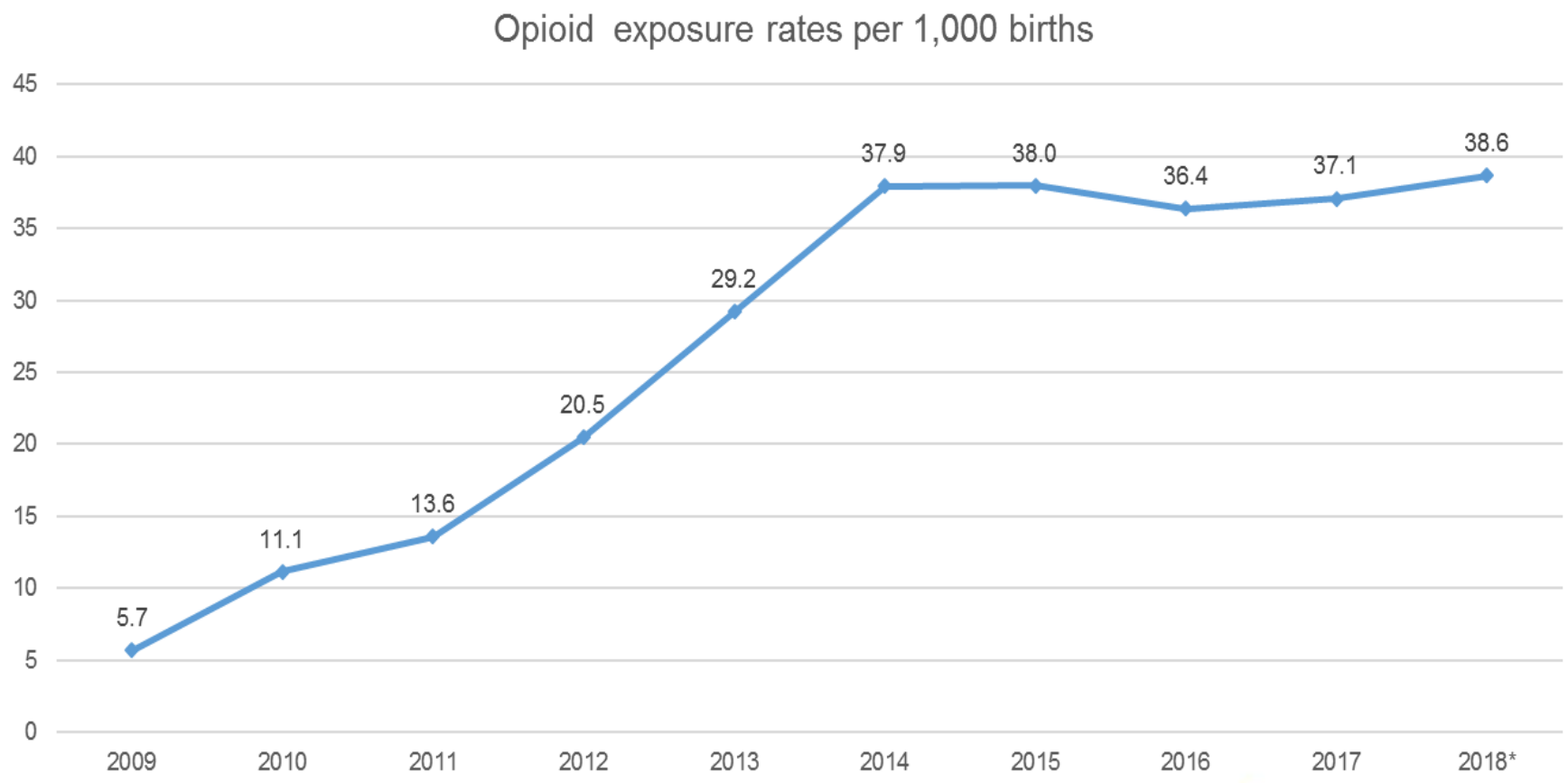
Cincinnati Region: Opioid exposure rate per 1,000 births
Cincinnati Region (677% increase)



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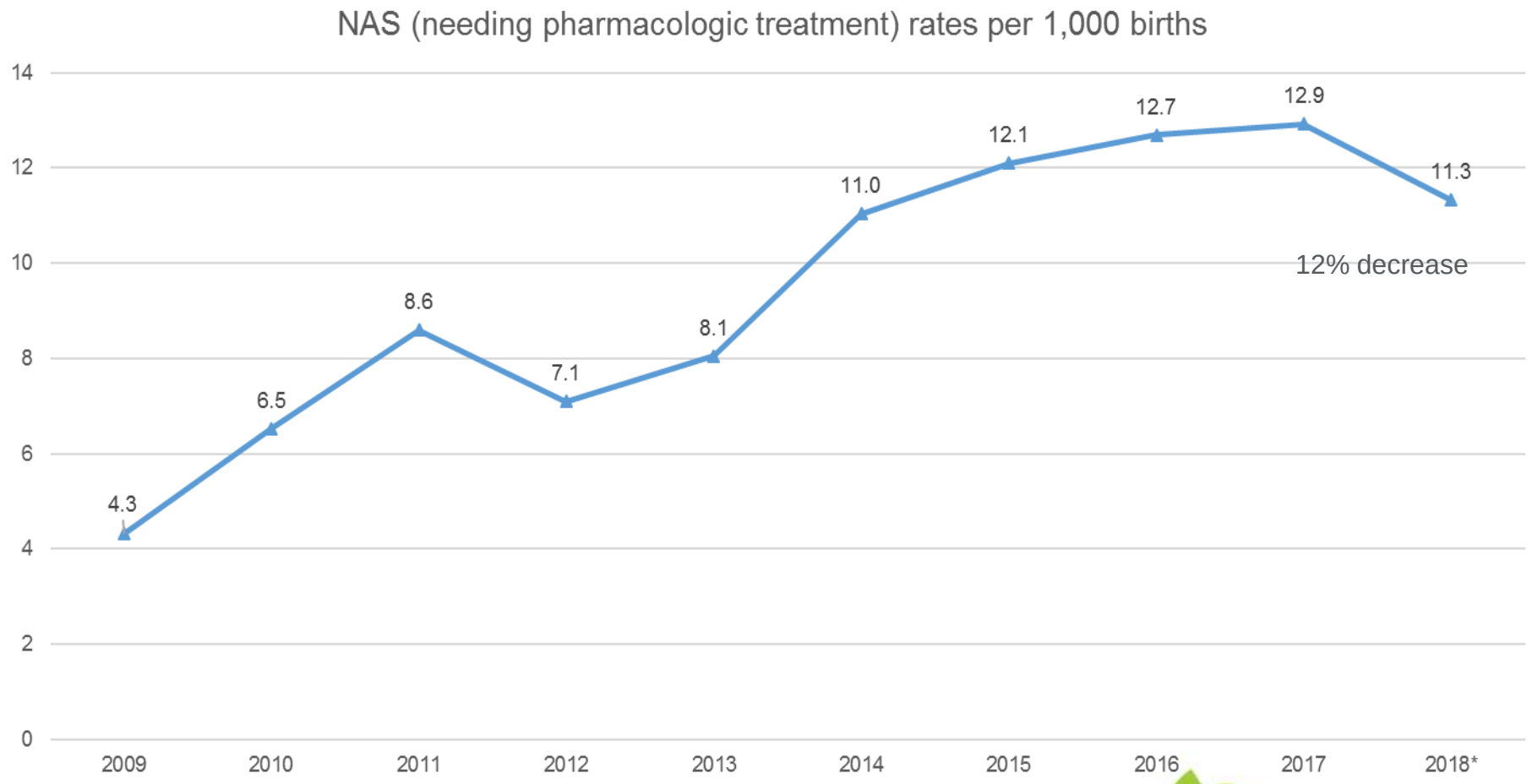
Cincinnati Region: NAS rate per 1,000 births (defined as **requiring pharmacologic treatment**) Cincinnati Region (262% increase)



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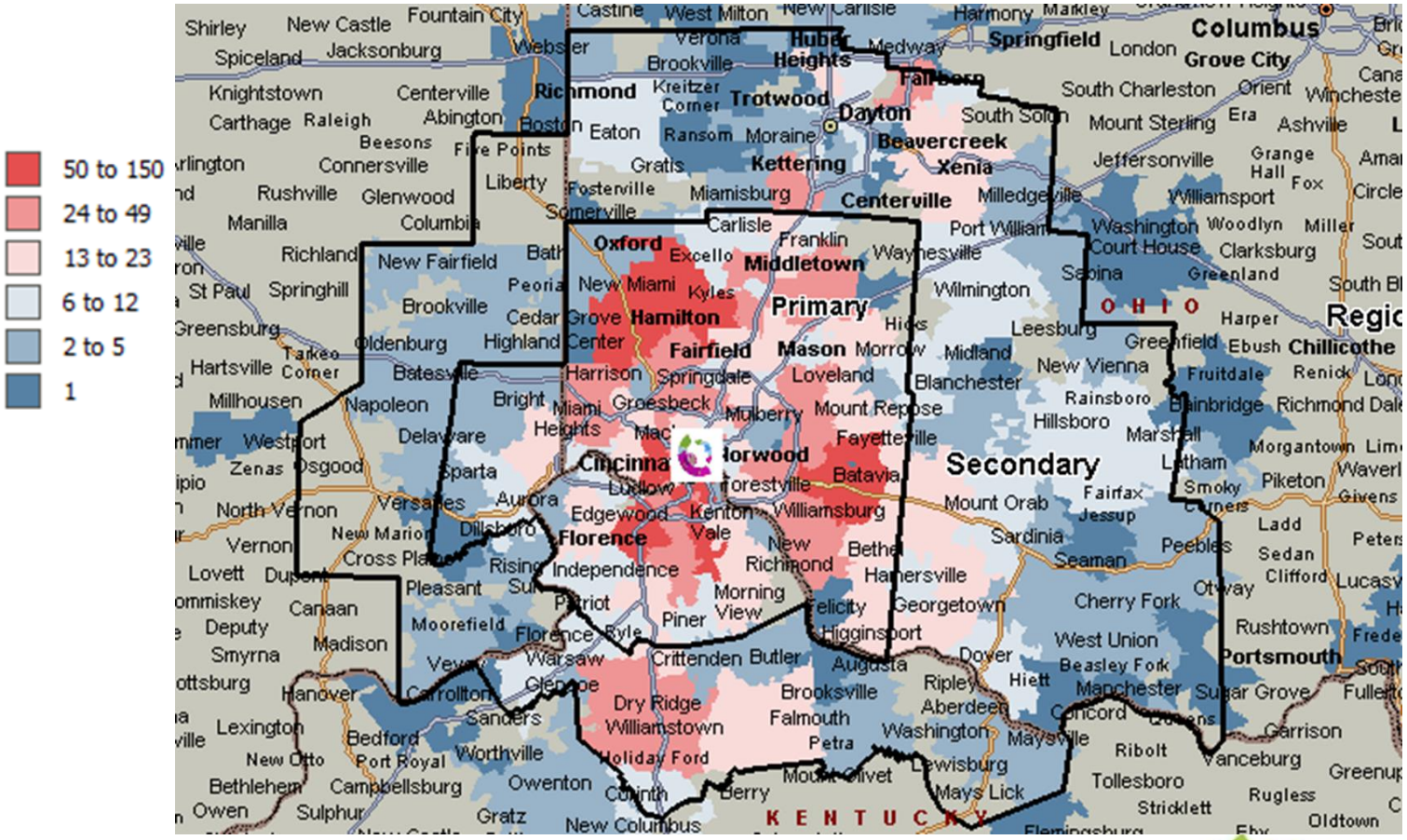
NAS cases FY14-FY16



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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

- PEDIATRICS Vol. 129 No. 2 February 1, 2012
- PEDIATRICS Vol. 135, August 2014.

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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

PEDIATRICS Vol. 129 No. 2 February 1, 2012
pp. e540 -e560

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Monitoring in the Hospital

- Infants are typically monitored:
  - **72** hours for short acting opioids (heroin, prescription pain medications)
  - **96** hours for long acting opioid exposure (methadone, buprenorphine)

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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

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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

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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**

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Follow-Up Care

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

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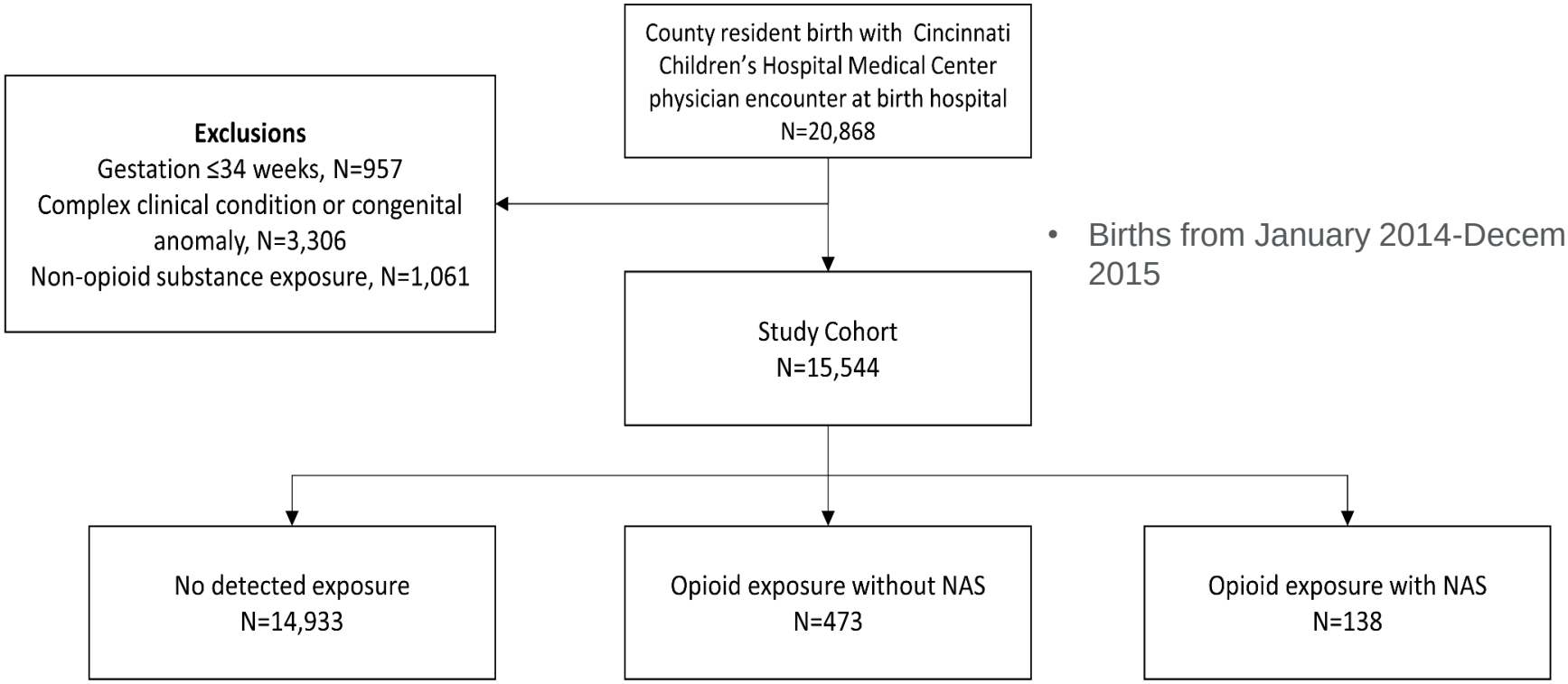
Developmental and Medical Problems in Opioid Exposed Children



- Births from January 2014-December 2015

Hall et al, Population Health Management, 2018

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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.

	No Detected Exposure N=14,933		Opioid Exposure without NAS N=473		Opioid Exposure with NAS N=138		P-value [a]	P-value [b]
Behavioral or emotional disorder; N, %	171	1.1	14	3.0	8	5.8	0.0008*	0.12
Developmental delay; N, %	1,138	7.6	74	15.6	39	28.3	< 0.0001*	0.0008*
Hepatitis C exposure; N, %	21	0.1	32	6.8	48	34.8	< 0.0001*	< 0.0001*
Motor function developmental disorder; N, %	215	1.4	13	2.7	7	5.1	0.03	0.18
Otitis media; N, %	4,221	28.3	155	32.8	43	31.2	0.03	0.72
Plagiocephaly; N, %	270	1.8	5	1.1	14	10.1	0.23	< 0.0001*
Sensory disorder; N, %	1,095	7.3	49	10.4	29	21.0	0.01	0.001*
Speech disorder; N, %	964	6.5	48	10.1	19	13.8	0.001*	0.23
Strabismus; N, %	149	1.0	16	3.4	15	10.9	< 0.0001*	0.0004*
Torticollis; N, %	322	2.2	6	1.3	12	8.7	0.19	< 0.0001*

NAS=Neonatal abstinence syndrome

[a] Comparison of opioid exposure without NAS and no detected exposure

[b] Comparison of opioid exposure without NAS and opioid exposure with NAS

* Statistical significance after Bonferroni-Holm correction for multiple comparisons

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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)

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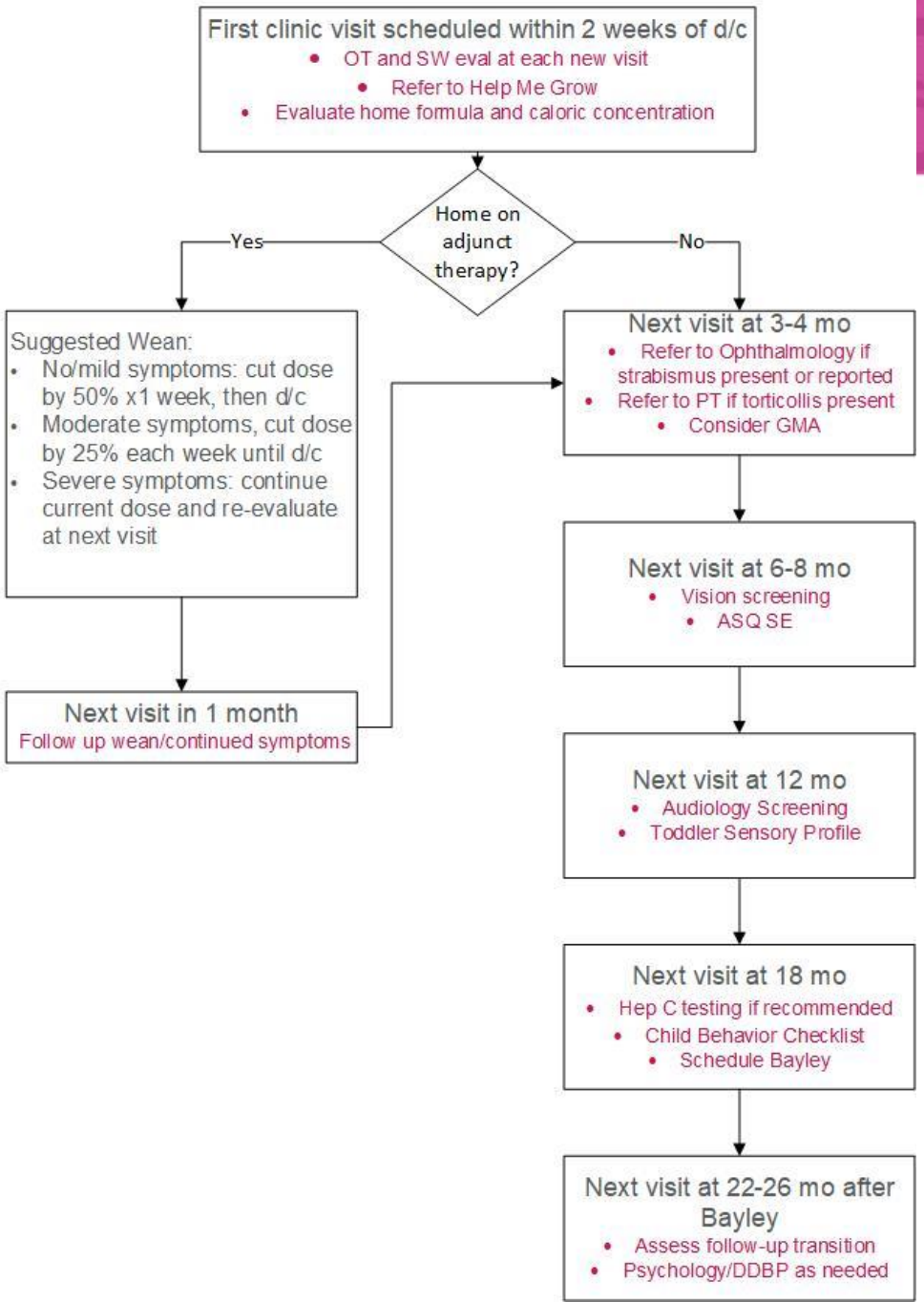
NAS Follow-Up Clinic Algorithm



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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

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New Visits - Medical

- Evaluate growth, need for higher calories
- Discuss GI issues:
  - Gas
  - Constipation
  - Reflux
  - Nutrition/formula choice
- Visual problems
- Muscle tone, development, sensory processing in conjunction with OT

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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

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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

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Hypertonia

- Commonly affected areas of the body:
  - Cervical area (torticollis or shoulder elevation)
    - May see 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

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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 _____ times per day.
  - Lightly hold your baby's hands and be gentle with all the movements you do with your baby.
  - Hold each stretch _____ seconds. Repeat each stretch _____ times.
  - 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

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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.

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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.

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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.

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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.

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Hypotonia

- Some infants may present with muscle tone on the low end of normal (hypotonia)
- Their muscles appear extra loose or floppy compared to other babies their age
- May demonstrate a more persistent head lag or have a hard time tolerating tummy time

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Hypotonia (continued…)

- Interventions focus on strengthening and positioning
- Tummy time!
  - Towel roll
  - Inclined surface
- Reaching
  - Towel rolls under shoulders to support reaching against gravity
  - Sidelying to support reaching in a more neutral position

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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.

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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)

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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

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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

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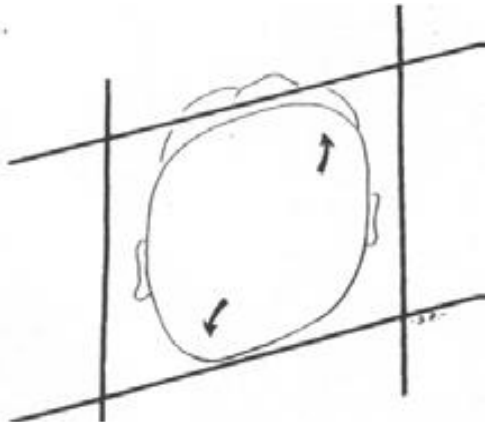
Plagiocephaly

- 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.



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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.
  - It is very important to put your baby on his tummy when he is awake and being watched. This takes the pressure off the back of your baby's head and reduces the chance to develop a flat spot

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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

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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

Principles for Intervention for SOR

- "Empty the cup"
- Do not surprise them with the sensation, and equip them to be prepared for situations where there could be “surprise” sensations
- Use gentle stimulation
- Provide notice in advance—predictability is key!
- Use calming (inhibitory) activities:
  - Linear swinging
  - Deep touch pressure
  - Proprioceptive input

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

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Participation in ADL's (continued...)

- Infants with NAS may also experience:
  - Poor sleep hygiene
    - Hyperactive startle
    - Need for additional calming strategies
  - Poor feeding abilities
    - Nasal congestion affecting suck-swallow-breathe coordination
    - State of arousal

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Calming strategies

- 5 S's to calm a fussy baby
  - Swaddle
  - Side or stomach position
  - Shush
  - Swing
  - Suck

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

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Feeding strategies

- 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
  - Learning to read an infant's states/cues will guide the feeder on how to support the infant through the feed
- Identification of environmental triggers for infant irritability, such as light, sound and handling, and of the nonpharmacological strategies that decrease them
  - Use of 5 S's or sensory strategies to assist in state regulation prior to attempting feeding
- External pacing
  - Pacing is used to support an infant's coordination; appropriate pacing can significantly improve an infant's ability to manage fluid, coordinate breathing, and maintain vital sign stability

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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
  - Report of strabismus incidence 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

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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

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EI and NAS

J Dev Behav Pediatr, 40 (6), 441-450 Jul/Aug 2019

Early Intervention Referral and Enrollment Among Infants With Neonatal Abstinence Syndrome

Elizabeth Peacock-Chambers [1] [2], JoAnna K Leyenaar [3], Sheila Foss [1], Emily Feinberg [4], Donna Wilson [5], Peter D Friedmann [5], Paul Visintainer [5], Rachana Singh [1]

- 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 ($p \leq 0.05$)
- This difference persisted in multivariable analysis

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Ongoing importance of EI

- 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)

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Considerations for EI providers

- Periodic or consultative model of intervention when a child appears to be on target during these first 6 months
  - If scheduling allows, consider recommendations for a periodic frequency (1x/month or every other month) to allow for regular check-ins with the family
  - 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, such as torticollis and/or plagiocephaly, which are very likely to emerge after initial assessment has been completed

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Take-Away

- Research indicates that both treated and non-treated infants are at high risk for a variety of developmental concerns.
- At first assessment, they 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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Presenter Contact Information

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