

Development of a hospital feeding protocol for infants diagnosed with Neonatal Abstinence Syndrome (NAS).

Leadership Education in Neurodevelopmental Disabilities (LEND) Capstone project 2022

LEND Trainee 2021-2022: Tiffany Robinson, RD. LD.

LEND Mentor: Shannon Gregg, MS. RD. LD

Agenda

LEND Competencies

Problem-framing

Research

Product

Dissemination

LEND Competencies

Leadership skills:

- Lead through practice, research, and administration.
- Demonstrate networking and advocacy skills.

Interdisciplinary practice:

- Collaborate effectively with individuals, families, peers, faculty and other professions.
- Demonstrate clinical reasoning and skills.

Research, Quality Improvement, and Evidence-Based Practice:

- Use science-based judgement and evidence-based practice.
- Gain experience with framing a problem, researching, developing a product

Problem Framing

What is NAS?

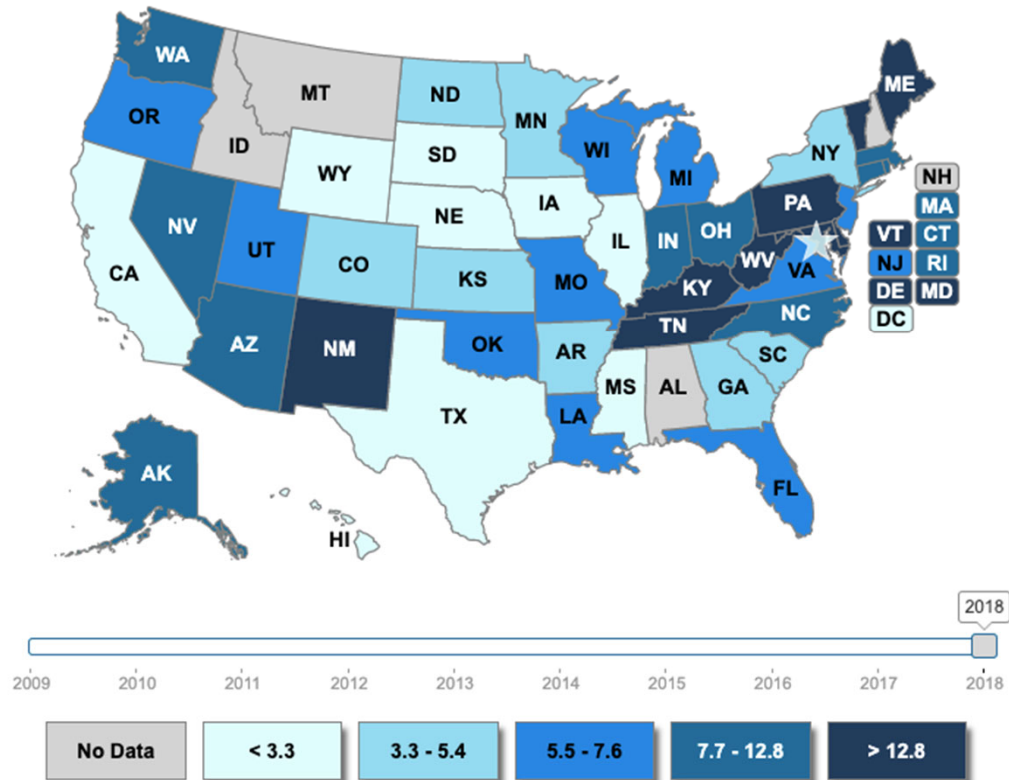
A drug withdrawal syndrome that occurs in infants that are exposed to addictive substances, opioids and other substances, while in utero.

Problem Framing

Increased prevalence in New Mexico and the United States

Rate of NAS per 1,000 Newborn Hospitalizations

2018 National rate: 6.8



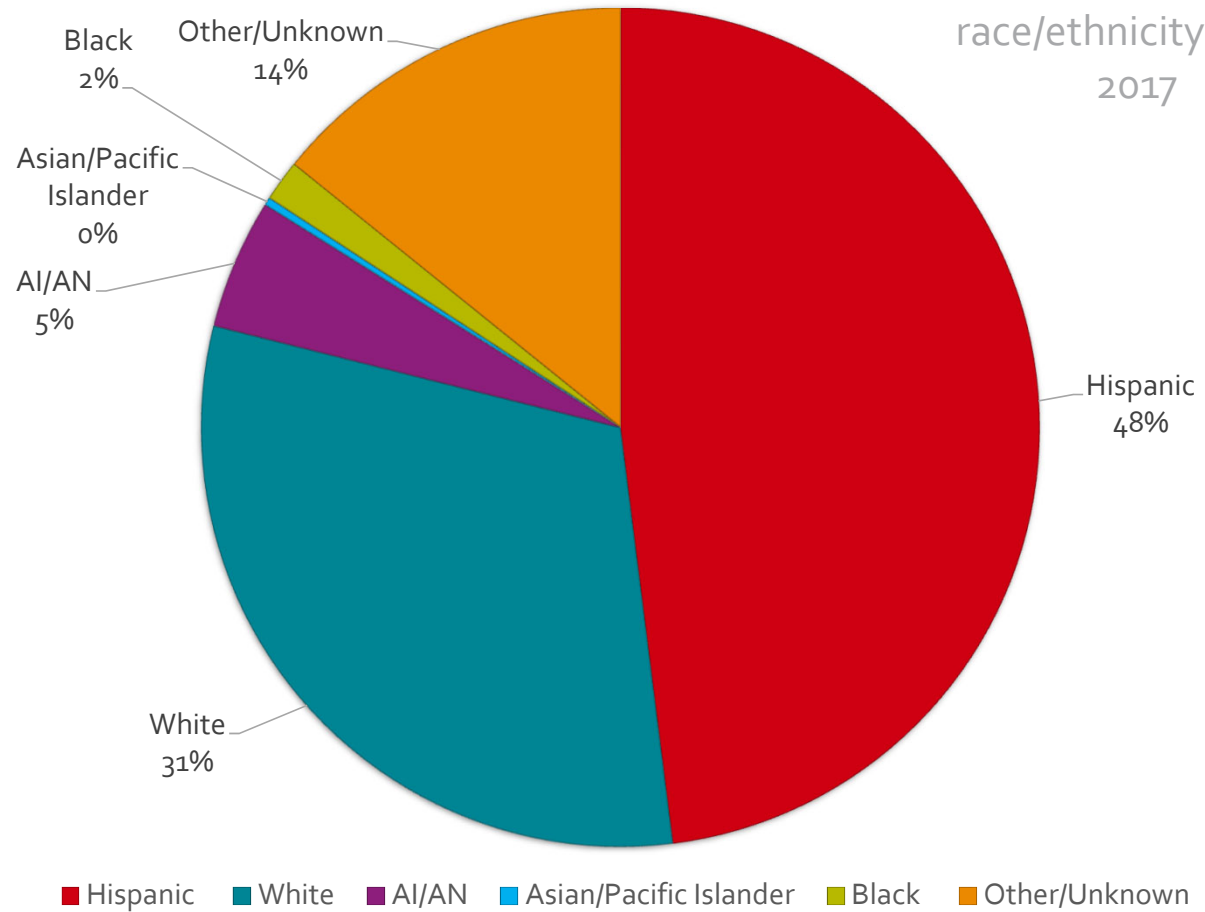
Agency for Healthcare Research and Quality.
<https://hcup-us.ahrq.gov/faststats/NASMap?setting=IP>

Problem Framing

Prevalence in New Mexico

Saavedra, L. G. 2018

NM NAS cases by race/ethnicity 2008-2017

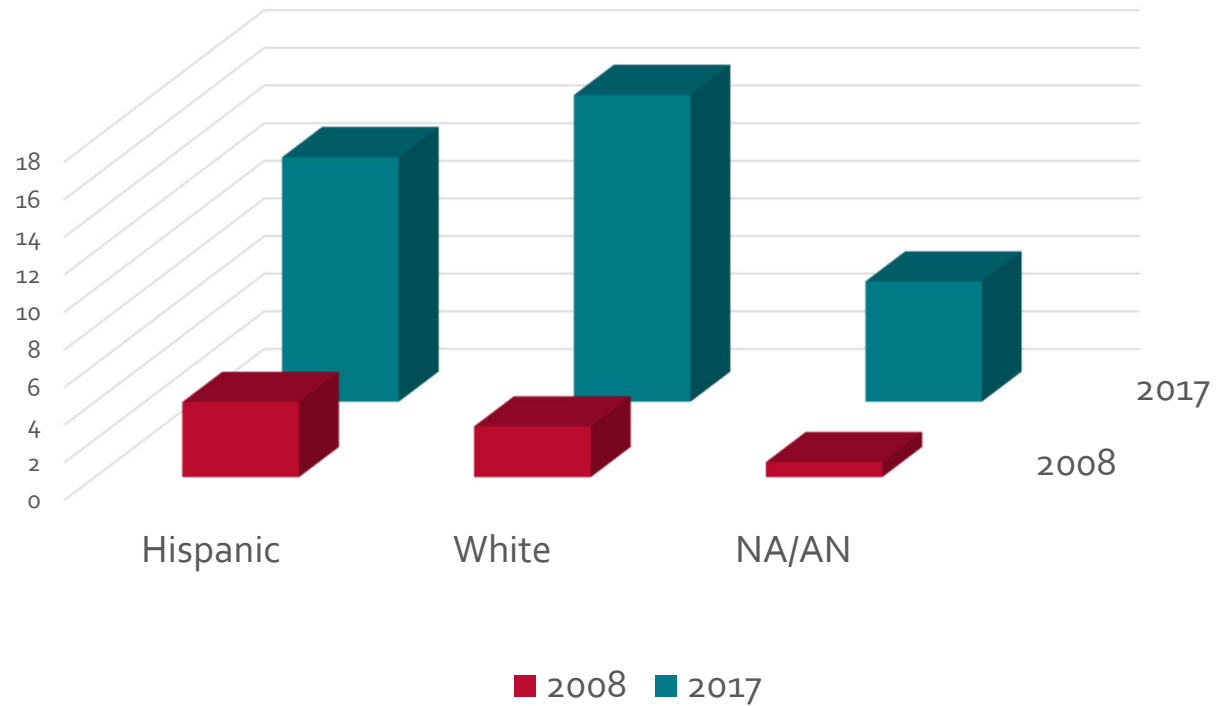


Problem Framing

Prevalence in New Mexico

Saavedra, L. G. 2018

Change in NAS prevalence over time



Problem Framing

NAS Signs and Symptoms

Pandey, R. 2021. Maguire DJ.
2016. McQueen K. 2019

- Irritability
- Hypertonicity
- Uncoordinated suck swallow
- Nasal stiffness
- Jitteriness/tremors
- Poor sleep (altered sleep-wake cycles, sleeplessness)
- Poor growth
- Respiratory distress
- Temperature instability
- Tachypnea
- GI distress (nausea, vomiting, projectile vomiting, regurgitation, cramping, and loose stools)
- Excessive high-pitched crying

Problem Framing

Areas of concern for NAS infants

Vision

Motor skills

Behavioral and Cognitive

Adverse Childhood Experience (ACE)

Maguire, DJ. 2016.

Problem Framing

NAS and long-term
outcomes

Maguire DJ. 2016

NAS infants face additional threats after withdrawal subsidies

- Inconsistent caregiving
- Family instability
- Out-of-Home placement
- Chronic stress
- Poverty

Problem Framing

Feeding protocol importance

Tolerance formula, especially lactose-free formula, is commonly used as an alternative feeding method for NAS infants around the country.
- Pandey et al.

Use of partially hydrolyzed formula (PHF) may alter production of enzymes in the digestive tract.
- Alsaleem et al.

These formulas (PHF) can be reduced or completely absent of lactose in addition to hydrolyzed proteins.
- Alsaleem et al.

There is significant variation in the nutritional management of infants with NAS.
- Bogen et al.

Problem Framing

Difficulties of breastfeeding with NAS

Inconsistent advice

Lack of promotion of breastfeeding for newborns with NAS

Feeding problems due to drug exposure

Breastfeeding is challenging in the setting of NAS

Problem Framing
Different formulas



Research

Gathering
data/information

Conducted literature review using PubMed, Cumulative Index to Nursing and Allied Health (CINAHL), and the Cochrane Library.

Search terms:

- “Neonatal Abstinence Syndrome” or “NAS” or “Drug withdrawal”:
 - “Infant formula”
 - “Hydrolyzed formula”
 - “Feeding”
 - “High-calorie formula”

Other parameters:

- Human trials, printed in English, published between 2011-2022

Research

Gathering
data/information



Research

Literature review results

Lactose-free infant formula does not change outcomes on neonatal abstinence syndrome (NAS): a randomized clinical trial

Aim: Determine if lactose-free (LF) or lactose-containing (LC) formula would be more beneficial in the management of NAS.

- Results: When comparing lactose-free (LF) group to lactose-containing (LC) group
 - Results similar: NAS scores during the first 72 hours of life, first 5 days of life, first 7 days of life, cumulative morphine dose, morphine dose (mg/kg body weight), highest morphine dose, additional medication administered for NAS treatment, neonatal intensive care unit (NICU) admission, duration of NAS treatments, length of stay (LOS) in the hospital

Pandey et al. 2021

Research

Literature review results

The Impact of Infant Feeding Methods on Neonatal Abstinence Scores of Methadone-Exposed Infants

Aim: Determine if NAS scores of infants exposed to methadone during pregnancy differ by feeding method.

- Results: When comparing predominantly breastfed, combination fed, and predominantly formula fed infants
 - The predominantly breast-fed infant group had significantly fewer number of NAS scores taken (lower severity of NAS scores) when compared to the combination and primarily formula fed groups.

McQueen et al. 2011

Research

Literature review results

Effects of Partially Hydrolyzed Formula on Severity and Outcomes of Neonatal Abstinence Syndrome

Aim: Determine if partially hydrolyzed formulas (PHF) would decrease severity and short-term outcomes of NAS when compared to standard formula (SF).

- Results: Comparing Partially hydrolyzed formulas (PHF) to Standard Formula (SF)
 - After adjusting for confounding factors, there was no difference in LOS, maximum dose or duration of morphine therapy.

Alsaleem et al. 2019

Research

Literature review results

Randomized Clinical Trial of Standard- Versus High-Calorie Formula for Methadone-Exposed Infants: A Feasibility Study

Aim: Compare the efficacy of standard calorie formula (SCF), 20 kcal/oz, when compared to high calorie formula (HCF), 24 kcal/oz, on preventing excessive weight loss and late return to birth weight of methadone exposed newborns.

- Results: Comparing standard calorie formula (SCF) to high calorie formula (HCF)
 - There is no statistically significant difference between groups for weight gain or mean daily volume of feedings
 - Trends favored HCF group due to larger weight gain

Bogan et al. 2018

Research

Literature review results

Effect of Low Lactose Formula on the Short-Term Outcomes of Neonatal Abstinence Syndrome: A Systematic Review

Aim: to determine if low lactose formula (LLF) decreases the severity and the duration of NAS symptoms of infants born at ≥ 35 weeks' gestation with NAS when compared to infants who received regular standard formula (RSF).

- Results: Systematic review where authors compared outcomes for the need of pharmacological therapy for NAS, duration and dose of pharmacological treatment, LOS, and effects of formula, low lactose formula (LLF) versus standard lactose formula (SLF) on infant growth.
 - No added benefit to provide LLF when compared to SLF in infants with NAS

Alsaleem M, Dusin J, Akangire G. 2011

Research

Literature review results

Breastfeeding and Formula Selection in Neonatal Abstinence Syndrome

Aim: Determine if LLF versus SLF would have an effect on weight-change, length of pharmacological intervention (LOT) and LOS.

- Results: Compared LLF versus SLF with a secondary analysis was conducted on infants who were exclusively breastfed.
 - Weight change per day was greater in the breastfed group when compared to the SLF and LLF groups after controlling for LOS
 - No difference in weight change between the SLF and LLF
 - Length of pharmacological treatment was shorter in the breastfeeding group when compared to the SLF and LLF

Lembeck et al. 2020

Research

Main Findings

- Breastfeeding benefits NAS infants
 - Barriers to initiating breastfeeding
 - Barriers to maintaining breastfeeding for 12 months
- No additional benefit found in low lactose formula with NAS outcomes
- Limited benefits in partially hydrolyzed formulas when compared to standard formula
- Additional research is needed in the area of hypercaloric formulas on NAS outcomes

Product



Applies To: UNM Hospitals
Responsible Department: FNS
Effective Date: TBD

Title: NAS infant feeding protocol	Procedure
Patient Age Group: () N/A () All Ages (X) Newborns () Pediatric () Adult	

PROCEDURE STATEMENT
Neonatal Abstinence Syndrome (NAS) protocol should be implemented in term infants (infants born ≥ 37 weeks gestation) who are diagnosed with NAS using a facility-approved neonatal abstinence scoring tool. This includes the Modified Finnegan Neonatal Abstinence Scoring System or the Eat, Sleep, Console, Assessment.

This feeding protocol should be used in conjunction with University of New Mexico Hospital (UNMH) Neonatal Abstinence Syndrome patient care protocol.

IMPLEMENTATION PROCEDURES

1. Breastfeeding:
 - 1.1 Should be encouraged and supported with all mothers when medically appropriate.
 - 1.2 Mothers who desire to breast feed NAS infants should be encouraged and supported in breastfeeding if:
 - 1.2.1 Mother is adhering to and is stable in an opioid maintenance program
 - 1.2.2 Infant custody remains with mother
 - 1.3 Mother should not breastfeed or provide expressed breast milk (EBM) if:
 - 1.3.1 Contraindications to breastfeeding exist:
 - 1.3.1.1 Mother is diagnosed with human immunodeficiency virus (HIV)
 - 1.3.1.2 Infant is diagnosed with classic galactosemia
 - 1.3.1.3 Mother is infected with human T-cell lymphotropic virus type one or type two
 - 1.3.1.4 Mother is using illicit street drugs
 - 1.3.1.5 Mother takes prescription medication that is contraindicated in breastfeeding.
 - 1.3.1.6 Mother has suspected or confirmed Ebola virus disease
 - 1.3.1.7 Mother is infected with brucellosis
 - 1.3.1.8 Mother is undergoing diagnostic imaging with radiopharmaceuticals
 - 1.3.1.9 Mother has an active herpes simplex virus (HSV) infection with lesions present on the breast
 - 1.3.1.10 If infant will not be discharged in the care of mother.
 - 1.4 If no contraindications exist and mother elects to breastfeed.
 - 1.4.1 Medical personnel to provide mother with education on benefits of breastfeeding.

Title: NAS infant feeding protocol
Owner: FNS
Effective Date: TBD

- 1.4.2 Mother should be taught how to pump and/or breast feed within 6 hours of birth by qualified hospital staff.
2. Formula feeding:
 - 2.1 Should be used if:
 - 2.1.1 Mother has contraindications to breastfeeding
 - 2.1.2 Mother elects not to breastfeed
 - 2.1.3 Mother is not able to produce sufficient breast milk for adequate growth velocity and requires supplemental formula
 - 2.1.4 Infant will not be discharged in the care of birth mother
 - 2.2 Term milk-based infant formula (Gerber Gentle, Similac Advance, Enfamil Infant, or available ready to feed formula)
 - 2.2.1 Should be provided at the caloric concentration at 22 kcal per ounce or concentrated based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
 - 2.2.2 Should be offered every 2-3 hours
 - 2.2.3 Should be discontinued if:
 - 2.2.3.1 Cow's Milk Allergy (CMA) suspected or confirmed
 - 2.3 Term Mild intolerance/Low Lactose Formula (Gerber Soothe, Similac Sensitive, Enfamil Gentlease, or available ready to feed formula)
 - 2.3.1 Provide if patient shows signs of intolerance to term milk-based formula.
 - 2.3.2 Should be provided at the caloric concentration at 22 kcal per ounce or concentrated based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
 - 2.3.3 Should be provided ever 2-3 hours
 - 2.3.4 Should be discontinued if:
 - 2.3.4.1 CMA suspected or confirmed
 - 2.4 Term Elemental formula (Elecare, Neocate, Puramino, Alfamino)
 - 2.4.1 Should be provided if infant does not tolerate, suspected intolerance of term milk-based formula or term mild intolerance/low lactose formula, or suspected CMA – Per GI or physician
 - 2.4.2 Should be provided at the caloric concentration at 22 kcal per ounce or concentrated based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
 - 2.4.3 Should be provided every 2-3 hours

Title: NAS infant feeding protocol
Owner: FNS
Effective Date: TBD

Product

NAS term infant feeding protocol

Neonatal Abstinence Syndrome (NAS) feeding protocol: Term infants (born ≥ 37 months gestation)

- Neonatal Abstinence Syndrome (NAS) protocol should be implemented in term infants (infants born ≥ 37 weeks gestation) who are diagnosed with NAS using a facility-approved neonatal abstinence scoring tool (the Modified Finnegan Neonatal Abstinence Scoring System or the Eat, Sleep, Console, Assessment).
- This feeding protocol should be used in conjunction with University of New Mexico Hospital (UNMH) Neonatal Abstinence Syndrome patient care protocol.

Product

NAS term infant feeding protocol

Breastfeeding

- Should be encouraged and supported with all mothers when medically appropriate.
- Mothers who desire to breast feed NAS infants should be encouraged and supported in breastfeeding if:
 - Mother is adhering to and is stable in an opioid maintenance program
 - Infant custody remains with mother
- Mother should not breastfeed or provide expressed breast milk (EBM) if contraindications exist or if infant will not be discharged in mother's care.
- If no contraindications exist and mother elects to breastfeed:
 - Medical personnel to provide mother with education on benefits of breastfeeding
 - Mother should be taught how to pump and/or breast feed within 6 hours of birth by qualified hospital staff.

Product

NAS term infant feeding protocol

Formula feeding

- Should be used if:
 - Mother has contraindications to breastfeeding
 - Mother elects not to breastfeed
 - Mother is not able to produce sufficient breast milk for adequate growth velocity and requires supplemental formula
 - Infant will not be discharged in the care of birth mother

Product

NAS term infant feeding protocol

Term milk-based infant formula (Gerber Gentle, Similac Advance, Enfamil Infant, or available ready to feed formula)

- Should be provided at the caloric concentration at 22 kcal per ounce or modify concentration based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
- Should be offered every 2-3 hours
- Should be discontinued if:
 - Cow's Milk Allergy (CMA) suspected or confirmed

Product

NAS term infant feeding protocol

Term Mild intolerance/Low Lactose Formula (Gerber Soothe, Similac Sensitive, Enfamil Gentlease, or available ready to feed formula)

- Provide if patient shows signs of intolerance to term milk-based formula.
- Should be provided at the caloric concentration at 22 kcal per ounce or modify concentration based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
- Should be provided every 2-3 hours
- Should be discontinued if:
 - CMA suspected or confirmed

Product

NAS term infant feeding protocol

Term Elemental formula (Elecare, Neocate, Puramino, Alfamino)

- Should be provided if infant does not tolerate, suspected intolerance of term milk-based formula or term mild intolerance/low lactose formulas, or suspected CMA – Per GI or Physician
- Should be provided at the caloric concentration at 22 kcal per ounce or modify concentration based on physicians or registered dietitian recommendation (20 kcal/ounce, 24 kcal/ounce, 26 kcal/ounce).
- Should be provided every 2-3 hours

Dissemination

UNMH NAS Protocol

Review

Review protocol with Pediatric inpatient team.

Review

Review protocol with clinical nutrition manager.

Provide

Provide to family medicine attending to review.

Submit

Submit protocol for approval from UNMH.

Dissemination

Future plan

Utilize

Utilize the literature review conducted for Capstone project.

Build

Build upon current research by reviewing literature on hypercaloric formulas for term NAS infants.

IRB

IRB through UNM HSC will be needed for planned research project.

Conduct

Conduct a retrospective chart review on outcomes of NAS patients who are provided hypercaloric formula >50% of feeds. (22kcal/oz vs. 24 kcal/oz).

References

1. Pandey R, Kanike N, Ibrahim M, Swarup N, Super DM, Groh-Wargo S, Kumar D. Lactose-free infant formula does not change outcomes of neonatal abstinence syndrome (NAS): a randomized clinical trial. *Journal of Perinatology*. 2021; 41(3):598-605.
2. Alsaleem M, Berkelhamer SK, Wilding GE, Miller LM, Reynolds AM. Effects of partially hydrolyzed formula on severity and outcomes of neonatal abstinence syndrome. *Am J Perinatol*. 2020; 37:1177-1182.
3. Jilani SM, Frey MT, Pepin D, et al. Evaluation of state-mandated reporting of neonatal abstinence syndrome – six states, 2013-2017. *Mmwr morbidity and mortality weekly report*. 2019;68(1):6-10. doi:10.15585/mmwr.mm6801a2
4. Garcia Saavedra L. Neonatal Abstinence Syndrome Surveillance in New Mexico. *New Mexico Epidemiology*. 2018;10: 1-4. <https://www.nmhealth.org/data/view/report/2194/>
5. McQueen K, Taylor C, Murphy-Oikonen J. Systematic review of newborn feeding method and outcomes related to neonatal abstinence syndrome. *JOGNN*. 2019; 48(4): 398-407.
6. Maguire DJ, Taylor S, Armstrong K, Shaffer-Hudkins E, Germain AM, Brooks SS, Cline GJ, Clark L. Long-term outcomes of infants with neonatal abstinence syndrome. *Neonatal network*. 2016; 35(5):277-286. – Only information for introduction
7. McQueen KA, Murphy-Oikonen J, Gerlach K, Montelpare W. The impact of infant feeding methods on neonatal abstinence scores of methadone-exposed infants. *Adv Neonatal Care*. 2011; 11(4):282-290.
8. Bogen DL, Hanusa BH, Baker R, Medoff-Cooper B, Cohian B. Randomized clinical trial of standard- versus high-calorie formula for methadone-exposed infants: a feasibility study. *Hospital Pediatrics*. 2018; 8(1):7-14.
9. Lembeck AL, Tuttle D, Locke R, Lawler L, Jimenez P, Mackley A, Paul DA. Breastfeeding and formula selection in neonatal abstinence syndrome. *American Journal of Perinatology*. 2020; 10.1055/s-0040-1713754. doi:10.1055/s-0040-1713754
10. Alsaleem M, Dusin J, Akangire G. Effect of low lactose formula on the short-term outcomes of neonatal abstinence syndrome: a systematic review. *Glob Pediatr Health*. 2021; 8:2333794X211035258. Published 2021 Jul 22. doi: 10.1177/2333794X211035258
11. Jarvinen-Seppo KM, Sicherer SH, TePas E. Milk allergy: Clinical features and diagnosis. UpToDate. Last updated March 2022. Reviewed 4/10/2022. https://www.uptodate-com.libproxy.unm.edu/contents/milk-allergy-clinical-features-and-diagnosis?search=infant%20lactose%20allerg&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
12. Internet Citation: HCUP Fast Stats. Healthcare Cost and Utilization Project (HCUP). September 2021. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/faststats/nas/nasmap.jsp?setting=IP.