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A Review of Feeding Practices in Infants With Neonatal Abstinence Syndrome

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ABSTRACT

Background: There has been an increase in infants with neonatal abstinence syndrome (NAS) in neonatal intensive care units (NICUs) over the past several decades. Infants with NAS experience withdrawal as a result of the sudden termination at birth of substance exposure during pregnancy. A serious sign related to infants diagnosed with NAS is poor feeding. The prevalence of NAS urges researchers and clinicians to develop effective strategies and techniques to treat and manage the poor feeding of infants exposed to substances in utero.

Purpose: To synthesize current feeding methods and practices used for infants diagnosed with NAS.

Methods/Search Strategy: PubMed, CINAHL, and Scopus were searched for articles published within the last 20 years that focused on feeding practices or feeding schedules, were written in English, were peer-reviewed, and described human studies. The search terms utilized were "neonatal abstinence syndrome" OR "neonatal opioid withdrawal syndrome" AND "feeding."

Findings/Results: Three findings emerged regarding techniques and management of poor feeding in the NAS population. The findings included infants who received mother's own milk had decreased severity and later onset of clinical signs of withdrawal, demand feeding is recommended, and the infant's cues may be helpful to follow when feeding.

Implications for Practice: Clinicians should encourage mother's own milk in this population unless contraindications are present. Caregivers and clinicians must be receptive to cues when feeding infants with NAS.

Implications for Research: Even with the clinical knowledge and experience that infants with NAS are difficult to feed, there is limited research assessing techniques and schedules that are effective in managing successful feeding. Future research should compare feeding schedules such as on-demand feeding versus regimented feeding schedules, as well as investigate techniques that mothers and nurses can utilize to encourage oral intake in this population.

Video abstract available at https://journals.lww.com/advancesinneonatalcare/Pages/videogallery.aspx?autoPlay=false&videoId=37

Key Words: breastfeeding promotion, breastfeeding—psychosocial factors, feeding, human milk, infant nutritional physiological phenomena, lactation, neonatal abstinence syndrome, neonatal abstinence syndrome—prevention and control, neonatal opioid withdrawal syndrome, neonate

Newborns who are exposed to substances in utero are at risk of neonatal abstinence syndrome (NAS) after birth as a result of the sudden discontinuation of substances used by the mother during pregnancy.[1] These infants often experience withdrawal, and the severity of withdrawal is dependent on various risk factors such as polysubstance exposure and genetic polymorphisms.[2]

NAS is characterized by signs of central and autonomic nervous system disturbances, as well as gastrointestinal distress.[1] Withdrawal from illicit or prescribed substances is becoming more common in infants around the world.[1] In 2017, the US Department of Health and Human Services declared a public health emergency regarding the opioid epidemic plaguing the nation.[3] Unfortunately, pregnant women are not spared from the addictive nature of opioids. Every 15 minutes an infant is born withdrawing from opioids.[4] Infants are also susceptible to withdrawal from benzodiazepines, selective serotonin reuptake inhibitors, tricyclic antidepressants, methamphetamines, and inhalants, although this list is not exhaustive.[1] Seven newborns are diagnosed with NAS for every 1000 newborn hospital stays, with nearly 80 newborns being diagnosed every day in the United States.[5]

The severity of infant withdrawal is typically scored around the clock using an instrument to determine withdrawal severity.[1] Several tools are used in clinical practice, with some of the most common including the Finnegan Neonatal Abstinence Scoring System (FNASS), the Lipsitz tool, the MOTHER NAS Scale, and the Eat, Sleep, Console method.[6-9] A 2013 survey found that 95% of

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institutions used the FNASS to guide NAS assessment and management.[10] These tools are used in treatment decisions to determine whether pharmacological intervention is necessary to help manage withdrawal. Infants experiencing withdrawal are most often managed initially with nonpharmacological interventions (NPIs), because they are more readily available, less expensive, and less controversial than treating withdrawal with medication.[1] In fact, many infants with mild to moderate signs of withdrawal can avoid pharmacological treatment using just NPI. Suggested NPIs include gentle handling, demand feeding, swaddling, low stimulation, music therapy, massage, and skin-to-skin care.[1]

Poor feeding is associated with excessive sucking, hyperirritability, and vomiting and can put infants at risk for poor weight gain.[1] The delay in weight gain that results from poor feeding may lead to lengthier hospital stays. Poor feeding is most severe in the initial phase of NAS, typically lasting for 1 to 2 weeks.[1] Researchers describing feeding behaviors in infants with NAS reported behaviors that disrupted feedings included categories of fussing, resting, crying, and sleeping/sedated.[11] Infants were found to spend almost twice as much time fussing as feeding. Feeding occurred 24% of the time, with fussing and crying occurring 51% of the time mothers were attempting to feed their infants. Infants spent anywhere between 1 and 11 minutes fussing during their feeding, and fussing disrupted feeding in each subject at least once. Data suggest that infants with NAS express feeding cues less clearly than control infants.[12] During an observed feeding, infants with NAS scored lower on showing a decrease in tension after starting a feeding, displaying smooth and coordinated movements during feeding, initiating contact with the caregiver's face/eyes, and showing satiation at the end of the feeding.[12] The lack of clarity of cues can make feeding time stressful for a caregiver. These studies empirically support that infants with NAS can be challenging feeders and caregivers can experience difficulty and frustration during feeding time.

Infants with NAS have different swallow–breath interactions when compared with unaffected term infants, actually being more comparable with preterm infants.[13] Infants with NAS exhibit immature suck–swallow–breathe rhythms during nonnutritive sucking. La Gasse and colleagues[14] found that infants diagnosed with NAS had prolonged sucking with fewer pauses, more feeding problems such as spitting up and refusal, and increased arousal. At 3 days of life, infants with NAS exhibited less efficient feeding than control infants with decreased volume per swallow but with a faster swallow rate.[15] The immaturity of the suck–swallow–breathe reflexes may be a contributing factor to the feeding difficulty of infants diagnosed with NAS.[13]

Evidence exists regarding the impact of mother's own milk on improving symptoms of NAS and reducing hospital length of stay compared with formula feeding, but there is limited literature on feeding practices such as schedules and techniques that may improve the quality of feedings.[16,17] Despite the evidence that mother's own milk decreases the severity of withdrawal in infants with NAS, lactation rates among women on methadone are low, with estimates of around 24%.[18] Even if mothers initially chose to provide human milk for their infant, only 10% to 19% have been found to still be exclusively supplying milk at discharge.[16,18]

While many researchers recommend demand feeding, there is currently no empirical evidence supporting the practice.[9,19-22] Frequent, small feedings are recommended on the basis of expert opinion.[22] Researchers who suggest demand feeding infants with NAS provide the following support:

- Infants with NAS have increased caloric needs, and "comfort feeding" may aid in improving caloric intake[23];
- Small-volume and frequent feedings of colostrum are more likely to be better tolerated and more calming for an infant with NAS[23]; and
- Small, frequent feedings help establish a circadian rhythm and are more well-tolerated by infants with NAS experiencing gastrointestinal symptoms.[24]

Excessive early weight loss in infants with NAS may be due to poor feeding, rapid gut transit time, and increased caloric needs due to tremors, tachypnea, and poor sleep patterns.[25] Despite the lack of evidence on optimal feeding schedules, some hospital guidelines include orders to feed infants with NAS every 3 hours due to concerns for poor weight gain using a volume-driven approach. Volume-driven approaches based on an infant's weight often lead to strictly scheduled interval feeds in contrast to demand feeding recommended in the literature.[26]

The purpose of this literature review was to explore and critically appraise relevant research about current feeding practices used in infants with NAS in the neonatal intensive care unit (NICU) setting and make recommendations to guide clinical practice and research.

METHODS

PubMed, CINAHL, and Scopus searches were conducted in April 2020 to retrieve original research associated with NAS and feeding practices. To be eligible for review, peer-reviewed articles must have been published within the last 20 years and addressed feeding practices such as techniques used during feedings or feeding schedules. Inclusion criteria were also limited to the English language and

human studies. Literature review articles were excluded.

With the guidance of an experienced medical librarian, MESH terms were used in PubMed to retrieve the most relevant articles. The terms utilized were "neonatal abstinence syndrome" OR "neonatal opioid withdrawal syndrome" AND "feeding." The CINAHL search utilized the subject terms "neonatal abstinence syndrome" OR "neonatal opioid withdrawal syndrome" AND "feeding." Titles and abstracts were searched in Scopus using the terms "neonatal AND abstinence AND syndrome AND feed*."

RESULTS

Database searches generated 749 articles. The search terms were purposefully broad with the goal of a comprehensive search. After abstract reviews and removal of duplicates, 26 full-text articles were assessed for eligibility. Eleven of these articles did not meet inclusion criteria. These articles were excluded for various reasons including the following:

- Studies supporting that infants with NAS are poor feeders, but no practices or techniques were described;
- Studies regarding lactation rates or barriers to lactation without detail to practices or techniques or effects on outcomes; and
- Studies quantifying the amount of methadone transferred in human milk.

After reviewing the reference lists of the full-text articles assessed for eligibility, one additional article was deemed eligible for synthesis. The broad search terms are likely the reason why so many articles were retrieved in the initial search, but only 15 articles in total met inclusion criteria. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram process is depicted in Figure 1.

When assessing the quality of evidence, consideration was given to study design, limitations, and potential for bias. No randomized controlled trials were identified in the search. Evidence in this review ranks lower on the traditional hierarchy of evidence, ranging from expert opinion focus groups to quality improvement (QI) initiatives. The selected articles consisted of 2 QI initiatives, 1 focus group, 10 retrospective medical record reviews 1 ambidirectional study, and 1 mixed-methods feasibility study included in the final synthesis. Most of the studies included in the review were found to have small sample sizes. The 15 articles are summarized in Table 1.

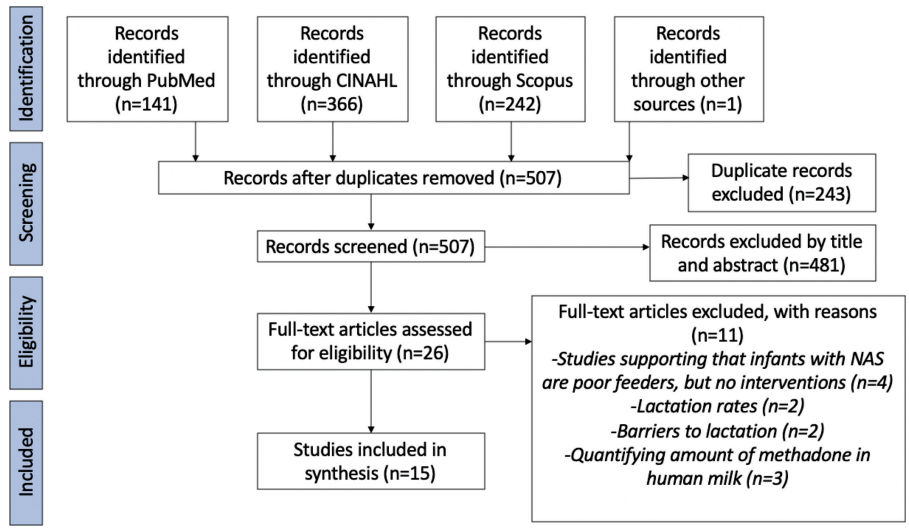
Three themes emerged from the synthesis of articles including the following:

- Infants who received mother's own milk had decreased severity and later onset of clinical signs of withdrawal;
- Demand feeding is recommended; and
- The infant's cues may be helpful to follow when feeding.

Benefits of Mother's Own Milk

The relationship between mother's own milk and infant withdrawal was the focus of 12 studies in the review. There is evidence that infants with NAS who are fed mother's own milk experience less severe

FIGURE 1



Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram of results of the literature search. NAS indicates neonatal abstinence syndrome.

TABLE 1. Summary of Evidence: Feeding Practices in Infants With NAS

Authors (Year)	Design, Sample	Key Findings	Limitations
Favara et al (2019)[27]	Retrospective medical record review (N = 1738)	-Median length of pharmacological treatment was significantly lower in infants who received ANY mother's own milk compared with exclusive formula -Median length of hospitalization significantly reduced	-No differentiation between expressed mother's own milk and direct breastfeeding -Quantity of mother's own milk was not included -Only infants in NICUs
Isemann et al (2011)[28]	Retrospective medical record review (N = 128)	-Inverse correlation between the amount of mother's milk received and LOS -Mother's milk feedings associated with shorter duration of pharmacotherapy	-Some incomplete data from records -Potential bias in initiating pharmacotherapy and weaning of infants fed mother's milk
McQueen et al (2011)[29]	Retrospective medical record review (N = 28)	-Infants predominately fed mother's own milk have lower mean M-FNAS scores than combination or formula-fed infants	-Small sample size -Self-report of methadone use for eligibility
Abdel-Latif et al (2006)[30]	Retrospective medical record review (N = 190)	-Mean Finnegan scores lower in the infants fed mother's own milk -Median time to withdrawal later in infants fed mother's own milk -Fewer infants fed mother's own milk required pharmacotherapy -No difference between infants who were fed expressed mother's own milk by bottle or gastric tube and directly breastfed infants	-Outpatient weaning of withdrawal medications reliant on mothers for drug administration
Dryden et al (2009)[31]	Retrospective medical record review (N = 444)	-Infants who received mother's own milk required less treatment of NAS -Higher maternal methadone use was associated with a higher incidence of NAS	
O'Connor et al (2013)[32]	Retrospective medical record review (N = 85)	-Data suggest that infants who receive mother's own milk have less severe NAS and are less likely to require pharmacological treatment	-Results not statistically significant -Cannot distinguish effects of other nonpharmacological interventions from effects of mother's own milk
Pritham et al (2012)[33]	Retrospective medical record review (N = 152)	-LOS was shorter for infants who received mother's own milk than for combination or formula-fed infants	-Maternal drug use based on self-report -Neonatal drug regimen not controlled for across groups
Welle-Strand et al (2013)[34]	Three-part ambidirectional study (N = 124)	-Infants who received mother's own milk had a lower incidence of NAS that required pharmacological treatment	-Small study groups -Data from 18 hospitals with varying experience and protocols for NAS management
Liu et al (2015)[35]	Retrospective medical record review (N = 194)	-No significant effect on the modality of feeding on the rates of infants with NAS requiring treatment -Direct breastfeeding delayed the onset of NAS compared with expressed mother's own milk	-Small sample size for expressed mother's own milk group -Maternal self-reporting leading to possibility of polydrug use
MacVicar et al (2018)[36]	Mixed-methods feasibility study (N = 14)	-Infants who received mother's own milk were less likely to require pharmacotherapy and have a shorter LOS	-Small sample size
Short et al (2016)[37]	Retrospective medical record review (N = 3725)	-LOS was reduced by 9.4% in the mother's own milk group in comparison with the formula-fed group	

(continues)

TABLE 1. Summary of Evidence: Feeding Practices in Infants With NAS (*Continued*)

Authors (Year)	Design, Sample	Key Findings	Limitations
Howard et al (2017)[38]	Retrospective medical record review (N = 86)	-Any amount of mother's own milk associated with decreased LOS -Mother's own milk associated with decreased duration of pharmacotherapy and significantly lower mean NAS score	-Differences in scores were not clinically significant -Infants who did not receive pharmacological treatment not included
Grossman et al (2017)[39]	QI project (N = 287)	-Nonpharmacological interventions included a low stimulation environment, parents involved in care, parents encouraged to room-in and feed infants on demand, encouraged mother's own milk -Used the Eat, Sleep, Console method -LOS decreased from 22.4 to 5.9 d -Proportions of infants treated with morphine decreased from 98% to 14% -Costs per infant decreased from $44,824 to $10,829	-Feeding practices were not isolated and were part of the QI bundle -Lengthy intervention with changes in staffing models and policies that could have affected results
Holmes et al (2016)[40]	QI project (N = 163)	-Nurses were trained to score infants only after on-demand feeds during skin-to-skin care -Treatment with morphine decreased from 46% to 27% -LOS decreased from 16.9 to 12.3 d -Average costs per at-risk infant dropped from $11,000 to $5300	-On-demand feeding was part of the intervention, but not isolated -Generalizability may be limited to hospitals where labor and delivery services are colocated
Maguire et al (2018)[41]	Focus group (N = 12; with 10 NICU nurses and 2 speech–language pathologists)	-Experts asked to describe the most challenging infant with NAS they had fed and tips and techniques they use for feeding -Techniques do not work the same for every infant, even more important to read infant cues -Techniques included feeding in a flexed "C position," calming infants with a bath or burping before feeds, using a pacifier to calm the infant during burping, using chin and cheek support, finding the "sweet spot" on the infant's palate to encourage sucking, vertical rocking, and feeding with the infant facing away	-Small sample size -Lactation and rooming-in not mentioned by participants

Abbreviations: NICU, neonatal intensive care unit; LOS, length of stay; M-FNAS, Modified Finnegan Neonatal Abstinence Scoring Tool; NAS, neonatal abstinence syndrome; QI, quality improvement.

short-term outcomes from withdrawal. Multiple researchers have reported a decrease in severity of NAS symptoms in infants who receive mother's own milk.[29,30,32,34,38] The mean peak NAS score of infants fed mother's own milk has been reported to be lower than that of formula-fed infants (8.83 vs 9.65), although not statistically significant ($P = .17$).[32] McQueen and colleagues[29] conducted a retrospective medical record review of 28 infants and found that infants who received mother's own milk at more than 75% of feedings exhibited the lowest mean NAS scores ($M = 4.9$), followed by combination fed infants (<75% of mother's own milk at feedings) ($M = 6.5$), and then exclusively formula-fed infants ($M = 6.9$). Abdel-Latif and colleagues[30] reported that there was no difference in the severity of NAS symptoms between infants fed mother's own milk by bottle or gastric tube in comparison with those who were directly breastfeeding, but no statistical data are provided.

Onset of withdrawal has been reported to be later in infants who receive mother's own milk.[30] The median time to withdrawal occurred much later in infants fed mother's own milk compared with infants fed formula (10 days vs 3 days; $P < .001$) in a study of 190 infants.[30] Liu and colleagues[35] found that direct breastfeeding during the first 48 hours of life was associated with a delayed onset of symptoms in comparison with infants who were fed expressed mother's own milk, although a limitation is that there were only 12 infants in the expressed milk group ($P = .04$).

Feeding with mother's own milk has also been associated with a shorter duration of pharmacotherapy, if pharmacotherapy is even necessary.[27,28,38] Infants with NAS who receive mother's own milk have lower rates of pharmacological therapy initiation.[30-32,34] Infants fed mother's own milk were less likely to score an 8 or above on a modified FNASS (65%), the initial potential pharmacological treatment criterion, than formula-fed infants (75%).[32] Dryden and colleagues[31] found that receipt of mother's own milk for greater than 72 hours after birth was independently associated with a 50% less chance of an infant requiring pharmacological treatment. In a study of 124 infants exposed to opioids in utero, methadone-exposed newborns receiving mother's own milk had a significantly lower incidence of pharmacological treatment (53%) than methadone-exposed newborns who were formula-fed (80%).[34] In contrast to these findings, Liu and colleagues[35] reported that there was no significant difference in rates of pharmacological treatment between infants fed via direct breastfeeding, expressed mother's own milk, or formula ($P = .11$) via a retrospective medical record review (N = 194).

Infants with NAS who receive mother's own milk have been found to have decreased length of stay in the hospital.[27,28,33,36-38] In a mixed-methods study, infants receiving mother's own milk were discharged from the hospital sooner (10.8 days) than formula-fed infants (30 days), although only 14 infants were enrolled in the study.[36] Abdel-Latif and colleagues[30] reported that infants fed mother's own milk were hospitalized about 5 days less than formula-fed infants. Researchers who conducted a larger retrospective cohort study (N = 3725) found that hospital length of stay was 9.4% shorter in the mother's own milk group of infants with NAS than in the formula-fed group.[37] Any amount of mother's own milk was associated with a decreased length of stay (16.5 days vs 21.1 days; $P < .01$) in a study examining parental presence at the bedside of infants with NAS.[38] Infants in this study who received mother's own milk also had decreased duration of pharmacotherapy, decreased dosages of morphine, and lower mean NAS scores. The authors had to adjust for the significant effects of receiving mother's own milk to determine that parental presence was in fact associated with reduced NAS scores and days of pharmacotherapy.[38] Favara and colleagues[27] found that feeding any mother's own milk to infants with NAS was associated with decreased length of stay and decreased pharmacological treatment when compared with exclusively formula-fed infants.

In addition, infants fed mother's own milk may stop showing withdrawal signs earlier. O'Connor and colleagues[32] reported that infants with NAS who received mother's own milk displayed resolving symptoms of NAS 2 hours earlier than the formula-fed group.

Demand Feeding

Researchers have used demand feeding in multiple QI initiatives as part of a QI bundle of NPIs in an effort to decrease pharmacological intervention, reduce the length of stay, and reduce hospital costs for infants with NAS.[39,40] In one study, nurses scored infants using the Finnegan scoring system only after on-demand feeds during skin-to-skin care.[40] Grossman and colleagues[39] used a low stimulation environment, rooming-in, demand feedings, and lactation to comprise the NPIs included in the QI initiative. In both QI initiatives, the number of infants treated with medications decreased and average length of stay decreased, which decreased average hospital costs per infant. Grossman and colleagues[39] reported that the percentage of infants treated with morphine decreased from 98% to 14% and the average length of stay decreased from 22.4 to 5.9 days postintervention. While both of these QI bundles are promising and demand feeding was a significant part of the intervention, these initiatives evaluated a combination of interventions together and did not isolate the effectiveness of demand feeding or cue-based feeding on pharmacological intervention or length of stay.

Following an Infant's Cues

The importance of following an infant's cues during feeding was emphasized in one study. Maguire and colleagues[41] conducted focus groups with expert caregivers to learn the techniques they use to be successful in feeding challenging infants with NAS. The participating nurses and speech–language therapists from 3 hospitals described multiple techniques used to successfully feed infants including feeding in a flexed "C position," calming infants with a bath or burping before feeds, using a pacifier to calm the infant during burping, using chin and cheek support, finding the "sweet spot" on the infant's palate to encourage sucking, vertical rocking, trying different bottle nipples, and feeding with the infant facing away from the caregiver. The participants confirmed that following the infant's cues was critical to their success, because each infant responds differently to their arsenal of techniques, and that individuals change over time as their patterns of withdrawal change. In addition, all 12 participants discussed the importance of recognizing and following the infant's cues during feeding time. Participants reported that infants with NAS are not always ready to feed when picked up, so nurses must assess feeding cues and allow the infant to have some control in order to have a successful feed. Participants reported that the techniques they use to feed infants with NAS do not work the same for every infant, so it is even more important to be receptive to infant cues for a feed to be successful. The study results provide insight into numerous feeding techniques that nurses use to feed infants with NAS based on an infant's cues. Still, additional techniques recommended in the literature were not mentioned by any of the participants, such as rooming-in[39,40,42,43] and lactation.[27-38]

DISCUSSION

There is limited empirical evidence in the literature regarding NPIs and most evidence is expert opinion.[22] Although there is evidence supporting mother's own milk improving short-term outcomes in infants with NAS, rates of lactation remain low and clinicians should be encouraging lactation unless there are clear contraindications such as HIV infection, active herpes lesions, or illicit drug use.[20,44] If mothers do not wish to directly breastfeed, milk expression should be encouraged to offer infants their mother's own milk via bottle or gastric tube to decrease symptom severity.[30] Findings that feeding any mother's own milk to infants with NAS was associated with decreased length of stay and length of pharmacological treatment[27,38] indicate that clinicians should encourage mothers to provide any amount of milk possible, even if they are not producing much. If mothers are struggling with lactation, nurses and lactation consultants should be available for support and encouragement. Rooming-in is one of the most effective interventions to promote lactation among mothers of infants with NAS.[45] Rooming-in should be encouraged in this population, as it not only improves lactation rates but has been shown to decrease rates of pharmacotherapy and length of stay as well.[39,40]

Several authors have suggested that small, frequent feedings are more beneficial for infants with NAS. While demand feeding has been recommended throughout the literature,[9,19-21] some institutions still employ a regimented feeding schedule every 3 hours. For example, in the study by Maguire and colleagues,[11] infants at the selected study facility were fed every 3 hours on a schedule and feeding cues were not utilized. Feeding in the NICU has been notoriously healthcare provider–driven instead of infant-driven. If infants are fed on a strict schedule, infants who are sleeping may be woken up to feed. Infants with NAS often present with frequent sleep disturbances while experiencing withdrawal.[1] Successful management of an infant with NAS includes avoidance of waking a sleeping infant,[1] but contrary to that recommendation, volume-driven approaches often lead to the disruption of critical sleeping time. Certain barriers exist that may inhibit NICU nurses or families from cue-based feeding. Staffing ratios may make feeding infants on demand more difficult for nurses if parents are not at the bedside for feedings. In a national survey, NICU nurses caring for infants with NAS were found to be given higher workloads (2.69 infants) than other NICU nurses (2.51 infants),[46] creating a potential barrier to effective cue-based feeding practice. The difficulty of feeding infants with NAS should be taken into account when assigning staff to patients in the unit. Nurses who have become accustomed to feeding infants based on a volume-driven schedule will need sufficient education and support from unit leadership in order to make cue-based feeding protocols successful.

Volume-driven approaches are often utilized in practice because of excessive early weight loss seen in infants with NAS,[25] but cue-based protocols may be more effective if weight loss or suboptimal weight gain is a concern. Davidson and colleagues[47] reported that a cue-based feeding protocol led to significantly greater velocity in weight gain in preterm infants than in a healthcare provider volume-driven feeding schedule ($P = .044$). Dryden and colleagues[25] found that formula-fed infants with NAS presented with weight loss in excess of the 95th percentile compared with less than a quarter of infants with NAS who received mother's own milk. This may be attributed to the greater severity of withdrawal symptoms in formula-fed infants. These data suggest that greater tolerance of early weight loss in infants with NAS who receive mother's own milk may be

appropriate[25] and supplementation of formula may not be necessary or beneficial. Studies examining velocity of weight gain in infants diagnosed with NAS on a cue-based feeding schedule versus a regimented volume-driven schedule may provide empirical support and evidence for institutional policy changes to move away from volume-driven approaches.

Because infants with NAS can exhibit unclear cues at feeding time,[12] it is crucial that nurses are well educated on infant hunger and feeding cues in order to counsel mothers. Unclear cues can be a source of frustration for mothers of infants with NAS, and this frustration can act as a barrier to attachment if not addressed.[12] Techniques recommended by expert caregivers[41] may be useful for mothers and nurses to utilize during challenging feeds, although the effects of these techniques have not yet been studied.

Techniques or practices that improve infant feeding experiences could lead to decreases in withdrawal severity and decreases in hospital length of stay. Empirical evidence that supports the use of certain techniques or practices, such as demand feeding or a certain position, could influence practice change and management of infants with NAS. There is considerable variability in the assessment and management of infants with NAS, and institutional protocols vary widely.[48] Further research into techniques and practices that are effective could offer some degree of homogeneity in how NICU nurses and families feed infants with NAS to optimize outcomes. With that in mind, it is important to remember that potentially not every technique would work for every infant, so clinicians should be highly receptive to infant cues and needs.

LIMITATIONS

The studies included in the review have small sample sizes. Most of the included articles were retrospective medical record reviews with notable limitations. When researchers use medical charts for review, they are relying on the availability and completeness of the records as well as the accuracy of the clinicians' documentation. Randomized controlled trials with larger sample sizes could be used to test techniques and practices to improve feeding experiences. While most articles retrieved in the search related to the benefits of infants with NAS receiving mother's own milk, the most significant limitation of this review is the sparsity of available evidence on techniques or schedules used for feeding infants with NAS.

CLINICAL AND RESEARCH IMPLICATIONS

Clinicians should be aware of the challenges related to feeding infants with NAS and should be prepared to educate caregivers on reading infant cues and using feeding techniques to encourage successful feeding interactions. Unit leadership and charge nurses must be mindful of the challenges of feeding infants diagnosed with NAS when determining patient assignments. Clinicians should encourage lactation on demand as long as no contraindications are present. Nurses should be well versed on contraindications for supplying mother's own milk in order to provide accurate information to mothers who are eligible for lactation. Mothers should be educated during pregnancy about the benefits of lactation. If mothers do not wish to directly put the infant to breast, providing expressed human milk should be supported. As infants undergoing acute withdrawal may be more difficult to position and successfully latch during lactation, a lactation consultant should be involved in patient care. Nurses should remain nonjudgmental and encourage mothers to room-in with their infants when possible. It is imperative that clinicians help mothers identify infant cues before and during feeds while in the hospital to set the dyad up for success upon discharge.

There are no studies specifically focused on feeding schedules of infants with NAS. An area of further nursing research is comparing demand feeding schedules with more regimented feeding schedules in

Summary of Recommendations	
What we know:	• Infants with NAS can be challenging for nurses and caregivers to feed. • Mother's own milk has been shown to decrease the severity of withdrawal experienced by infants. • Sources recommend demand feedings, but there is no empirical evidence supporting the practice. • Caregivers feeding infants should follow an infant's cues when feeding.
What needs to be studied:	• The effect of demand feeding on withdrawal severity, rates of pharmacological intervention, and length of stay. • Techniques and practices that can be used to improve feedings.
What can we do today:	• Encourage lactation. • Remain nonjudgmental and support rooming-in. • Counsel mothers on infant cues and how to respond to infant cues before and during feeds.

the NICU. There is limited evidence, and recommendations, on feeding techniques for these infants such as type of bottle, type of nipple, feeding position, or pacing that might optimize feeding. Limited data, besides expert opinion, are available to support techniques to employ during feedings infants with NAS. More robust data collection is needed to develop evidence-based recommendations.

CONCLUSION

Mother's own milk has been found to decrease withdrawal severity, pharmacological therapy, and length of stay in infants with NAS. Demand feeding and following an infant's cues are recommended with limited evidence. It is clear based on the lack of published literature that more research is needed to determine the feeding techniques and schedules that are most effective in managing infants who are withdrawing from in utero substance exposure. There is a need for clinicians and researchers to collaborate to develop high-quality studies that provide strong evidence of effective NPIs in the management of infants diagnosed with NAS, including the most effective feeding techniques and practices with the goal of decreasing withdrawal severity and pharmacological management, therefore decreasing length of stay and hospital costs.

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