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Breastmilk feeding for mothers and infants with opioid exposure: What is best?

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ABSTRACT

With rare exception, breastfeeding is the optimal way to feed infants, and has special benefits for women and infants with perinatal opioid exposure. Infants breastfed and/or fed their mother's own breastmilk experience less severe opioid withdrawal symptoms, have shorter hospital stays, and are less likely to be treated with medication for withdrawal. The specific impact of mothers' milk feeding on opioid withdrawal may be related to the act of breastfeeding and associated skin-to-skin contact, qualities of breastmilk, healthier microbiome, small amounts of opioid drug in breastmilk, or a combination of these. Women with opioid use disorder face significant breastfeeding obstacles, including psychosocial, behavioral, concomitant medications, and tobacco use and thus may require high levels of support to achieve their breastfeeding goals. They often don't receive information to make informed infant feeding decisions. Hospital practices such as prenatal education, rooming-in and having a policy that minimizes barriers to breastfeeding are associated with increased breastfeeding rates.

1. Introduction

With rare exception, breastfeeding is the optimal way to feed infants [1]. Medications and substance use are often included among the rare exceptions to this mantra, at times without careful consideration of the specific circumstances and exposures [2]. The aim of this paper is to review the evidence to guide recommendations about when and why breastfeeding should be encouraged and supported, and when it may be prudent to delay or forego breastfeeding in women with an opioid use disorder (OUD). This topic is particularly timely in light of the North American opioid epidemic. The number of pregnant women with OUD and the corresponding increase in the number of infants who experience neonatal opioid withdrawal syndrome (NOWS) due to in utero opioid exposure has increased more than four-fold this past decade [3–5].

2. Importance of breastfeeding

Breastfeeding is the gold standard of infant feeding to which all other methods should be compared. As indicated in the Surgeon General's Call to Action to Support Breastfeeding [6], it is important to consider the risks of not breastfeeding for both the mother and her infant when making recommendations regarding infant feeding. Lactation is an integral part of the reproductive process. Women's bodies begin the preparation for breastfeeding with the onset of pregnancy and devote significant energy to developing the breastmilk production system each pregnancy. Women who do not breastfeed have more prolonged postpartum bleeding, an increased risk of developing type 2 diabetes and cardiovascular disease, and an increased risk for breast and ovarian cancer [7–13]. Similarly, infants who are not breastfed have increased risks for a host of short- and long-term health conditions including ear infections, lower respiratory tract infections, urinary tract infections, leukemia, asthma, inflammatory bowel disease, obesity, Sudden Infant Death Syndrome (SIDS) and others [14–19].

Breastfeeding may be particularly important for mother-infant dyads impacted by opioid use in pregnancy. Numerous observational studies from multiple countries have consistently found that infants breastfed and/or fed their mother's own breastmilk experience less severe withdrawal symptoms, have shorter hospital stays, and are less likely to be treated with medication for NOWS. When pharmacologic treatment is prescribed, breastfed infants require lower doses of medication and are less likely to receive a second medication [20–22].

Although there are data to support the long-term benefits of breastfeeding on a host of child neurodevelopmental outcomes in

Abbreviations: NOWS, neonatal opioid withdrawal syndrome; OUD, opioid use disorder; MAT, medication assisted therapy

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general [23,24], there are no studies that have evaluated these effects among opioid-exposed infants. It would be ideal to conduct studies similar to those conducted among women with epilepsy. For example, findings from the Neurodevelopmental Effects of Antiepileptic Drugs (NEAD) Study, demonstrated that among children who were exposed to antiepileptic drugs in utero, those who were also exposed through breast milk had no deleterious effect on IQ scores on average at age 3 and did not differ significantly in the prevalence of neurodevelopmental delays compared to children without additional breast milk exposure [25].

3. What is the mechanism by which breastfeeding and breastmilk feeding impact NOWS severity?

When considering outcomes attributed to breastfeeding in the face of NOWS, it is important to define breastfeeding exposure carefully – specifically the proportion of feedings that are breastmilk (e.g., any, partial or exclusive), length of exposure (e.g., a day, a week, months), and mode of feeding (e.g., at breast, expressed milk or both). For clarity, we use the following definitions set forth in The Academy of Breastfeeding Medicine Position Paper on Breastfeeding [26]:

- Breastfeeding: mother/child act of milk transference
- Exclusive breastfeeding: no other liquid or solid food is fed to the infant, with exception of medicines and vitamins
- Breastmilk feeding or mother's milk feeding: provision of the mother's milk to the infant
- Human milk feeding: feeding of milk from any other mother or pooled human milk
- Artificial breastmilk substitutes: commercial infant formula (in accordance with the language of the International Code of Marketing of Breast-milk Substitutes) [27].

The specific impact of mothers' milk feeding on infants experiencing NOWS may be related to the act of breastfeeding and associated skin-to-skin contact, qualities of the breastmilk, the small amount of opioid drug in breastmilk, or a combination of these. To date, only one small study parsed apart these effects specifically [28].

Breastfeeding is both the act of the infant latching to the breast and the transfer of breastmilk to the infant. Breastfeeding provides skin-to-skin contact between mother and infant. Skin-to-skin contact reduces infant metabolic needs and promotes physiologic stability in the newborn. Infants placed skin-to-skin have lower risk of developing hypothermia and hypoglycemia, are less likely to be transferred to the neonatal intensive care unit for these conditions, have lower resting heart and respiratory rates, and experience lower cortisol levels [27,29–32]. Infants withdrawing from opioids have increased metabolic needs compared with healthy newborns due to their increased insensible losses from elevated respiratory rates, high muscle tone, sweating, vomiting and diarrhea. Therefore, skin-to-skin contact associated with breastfeeding may be one factor reducing the severity of NOWS.

Intrauterine drug exposure adversely impacts development of brainstem respiratory and swallow centers, which leads to a dysregulation of the underlying biorhythms of feeding as well as altered sucking patterns. [31] For example, at three days of age, bottle-fed drug-exposed infants demonstrate more apneic swallows, less breath-breath rhythmic stability, and shorter swallow-breath intervals. They also ingest less volume per group of swallows than controls predisposing them to less efficient feeding - especially problematic in the face of increased metabolic demands and calorie loss. Specifically, opioid-exposed infants show prolonged sucking, fewer pauses, more feeding problems, and increased arousal which may further exacerbate NOWS outcomes [33,34].

Breastfeeding is the natural and innate way to feed infants, and it is possible that feeding at the breast could assuage some of the challenges seen in bottle fed infants. During breastfeeding, the infant learns self-pacing and regulates milk intake. Among artificially-fed infants experiencing NOWS, many demonstrate hyperphagia in the first two weeks of life [35]. Small, frequent feedings initiated at early hunger cues are more often seen in breastfed infants and are considered physiologic. For infants experiencing hyperphagia due to NOWS, small volume feedings of colostrum are likely to be better tolerated and more calming for the fussy infant. Additionally, as hyperphagia may be due to the increased caloric demands of NOWS, allowing the infant to "comfort feed" at the breast may aid in improving caloric intake which may otherwise be restricted in bottle-fed infants due to provider concern for overfeeding with faster milk flow through an artificial nipple. Decreasing fussiness using infant-led cue-based breastfeeding and comfort nursing may allow more breastmilk intake, decreasing points given for crying and excessive suck in the most commonly used NOWS scoring system, the Finnegan Neonatal Abstinence Syndrome Scoring Tool [36].

Another possible mechanism by which breastmilk feeding and skin-to-skin care may impact opioid-exposed infants is through a more diverse and healthier microbiome [37]. In animal models, there is emerging evidence that opioids modify the gut microbiome and the gut-brain connection [38]. This literature suggests that the microbiome of the infant may have short- and long-term health impacts [39]. In addition, breastfed infants have significantly lower rates of infectious diarrhea than those fed artificial breastmilk substitutes [40–42]. Breastmilk is more easily digested and is emptied more quickly from the stomach and small intestines; this may reduce the gastrointestinal symptoms of reflux, vomiting and diarrhea, which are often included in the measures used to assess severity of NOWS.

It is also plausible that the very small quantities of maternal opioids in breastmilk could impact the withdrawal process. Among women treated with methadone or buprenorphine during pregnancy who breastfeed their infants, there are small but measurable levels of medication in their breastmilk and in the infants fed their mother's milk. The quantity of methadone in mother's milk is orders of magnitude less than infants experience in utero but can also vary widely, likely due to differences in pharmacogenomics [43]. Because buprenorphine is less orally bioavailable than methadone, levels measured in infants are usually very low and sometimes undetectable [44–46]. For methadone in particular, there is some evidence that the small quantities of drug in the milk may play a role in withdrawal symptoms. Malpas and Darlow published a case report of two methadone-exposed infants who experienced symptoms of acute opioid withdrawal after rapid discontinuation of exclusive breastfeeding [47]. In another small retrospective medical record review study among infants prenatally exposed to methadone and treated with methadone for NOWS, 5 (4%) were readmitted within two weeks after hospital discharge; all readmitted infants were primarily fed their mother's breastmilk during the hospital stay but received little to no breastmilk after hospital discharge [48]. These two reports support the notion that the small amount of methadone received in their mother's breastmilk may help opioid-exposed infants experience less severe NOWS. On the other hand, Hogsdon et al. examined outcomes for infants whose mothers were predominantly prescribed methadone, and in addition to demonstrating a reduced pharmacologic treatment rate for those ever breastfed, they anecdotally reported that infants initially breastfed and then switched to formula did not require pharmacologic treatment, suggesting the role played by methadone in breastmilk in lessening NOWS symptoms may instead be minimal [49]. Interestingly, there are no reports of infants experiencing acute withdrawal symptoms with cessation of breastfeeding when infants are older. This may be because a natural, gradual wean from breastmilk feeding and maturation of the cytochrome P450 system allows infant drug levels to fall slowly, decreasing the likelihood of withdrawal symptoms.

Based on the benefits of mother's own milk feeding on NOWS in the nursery, there is increasing interest in the use of donor human milk for

Table 1
Literature on the Association between Breastmilk Feeding and NOWS (reverse chronologic order).

Author/Year	Sample N Location	Study Design Years	BF Exposure	Opioid Exposure	Main Outcomes	Comments
Yonke 2018 [69]	N = 228 **New Mexico** **US**	Retrospective cohort women enrolled in perinatal substance abuse treatment program **2011–2015**	Breastfeeding (BF) at discharge - Exclusive - Partial - None	Methadone (MTD) (47%) Buprenorphine (BUP) (53%)	Treated for NOWS Exclusive: 15.8% Partial: 36.8% Formula: 47.4% Chi square $p < .05$ (no adjustments)	Despite most women taking MTD and BUP intended to BF (87 vs 81%, p = ns), exclusively BF rates low at discharge (31 vs.19.6%)
Short 2016 [71]	N = 3725 **Pennsylvania,** **US**	Retrospective cohort using PA birth certificate data 2012–2014	BF at hospital discharge < 50%	Mixed opioids Not specified: identified infants diagnosed with NAS	9.4% reduced length of hospitalization in BF vs. non-BF group (after adjustment for many covariates)	BF infants more likely to have normal birth weight (86.9% vs 81.6%, $p < 0.0001$) – birth weight in adjusted models
Liu 2015 [70]	N = 194 **Western Australia**	Retrospective cohort 2002–2006	Predominant feeding method first 2 days of life ● Direct BF:16.5% ● Expressed breastmilk (BM): 6.2% ● Formula (FF): 77%	MTD	Predominant BF first 2 days of life associated with a 37% reduction in need for NAS treatment (ns) BF during first 2 days of life associated with a delayed onset of NAS (p = 0.04)	In multiple logistic regression model, MTD dose and gestational age also associated with predicting need for pharmacologic treatment for NAS
O'Connor 2013 [22]	N = 85 **Maine,** **US**	Retrospective Cohort 2007–2012	76% BF after birth; Of these women, 66% still BF 6–8 weeks (wk) postpartum	BUP	BF vs. FF: -Modified Finnegan Scoring mean peak score: 8.83 vs 9.65 (ns) -Pharmacologic treatment 23.1% vs 30.0% (ns)	Trend but not statistically significant differences FF cohort more likely to have been exposed to illicit substances during 3rd trimester (p = .004)
Welle-Strand 2013 [72]	N = 124 **Norway** Frist child while on opioid maintenance therapy	3 parts: 1) Retrospective (n = 36) 1999–2003 2) Prospective (n = 36) 2005-2/2007 3) Retrospective (n = 52) 2004, 2007- 3/2009	Ever BF: MTD 74% BUP 78% Any BF MTD/BUP at: 4 wk: 58%/56% 8 wk: 53%/39% 12 wk: 46%/34% 26 wk: 21%/15% 52 wk: 7%/5% Median BF time: MTD 12 wk BUP 7 wk	MTD 63% BUP 37%	Treatment for NAS Yes/No: MTD: BF 53% vs FF 80%, $p < .05$ BUP: no difference NAS Treatment duration (days) MTD: BF 31.0% vs FF 48.9%, $p < .05$ BUP: no difference In multivariate analysis, BF still had significant impact on LOS for MTD group	Adjusted models for parity, # cigarettes last month before delivery, use of opiates, benzodiazepines, amphetamines or cannabis last month before delivery and gestational age
Wachman 2013 [73]	N = 86 **Massachusetts + Maine, USA**	Prospective multicenter cohort 2011–2012	Any BF	MTD 64% BUP 36%	BF consistent association with all outcome measures: BF decreased LOS (15.8 days vs 27.4 days; $p < .001$) Receipt of any medical treatment for NAS (50% vs 77%; $p = .009$)	Main focus of study on genetics

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Table 1 (*continued*)

Author/Year	Sample N Location	Study Design Years	BF Exposure	Opioid Exposure	Main Outcomes	Comments
Pritham 2012 [76]	N = 152 **Maine, US**	Retrospective cohort 2005–2007	MTD: BM only: 10.6% BM + FF: 16.7% FF only: 72% BUP: BM only: 18.8% BM + FF: 25% FF only: 56.2%	MTD 89.5% BUP 10.5%	For MTD only: LOS shorter in BF than FF-infants in multivariate model Infant Feeding Method Beta = .176, t −1.970 p = .05	
Hogsdon 2012 [49]	N = 259 **British Columbia, Canada**	Retrospective cohort 2003–2006	Ever BF: 75.6%	MTD ± other opiates	BF: Lower NAS treatment with morphine (OR 0.21 ± 1.43; 95%CI 0.10–0.42, p 0.001)	Also looked at maternal MTD and NAS Rx Anecdotally, babies initially BF then switched to FF gained weight effectively and did not require NAS treatment
McQueen 2011 [74]	N = 28 **Northwestern Ontario, Canada**	Retrospective cohort **2007–2008**	> 75% BM: 8 25–75% BM: 11 Mostly FF: 9	MTD	Overall mean NAS scores: > 75% BM: M = 4.9, SD = 2.9 25–75% BM: M = 6.5, SD = 3.7 Mostly FF: M = 6.9, SD = 4.2	Nonparametric Kruskal-Wallis test significant differences between groups (H[2] = 43.52; p = .0001
Isemann 2011 [48]	N = 128 **Ohio** **US**	Retrospective cohort Infants treated with MTD for NOWS **2002–2007**				
Dryden 2009 [75]	N = 444 **United Kingdom**	Retrospective cohort **2004–2006**	Ever BF: 27.7% (32% w/exp BM) BF ≥ 72 h: 23% Any BF at d/c: 11.3% Outcomes based on BM > 72 h	MTD	Multivariate analysis: Need for NAS Rx lower if BF > 72 h OR 0.55 (.34-.88), p = .013	
Abdel-Latif 2006 [28]	N = 190 **Australia**	Retrospective cohort 1998–2004	Predominant milk consumed at day 5: BM: 85 (45%) - 58 breastfed; 27 fed expressed breast milk by bottle or gavage tube feeds FF: 105 (55%)	Most on MTD but mix of opioid exposures	Onset of NAS later with BM Unadjusted analyses: Pharm treat NAS: BM 52.9% vs FF 79.0% LOS: BM 14.7 days (sd 14.9) vs FF 19.1 days (sd 15.0) ADJUSTED (for polydrug use, drug exposure, prematurity) Pharm treat NAS: mostly BM OR .356 (.178-.711) p = .003	Within BM group, no difference in Finnegan scores between infants breastfed and those given breast milk by bottle or gavage tube
Arlettaz 2005 [79]	N = 86 **Switzerland**	Retrospective cohort **1996–2001**	> 50% of total amount of milk during hospital stay was BM	MTD	26% (7/27) BF and 78% (42/54) FF treated for NAS ($p < 0.01$).	Non- adjusted analysis

infants at risk for withdrawal. Interestingly, in a recent survey to those participating in the Better Outcomes through Research for Newborns (BORN) Network, 4% of newborn nurseries reported the use of donor human milk for opioid-exposed infants [50], eventhough there are no published reports on the impact of donor human milk on the severity of NOWS. Studies of this kind would help to parse out the role of breastmilk feeding on NOWS in regard to medication received through breastmilk vs some natural qualities of breastmilk itself.

4. How might breastfeeding additionally impact maternal-infant outcomes?

In addition to being the optimal feeding method for most infants, breastfeeding may have special additional benefits for mother-infant dyads with perinatal opioid exposure. Women with OUD often face limited social support and high rates of adverse childhood experiences, which are associated with compromised mental and physical health both for women and their children [51]. The environments of drug-exposed infants put them at increased risk for adverse outcomes if their mothers are not in recovery for their OUD. Findings from the Maternal Lifestyle Study suggest that less than optimal maternal care and poor postnatal environments are associated with lower scores on the Mental Development Index, Psychomotor Development Index, and Behavioral Record scores [52,53]. In a smaller sample of opioid-exposed and socio-economically matched unexposed African American 1-year-old infants, poorer performance of the opioid-exposed group in mental development was also related to social-environmental risk factors [54]. Two additional studies demonstrate the impact that breastfeeding, especially with longer duration, may have on decreasing the risk of childhood maltreatment, a concern among parenting women with a history of substance use disorder [55,56]. These findings highlight the crucial influence of the postnatal environment and breastfeeding support on outcomes for opioid-exposed infants. It is essential to promote sobriety in women with OUD and provide necessary supports to improve their personal social determinants of health and promote breastfeeding initiation and continuation.

Preliminary findings from a recent randomized clinical trial suggest that interventions focusing on maternal-infant attachment may benefit women and infants with OUD [57]. Women with OUD are at risk for insecure attachment due in part to the impact of opioids on reward pathways in the brain as well as their own experiences with attachment and stress [57]. Infants who experience poor attachment are known to experience significant long-term behavioral, psychological and emotional difficulties [58]. For these reasons, breastfeeding and skin-to-skin may be especially beneficial because they promote early attachment [59,60]. The oxytocin surge that occurs with each breastfeeding supports relaxation and reduces stress responses, promoting attachment [61–63]. Compared to women who formula feed, those who breastfeed have higher levels of oxytocin and prolactin, and lower levels of cortisol and stress. Increased relaxation and reduced stress responses with breastfeeding may decrease the anxiety and stress that women with OUD experience due to feelings of guilt around exposing their infant to their medication assisted therapy (MAT) [64,65]. The act of breastfeeding her own infant may also help a mother with her feelings of guilt when she sees how it calms her infant and helps decrease the neurobehavioral difficulties of NOWS [22].

Women with substance use disorders make significant behaviour changes during pregnancy – including achieving higher rates of abstinence from illicit substances than at other times [66]. It is likely that this is related to the physical connection a women has with her developing fetus and the desire to reduce harm to her baby. Perhaps the physical connection women experience during pregnancy that motivates their participation and adherence to MAT can be prolonged by the physical connection they experience with their infant after birth. The desire to breastfeed to help promote optimal health and bonding in their newborn can be a strong motivator for some women to refrain from illicit substances and remain in MAT. Although there are no clear data to support this assertion, supporting breastfeeding as a special means to encourage continued treatment of a mother's OUD may aid in promoting attachment and better neurodevelopmental outcomes as untreated maternal mental health conditions are independently associated with decreased maternal-infant attachment [67] and poor neurodevelopmental outcomes in infants [68].

5. What are the data that breastfeeding and/or breastmilk feeding reduce the severity of NOWS?

There are more than a dozen studies in which the association between breastfeeding and measures of NOWS severity have been evaluated – including the impact of breastfeeding or breastmilk feeding on pharmacologic treatment rates, dose of treatment, duration of treatment, and hospital length of stay. Without exception, although with limitations in study design (e.g., nearly all are retrospective cohort studies), these studies support the association between breastfeeding or breastmilk feeding and better in-hospital outcomes (Table 1) [22,28,48,49,69–76]. We refer the reader to several reviews of these studies for a more detailed overview [20–22,77–79]. Older studies primarily examined infants exposed to methadone, the mainstay of treatment for pregnant women with OUD until about 2010. More recent studies include buprenorphine as well as methadone. Unfortunately, few studies differentiate direct breastfeeding from breastmilk feeding by other means [28,70]. Those that do, suggest no significant differences but the numbers are small. Given the limited data, t's not possible to make inferences regarding the impact of breastfeeding itself or the receipt of breastmilk. A few studies examined the quantity of breastmilk exposure (proportion of breastmilk feeding or exclusive vs partial) and these data do support that exclusive breastmilk feeding has a larger impact on short-term NOWS outcomes than partial breastmilk-feeding [70,74]. Another challenge is the sociodemographic differences between women who do and do not choose to breastfeed; many of the studies don't adjust for these important determinants. However, among those that do, breastfeeding or breastmilk feeding are independently associated with improved in-hospital short-term outcomes [28,70,71,75].

Rooming-in is an important consideration in discussions of breastfeeding and NOWS outcomes. There is a growing body of evidence that support infants staying together with their mothers for their entire hospital stay, unless intensive care is required for reasons other than NOWS. Studies promoting rooming-in care for opioid-exposed newborns are associated with decreased pharmacologic treatment rates, shortened duration of treatment, shorter lengths of stay, and lower hospital costs [49,80–87]. Rooming-in care supports a woman's breastfeeding efforts as it allows greater proximity to her infant to respond to early hunger cues and allows privacy for skin-to-skin contact and breastfeeding. Grossman et al. reported that the proportion of infants taking the majority of their feeds from breastmilk increased from 20% to 45% ($p = .01$) after they moved care from a neonatal intensive care setting where infants were unable to room-in with their mothers to rooming-in care on the birthing and/or pediatric unit [87]. Similarly, Abrahams et al. demonstrated an increased rate of breastfeeding among prenatally opioid-exposed mother-infant dyads that roomed-in together during the birth hospitalizations [85]. The impact of the rooming-in experience itself versus the act of breastfeeding on NOWS outcomes remains unclear. Rooming-in promotes parental presence and maximal parental presence is associated with improved short-term NOWS outcomes [88]. It is hard to fully separate the effects of parental presence and breastfeeding on NOWS outcomes; an important area for future study.

Table 2
Recent published guidelines related to breastfeeding and opioid use and or substance use disorder.

Organization Guidance	Key Recommendations Regarding Opioids
Academy of Breastfeeding Medicine (ABM) Clinical Protocol #21: Guidelines for Breastfeeding and Substance Use or Substance Use Disorder, Revised 2015 [103]	Opioids/narcotics • Encourage stable methadone- or buprenorphine-maintained women to breastfeed regardless of dose. • Management of mothers who use chronic opioid therapy for pain should be closely supervised by a chronic pain physician who is familiar with pregnancy and breastfeeding: • Length of time on these medications, total dose, and whether the medications were used during pregnancy should all help inform the decision of whether breastfeeding may be safely undertaken in certain cases. • Judicious amounts of oral narcotic pain medication, when used in a time-limited situation for an acute pain problem, are generally compatible with continued breastfeeding if supervision and monitoring of the breastfeeding infant are adequate. • Rapidly increasing narcotic dosing in a breastfeeding mother should prompt further evaluation and reconsideration of the safety of continued breastfeeding.
American College of Obstetrics and Gynecology (ACOG) Committee Opinion (Number 711) August 2017 Opioid Use and Opioid Use Disorder in Pregnancy [104]	• Breastfeeding is beneficial in women taking methadone or buprenorphine and has been associated with decreased severity of neonatal abstinence syndrome symptoms, less need for pharmacotherapy, and a shorter hospital stay for the infant. • In addition, breastfeeding contributes to attachment between a woman and her infant, facilitates skin-to-skin care, and provides immunity to the infant. • Breastfeeding should be encouraged in women who are stable on their opioid agonist, who are not using illicit drugs, and who have no other contraindications, such as HIV infection. • Women should be counseled about the need to suspend breastfeeding in the event of a relapse.
American Academy of Pediatrics (AAP) Breastfeeding and the use of human milk. *Pediatrics.* 2012 [1]	• Maternal substance abuse is not a categorical contraindication to breastfeeding. • Adequately nourished narcotic-dependent mothers can be encouraged to breastfeed if they are enrolled in supervised methadone maintenance program and have negative screening for HIV and illicit drugs. • Street drugs such as PCP (phencyclidine), cocaine, and cannabis can be detected in human milk, and their use by breastfeeding mothers is of concern, particularly with regard to the infant's long-term neurobehavioral development and thus are contraindicated.
AAP Neonatal Drug Withdrawal *Pediatrics.* 2012 [105]	• Breastfeeding and the provision of expressed human milk should be encouraged if not contraindicated for other reasons. • When possible, and if not otherwise contraindicated, mothers who adhere to a supervised drug treatment program should be encouraged to breastfeed so long as the infant continues to gain weight.
Substance Abuse and Mental Health Services Administration (SAHMSA) Clinical Guidance for Treating Pregnant and Parenting Women with Opioid Use Disorder and Their Infants HHS Publication No. (SMA) 18-5054 [106]	Breastfeeding Considerations for Infants at Risk for Neonatal Abstinence Syndrome (Section 2) Upon delivery, women who are stable on buprenorphine, buprenorphine/naloxone combination, or methadone should be advised to breastfeed, if appropriate. Fact sheet 11 of report, *Breastfeeding Consideration for Infants at Risk for Neonatal Abstinence Syndrome*, provides a patient friendly explanation of the benefits and risks of breastfeeding in the face of OUD. https://store.samhsa.gov/system/files/sma18-5054.pdf
Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) Practice Brief # 4 Breastfeeding Recommendations for Women Who Receive Medication Assisted Treatment for Opioid Use Disorders [107] (2016)	• Breastfeeding should be encouraged for all mothers who receive medication assisted treatment (MAT) as long [5]as they abstain from the use of other illicit substances. • A large body of evidence now supports the safety of methadone for use in breastfeeding mothers. • The safety of buprenorphine during breastfeeding is not as well established; however, only small, clinically insignificant amounts of methadone and buprenorphine pass into breastmilk. • Therefore, both medications are considered to be safe during breastfeeding regardless of the dose given to the mother. • In addition to the many known benefits of breastmilk, breastfeeding may delay the onset of and reduce the severity and duration of NAS symptoms in neonates. • Education about the dangers of continued illicit substance use while breastfeeding must be provided for breastfeeding mothers who have known substance use disorders. • An open line of communication between the woman, her health care provider, and her addiction treatment counselor must be established so that if a relapse occurs, the woman will feel comfortable sharing this information with health care providers. • As for all breastfeeding mothers, the provision of early lactation support and current, accurate, and consistent information is essential.
World Health Organization (WHO) Guidelines for the Identification and Management of Substance Use and Substance Use Disorders in Pregnancy [108] (2014)	• Mothers with substance use disorders should be encouraged to breastfeed unless risks clearly outweigh benefits. • Breastfeeding women using alcohol or drugs should be advised and supported to cease alcohol or drug use; however, substance use is not necessarily a contraindication to breastfeeding. • A risk assessment should take into account risks of exposure to alcohol and drugs in breast milk, HIV status, specific pattern of substance use in each case, availability of safe and affordable breast milk substitutes, as well as access to clean water, sterilizing equipment, and age of infant/child. • Heavy daily alcohol consumption (e.g., alcohol dependence) would constitute high risk to infant & in presence of safe breast milk alternatives, it would be preferable not to breastfeed.

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Table 2 (*continued*)

Organization Guidance	Key Recommendations Regarding Opioids
New South Wales, Australia: National clinical guidelines for the management of drug use during pregnancy, birth and the early development years of the newborn [109] (2006)	• It is possible to reduce the risk of exposure through breastfeeding by altering the timing of breastfeeding, or by use of temporary alternatives, such as stored (frozen) breast milk or breast milk substitutes where they are available and can be safely used. • Mothers of infants with a neonatal withdrawal syndrome should be offered appropriate breastfeeding information and support. • Mothers who are drug dependent should be encouraged to breastfeed with appropriate support and precautions (Section 2.5.1) • A harm minimisation approach to breastfeeding is recommended in these guidelines. Encouraging breastfeeding is preferred to avoiding breastfeeding, provided that: women informed about the likely effects on the infant of the drugs she is using (or may use) and women are assisted to plan minimum exposure of the infant to the effects • Mothers who are stable on methadone treatment programs should be supported if they choose to breastfeed (Section 2.5.5) • Mothers who are unstable, continuing to use short acting opioids such as heroin, or using multiple drugs, should be encouraged not to breastfeed, and attention should be paid to assisting them to stabilise their lifestyle.
Canadian Pediatric Society [110] (2018)	• Breastfeeding should be encouraged because it can delay the onset and decrease the severity of withdrawal symptoms as well as decrease the need for pharmacological treatment. • HIV-negative mothers who are stable and on opioid maintenance treatment with either methadone or buprenorphine should be encouraged to breastfeed • Breastfeeding provides optimal nutrition, promotes maternal–infant attachment and facilitates parenting competence. • Mothers with a dependency who wish to breastfeed may require extra support as they are less likely to initiate breastfeeding successfully and more likely to stop breastfeeding early.

6. Breastfeeding rates among women with OUD

Despite clear benefits associated with breastfeeding, women in MAT for OUD are less likely to breastfeed compared to other women in the United States. Even in hospitals with the Baby Friendly Hospital Designation [74] and strong breastfeeding support [89,90], women with OUD face significant barriers to breastfeeding and subsequently experience lower rates of breastfeeding initiation and continuation [21,76,91–93]. Women with OUD and receiving MAT face social stigma and are often told they should not breastfeed by family, acquaintances, and health care providers [94] despite data that support its safety and benefits [2]. They are given inconsistent information about breastfeeding and medication use despite availability of evidence-based resources reviewing its safety [95]. Additionally, they are provided misinformation about the safety of breastfeeding with co-exposure to hepatitis C or simply not provided any information, so women choose not to breastfeed for fear of harming their infant in this situation [94]. Additionally, women are rarely informed of the importance and benefits of breastfeeding, for their own health and that of their infant, by providers who are not educated on the benefits of breastfeeding or its safety for women on MAT with no other concerning substance use [94].

Women with OUD also have high rates of co-occurring mental health issues that can pose breastfeeding challenges. More than half are prescribed at least one psychotropic medication during pregnancy [96]; these may be of concern to the pregnant women and her health care providers if they are not knowledgeable about the medication's safety profile in lactation [97]. Although some studies suggest lower rates of anxiety and depression among women who breastfeed [98], among women with OUD, anxiety or depression may contribute to breastfeeding difficulties due to excessive worry around milk intake in their newborn and/or due to difficulties experienced with breastfeeding. Women with OUD also have very high rates of tobacco use [99] and women who smoke are less likely to intend to breastfeed and stop breastfeeding sooner than women who do not [100], eventhough this is no longer listed among contraindications to breastfeeding. [2] Providers should review the benefits of breastfeeding and risks of tobacco and passive smoke exposure with pregnant and newly parenting women, and offer supports for smoking cessation. These efforts can help to increase breastfeeding rates and further improve health outcomes for infants, especially those related to ear and respiratory tract infections, asthma, and SIDS known to be increased in infants exposed to passive smoke.

When women in MAT do initiate breastfeeding, it can be physically and emotionally challenging [93,101]. The infant's withdrawal symptoms can directly interfere with breastfeeding – such as fussiness/crying, rapid state changes and increased tone [102]. However, hospital policies and support can have a significant impact on breastfeeding rates as demonstrated by the Boston Medical Center (BMC) experience [84,91,92,101]. More than a decade ago, BMC noted the benefits of breastfeeding for the opioid-exposed infant and developed a hospital policy to support breastfeeding for women who were adherent to drug treatment. Over the past decade, they worked to increase their support for breastfeeding in this population and revised their hospital policy to decrease barriers to breastfeeding for women with OUD who have established themselves as adherent to MAT. These policy changes increased the proportion of mothers eligible to breastfeed to 82% in 2016. The efforts resulted in increases in the breastfeeding initiation rates among eligible women from 38 to 56% and breastfeeding at hospital discharge from 8% to 34% [101]. Although these rate increases were notable, it is still important to recognize that many women did not continue breastfeeding beyond their infant's first few days. Given the significant benefits of breastfeeding for women with OUD and their infants, it is important to identify ways to overcome breastfeeding barriers for this patient population.

7. Policies related to breastfeeding

Over the past 5 years, several key organizations have published policies, guidelines or recommendations for management of pregnant and lactating women with OUD or another substance use disorder, which are summarized in Table 2. In general, these policies support breastfeeding among women with OUD who have demonstrated some level of adherence to a drug treatment program, allow communication between members of the care team with their drug treatment program and have received some level of prenatal care. The specifics of adherence vary and are not consistently defined likely due to a limited literature to guide practice recommendations.

8. Importance of ensuring no illicit drug use

OUD is a chronic illness characterized by intermittent relapses. Breastfeeding during a relapse is dangerous because illicitly used drugs can have serious adverse effects on infants, including respiratory arrest [2]. Also, maternal impairment due to drug use can result in unsafe situations for children, including while feeding if a mother was to fall asleep with her baby. It is therefore of utmost importance that women with OUD, especially those who are breastfeeding, plan on what to do if they experience a relapse. This requires a face-to-face discussion to help women think through their options and make plans well in advance, still always recommending abstinence from any other substances than those prescribed. First and foremost, a mother should not directly (breast)feed her baby while affected by a substance, and secondly should not provide her substance-exposed breastmilk to her baby. She should identify another non-substance affected caregiver to safely care for and feed her baby substance-free breastmilk or another safe milk substitute in the face of relapse. Additionally, in routine breastfeeding counselling, women are told that it is important to empty milk frequently from their breasts to maintain a robust milk supply. If a woman has used substances, she should “pump and dump” her milk for the period of time that the substance is known to stay in breastmilk. This information can be found on the National Institute of Health, National Library of Medicine LactMed website [95]. If the substance in question is one identified as of serious concern to infants [2], it is recommended that a mother not breastfeed and provide her infant with an alternative safe milk substitute. Some women also worry that if their baby is used to drinking breastmilk with some of their MAT medication in it, that their baby may withdraw if they do not give their breastmilk. There are cases in which mothers gave their baby a portion of their methadone dose to reduce the baby's chance of withdrawal. It is essential that a mother understand that this practice is not recommended and is extremely dangerous due to its potential to cause overdose and respiratory depression in the infant.

9. Conclusion

The North American opioid epidemic has not spared pregnant and parenting families. There is a need for comprehensive approaches to treatment that addressed the needs of families. Encouraging and supporting breastfeeding is an important, lowcost component of a comprehensive approach. Infants breastfed and/or fed their mother's own breastmilk experience less severe short-term outcomes for NOWS. Women with OUD should be supported to breastfeed if they have been adherent to their treatment program prior to birth, have attended prenatal visits, have ongoing support, and do not have other contraindications to breastfeeding. Hospital policies should support and decrease barriers to breastfeeding for women with OUD through consistent provider messaging around breastfeeding, support for rooming-in, prenatal and postnatal education, and hands-on breastfeeding support. Abstinence from any other substances than those prescribed should be strongly encouraged for breastfeeding and parenting women with OUD. As OUD is a relapsing chronic illness, providers should proactively and prospectively brainstorm safe care and feeding options with mothers in event of a future relapse.

Practice points

1. Infants breastfed and/or fed their mother's own breastmilk experience less severe withdrawal symptoms, have shorter hospital stays, and are less likely to be treated with medication for NOWS. When pharmacologic treatment is prescribed, breastfed infants require lower doses of medication and are less likely to receive a second medication.
2. Women with OUD should be supported to breastfeed if they have been adherent to their treatment program prior to birth, have attended prenatal visits, have ongoing support, and do not have other contraindications to breastfeeding (e.g. HIV).
3. Hospital policies should support and decrease barriers to breastfeeding for women with OUD through consistent provider messaging around breastfeeding, support for rooming-in, prenatal and postnatal education, and hands-on breastfeeding support.
4. Abstinence from any other substances than those prescribed should be strongly encouraged for breastfeeding and parenting women with OUD.
5. As OUD is a relapsing chronic illness, providers should proactively and prospectively brainstorm safe care and feeding options with mothers in event of a future relapse.

Research directions

- Study the impact of breastfeeding at the breast (including skin-to-skin) compared to supplementation with mother's expressed milk and/or donor human milk on short- and longer term NOWS outcomes.
- Study the impact of parental presence vs breastmilk feeding on short-term NOWS outcomes in infants who room-in with their mothers.
- Evaluate the role of breastfeeding and breastmilk feeding on the trajectory of women's substance use recovery.
- Determine the long-term child outcomes (e.g. behavior, development, attachment) by feeding method (breastfeeding, breastmilk feeding, and formula feeding).

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