National Association of Neonatal Nurses

The Use of Human Milk and Breastfeeding in the Neonatal Intensive Care Unit

Position Statement #3065

NANN Board of Directors
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Human milk and breastfeeding are essential components in supporting optimal health for the critically ill newborn. As the professional voice of neonatal nurses, the National Association of Neonatal Nurses (NANN) strongly endorses the use of human milk and breastfeeding as a lifesaving medical intervention. All nurses should be equipped with the knowledge and skills to provide assessment, education, interventions, and encouragement to lactating parents of critically ill newborns to ensure the receipt of human milk and that parents can meet their personal goals for the provision of human milk and/or breastfeeding.

Association Position

Human milk and breastfeeding are foundational to the growth and development of the most vulnerable infants. All infants should be exclusively breastfed for the first 6 months, with continued breastfeeding for a year or more (Meek et al., 2022). A top priority for neonatal nurses is to ensure that all families understand the unique role that human milk plays in the health of their children. It is the responsibility of neonatal nurses to provide all lactating parents with education about the benefits of human milk for their infants, regardless of the persons' initial intent regarding feeding, and to encourage them to express milk for as long as possible. Neonatal nurses should incorporate lactation support into their daily care to ensure that infants receive human milk through discharge from the neonatal intensive care unit (NICU) and to help lactating parents achieve their personal breastfeeding goals. Nurses must possess evidence-based knowledge regarding the science of human milk, lactation, and breastfeeding.

Background and Significance

The U.S. Department of Health and Human Services' Office of Disease Prevention and Health Promotion (n.d.) Healthy People 2030 objectives include targets for breastfeeding with a goal of 42.4% of infants exclusively breastfeeding through 6 months and 54.1% breastfeeding in any extent at 12 months. The Centers for Disease Control and Prevention (CDC) 2022 Breastfeeding Report Card indicates that 83.2% of infants born in 2019 ever received human milk, 55.8% were receiving any human milk at 6 months, and 35.9% were still receiving any human milk at 12 months (CDC, 2025c). However, only 27.9% of infants born in 2022 were exclusively breastfed through 6 months (CDC, 2025a).

In a CDC publication, Chiang and Anstey (2021) report that infants born to non-Hispanic Black mothers were significantly less likely to be breastfed than infants born to non-Hispanic White or Hispanic mothers, highlighting persistent racial disparities in breastfeeding initiation and duration. Addressing racial disparities in breastfeeding remains crucial for neonatal nurses. Among U.S. populations, suboptimal breastfeeding rates disproportionately affect non-Hispanic Black infants, contributing to 1.7 times higher incidence of acute otitis media, 3.3 times higher necrotizing enterocolitis (NEC) cases, and 2.2 times higher infant death rates compared with non-Hispanic White infants (Bartick et al., 2016).

A national cohort analysis of 2017 U.S. births found that any breastfeeding among non-Hispanic Black infants is associated with a 29% lower neonatal mortality (7–27 days), a 17% lower overall infant mortality (7–364 days), and a 13% lower postneonatal mortality (28–364 days; Meek et al., 2022). For NICU infants at heightened risk for brain injury or inflammatory disease, prioritized human milk feeding remains a lifesaving, neuroprotective intervention (Meek et al., 2022; Spatz, 2025).

In the United States, infant mortality could be reduced by an estimated 20%–22% if all infants received exclusive human milk feeding for the first 6 months of life (Bartick et al., 2016). Human milk provides extensive, evidence-based health benefits for vulnerable infants, both during hospitalization and after discharge (Meek et al., 2022; Victora et al., 2016; World Health Organization, 2023). These benefits include up to a 70% reduction

in lower respiratory tract infections, a 60%–65% reduction in gastrointestinal infections, and substantially lower rates and severity of hospital-acquired infections (Meek et al., 2022). Human milk also decreases the risk of NEC by approximately two-thirds in preterm infants (Altobelli et al., 2020).

Infants who receive human milk demonstrate improved visual acuity, cognitive performance, and brain white matter development, with neuroimaging studies showing up to 20% more white matter volume and superior neurodevelopmental outcomes for human milk–fed babies compared with formula-fed infants (Blesa et al., 2019; Deoni et al., 2013). These outcomes are attributed to human milk containing immune cells, immunoglobulins, long-chain polyunsaturated fatty acids, cytokines, nucleotides, hormones, and bioactive peptides that support immune maturation, intestinal development, and mucosal protection (Meek et al., 2022; Spatz, 2025). Emerging research on the human milk microbiome and metabolome highlights how maternal milk dynamically adapts to the infant's genetic, developmental, and environmental context, offering personalized immunologic and microbial support (Moossavi et al., 2018; Pannaraj et al., 2017). Moreover, a clear dose-response relationship exists between human milk exposure and developmental outcomes, emphasizing that greater duration and exclusivity of human milk feeding confer stronger protection and improved brain growth (Blesa et al., 2019; Deoni et al., 2013).

Based on this evidence, all healthcare providers should promote the provision of human milk and breastfeeding as the preferred form of nutrition for optimal health and developmental outcomes. The Baby Friendly Hospital Initiative (BFHI), which was developed for healthy lactating dyads, continues to gain momentum in the United States, with approximately 461 hospitals being designated Baby Friendly® (Baby Friendly USA, n.d.). For infants separated from the lactating parent or requiring intensive care, different models of care are essential. Spatz (2004) developed a 10-step model for the use of human milk and breastfeeding in vulnerable infants which has been implemented worldwide (Edwards & Spatz, 2010; Fugate et al., 2015; Spatz, 2018; Swanson, 2023; Takako et al., 2020). This position statement's recommendations are organized to align with the Spatz 10-step framework to promote standardization of neonatal nursing and lactation care.

Recommendations

1. Prenatal Lactation Intervention

Infants who are cared for in intensive care units are often the result of high-risk pregnancies. While a family is receiving prenatal care, it is important to educate them about the need for the provision of human milk for their child. Ideally this education would be done with the birthing parent and any other family members or support people who are available. Healthcare professionals should be aware of the diverse family structures encountered in clinical care. Not all families identify as heteronormative. Nurses must be sensitive and ask families about preferred pronouns and terminology related to human milk and breast- or chest-feeding (Paul et al., 2023).

Prenatal education should be tailored based on the infant's diagnosis and forecasted intensive care stay (D'Ambrosio & Neu, 2025). Research demonstrates that when

parents learn the science of human milk, they almost all opt to initiate pumping for their child and most will continue this practice through discharge; parents who participated in group prenatal care and received specific lactation education demonstrated a 100% pumping initiation rate, with 87% continuing to provide milk for their infants through discharge (Froh, Schwarz, & Spatz, 2020). Spatz and colleagues' (2019) research about infants with congenital diaphragmatic hernia found that when families received tailored prenatal education, all decided to provide milk for their infants, even if they did not have prenatal intent to breastfeed, and 80% of those infants received human milk through discharge.

In addition to instructing the family about the science of human milk, the provider also should use the prenatal consult to assess risk factors that could impact milk production and/or secretory activation (Spatz et al., 2024a). Providers also must educate families about taking a proactive approach to initiation of lactation to ensure effective secretory activation (Spatz et al., 2024b). It is essential that providers teach parents that there is a critical window for milk supply and that the first hours after birth, the first day, the first 3-5 days, and the first 2 weeks will predict long-term milk production—thus the need to pump early and often.

Parents also can consider antenatal milk expression (AME) if they are expected to be pregnant for at least 37 weeks. This will not be an option for all families. Juntereal and colleagues' (2024) research on AME found that mothers of infants with complex surgical anomalies were able to hand express small volumes of colostrum. The milk can be collected using oral syringes, labeled, and frozen for use once the infant is born. It is important to note that AME is safe and can increase maternal confidence in the ability to provide milk for the infant (Juntereal & Spatz, 2021) but will not result in earlier secretive activation (Juntereal et al., 2025).

Parents who have experienced sexual trauma may want to express milk for their infant but find it difficult to overcome psychological barriers. Patients aren't likely to say that they have been victims, so it is important that nurses practice trauma-informed care. Sharing knowledge of the unique role that human milk has to impact their infant's hospital stay and future health can help trauma survivors achieve their personal goals for the provision of human milk and/or breastfeeding (Kendall-Tackett, 2022).

The Academy of Breastfeeding Medicine's clinical protocol regarding breastfeeding and substance use disorders includes guidance on parent use of opioids, sedative hypnotics, stimulants, alcohol, tobacco smoking and nicotine vaping, and cannabis use (Harris et al., 2023). Recommendations include that individuals in treatment programs should be encouraged to breastfeed and provide milk for their infants (Harris et al., 2023). Given the complexity of lactating parents with substance use disorders, individualized care plans should be created in partnership with the patient and the multidisciplinary care team to ensure appropriate decisions are made related to the use of human milk. Counseling should include the impact of neonatal withdrawal, co-occurring conditions and treatments, and other factors that may affect lactation and feeding (Harris et al., 2023).

Cannabis use has increased dramatically in the United States due to legalization, with national data reporting that 7.2% of pregnant women use cannabis (Harris et al., 2023). The Academy of Breastfeeding Medicine encourages cessation or education of cannabis use while providing human milk. Neonatal nurses need to be willing to have open and honest conversations with parents about cannabis use to determine route, type of cannabis product (delta-9-tetrahydrocannabinol [THC] and/or cannabidiol), potency, dose, and frequency of product used (Harris et al., 2023; Spatz, 2022). This shared decision-making discussion must include consideration of risks and benefits. While cannabis exposure may present risks to the infants, not receiving human milk also presents great risks (i.e., decreased white matter development and increased risk of NEC; Spatz, 2022).

In the United States, new guidance for parents living with human immunodeficiency virus (HIV) allows for a shared decision-making process in determining whether babies should be fed human milk. The CDC states the risk of transmitting HIV can be reduced by feeding the infant pasteurized donor human milk from a milk bank or using infant formula. However, if the HIV-positive parent wants to provide milk for the infant, providers should emphasize the importance of taking antiretroviral therapy (ART) as directed to sustain an undetectable HIV viral load. When a parent can achieve and maintain viral suppression through ART during pregnancy, birth, and lactation, the risk of transmission through human milk is less than 1%, though not zero (CDC, 2025b).

2. Assessment and Maintenance of Human Milk Supply

The bedside neonatal nurse plays a critical role in helping parents establish milk supply. Lactation consultants may not always be available or may see parents infrequently. The neonatal nurse must teach families to be proactive in establishing milk supply and that the first two weeks are critical for long-term milk production (Spatz et al., 2024b). As part of nurse-to-nurse report, the nurse should know the number of pumping sessions and the total daily volume of milk expressed each day. During the first 3-5 days the infant may still be nil per os, but the parent should still pump because this is the critical time to ensure milk production; thus, education and assessment are essential components of the neonatal nurses' daily tasks.

To initiate lactation, people who are separated from their infants need to use the highest quality breast pumps that have breast pump suction patterns (BPSPs) to mimic a newborn suckling pattern. The initiation technology (BPSP) pattern has been shown to increase removal of colostrum from the breast, facilitate secretory activation, and increase milk production and maintenance of milk supply (Meier et al, 2012). The initiation pattern is used for 15 minutes per pumping session and should be utilized until about 20 milliliters (mLs) are pumped from each breast at which point the parent would switch to the 2-phase pattern. When pumping with the 2-phase pattern, it is important that the parent always pump at the highest suction that is comfortable but does not hurt. The parent should feel pressure but not pain. Parents should pump until they see no more jets of milk and then an extra 2 minutes to ensure complete breast emptying (Spatz, 2018). With the right pump, expression sessions may only take 10-20 minutes.

Cost is often cited as a barrier to the use of high-quality breast pumps that can ensure milk supply during parent-infant separation. However, the cost of a pump rental is significantly less than feeding an infant formula for one full year of life. Hospitals can consider developing loaner programs for these pumps and/or write letters of medical necessity to the insurance company to pay for the cost. The recently released National Academies breastfeeding consensus study includes a specific recommendation calling for comprehensive coverage and payment of breastfeeding services and supplies to guarantee equal access to a standard package of services and durable medical equipment (National Academies of Sciences, Engineering, and Medicine, 2025).

Parents must express milk every 2-3 hours with a goal of eight pumps per 24-hour period (Spatz et al., 2015). It is important that the lactating parent pump right before sleep, at least once in the middle of the night, and first thing in the morning. The lactating parent should be provided with a target daily milk volume of about 750 mLs (range 500 to 1,000 mLs). These volumes are based on research regarding 24-hour milk production of healthy dyads where average daily milk production was 788 mLs with a range of 478-1357 mLs (Kent et al., 2006).

In a small pilot of 29 mothers of very low birth weight (VLBW) infants, the researchers reported that if mothers pumped at least 5-8 times per day, they were more likely to come to volume, but those with the most frequent milk-expression sessions in the first 5 days came to volume more quickly (Medina Poeliniz et al., 2025). Early initiation of pumping is associated with increased milk supply and increases the likelihood of first human milk enteral feeding, resulting in longer human milk exposure and any or exclusive human milk diet at discharge (Davis et al., 2022). This underscores the importance of robust nursing and lactation support and the need for early parental milk expression (Davis et al., 2022). Clinically, these findings support proactive lactation consultation, streamlined milk-expression workflows for parents, and strategies to minimize formula supplementation during the initial postpartum and NICU periods (Davis et al., 2022; Gertz & DeFranco, 2019).

3. Oral Care with Human Milk

As soon as the infant is born and the parent initiates pumping, oral care with human milk can commence. This should be done each time the parent pumps around the clock, until the infant can receive human milk by mouth. Oral care mimics what would occur with a healthy term infant feeding by breast. There are three primary rationales regarding the benefits of oral care for the infant:

- Human milk is a powerful antimicrobial agent that provides a front-line defense when the infant's mouth is coated in human milk (Edwards & Spatz, 2010; Gephart & Weller, 2014).
- Human milk is a rich source of cytokines that may be absorbed through the infant's buccal mucosa, benefiting the infant's immune system (Garofalo & Caplan, 2019)
- human milk has a sweet flavoring, providing a positive oral experience when used during oral care (Edwards & Spatz, 2010; Gephart & Weller, 2014).

In addition, recent research by Froh and colleagues (2015) demonstrated that maternal and family participation in human milk oral care was a strong motivator for parents to keep pumping to build their milk supply for their infant.

4. *Management and Prioritization of Human Milk and Optimizing Human Milk Feedings*

The use of dedicated technicians and barcoding has been demonstrated to reduce human milk errors and to improve the accuracy and efficiency of milk preparation (Spatz et al., 2014; Steele & Alessi, 2024). Using colostrum first has been shown to prime the infant's intestine because of colostrum's high concentration of immunoglobulin A (Spatz, 2018). After the infant has received colostrum, fresh human milk feeds can be introduced. Human milk can be stored for up to 96 hours in the refrigerator (Slutzah et al., 2010). Fresh milk feeds—versus feeding previously frozen human milk—should always be prioritized to ensure the infant receives the maximal benefit and effect of the milk. Freezing damages many of the beneficial components of human milk by destroying them (white blood cells) or reducing their potency (lactoferrin, lysozyme, IgA, and antioxidants; Akinbi et al., 2010; Sheen et al., 2021).

If fresh human milk is unavailable, frozen milk should be thawed and used within 24 hours of thawing. If parental human milk is not available, pasteurized donor human milk should be used rather than formula (Committee on Nutrition, Section on Breastfeeding, & Committee on Fetus and Newborn, 2017). If human milk availability is limited, priority should be given to infants <1500 grams (birth weight) and high-risk infants.

Human milk is highly variable, especially in fat content. Typically, fat increases as the breasts are emptied during a pumping and is lower after a longer nonpumping interval (e.g., the first pumping session of the day; Spatz, 2018). Given this variability, instructing the parent to maintain a pumping log to monitor the 24-hour production can be useful in assessing the need for modifications in the choice of specific milk specimens for smaller-volume feedings. The lactating parent can be taught to easily separate/fractionate their milk to increase the caloric density of milk used to feed to the infant (Spatz, 2018).

For the VLBW infant, human milk alone does not provide the levels of protein and minerals required for adequate growth. A 2020 Cochrane review of 18 studies found that feeding VLBW infants fortified human milk is associated with modest increases in in-hospital growth rates (Brown et al., 2020). However, there is insufficient evidence to show whether multinutrient fortification has any effect on long-term growth or neurodevelopment (Brown et al., 2020). Practitioners should carefully consider their options before adding fortification.

Currently, U.S. commercially available human milk fortifiers are bovine products made by formula companies or a human milk-based product made by Prolacta BioScience. Prolacta reports that 55% of Level 3 and 4 NICUs in the United States utilized their fortifiers (Prolacta Bioscience, 2024). Prolacta fortifiers enable infants to receive an exclusive human milk diet (EHMD). A publication representing seven different NICUs reported that EHMD implementation led to reductions in rates of both medical and

surgical NEC and a substantial cost avoidance, ranging between $515,113 and $3,369,515 annually per institution (Swanson, 2023).

If a bovine product is used, the infant should be assessed daily for signs of intolerance. Research demonstrates that bovine milk fortifiers can increase osmolality, pH, and lipase activity and conclude that although fortifiers enhance select nutrients, each has the potential to affect the properties of human milk (Donovan et al., 2017).

In a recent meta-analysis of 59 studies, Campbell-Yeo and colleagues (2025) examined the type of feeding regiments in each study to understand how infant feeding method and fortification type affected comorbidities and mortality rates of preterm infants. **Table 1** summarizes the findings from this meta-analysis.

Table 1
NICU Feeding Recommendations for Specific Outcomes

Outcome	**Feeding Recommendations**
Decreased mortality, NEC, and time to reach full enteral feeds	Human milk and/or pasteurized donor human milk with a human milk-based fortifier
Decreased retinopathy of prematurity and bronchopulmonary dysplasia	Human milk with phosphorus fortifier
Decreased sepsis	Human milk fortified with formula
Decreased periventricular leukomalacia	Human milk and/or pasteurized donor human milk with bovine fortifier
Improved Bayley II MDI scores	Human milk with formula or bovine fortification

The table highlights that higher intake of a parent's milk is associated with improved clinical outcomes. However, there remains insufficient high-quality evidence to support one type of fortification regimen over another (Campbell-Yeo et al., 2025).

5. Transitioning the Vulnerable Infant to At-Breast Feedings

Skin-to-skin care is an essential component of NICU care that allows parents to feel connected to their infants and has been demonstrated to improve breastfeeding outcomes, among other benefits (Conde-Agudelo & Díaz-Rossello, 2016). Prior to holding the infant skin-to-skin, the lactating parent should completely empty the breasts. Skin-to-skin contact has been demonstrated to improve milk supply and is a vital component of transitioning the infant from tube feedings to direct feedings at the breast (Conde-Agudelo & Díaz-Rossello, 2016). As a component of skin-to-skin care, non-nutritive sucking at the emptied breast during tube feeds can be initiated as soon as the infant is no longer ventilator dependent (Foster et al., 2016). Non-nutritive sucking is associated with transitioning to full oral feeds 11 days earlier, faster weight gain, and earlier discharge by 7 days (Calik & Esenay, 2019).

Parents who receive prenatal intervention regarding human milk and lactation have significantly higher breastfeeding initiation rates (98%) and longer breastfeeding duration rates when compared to CDC data during the same period (Froh & Spatz, 2022). In a study of 160 women who received prenatal nutrition consultations, 92% of their infants received human milk as their first feed and 92% were still receiving human milk at discharge (Froh & Spatz, 2022).

For parents receiving prenatal intervention, postdischarge breastfeeding rates were 89.4% (3 months), 76.9% (6 months) and 50.6% (one year), significantly higher than the CDC's national breastfeeding rates during the same period. Over one-third of the study's participants (34.4%) breastfed beyond a year (Froh & Spatz, 2022).

Many NICUs struggle to effectively transition NICU infants to at-breast feeds (Spatz, 2018). Some providers encourage bottle feeding versus feeding at the breast due to the misconception that oral intake is more accurate or that it will decrease length of stay. Once an infant is stable for oral feedings at the breast, an electronic scale should be used to measure the baby's weight pre- and postfeeding (known as pre- and postweights) to determine milk transfer volume (Haase et al., 2009; Swanson, 2023). Pre- and postweights are the only method to directly measure milk transfer to ensure an infant is not over- or underfed (Spatz, 2018). Observational assessments do not accurately reflect infants' actual milk transfer compared to use of pre- and postweights (Perrella et al., 2020).

A recent quality improvement project aimed to standardize clinical practices to increase direct breastfeeding (DBF) at the first oral meal, total DBF meals during hospitalization, and use of test weighing to measure milk transfer for preterm infants (Swanson et al., 2023). In the QI project, the number of first oral feedings at the breast more than doubled (from 22% to 54%) and the mean number of direct breastfeeding sessions increased from 13.3 to 20.3 sessions during the NICU stay; the use of pre- and postweights increased by 166% (Swanson et al., 2023). Additionally, the use of pre- and postweights and home support from community nursing and lactation consultants have been demonstrated to increase breastfeeding rates postdischarge (Meerlo-Habing et al., 2009). Cue-based feeding (infant-directed feeding) also can facilitate earlier transition to oral feeds, increase DBF, and shorten length of stay (Ofek Shlomai, 2024; Chrupcala, 2017). It is important to understand that not all infants may be able to feed at the breast due to their diagnoses; however, parents value their infants receiving a human milk diet (Froh et al., 2017).

Parents must have a realistic expectation of the postdischarge breastfeeding ability of their infant. Postdischarge pediatric offices have a vital role in supporting the lactating dyad (Slater & Spatz, 2025). Pediatric providers need to assess milk supply and the infant's ability to effectively feed at the breast. Some infants have little exposure to direct breastfeeding; therefore, it will be essential for providers to understand the infant's feeding patterns (at breast, by bottle, or with feeding tube) and ensure the parent has adequate milk supply and appropriate technology at home (i.e., breast pump and scale). After discharge, parents also benefit from in-person or online breastfeeding support groups (Reicher & Spatz, 2024).

Conclusion

Neonatal nurses have a responsibility to facilitate, through support and evidence-based information, the provision of human milk and breastfeeding. This is essential to ensure infants receive human milk through hospital discharge and that parents can reach their personal breastfeeding goals.

References

Akinbi, H., Meinzen-Derr, J., Auer, C., Ma, Y., Pullum, D., Kusano, R., Reszka, K. J., & Zimmerly, K. (2010). Alterations in the host defense properties of human milk following prolonged storage or pasteurization. *Journal of Pediatric Gastroenterology and Nutrition, 51*(3), 347–352. https://doi.org/10.1097/MPG.0b013e3181e07f0a

Altobelli, E., Angeletti, P. M., Verrotti, A., & Petrocelli, R. (2020). The impact of human milk on necrotizing enterocolitis: A systematic review and meta-analysis. *Nutrients*, *12*(5), 1322. https://doi.org/10.3390/nu12051322

Baby-Friendly USA. (n.d). *About Us*. https://www.babyfriendlyusa.org/about/

Bartick, M. C., Schwarz, E. B., Green, B. D., Jegier, B. J., Reinhold, A. G., Colaizy, T. T., Bogen, D. L., Schaefer, A. J., & Stuebe, A. M. (2016). Suboptimal breastfeeding in the United States: Maternal and pediatric health outcomes and costs. *Maternal & Child Nutrition*, *13*(1), e12366. https://doi.org/10.1111/mcn.12366

Blesa, M., Sullivan, G., Anblagan, D., Telford, E. J., Quigley, A. J., Sparrow, S. A., Serag, A., Semple, S. I., Bastin, M. E., & Boardman, J. P. (2019). Early breast milk exposure modifies brain connectivity in preterm infants. *NeuroImage*, *184*, 431–439. https://doi.org/10.1016/j.neuroimage.2018.09.045

Brown, J. V., Lin, L., Embleton, N. D., Harding, J. E., & McGuire, W. (2020). Multi-nutrient fortification of human milk for preterm infants. *Cochrane Database of Systematic Reviews*, *6*(6), CD000343. https://doi.org/10.1002/14651858.CD000343.pub4

Calik, C., & Esenay, F. (2019). The clinical effect of pacifier use on orogastric tube-fed preterm infants: A randomized controlled trial. *JPMA, The Journal of the Pakistan Medical Association*, *69*(6), 771–776.

Campbell-Yeo, M., Gullickson, C., McCulloch, H., Disher, T., & Hughes, B. (2025). Effect of multi-nutrient milk fortification on preterm neonate outcomes: A network meta-analysis. *Nutrients*, *17*(10), 1651. https://doi.org/10.3390/nu17101651

Centers for Disease Control and Prevention. (2025a, August 21). *NIS-Child data results*. U.S. Department of Health and Human Services. https://www.cdc.gov/breastfeeding-data/survey/results.html

Centers for Disease Control and Prevention. (2025b, December 8). *HIV and breastfeeding*. https://www.cdc.gov/breastfeeding-special-circumstances/hcp/illnesses-conditions/hiv.html

Centers for Disease Control and Prevention. (2025c, December 12). *Breastfeeding report card, 2022.* https://www.cdc.gov/breastfeeding-data/breastfeeding-report-card/index.html

Chiang, K. V., Li, R., Anstey, E. H., & Perrine, C. G. (2021). Racial and ethnic disparities in breastfeeding initiation—United States, 2019. *MMWR. Morbidity and Mortality Weekly Report*, *70*(21), 769–774. https://doi.org/10.15585/mmwr.mm7021a1

Chrupcala, K. A., Edwards, T. M., & Spatz, D. L. (2015). A continuous quality improvement project to implement infant-driven feeding as a standard of practice in the newborn/infant intensive care unit. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *44*(5), 654-664. https://doi.org/10.1111/1552-6909.12727

Conde-Agudelo, A., & Díaz-Rossello, J. L. (2016). Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane Database of Systematic Reviews,* (8), CD002771. https://doi.org/10.1002/14651858.CD002771.pub4

Committee on Nutrition, Section on Breastfeeding, & Committee on Fetus and Newborn (2017). Donor human milk for the high-risk infant: Preparation, safety, and usage options in the United States. *Pediatrics*, *139*(1), e20163440. https://doi.org/10.1542/peds.2016-3440

D'Ambrosio, M. A., & Neu, M. (2025). Breast milk feeding for infants who required major surgery. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *54*(2), 189–200. https://doi.org/10.1016/j.jogn.2024.09.002

Davis, J. A., Glasser, M., Spatz, D. L., Scott, P., & Demirci, J. R. (2022). First feed type is associated with birth/lactating parent's own milk use during NICU stay among infants who require surgery. *Advances in Neonatal Care*, *22*(6), 578–588. https://doi.org/10.1097/ANC.0000000000000981

Deoni, S. C., Dean, D. C., Piryatinsky, I., O'Muircheartaigh, J., Waskiewicz, N., Lehman, K., Han, M., & Dirks, H. (2013). Breastfeeding and early white matter development: A cross-sectional study. *Neuroimage, 82*, 77–86. https://doi.org/10.1016/j.neuroimage.2013.05.090

Donovan, R., Kelly, S. G., Prazad, P., Talaty, P. N., Lefaiver, C., Hastings, M. L., & Everly, D. N. (2017). The effects of human milk fortification on nutrients and milk properties. *Journal of Perinatology*, *37*(1), 42–48. https://doi.org/10.1038/jp.2016.166

Edwards, T. M., & Spatz, D. L. (2010). An innovative model for achieving breast-feeding success in infants with complex surgical anomalies. *The Journal of Perinatal & Neonatal Nursing, 24*(3), 246-253.

Foster, J. P., Psaila, K., & Patterson, T. (2016). Non-nutritive sucking for increasing physiologic stability and nutrition in preterm infants. *Cochrane Database of Systematic Reviews*. https://doi.org/10.1002/14651858.CD001071.pub3

Froh, E. B., & Spatz, D. L. (2022). Lactation outcomes after participation in a tailored prenatal nutrition consultation among women with infants with congenital anomalies. *Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*, *51*(6), 590–598. https://doi.org/10.1016/j.jogn.2022.07.007

Froh, E. B., Schwarz, J., & Spatz, D. L. (2020). Lactation outcomes among dyads following participation in a model of group prenatal care for patients with prenatally diagnosed fetal anomalies. *Breastfeeding Medicine, 15*(11), 698-702. https://doi.org/10.1089/bfm.2020.0061

Froh, E. B., Deatrick, J., Curley, M. A. Q., & Spatz, D. L. (2015). Making meaning of pumping for mothers of infants with congenital diaphragmatic hernia. *Journal of Obstetric Gynecologic and Neonatal Nursing: JOGNN, 44*(3), 439–449. https://doi.org.1111/1552-6909.12564

Froh, E. B., Deatrick, J. A., Curly, M. A. Q., & Spatz, D. L. (2017). Mothers of infants with congenital diaphragmatic hernia describe “breastfeeding” in the neonatal intensive care unit “as long as it’s my milk, I’m happy.” *Journal of Human Lactation*, *33*(3), 524–532. https://doi.org/10.1177/089033441770969

Fugate, K., Hernandez, I., Ashmeade, T., Miladinovic, B., & Spatz, D. L. (2015). Improving human milk and breastfeeding practices in the NICU. *The Journal of Obstetric Gynecologic & Neonatal Nursing: JOGNN, 44*(3), 426–E15. https://doi.org/10.1111/1552-6909.12563

Garofalo, N. A., & Caplan, M. S. (2019). Oropharyngeal mother’s milk: State of the science and influence on necrotizing enterocolitis. *Clinics in Perinatology*, *46*(1), 77–88. https://doi.org/10.1016/j.clp.2018.09.005

Gephart, S. M., & Weller, M. (2014). Colostrum as oral immune therapy to promote neonatal health. *Advances in Neonatal Care*, *14*(1), 44–51. https://doi.org/10.1097/ANC.0000000000000052

Gertz, B., & DeFranco, E. (2019). Predictors of breastfeeding non-initiation in the NICU. *Maternal & Child Nutrition*, *15*(3), e12797. https://doi.org/10.1111/mcn.12797

Haase, B., Barreira, J., Murphy, P. K., Mueller, M., & Rhodes, J. (2009). The development of an accurate test weighing technique for preterm and high-risk hospitalized infants. *Breastfeeding Medicine, 4*(3), 151–156. https://doi.org/10.1089/bfm.2008.0125

Harris, M., Schiff, D. M., Saia, K., Muftu, S., Standish, K. R., & Wachman, E. M. (2023). Academy of Breastfeeding Medicine Clinical Protocol #21: Breastfeeding in the Setting of Substance Use and Substance Use Disorder (Revised 2023).

Breastfeeding Medicine, *18*(10), 715–733. https://doi.org/10.1089/bfm.2023.29256.abm

Juntereal, N. A., & Spatz, D. L. (2021). Integrative review of antenatal milk expression and mother-infant outcomes during the first 2 weeks after birth. *The Journal of Obstetric, Gynecologic, and Neonatal Nursing: JOGNN*, *50*(6), 659–668. https://doi.org/10.1016/j.jogn.2021.07.003

Juntereal, N. A., Geddes, D. T., Lake, E. T., & Spatz, D. L. (2024). A longitudinal observation of antenatal milk expression in mothers of infants with congenital anomalies. *Breastfeeding Medicine*, *19*(12), 901–910. https://doi.org/10.1089/bfm.2024.0086

Juntereal, N. A., Lai, C. T., Geddes, D. T., Lake, E. T., & Spatz, D. L. (2025). Measuring postpartum milk production following antenatal milk expression in mothers of infants with congenital anomalies. *Advances in Neonatal Care, 25*(3), 270–282. https://doi.org/10.1097/ANC.0000000000001270

Kendall-Tackett, K. (2022). Psychological trauma and breastfeeding: What we know so far. *Medical Research Archives*, *10*(9). https://doi.org/10.18103/mra.v10i11.3288.

Kent, J. C., Mitoulas, L. R., Cregan, M. D., Ramsay, D. T., Doherty, D. A., & Hartmann, P. E. (2006). Volume and frequency of breastfeedings and fat content of breast milk throughout the day. *Pediatrics*, *117*(3), e387–e395. https://doi.org/10.1542/peds.2005-1417

Medina Poeliniz, C., Hoban, R., Janes, J., & Meier, P. P. (2025). Pumping behaviors of breast pump-dependent mothers of preterm infants in the neonatal intensive care unit (NICU): Importance of the first five postpartum days. *Breastfeeding Medicine, 20*(7), 493–501. https://doi.org/10.1089/bfm.2024.0396

Meek, J. Y., Noble, L., & Section on Breastfeeding. (2022). Policy Statement: Breastfeeding and the Use of Human Milk. *Pediatrics*, 150(1), e2022057988. https://doi.org/10.1542/peds.2022-057988

Meerlo-Habing, Z. E., Kosters-Boes, E. A., Klip, H. & Brand, P. L. P. (2009). Early discharge with tube feeding at home for preterm infants is associated with longer duration of breast feeding. *Archives of Disease in Childhood. Fetal Neonatal Edition, 94*(4), F294–F297. https://doi.org/10.1136/adc.2008.146100

Meier, P. P., Engstrom, J.L., Janes, J. E., Jegier, B. J., & Loera, F. (2012). Breast pump suction patterns that mimic the human infant during breastfeeding: Greater milk output in less time spent on pumping for breast pump-dependent mothers with premature infants. *Journal of Perinatology, 32*(2), 103–110. https://doi.org/10.1038/jp.2011.64

Moossavi, S., Miliku, K., Sepehri, S., Khafipour, E., & Azad, M. B. (2018). the prebiotic and probiotic properties of human milk: Implications for infant immune

development and pediatric asthma. *Frontiers in Pediatrics*, *6*, 197. https://doi.org/10.3389/fped.2018.00197

National Academies of Sciences, Engineering, and Medicine. 2025. *Breastfeeding in the United States: Strategies to support families and achieve national goals*. National Academies Press. https://doi.org/10.17226/29118

Ofek Shlomai, N., Mordechai, C., Morag, I., Bdolach Abram, T., & Eventov Friedman, S. (2024). Cue-based feeding in the NICU-a pathway to earlier oral feeding of preterm infants. *Frontiers in Pediatrics*, *12*, 1417628. https://doi.org/10.3389/fped.2024.1417628

Office of Disease Prevention and Health Promotion. (n.d.). *Healthy People 2030: Nutrition and healthy eating*. U.S. Department of Health and Human Services. https://health.gov/healthypeople/objectives-and-data/browse-objectives/nutrition-and-healthy-eating

Pannaraj, P. S., Li, F., Cerini, C., Bender, J. M., Yang, S., Rollie, A., Adisetiyo, H., Zabih, S., Lincez, P. J., Bittinger, K., Bailey, A., Bushman, F. D., Sleasman, J. W., & Aldrovandi, G. M. (2017). Association between breast milk bacterial communities and establishment and development of the infant gut microbiome. *JAMA Pediatrics*, *171*(7), 647–654. https://doi.org/10.1001/jamapediatrics.2017.0378

Paul, K. J., Murosko, D., Smith, V. C., Montoya-Williams, D., & Parga-Belinkie, J. (2023). Defining Gender in Infant Care. *NeoReviews*, *24*(3), e199–e205. https://doi.org/10.1542/neo.24-3-e199

Perrella, S. L., Nancarrow, K., Rea, A., Murray, K., Geddes, D. T., & Simmer, K. N. (2020). Estimates of preterm infants' breastfeeding transfer volumes are not reliably accurate. *Advances in Neonatal Care, 20*(5), E93–E99. https://doi.org/10.1097/ANC.0000000000000721

Prolacta Bioscience. (2025, November 18). Majority of U.S. level III & IV NICUs in 2025 used Prolacta's 100% breastmilk-based fortifiers & formulas to improve outcomes for premature infants [Press release]. https://www.prolacta.com/en/news/majority-of-us-level-iii-and-iv-nicus-in-2025-used-prolactas-100-percent-breastmilk-based-fortifiers-formulas-to-improve-outcomes-for-premature-infants/

Reicher, H. K., & Spatz, D. L. (2024). Breastfeeding, chestfeeding, and lactating parents' experiences with online support groups: An integrative review. *Journal of Midwifery & Women's Health*, *69*(4), 531–542. https://doi.org/10.1111/jmwh.13618

Sheen, W., Ahmed, M., Patel, H., Codipilly, C. N., & Schanler, R. J. (2021). Is the antioxidant capacity of stored human milk preserved?. *Breastfeeding medicine*, *16*(7), 564–567. https://doi.org/10.1089/bfm.2020.0407

Slater, C. N., & Spatz, D. L. (2025). Guidelines for primary pediatric care professionals to help patients establish and protect milk supply. *MCN. The American Journal of Maternal Child Nursing*, *50*(4), 192–203. Advance online publication. https://doi.org/10.1097/NMC.0000000000001107

Slutzah, M., Codipilly, C. N., Potak, D., Clark, R. M., & Schanler, R. J. (2010). Refrigerator storage of expressed human milk in the neonatal intensive care unit. *The Journal of Pediatrics, 156*(1), 26-28. https://doi.org/10.1016/j.jpeds.2009.07.023.

Spatz, D. L. (2004). Ten steps for promoting and protecting breastfeeding for vulnerable infants. *Journal of Perinatal and Neonatal Nursing, 18*(4), 385–396. https://doi.org/10.1097/00005237-200410000-00009

Spatz, D. L. (2018). Beyond BFHI: The Spatz 10-Step and Breastfeeding Resource Nurse Model to Improve Human Milk and Breastfeeding Outcomes. *The Journal of Perinatal & Neonatal Nursing*, *32*(2), 164–174. https://doi.org/10.1097/JPN.0000000000000339

Spatz, D. L. (2022). Marijuana and Breastfeeding. *MCN. The American Journal of Maternal Child Nursing*, *47*(1), 54. https://doi.org/10.1097/NMC.0000000000000784

Spatz, D. L. (2025). Human milk is brain power and brain protection. *MCN. The American journal of maternal child nursing*, *50*(4), 238. https://doi.org/10.1097/NMC.0000000000001114

Spatz, D. L., Froh, E. B., Schwarz, J., Houng, K., Brewster, I., Myers, C., Prince, J., & Olkkola, M. (2015). Pump early, pump often: A continuous quality improvement project. *The Journal of Perinatal Education*, *24*(3), 160-170. https://doi.org/10.1891/1058-1243.24.3.160

Spatz, D. L., Froh, E. B., Bartholomew, D., Edwards, T., Wild, K. T., Hedrick, H., & Nawab, U. (2019). Lactation experience of mothers and feeding outcomes of infants with congenital diaphragmatic hernia. *Breastfeeding Medicine*, *14*(5), 320-324. https://doi.org/10.1089/bfm.2019.0011

Spatz, D. L., Schmidt, K. J., & Kinzler, S. (2014). Implementation of a human milk management center. *Advances in Neonatal Care, 14*(4), 253-261. https://doi.org/10.1097/ANC.0000000000000084

Spatz, D. L., Álvarez Rodríguez, S., Benjilany, S., Finderle, B., von Gartzen, A., Yates, A., & Brumley, J. (2024a). Having enough milk to sustain a lactation journey: A call to action. *Nursing for Women's Health*, *28*(4), 256–263. https://doi.org/10.1016/j.nwh.2024.02.007

Spatz, D. L., Álvarez Rodríguez, S., Benjilany, S., Finderle, B., von Gartzen, A., Yates, A., & Brumley, J. (2024b). Proactive management of lactation in the birth hospital to ensure long-term milk production and sustainable breastfeeding. *Journal of*

Midwifery & Women's Health, *70*(2), 343–349. https://doi.org/10.1111/jmwh.13726

Steele, C., & Alessi, S. (2024). Evaluation of the use of dedicated technicians and bar code scanning technology for fortified human milk feeding preparation in a single neonatal intensive care unit to reduce risk of adverse events. *Journal of the Academy of Nutrition and Dietetics*, *124*(5), 559–563. https://doi.org/10.1016/j.jand.2023.12.007

Swanson, J. R., Becker, A., Fox, J., Horgan, M., Moores, R., Pardalos, J., Pinheiro, J., Stewart, D., & Robinson, T. (2023). Implementing an exclusive human milk diet for preterm infants: real-world experience in diverse NICUs. *BMC Pediatrics*, *23*(1), 237. https://doi.org/10.1186/s12887-023-04047-5

Swanson, N. M., Elgersma, K. M., McKechnie, A. C., McPherson, P. L., Bergeron, M. J., Sommerness, S. A., Friedrich, C. L., & Spatz, D. L. (2023). Encourage, Assess, Transition (EAT): A quality improvement project implementing a direct breastfeeding protocol for preterm hospitalized infants. *Advances in Neonatal Care*, *23*(2), 107–119. https://doi.org/10.1097/ANC.0000000000001037

Takako, H., Mizue, M., Izumi, H., Chie, O., Harue, T., Uchida, M., & Spatz, D. L. (2020). Improving human milk and breastfeeding rates in a perinatal hospital in Japan: A quality improvement project. *Breastfeeding Medicine, 15*(8), 538-545. https://doi.org/10.1089/bfm.2019.0298

Victora, C. G., Bahl, R., Barros, A. J., França, G. V., Horton, S., Krasevec, J., Murch, S., Sankar, M. J., Walker, N., Rollins, N. C., & Lancet Breastfeeding Series Group (2016). Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet*, *387*(10017), 475–490. https://doi.org/10.1016/S0140-6736(15)01024-7.

World Health Organization. (2023, December 20). *Infant and young child feeding*. https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding

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