Evidence-Based Practice Reports

Formula Supplementation of Breastfed Infants

Helpful or Hazardous?

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Abstract: *Formula supplementation of the breastfed infant is engaged in for numerous reasons, many of which are not evidence based. While clinicians and mothers may view this practice as a benign intervention, there are a number of undesired side effects of which parents and health care providers may be unaware. These side effects can result in adverse outcomes on the maternal milk supply, on the duration and exclusivity of breastfeeding, and on the infant's gut microbiome. Alterations of the neonatal gut environment from formula supplementation can be responsible for mucosal inflammation and disease, autoimmunity disorders, and allergic conditions in childhood and adulthood. Soy infant formula can contain genetically modified ingredients and present a food with lower nutritional quality. Careful assessment and interventions that are designed to produce outcomes of abundant milk production and rapid resolution of breastfeeding problems help preserve the exclusive breastfeeding experience and result in optimal health outcomes for mothers and their infants.*

Keywords: human lactation; early lifespan nutrition; formula supplementation; gut microbiome

By the late 19th and early 20th centuries, mixed feeding or supplementation of breastfed infants had become culturally entrenched in the United States.[1] Changing social forces, popularity of advice and advertisements in women's magazines, and adoption of the notion of scheduled feedings all conspired to culminate in the widespread acceptance of supplementing breastmilk with other foods, including commercial formulas. Long intervals between feedings at the breast and the contagious belief of insufficient breastmilk further contributed to the still commonly seen behavior of breastmilk supplementation. The *2014 Breastfeeding Report Card* compiled by the Centers for Disease Control and Prevention showed that supplementation starts early, with up to 28% of infants in some states receiving formula supplementation within the first 48 hours of life.[2] In some hospitals this supplementation rate is even higher, with 31% of vaginally born term infants supplemented with formula and 51% of cesarean born infants being given formula, even when the mothers intended to exclusively breastfeed.[3] There will always be a small number of breastfed infants who require supplementation for medical reasons[4]; however, the Healthy People 2020 health objectives for the nation targets a reduction in formula supplementation to 14.2% during the first 2 days of life.[5] Furthermore, the Joint Commission, which accredits health care institutions in the United States, requires in its perinatal

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care core measure set that less than 10% of breastfed infants should be supplemented with formula during the birth hospitalization.[6] Formula supplementation that is started in the hospital frequently continues after discharge, especially when mothers are not provided with specific feeding plans to remedy problems or situations that triggered the supplementation.

Supplementation is engaged in for numerous reasons, many of which are not evidence based. Mothers may supplement with formula because of real or perceived insufficient milk, to settle a fussy baby, to assure that the baby is satisfied and getting enough milk, to obtain more sleep, as a response to pressure from family and friends, to resolve breastfeeding problems, or at the recommendation by health care providers. Mothers may fall prey to the misleading marketing tactics of formula manufacturers that urge the use of formulas labeled for breastfeeding supplementation. One manufacturer assures mothers that 8 out of 10 mothers who supplemented with formula stated that it helped them continue to provide breastmilk. Clinicians may recommend formula supplementation due to conservative hypoglycemia policies, to solve breastfeeding problems, to provide a quick method of getting nutrition into a baby, to assure infant weight gain, to prevent newborn weight loss, or with the mistaken notion that infant formula supplementation is a benign intervention with no side effects. For example, Flaherman and colleagues enrolled 40 full-term newborns into a study if they had lost ≥5% of their birth weight and were less than 36 hours of age.[7] Half of the infants were supplemented with 10 mL of formula by syringe after each breastfeeding as an intervention designed to prolong breastfeeding. However, expert consensus guidelines do not consider a 5% weight loss as a contributor to adverse health outcomes,[4] and the study design has been noted to have critical limitations (Box 1) including a coauthor who functions as a consultant for 4 formula companies.[8]

Box 1.

Limitations of Flaherman Study.

- Small sample size—Limits the study's generalization
- Only 62% of the mothers intended to exclusively breastfeed—Intent is predictive of outcomes, with many mothers comfortable with formula supplementation
- Enrolled infants at 5% below birth weight at ≤36 hours—Evidence does not consider this population of infants at risk. Should have enrolled infants clearly at risk for poor outcomes
- Inadequate breastfeeding teaching—No clinical interventions were offered from an international board certified lactation consultant prior to formula supplementation
- Volume of formula supplemented was equivalent to the full volume of a colostrum feeding—This could have depressed the infant's appetite for the next breastfeeding
- More multiparas in early limited formula group—This is predictive of exclusive breastfeeding
- Lacked maternity unit protocols to optimize early exclusive breastfeeding outcomes
- Did not account for diuresis from maternal IV fluids—This is a contributor to newborn weight loss and not an indication for formula supplementation
- Did not account for weight loss from meconium stooling—Large meconium stooling can account for weight loss and is not an indication for formula supplementation
- Did not assess for swallowing—No breastfeeding assessment was performed to discover reason for weight loss
- Why was formula used for supplementation and not maternal colostrum or donor human milk?
- Mother had to agree that she did not mind her baby receiving formula
- Mothers were not provided with information regarding potential side effects of formula supplementation and were unaware of the risks. This bypasses informed consent—Side effects such as alterations to the infant gut microbiome and provoking an inflammatory state in the gut, which increases the risk for obesity and autoimmune diseases, should have been communicated to the mothers in this study
- Misleading conclusions could translate into "syringe feed every baby who is down 5% of his birth weight" rather than perform a breastfeeding assessment and provide clinical interventions that would avoid formula supplementation

Nonmedically indicated formula supplementation can cause unintentional harm to the lactation process, to the breastfeeding relationship, to the infant, and to the mother, leaving even more problems in its wake.

Side Effects of Formula Supplementation

Early Abandonment of Breastfeeding and Reduced Milk Production

Early formula supplementation has been associated with double the risk of not fully breastfeeding between 30 and 60 days postpartum, triple the risk of breastfeeding cessation by day 60, and is significantly dose dependent, with increased numbers of formula feeds contributing to an earlier abandonment of breastfeeding.[9] Reasons for supplementation vary depending on the age of the baby. The description of insufficient milk remains one of the main causes of formula supplementation throughout the first year and is often attributable to mothers' lack of knowledge regarding the normal physiological process of lactation, not to a lack of milk.[10] Initial difficulties with breastfeeding mechanics or perceived insufficient milk can usually be overcome with appropriate clinical interventions from knowledgeable health professionals such as dietitians and international board certified lactation consultants rather than resorting to formula supplementation. Early formula supplementation may inherently interfere with production of a full milk supply, especially if the mother has not been instructed to express her colostrum/milk and the original reason for the supplementation has not been addressed. Breastfed infants who are supplemented with a bottle may have subsequent difficulty latching to the breast properly and may cause nipple damage and reduced milk transfer, further jeopardizing the maternal milk supply. Mothers may describe latch difficulties, sore nipples, and lack of satisfaction by the infant as early contributors to supplementation and later in the first year ascribe the infant's lack of interest, dwindling milk production, or distractibility as reasons for weaning. Breastfeeding interventions during the early days and weeks should focus on education regarding the mechanics and physiology of breastfeeding. Hospitals with the Baby Friendly designation enjoy elevated rates of breastfeeding initiation and exclusivity,[11] a goal that portends continued exclusive breastfeeding following hospital discharge. Clinicians may wish to encourage their facility to achieve the Baby Friendly designation as a means of offering optimal breastfeeding support. Institutions designated as Baby Friendly follow the *Ten Steps to Successful Breastfeeding* as the foundation for evidence-based lactation care (Box 2).

Box 2.

The Ten Steps to Successful Breastfeeding for Hospital Implementation.

1. Have a written breastfeeding policy that is routinely communicated to all health care staff
2. Train all health care staff in the skills necessary to implement this policy
3. Inform all pregnant women about the benefits and management of breastfeeding
4. Help mothers initiate breastfeeding within 1 hour of birth
5. Show mothers how to breastfeed and how to maintain lactation, even if they are separated from their infants
6. Give infants no food or drink other than breastmilk unless medically indicated
7. Practice rooming-in—allow mothers and infants to remain together 24 hours a day
8. Encourage breastfeeding on demand
9. Give no pacifiers or artificial nipples to breastfeeding infants
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or birth center

Cow's Milk Allergy and Diabetes

Even just one bottle of formula has the potential to adversely affect the infant. Breastfed infants from susceptible families can be sensitized to cow's milk protein by the giving of just one formula bottle (inadvertent, planned, or unnecessary supplementation) in the newborn nursery during the first 3 days of life.[12-14] Formula supplementation has also been associated with the development of type 1 diabetes in susceptible infants. It is thought that one potential cause of the diabetes could stem from inflammation in the infant gut and/or the increased permeability of the gut when it encounters cow's milk–based infant formula.[15] A family history of allergies and diabetes should be obtained before supplementing with cow's milk–based formulas. Donor human milk from a milk bank within the Human Milk Banking Association of North America for supplementation in the hospital would be a better option. Prior to formula supplementation after discharge, careful assessment is necessary, interventions should address the problem, and every effort should be made to increase breastmilk production. Mother's own milk is the first choice for supplementation, with banked donor human milk a good alternative. However, banked milk may not be available for healthy full term infants. Shared human milk must be carefully screened and hydrolyzed formula may be the last option.

Alteration of the Neonatal Gut Microbiome

In the human gut resides an immense and diverse population of microorganisms, the bulk of which are bacteria. Gut microbiota direct the growth and differentiation of the gut's epithelial cells and perform nutritive, metabolic, immunological, and protective functions. The quantity of bacterial cells in the

gastrointestinal tract and their genes far outnumber the human cells and their genes in the entire body. The total community of gut microorganisms, their genetic elements, and their environmental interactions is known as the microbiome. This "super organ's" functions include executing enzymatic reactions and modulating gene expression involved in mucosal barrier fortification, forming new blood vessels, and promoting intestinal maturation following birth. Bacteria regulate the development of the intestinal barrier as well as its functions, preventing pathogens, toxins, and antigens from entering the body and causing acute or chronic diseases and conditions. What happens in the gut affects even distant organs. For example, the central nervous system is affected through gut–brain communication pathways, with alterations in gut microbiota implicated in certain brain disorders such as autistic spectrum disorder.[16,17] The gut, being the largest interface between the body and the world outside it, contains 60% to 70% of the immune system. Illnesses and conditions associated with intestinal barrier dysfunction are more common in adults who were formula-fed as infants compared with those who were breastfed.[18]

The gut possesses several lines of defense against invading pathogens, the first being a physical barrier that is composed of a layer of columnar epithelial cells between which are the tight junctions. The tight junctions function as gatekeepers that control gut permeability, allowing passage of fluids, electrolytes, and small macromolecules, but preventing the passage of larger macromolecules. Because the gut is very permeable during fetal life and early after birth, it is important that the tight junctions close quickly and are not disrupted or opened by foreign invaders such as infant formula. Gut closure or closure of the tight junctions starts during the first postnatal week. Any delay, change, or insult to the gut that changes this process predisposes the infant to infection, inflammatory states, and allergic sensitization.[19] The gut closure process is mediated by hormones and growth factors in human milk that facilitate epithelial growth and maturation. Such factors are not present in infant formulas.

Supplementation with formula results in a rapid shift in the gut bacterial profile of a breastfed infant. When infant formula is added to the diet, the dominance of bifidobacteria during exclusive breastfeeding decreases.[20] Formula supplementation of breastfed infants during the first 7 days of life depresses and delays the production of a strongly acidic gut environment. When breastfed infants receive formula supplements they develop gut flora and gut behavior like those of formula-fed infants. The probability of an infant being appropriately colonized by bifidobacteria is reduced when the mother has a high body mass index, that is, is obese, the mother gains excessive weight during pregnancy, and the baby is delivered by cesarean section. The likelihood of appropriate bifidobacterial colonization increases when the mother is of normal weight, has appropriate bifidobacterial colonization in her own gut and in her breastmilk, and is actively breastfeeding.[21]

Perturbations and alterations to the normal healthy colonization patterns of the gut can result in lifelong disease.[22] Such perturbations can be specifically caused by the use of infant formula, which changes the gut's bacterial population. The protective features and actions of breastmilk rely mainly on its ability to modulate intestinal microflora composition during the early days of life.[23] Human milk is such an elegant symphony of components that it even contains specific bacteria destined for the infant's gut and oligosaccharides, the carbohydrates that serve as food for the friendly bacteria. The early bacterial colonizers of the infant's gut regulate the gene expression of the cells that line the digestive tract, creating a favorable environment for themselves that inhibits the growth of potentially pathogenic bacteria. Even small amounts of formula supplementation of breastfed infants will result in shifts from a breastfed micobiota pattern to a formula-fed pattern.[24] Clinicians may prudently wish to avoid giving formula to breastfed babies in the hospital and during the early days after discharge before gut closure occurs unless there is a specific medical reason to do so.

Supplementation Beyond the Neonatal Period

Formula supplementation after the neonatal period and even later in the first year interferes with the significant nutritional and protective contribution to an infant's development derived from breastmilk. The mothers' perception that breastfeeding alone did not satisfy their infant remained one of the top 3 reasons most frequently cited as a reason to stop breastfeeding throughout the first year of life.[10] Infants beyond the neonatal period may present behaviors that mothers interpret as insufficient milk such as taking a shorter time to feed, being easily distractable at breast, or the mothers' breast may seem smaller even though milk production has leveled off at a sufficient amount. Mothers who return to work benefit from a feeding and pumping plan that is created specifically for their situation and implemented well before the first day of work. Even in situations where diseases or conditions develop that require dietary alterations, breastmilk should remain the foundation of nutrition if at all possible. Positive feedback and support for breastfeeding the older baby remains an important intervention and contributor to the continued programming of the immune system and the overall health of the infant.

Clinical Implications

Research has shown that reduced or aberrant colonization of the infant gut during the first months of life (which can result from supplements of infant formula) provokes a slower maturation of the epithelial cell barrier functions, alters gut permeability, and consequently facilitates the invasion of pathogens and foreign or harmful antigens.[25] Nutrition during this time frame has a profound effect on the shape and trajectory, that is, the programming of the body's

microbiome. Preterm infants are extremely vulnerable and suffer an even higher risk to gut integrity when breastmilk is supplemented with infant formula. Preterm infants are at a high risk for acquiring NEC due to their lower gastric acid production, reduced ability to break down toxins, and low levels of sIgA, which increases bacterial adherence to the intestinal mucosa. In a study 62 preterm infants, it was demonstrated that those infants receiving greater than 75% of their diet as breastmilk had significantly lower intestinal permeability compared with formula-fed infants or those who received only small amounts of breastmilk. The dose of breastmilk became even more important over time, as more than 25% of the diet needed to be breastmilk at 30 days of age to still see a significant advantage.[26] Of concern is the limitation whereby preterm infants cannot fully digest carbohydrates and proteins. Undigested casein, a protein in infant formula, can function as a chemoattractant for neutrophils, exacerbating the inflammatory response and opening the tight junctions between intestinal epithelial cells, disrupting the integrity of the epithelium barrier, and allowing the delivery of whole bacteria, endotoxin, and viruses directly into the bloodstream.[27] Feeding preterm infants with infant formula may result in colonization of the intestine with pathogenic bacteria, resulting in an exaggerated inflammatory response. The sIgA from colostrum, transitional milk, and mature milk (which is absent in infant formula) coats the gut, preventing attachment and invasion of pathogens by competitively binding and neutralizing bacterial antigens. This passively provides immunity during a time of reduced neonatal gut immune function.[27]

Problems With Nutritional Components and Contaminants of Formula

Soy formula is a popular supplement to breastmilk, as many mothers are often led to believe that it will ameliorate colic, reduce fussiness, cure gas, and not provoke sensitivity or allergy to cow's milk. The American Academy of Pediatrics states that soy formulas have no advantage over cow's milk–based formulas for supplementation of breastfed infants and have few indications for use.[28] Soy formulas however can have potentially undesirable side effects. Soy formula use has been associated with specific autistic behaviors.[29] The bulk of soy products (90%) in the United States are genetically engineered or modified to survive heavy exposure to chemical herbicides that are systemically absorbed into soy plants, plant leaves, and soy beans. Infant formulas that contain genetically modified (GM) soy have been shown to contain high residue levels of glyphosate, Monsanto's Roundup Ready herbicide.[30] Furthermore, GM soybeans have been shown to differ in nutrient composition compared with soy beans grown conventionally or organically. GM soybeans contain reduced levels of protein, glucose, fructose, sucrose, and maltose. They demonstrate a less healthy profile of fatty acids with high levels of linoleic acid (LA; 18:2n-6), oleic acid (18:1n-9), and palmitic acid and reduced levels of α-linolenic acid (ALA; 18:3n-3). This unbalanced intake of fatty acids is a potential risk factor for developing obesity. In human cells, Roundup's glyphosate may induce endocrine disturbances.[31]

Soy formulas have a long history of aluminum contamination.[32] The aluminum content of infant formulas is between 10 and 40 times higher than the aluminum content of human milk.[33] In a comparison of the aluminum content of various types of formula, soy formula and the powdered version of formula contained the highest levels of aluminum.[34] Aluminum toxicity has been associated with significant unwanted side effects on neurodevelopment and bone health.[35]

Reducing Formula Supplementation in the Hospital[36]

There are a number of interventions that hospitals can take to reduce the amount of supplementation that is not medically indicated:

- Infant formula bottles can be stored in a special or locked cabinet where nurses must sign out each bottle, recording the name of the patient, why the bottle is being given, and the name of the nurse or clinician who obtains the bottle.
- Some hospitals have put formula bottles in their medication distribution system such as a Pyxis system. This demonstrates that formula supplementation is to be used in a manner similar to medication, that is, only when medically necessary. This system can track formula usage and serve to indicate where additional staff education may be necessary.
- Staffing of International Board Certified Lactation Consultants should follow the recommendations of the US Lactation Consultant Association, with patient ratios of 1.3 LCs per 1000 births in a Level I hospital, 1.6 LCs per 1000 births in a Level II hospital, and 1.9 LCs per 1000 births in a Level III hospital[37]
- Mothers' own expressed colostrum or expressed breastmilk are the first choices should supplementation become necessary. Pasteurized donor human milk would be the next choice in the hospital. If formula must be used, then a hydrolyzed formula rather than a standard cow's milk–based formula would be a better choice.[38] This would hopefully reduce the risk of alterations of the gut microbiome.
- Hospital staff should be educated regarding the side effects of formula supplementation of breastfed infants. Staff are ethically and legally responsible for acting in the best interests of their patients.
- Discharge bags from formula companies should not be distributed to mothers on leaving the hospital. These represent another form of pressure to supplement breastfeeding infants with a product that is potentially harmful.
- Infant formula samples pose a potential risk to the infant, staff, and

institution, as powdered formula is not sterile and can contain several types of bacteria such as *Cronobacter sakazakii* and *Salmonella*, instructions are seldom provided regarding how to safety reconstitute or use the product in the discharge bag, and the hospital usually has no mechanism to inform patients if there is a recall of the formula sample. This could leave the hospital liable for infant illnesses caused by the nonsterile powdered infant formula contained in industry-sponsored discharge bags.

When Would Human Milk Substitutes Be Warranted?

While the evidence is clear that there are risks to the infant, the mother, and to maternal milk production from infant formula supplementation, there may be situations where the mother's own milk as well as pasteurized donor human milk are unavailable or not an option. The World Health Organization lists infant and maternal conditions where it may be advisable to not breastfeed, either temporarily or permanently.[39] Box 3 summarizes some of the World Health Organization's medical reasons for the use of infant formula supplementation.

The Academy of Breastfeeding Medicine has a protocol for supplementation that includes indications and possible indications for infant formula supplementation.[4] Box 4 summarizes some of Academy of Breastfeeding Medicines medical reasons for infant formula use.

Infants whose mothers have a history of significant breast reduction or breast anomalies may also need formula supplementation. All these indications and potential indications require the clinical judgment and close monitoring by the clinician.

Box 3.

The World Health Organization's Selected Medical Reasons for the Use of Infant Formula Supplementation.

Classic galactosemia
Maple syrup urine disease
Phenylketonuria (some breastfeeding is possible with monitoring)
Very low birth weight or very preterm infants
Newborn hypoglycemia that is unresponsive to breastfeeding or breastmilk feeding
Maternal HIV infection
Herpes simplex virus type 1 on breast
Certain maternal medications
Substance abuse

Box 4.

Academy of Breastfeeding Medicine's Selected Medical Reasons for Infant Formula Use or Supplementation.

Separation of mother and infant
Infant with inborn error of metabolism (eg, galactosemia)
Infant unable to feed at the breast (eg, congenital malformation, illness)
Contraindicated maternal medications
Hypoglycemia unresponsive to appropriate breastfeeding
Significant dehydration (with clinical evidence)
Weight loss accompanied by delayed lactogenesis
Meconium stooling on day 5
Insufficient intake despite adequate milk supply (poor milk transfer)
Hyperbilirubinemia (starvation jaundice)
Delayed lactogenesis 2
Glandular insufficiency
Breast pathology
Intolerable pain during feedings

Supplementing With Alternative Feeding Methods

Clinicians frequently recommend that a supplement be delivered with a bottle and artificial nipple because it is a well-known and rapid way to feed an infant. However, sucking on an artificial nipple is not the same as sucking at the breast. It has been demonstrated that full-term infants supplemented with bottles

displayed more negative sucking behavior during attempts to latch to the breast and that mothers who used bottles to supplement breastfeeding had a lower perception of milk supply up to 4 weeks postpartum.[40] Artificial nipples typically require less vacuum application than the human nipple, are shaped differently, present a rigid stimulus to the mouth with little deflection, and produce a fast flow rate that may overwhelm some infants' ability to breathe due to rapid swallowing. A learned behavior such as a reduced application of vacuum while feeding may interfere with the amount of vacuum needed to feed effectively at the breast. Other choices of supplementing devices include a dropper, cup, syringe, spoon, or tube feeding device depending on the amount and length of time that supplementation is needed.[41]

How Much to Supplement

During the early days following birth, breastfed infants typically consume small amounts of milk and regurgitate excess amounts of formula when prodded to swallow in excess of what their stomachs can physiologically accommodate. Overfeeding an infant with formula models a behavior that can potentially lead to overweight and obesity. The amount of supplement offered to a breastfed infant should reflect the volume of colostrum typically available during the time period when a supplement is required as well as the weight of the infant. Average reported intake of colostrum by healthy breastfed infants is presented in Table 1. This can act as the clinician's guide for the amount of human milk or formula to use when supplementation is needed.

Stop, Look, and Listen Before Formula Supplementation

Since perceived insufficient milk, infant not receiving enough milk at a feeding, and mechanical issues of latching problems are early contributors to formula supplementation, clinicians should focus interventions on assuring that these barriers are surmounted with careful assessment, guidance, and follow-up. The first 14 days of lactation set the stage for producing a sufficient milk volume for the entire period of lactation. Efforts should be concentrated on creating an abundant milk supply during this important time period to avoid later milk supply issues. Careful assessment and a written feeding plan should be provided to mothers during the hospital stay (Box 5) to assure adequate intake and prevent hypoglycemia. Written feeding plans are also necessary for the early days after hospital discharge, for the return to work, and any time breastfeeding problems are experienced throughout the first year.

What, when, and how to supplement a breastfed infant depends on the individual situation, with breastmilk almost always the supplement of choice (Table 2).

Table 1.

Average Intake of Colostrum by Age of Healthy Breastfed Infants[42-45].

Age	Intake per Feeding (mL)
First 24 hours	2-10
24-48 hours	5-15
48-72 hours	15-30
72-96 hours	30-60

Box 5.

Initial In-Hospital Breastfeeding Plan for Term and Late Preterm Infants.

- Keep the infant skin-to-skin
- Breastfeed within 1 hour after birth
- Once every hour for the next 3 to 4 hours
- Every 2 to 3 hours until 12 hours of age
- At least 8 times each 24 hours during the hospital stay

Table 2.

Supplementation: When, What, and How.

When	What	How
Selected infant related issues		
Classic galactosemia	Lactose-free formula/protein hydrolysate formula	Clinicians can select the feeding aid that works best for the mother, the infant, and the situation:
Duarte galactosemia	Some breastmilk + lactose-free formula as needed	Tube-feeding device at the breast
Maple syrup urine disease	Breastmilk + MSUD formula if needed	Finger feeding

(continued)

Table 2. (continued)

When	What	How
Phenylketonuria	Breastmilk + PHE-free formula as needed	Spoon
Very low birth weight	Breastmilk/banked donor milk/fortifier if needed	Cup
Very preterm infant		Dropper
Hypoglycemia unresponsive to feeding	Breastmilk/IV glucose for severe hypoglycemia	Syringe
Congenital malformation	Breastmilk/expressed breastmilk/ banked donor milk	Bottle
Oral anomalies	Infant formula if none of the above are available for remaining conditions	
Illness		
Clinical dehydration		
Clinically significant weight loss		
Meconium stooling on day 5		
Starvation jaundice		
Inability to latch and/or suck		
Selected maternal related issues		
Maternal HIV infection	Infant formula	
Herpes simplex virus type 1 on breast	Breastfeed on contralateral breast/ expressed breastmilk	
Contraindicated maternal medications	Infant formula/express milk and discard until able to resume breastfeeding if possible	
Substance abuse	Infant formula unless on methadone maintenance, then breastfeed as long as mother remains clear of contraindicated substances	
Delayed lactogenesis II	Colostrum fed very frequently along with breast compressions to maximize intake	
Glandular insufficiency	Breastmilk/expressed breastmilk/infant formula if needed for remaining conditions	
Breast pathology		

(continued)

Table 2. (continued)

When	What	How
Surgical procedures on the breast (reduction/augmentation)		
Intolerable pain during feedings		
Physical or sexual abuse survivor		
Separation of mother and infant	Expressed breastmilk/banked donor milk/infant formula if necessary	Depending on the situation:
		Finger feeding
		Spoon
		Cup
		Dropper
		Syringe
		Bottle

As health care professionals, we can provide direct and honest communication and guidelines to the mothers and infants entrusted to our care. We owe them no less.

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References

1. Wolf JH. *Don't Kill Your Baby*. Columbus, OH: Ohio State University Press; 2001.
2. Centers for Disease Control and Prevention. Breastfeeding report card: United States/2014. http://www.cdc.gov/breastfeeding/pdf/2014breastfeedingreportcard.pdf. Accessed May 29, 2015.
3. Grassley JS, Schleis J, Bennett S, Chapman S, Lind B. Reasons for initial formula supplementation of healthy breastfeeding newborns. *Nurs Women's Health*. 2014;18:197-203.
4. ABM clinical protocol #3: hospital guidelines for the use of supplementary feedings in the healthy term breastfed neonate, revised 2009. *Breastfeed Med*. 2009;4:175-182.
5. US Department of Health and Human Services. *Healthy People 2020*. Washington, DC: US Department of Health and Human Services. https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health/objectives. Accessed May 29, 2015.
6. The Joint Commission. *Specifications Manual for Joint Commission National Quality Core Measures* (version 2012A). Oak Brook, IL: The Joint Commission.
7. Flaherman VJ, Aby J, Burgos AE, Lee KA, Cabana MD, Newman TB. Effect of early limited formula on duration and exclusivity of breastfeeding in at-risk infants: an RTC. *Pediatrics*. 2013;131:1059-1065.
8. Furman L. Early limited formula is not ready for prime time. *Pediatrics*. 2013;131:1182-1183.
9. Chantry CJ, Dewey KG, Peerson JM, Wagner EA, Nommsen-Rivers LA. In-hospital formula use increases early breastfeeding cessation among first-time mothers intending to exclusively breastfeed. *J Pediatr*. 2014;164:1339-1345.
10. Li R, Fein SB, Chen J, Grummer-Strawn LM. Why mothers stop breastfeeding: mothers' self-reported reasons for stopping during the first year. *Pediatrics*. 2008;122(suppl 2):S69-S76.
11. Merewood A, Mehta SD, Chamberlain LB, Philipp BL, Bauchner H. Breastfeeding rates in US baby-friendly hospitals: results of a national survey. *Pediatrics*. 2005;116:628-634.
12. Cantani A, Micera M. Neonatal cow milk sensitization in 143 case-reports: role of early exposure to cow's milk formula. *Euro Rev Med Pharmacol Sci*. 2005;9:227-230.
13. Host A. Importance of the first meal on the development of cow's milk allergy and intolerance. *Allergy Proc*. 1991;10:227-232.
14. Host A, Husby S, Osterballe O. A prospective study of cow's milk allergy in exclusively breastfed infants. *Acta Pediatr Scand*. 1988;77:663-670.
15. Knip M, Virtanen SK, Akerblom HK. Infant feeding and the risk of type I diabetes. *Am J Clin Nutr*. 2010;91(5 suppl):1506S-1513S.
16. Heijtz RD, Wang S, Anuar F, et al. Normal gut microbiota modulates brain development and behavior. *Proc Natl Acad Sci U S A*. 2011;108:3047-3052.
17. Kang DW, Park JG, Ilhan ZE, et al. Reduced incidence of *Prevotella* and other fermenters in intestinal microflora of autistic children. *PLoS One*. 2013;8:e68322.
18. Verhasselt V. Neonatal tolerance under breastfeeding influence. *Curr Opin Immunol*. 2010;22:623-630.
19. Maheshwari A, Zemlin M. Ontogeny of the intestinal immune system. *Haematol Rep*. 2006;2(10):18-26.

20. Favier CF, Vaughan EE, De Vos WM, Akkermans ADL. Molecular monitoring of succession of bacterial communities in human neonates. *Appl Environ Microbiol*. 2002;68:219-226.
21. Isolauri E. Development of healthy gut microbiota early in life. *J Paediatr Child Health*. 2012;48(suppl 3):1-6.
22. Di Mauro A, Neu J, Riezzo G, et al. Gastrointestinal function development and microbiota. *Ital J Pediatr*. 2013;39:15.
23. Guaraldi F, Salvatori G. Effect of breast and formula feeding on gut microbiota shaping in newborns. *Frontiers Cell Infect Microbiol*. 2012;2:94.
24. Mackie RI, Sghir A, Gaskins HR. Developmental microbial ecology of the neonatal gastrointestinal tract. *Am J Clin Nutr*.1999;69(5 suppl):1035S-1045S.
25. Perrier C, Corthesy B. Gut permeability and food allergies. *Clin Exp Allergy*. 2011;41:20-28.
26. Taylor SN, Basile LA, Ebeling M, Wagner CL. Intestinal permeability in preterm infants by feeding type: mother's milk versus formula. *Breastfeed Med*. 2009;4:11-15.
27. Claud EC, Walker WA. Hypothesis: inappropriate colonization of the premature intestine can cause neonatal necrotizing enterocolitis. *FASEB J*. 2001;15:1398-1403.
28. Bhatia J, Greer F; Committee on Nutrition. Use of soy protein-based formulas in infant feeding. *Pediatrics*. 2008;121:1062-1068.
29. Westmark CJ. Soy infant formula may be associated with autistic behaviors. *Autism Open Access*. 2013;3:120.
30. Loew T. Portland infant formula has pesticide-resistant GMOs. *Statesman J*. http://www.statesmanjournal.com/story/tech/science/environment/2014/10/23/portland-infant-formula-pesticide-resistant-gmos/17780357/. Accessed May 29, 2015.
31. Bohn T, Cuhra M, Traavik T, Sanden M, Fagan J, Primicerio R. Compositional differences in soybeans on the market: glyphosate accumulates in roundup ready GM soybeans. *Food Chem*. 2014;153:207-215.
32. Koo WW, Kaplan LA, Krug-Wispe SK. Aluminum contamination of infant formulas. *J Parenter Enteral Nutr*. 1988;12:170-173.
33. Fernandez-Lorenzo JR, Cocho JA, Rey-Goldar ML, Couce M, Fraga JM. Aluminum contents of human milk, cow's milk and infant formulas. *J Pediatr Gastroenterol Nutr*. 1999;28:270-275.
34. Burrell SA, Exley C. There is (still) too much aluminum in infant formulas. *BMC Pediatr*. 2010;10:63.
35. Fanni D, Ambu R, Gerosa C, et al. Aluminum exposure and toxicity in neonates: a practical guide to halt aluminum overload in the prenatal and perinatal periods. *World J Pediatr*. 2014;10:101-107.
36. Walker M. Formula supplementation of the breastfed infant: assault on the gut microbiome. *Clin Lact*. 2014;5:128-132.
37. US Lactation Consultant Association. *International Board Certified Lactation Consultant Staffing Recommendations for the Inpatient Setting*. Washington, DC: US Lactation Consultant Association. http://uslca.org/wp-content/uploads/2013/02/IBCLC_Staffing_Recommendations_July_2010.pdf. Published July 2010. Accessed May 29, 2015.
38. Committee on Nutrition, American Academy of Pediatrics. Hypoallergenic infant formulas. *Pediatrics*. 2000;106:346-349.
39. World Health Organization/UNICEF. *Acceptable Medical Reasons for Use of Breast-Milk Substitutes*. Geneva, Switzerland: World Health Organization/UNICEF (WHO/NMH/NHD/09.01, WHO/FCH/CAH/09/01). http://apps.who.int/iris/bitstream/10665/69938/1/WHO_FCH_CAH_09.01_eng.pdf?ua=1. Published 2009. Accessed May 29, 2015.
40. Huang YY, Gau ML, Huang CM, Lee JT. Supplementation with cup-feeding as a substitute for bottle-feeding to promote breastfeeding. *Chang Gung Med J*. 2009;32:423-431.
41. Walker M. *Supplementation of the Breastfed Infant*. Plano, TX: Hale; 2014.
42. Saint L, Smith M, Hartmann PE. The yield and nutrient content of colostrum and milk of women from giving birth to 1 month post-partum. *Br J Nutr*. 1984;52:87-95.
43. Casey CE, Neifert MR, Seacat JM, Neville MC. Nutrient intake by breast-fed infants during the first five days after birth. *Am J Dis Child*. 1986;140:933-936.
44. Evans KC, Evans RG, Royal R, Esterman AJ, James SL. Effect of caesarean section on breast milk transfer to the normal term newborn over the first week of life. *Arch Dis Child Fetal Neonatal Ed*. 2003;88:F380-F382.
45. Dollberg S, Lahav S, Mimouni FB. A comparison of intakes of breast-fed and bottle-fed infants during the first two days of life. *J Am Coll Nutr*. 2001;20:209-211.