



Breastfeeding: From Physiology to Clinical Practice and Beyond

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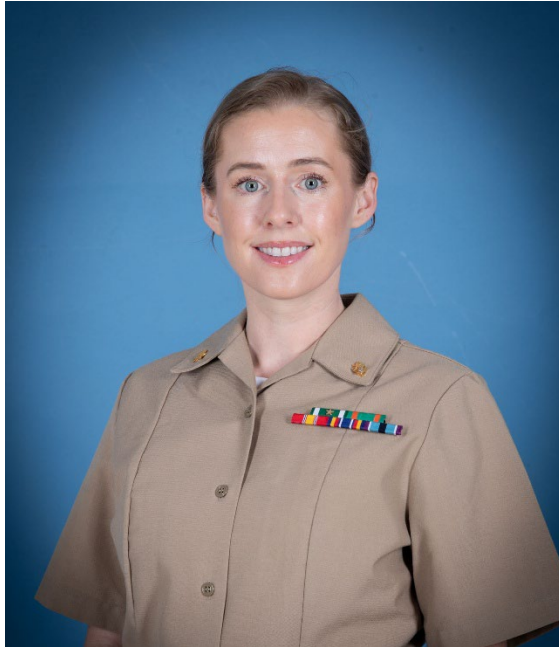


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Born and raised in Alexandria, VA, Mrs. Brannon earned degrees in Biology and Spanish before getting married and relocating to the Caribbean. While there, she helped manage a homeless shelter, served as a federal court interpreter, and taught both high school and university classes. Upon returning to the States, she earned a nursing degree and began serving the very hospital in which she was born. While there she performed duties as a postpartum nurse and a number of other roles. She has been recognized with nurse of the year, Daisy award nurse and the Speck award. From there, Mrs. Brannon went on to become a lactation consultant for now more than ten years and has been working at Walter Reed as such since 2018. She considers it an honor to have assisted the blossoming new families in their personal lactation journeys.



Disclosures



- LCDR Jena Glavy and Monica Brannon have no relevant financial or non-financial relationship(s) relating to the course content or with ineligible companies to disclose.
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Learning Objectives



At the conclusion of this activity, participants will be able to:

1. Review the public health implications of breastfeeding.
2. Describe the anatomy and physiology of lactation.
3. Recognize the role of health care providers in supporting breastfeeding.
4. Apply evidence-based principles to the management of lactating patients.
5. Discuss strategies to protect and support breastfeeding.



Why Does It Matter: The Economics of Breastfeeding



Evolution



- Milk makes us mammals
- Primitive mammary gland dates as far back as 310 million years
- Evolved first for protection or nutrition?
- Lactation favored by natural selection due to:
 1. Immune support
 2. Nutrition and growth
 3. Physical protection of young



(Photo courtesy of LCDR Glavy, 2023)



Recommendations: AAP and WHO



(Photo courtesy of LCDR Glavy, 2025)

- Recommend exclusive breastfeeding for six months
- Continued breastfeeding with complementary foods as long as mutually desired by mother and child for two years or beyond



Risks of Not Breastfeeding

	INFANT				MATERNAL			
SHORT TERM (During infancy / postpartum period)	 Increased infections (respiratory & GI)	 Increased hospital admissions	 Increased risk of NEC	 Increased risk of SIDS	 Increased postpartum bleeding (risk related to decreased oxytocin effect)	 Loss of lactational amenorrhea (earlier return of fertility)	 Possible increased risk of postpartum depression	
LONG TERM (Years to decades)	 Increased risk of obesity	 Increased risk of type 2 diabetes	 Increased risk of asthma	 Increased risk of childhood leukemia	 Increased risk of type 2 diabetes	 Increased risk of hypertension & cardiovascular disease	 Increased risk of breast & ovarian cancer	 Increased all-cause mortality

(Scientific content: Meek and Nobel, 2022. Graphic created with Chat GPT, 2026)



Polling Question 1



More than half of mothers who stop breastfeeding do so earlier than they intended. What do you think most often drives the gap between intention and outcome?

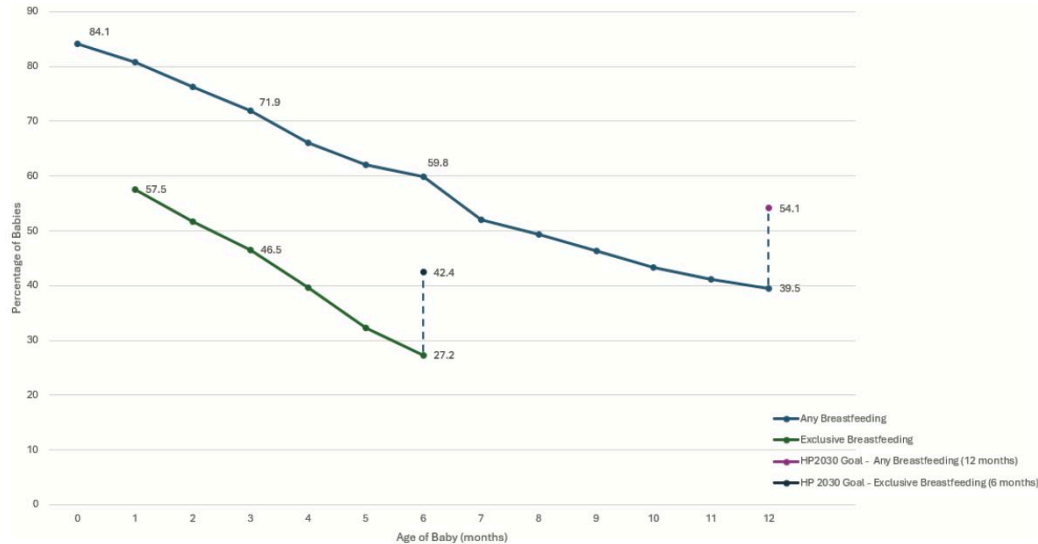
- A. Maternal or infant physiology
- B. Early breastfeeding challenges
- C. Clinical care and healthcare treatment
- D. Social, family, and workplace environments
- E. Changing feeding goals and priorities



Present Day



Breastfeeding in the United States



(National Academies, 2025)

- In 2022, 85.7% of mothers initiate breastfeeding
- 27% exclusively breastfed at six months
- More than half of women who stop, do so earlier than desired



Public Health Concern



- Improving breastfeeding practices has been shown to be one of the best investments a country can make
- Breastfeeding gives children a healthier start to life
- Environmentally friendly, reducing resources used to produce, transport, and market substitutes

US \$1 invested
to promote and support
breastfeeding results in a
US \$35 return

(Oot et al, 2021)



Global Impact



The Cost of Not Breastfeeding Tool

[Print](#) [Exit](#)

Globally, not breastfeeding according to WHO recommendations results in more than US\$507 billion in economic losses each year. [i](#)

More than half of children in the world are not breastfed according to WHO recommendations. The current global breastfeeding rates are 48% for Early Initiation of Breastfeeding (EIBF), 44% Exclusive Breastfeeding 0-5 months (EBF), and 65% Continued Breastfeeding at 12-23 months (CBF).

Not breastfeeding according to the recommendations results in annual global health, human capital and economic costs of approximately:

\$ \$507B total economic cost (0.6% of global income) [i](#)

🏥 \$23.94B in health system costs

🧠 195M IQ points lost

👶 4.6M child obesity cases

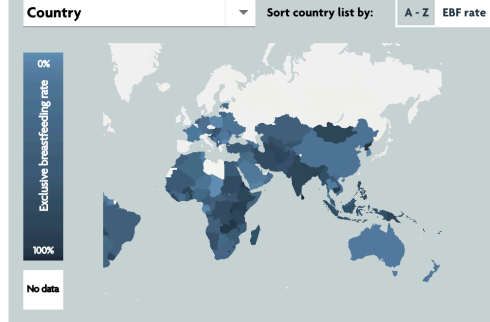
👤 93,863 maternal deaths

👤 424,249 child deaths

However, these costs vary by country and region. The Cost of Not Breastfeeding Tool provides advocates and policymakers with data to inform decision-making and influence investments.

The Cost of Not Breastfeeding Tool was first developed between 2007 and 2019 by Dr. Dylan Walters and Alive & Thrive, with funding from the Bill & Melinda Gates Foundation. In 2022, Nutrition International updated and developed the second version of the tool in partnership with Alive & Thrive and Limestone Analytics, with funding from the Government of Canada.

How to use The Cost of Not Breastfeeding Tool:



For more information or support in using the tool, please contact:

healthecon@nutritionintl.org

Data updated 2022-12-14

Developed in partnership
with



<https://www.aliveandthrive.org/en/the-new-cost-of-not-breastfeeding-tool>



Long Term Benefits



Breastfeeding in infancy and mortality in middle and late adulthood: A prospective cohort study and meta-analysis



Breastfed as a baby



Reduced risks of mortality

All causes: 5%
Cardiovascular diseases: 9%
Respiratory diseases: 6%

- Prospective study in the UK of 383,627 participants aged 40-73
- Meta analysis of four cohort studies
- Breastfeeding associated with lower risk of mortality in middle and late adulthood

(Wang et al, 2023)



Supporting Breastfeeding In the Military

- Military data is limited
 - The majority of active-duty women initiate breastfeeding
 - Duration is highly variable within the literature (13-62% at 6 months)
- Return to work is the most vulnerable point for breastfeeding continuation
- Lactation support enhances recovery, reduces infant infections, and improves long-term maternal health
- **Breastfeeding support → maternal and infant health → fewer disruptions to duty**

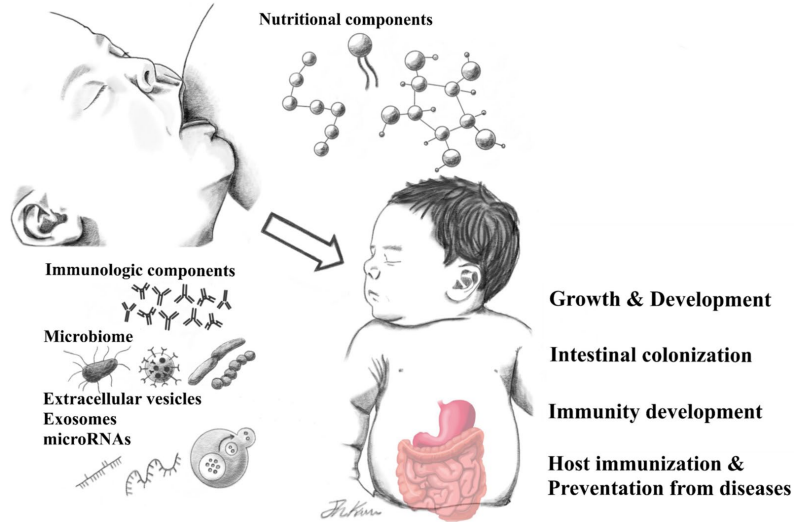
(Owens & DiTomasso, 2024; Delle Donne et al., 2019)



How Does It Work: The Biology Of Breastfeeding



The Roles of Breastmilk



(Yi et al, 2021)

Provides nutrition

Direct immunologic protection

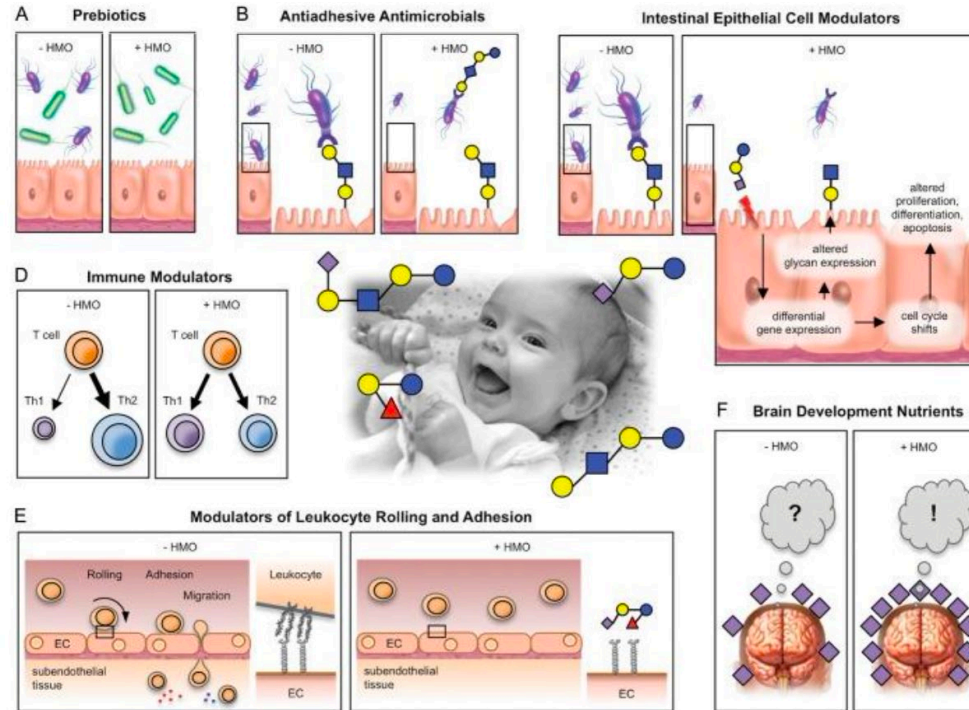
Moderates inflammation

Shapes the gut microbiome

Matures organs



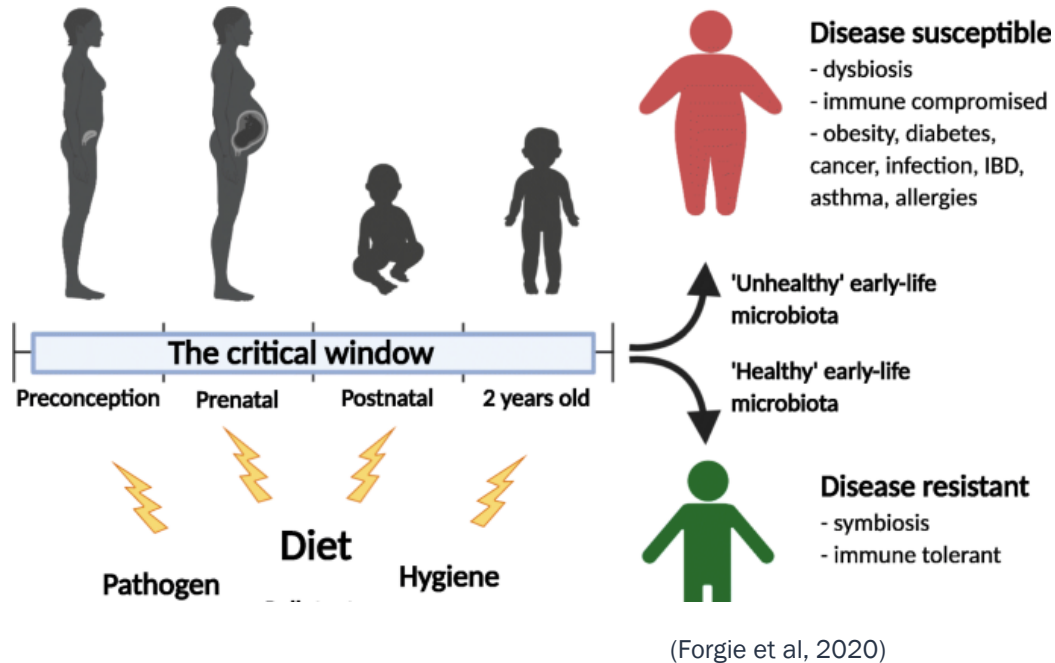
Oligosaccharides



(Quitadamo et al, 2021)



Human Milk Microbiome



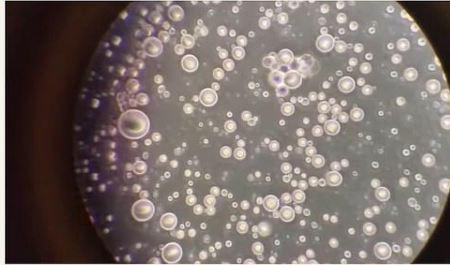
- Gut microbiome differs in breastfed vs formula infants
- Oligosaccharides are the “fertilizer” for beneficial bacteria
- Early-life critical window from conception to ~2 years of age for microbiome maturation



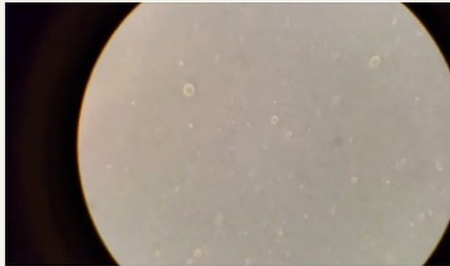
Immune Properties



breastmilk



formula

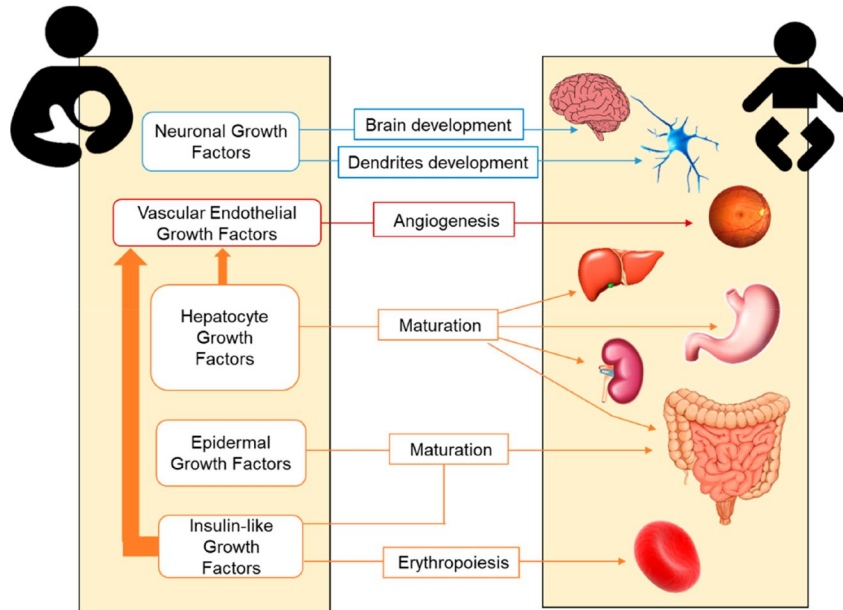


- Shapes the development of the immune system
- 10,000 to 350 million leukocytes from breastmilk daily
- sIgA binds pathogens and prevents an inflammatory response

Image Source: The Daily Mail, 2021



Organ Maturation



(Gila-Díaz et al, 2019)

- Oligosaccharides in breast milk improve retinal and brain maturity
- Human milk exposure in preterm infants has been associated with improved neurodevelopmental outcomes



Lactation Physiology

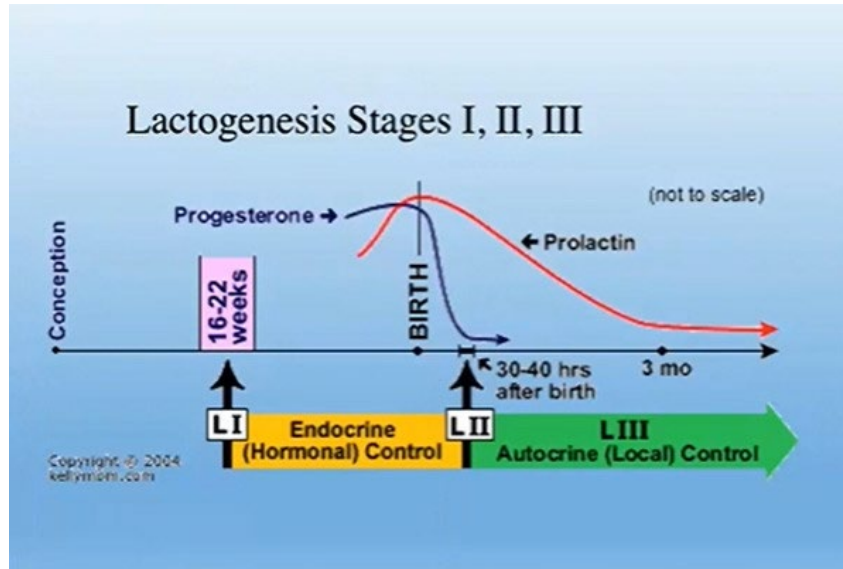
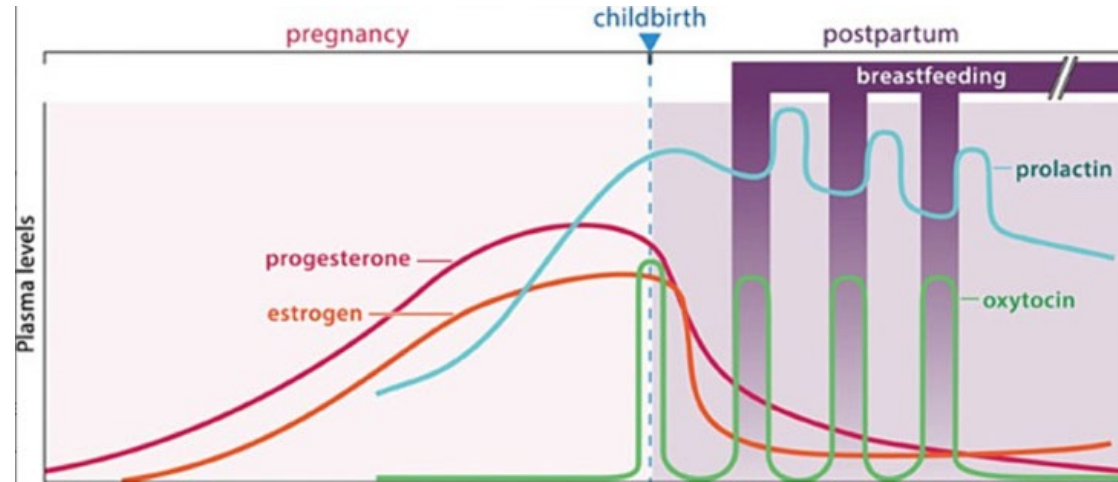


Image Source: KellyMom.com, 2004.

- Lactogenesis I (secretory differentiation)
 - Prenatal onset of milk production
- Lactogenesis II (secretory activation)
 - Onset of copious milk production
 - Rapid decline in progesterone after delivery of placenta necessary
 - Endocrine control
 - Occurs approx. 30 – 72 hrs. postpartum
- Galactopoiesis
 - Ongoing milk production
 - Autocrine control from continued milk removal



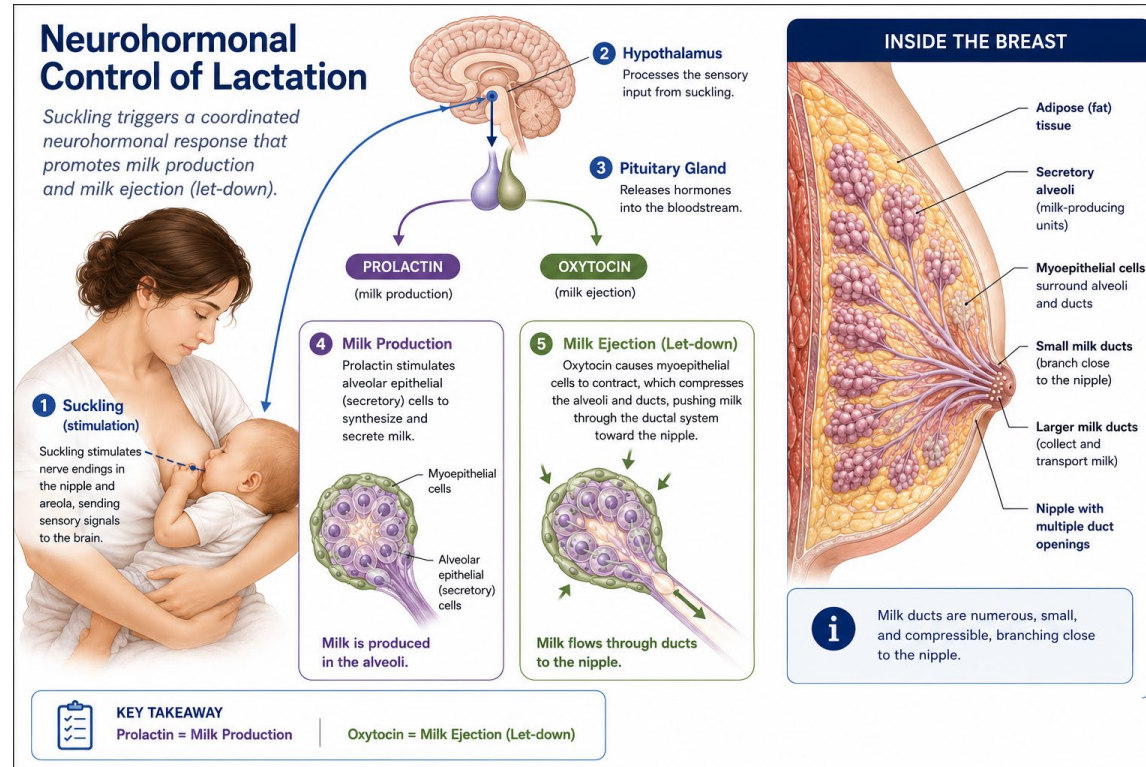
Supply and Demand



- Milk must be removed from the breasts to produce more
- Pressure on lactocytes will downregulate production (previously thought to be feedback inhibitor of lactation (FIL))
- Effective milk removal 8-12 times per 24 hrs. to establish full supply
 - Coincidentally newborns need to be fed at this rate and pattern



THE PERFECT ECOSYSTEM





How Can We Help: The Medicine of Lactation



Polling Question 2



True or False?

Drinking more water increases breast milk production.



Our Greatest Asset: Lactation Consultant's Role (1 of 3)



- Part of a collaborative care team supporting infant well-being and the family's feeding goals
- Provide safe, family-centered care by assessing, planning, implementing, and evaluating feeding plans for the breastfeeding/chest-feeding dyad.
- Provide safe, family-centered care by assessing, planning, implementing, and evaluating feeding plans for the pumping parent
- As an integral member of the health care team, the Lactation Consultant (LC) functions within the scope of practice as defined by the International Board of Lactation Consultant Examiners (IBLCE) as well as follow standards of practice as defined by our professional association, International Lactation Consultant Association



Lactation Consultant's Role (2 of 3)



(Photo courtesy of Monica Brannon, 2023)

- Assess feeding needs immediately postpartum
- Inquire about family's feeding goals
- Assist with positioning and latching
- Maternal comfort
- How do families know baby is adequately nourished
- See patients while admitted to antepartum
- Discuss importance of regular stimulation and removal even though separated
- What does that look like
- Closing the loop of communication and feeding plan with team



Lactation Consultant's Role (3 of 3)



(Photo courtesy of Monica Brannon, 2023)

- Education and Support
- What do the early hours and days look like
- What are expected behaviors
- Breastfeeding is a relationship



Newborn Behaviors



- Immediate Skin to skin
 - Nine Instinctive Phases
 - Completion of first feed
- Sleep & Recovery
 - 12 to 24 hours sleepy
- Frequency of feeds
 - Frequent sometime more than eight times in 24 hours
- How do families know baby is doing well



(Photo courtesy of Monica Brannon, 2021)



Baby-Friendly Designation



(Photo courtesy of Monica Brannon, 2025)



Barriers



(Photo courtesy of Monica Brannon, 2018)

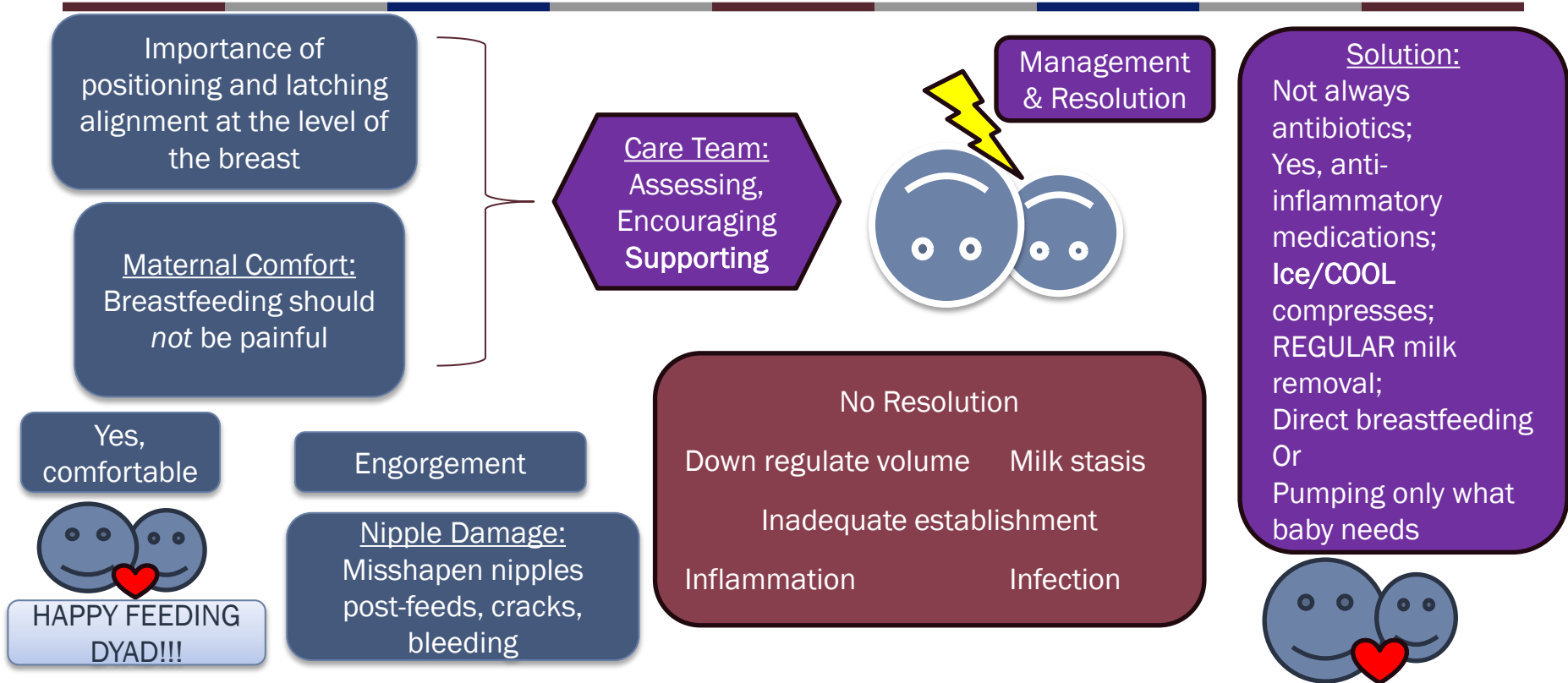


Multifactorial

- Time
- Staffing
- Patient education
- Regular staff education
- Provider support



Spectrum of Milk Production and Establishment





What Can You Do?



(Photo courtesy of Monica Brannon, 2023)

- Better understand what expected newborn behaviors are
- What do the first weeks look like
- Who and where are your community resources
- Support, what you say has tremendous impact on your patients



Common Problems – Is my Baby getting enough?

Signs	What to look for.....
1. Weight loss	< 10%
2. Birth Weight	Achieved by 2 weeks of age
3. Daily Weight Gain	28 g / 1 oz
4. Swallows	Audible and visible suck and swallow with a pause
5. Voids	One per each day of life ≥5-6 per day once mom's milk is in
6. Stools	One per each day of life ≥3 by DOL 3 Yellow and seedy by DOL 4
7. Mom's breasts	Full before feeds, softer after

- Milk typically “comes in” in 2-4 days
- Feed on demand – follow hunger cues (rooting, hands to mouth, turning head side to side)
- Normal milk production is 1-1.25 oz per hour (24 – 30 oz per day)
- Full milk supply not established until approx. 6 weeks



Common Problems – Nipple Pain



- Usually due to poor latch
 - Important to assess
- Almost never yeast
- Nipple cream (lanolin) can cause dermatitis
- Nipple cracks and fissures – moist, closed wound healing (hydrogel patch + balm)
- Larger craters may require absorptive filler material (e.g. PolyMem)



(Image Source: Lactation Lab, n.d.)



Common problems - mastitis

- Spectrum of conditions
 - “Plugged duct” = focal area of induration
 - Inflammatory mastitis = erythematous, edematous, painful region of breast
 - Bacterial mastitis = cellulitis with worsening or systemic symptoms
- Treatment
 - Feed on demand / physiologically → do not pump to empty
 - DO NOT MASSAGE
 - Cold compresses +/- NSAIDs
 - If fever or no improvement in 24 hrs.: antibiotics (dicloxacillin 500 mg QID)

ABM PROTOCOL

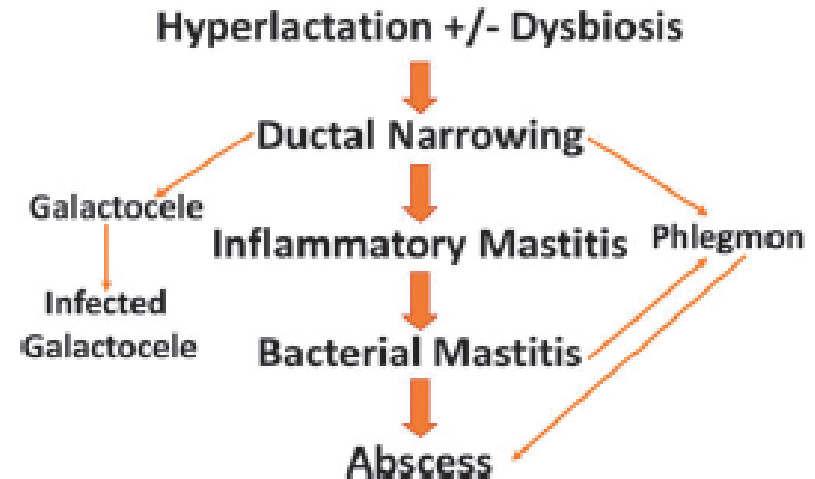


FIG. 1. Spectrum of inflammatory conditions in the lactating breast.

(Mitchell et al, 2022)



Inpatient Care



Medications During Lactation

Most medications are safe during lactation. Therefore, it is unlikely that a lactating parent needs to 'pump and dump' or to wean for treatment of medical problems. The most common form of treatment that likely requires weaning is cancer chemotherapy.

Below are several free, web-based resources on using medications during lactation:

Resource name	What is it?	How do I contact them?
LactMed	The US National Institute of Health Drugs & Lactation Database	https://www.ncbi.nlm.nih.gov/books/NBK501922/
Dr. Thomas Hale's Infant Risk Center Physician hotline	A research center for medication safety during pregnancy and lactation	(806) 352-2519 No answering machine. If busy or no answer, you will need to call back. Only open during regular business hours. You may also explore their Infant Risk website for info: www.infantrisk.com

Image Source: IABLE

- Support lactation
 - If postpartum mother is admitted, provide breast pump and/or allow nursing
- Most medications are safe in breastfeeding – “pump and dump” almost never indicated
 - Few ex: chemotherapy, radioactive iodine, illicit drugs
- Do not withhold imaging/treatment from lactating patients

- Principles of a “good” drug → less transfer into breast milk
 - Low maternal oral bioavailability
 - Shorter medication half life
 - High molecular weight (> 800 daltons does not diffuse)
 - High protein binding (if > 90%, milk levels low)
 - Not lipid soluble (lipophilic meds have higher milk levels)
- Consider effects on supply
 - Antipsychotics
 - Antihistamines
 - Estrogen containing contraception
 - Pseudoephedrine

Anesthesia & Breastfeeding:

More Often Than Not, They Are Compatible

In this issue, Lee *et al.*² randomized laboring patients to different concentrations of epidural fentanyl. There was no difference in successful breastfeeding outcomes at 6 weeks.

Breastfeeding is important to infant health. Receiving anesthesia should not affect mom's ability to breastfeed, or the safety of her breastmilk.¹⁻⁴

The central graphic is a large baby bottle filled with white liquid, topped with a yellow nipple. The bottle has several horizontal labels indicating categories of drugs. To the left and right of the bottle are smaller boxes listing specific drugs and their compatibility status with breastfeeding. The compatibility status is indicated by color-coded backgrounds: blue for 'PROCEED', orange for 'Monitor closely', red for 'AVOID', and light green for 'No Data'.

Drug	Status
Midazolam	PROCEED
Fentanyl (single dose IV)	PROCEED
Morphine	Monitor closely
Hydromorphone	Monitor closely
Meperidine	AVOID
Ondansetron	PROCEED
Dexamethasone	PROCEED
Metoclopramide	PROCEED
Propofol	PROCEED
Etomidate	PROCEED
Ketamine	No Data
Volatile anesthetics	PROCEED
Succinylcholine	PROCEED
NMBAs	PROCEED
Neostigmine/glycopyrrolate	PROCEED
Lidocaine	PROCEED
Bupivacaine	PROCEED

Perioperative Administration

- Benzodiazepines**
- Hypnotics**
- Opioids**
- Paralytics**
- Reversal**
- Antiemetics**
- Local anesthetics**

"A general principal is that a mother can resume breastfeeding once she is awake, stable, and alert after anesthesia has been given."²



Imaging



ABM PROTOCOL

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TABLE 1. COMMON NUCLEAR MEDICINE IMAGING AGENTS AND RECOMMENDATIONS FOR BREASTFEEDING

Imaging agent	Breastfeeding interruption
Noncontrast radiographs	No
Nonvascular administration of iodinated contrast	No
CT with iodinated intravenous contrast	No
MRI with gadolinium-based intravenous contrast	No
Nuclear medicine imaging	No
PET	No
Bone scan	No
Thyroid imaging	Cessation for this infant
I-131	Recommendations vary, up to 3 weeks
I-123	Up to 24 hours, depending on dose
Tc-99m pertechnetate	
Renal imaging	
Tc-99m DTPA	No ^a
Tc-99m MAG3	No ^a
Tc-99m DMSA	No ^a
Tc-99m glucoheptonate	No ^a
Cardiac imaging	
Tc-99m Sestamibi	No ^a
Tc-99m Tetrofosmin	No ^a
MUGA	
Tc-99m RBCs in vitro	No ^a
Tc-99m RBCs in vivo	Up to 12 hours, depending on dose
VQ scan	
Tc-99m MAA	12 hours
Breast imaging	
Screening or diagnostic mammography	No
Ultrasound	No
MRI with gadolinium-based intravenous contrast	No

^aThe International Atomic Energy Administration recommends withholding breastfeeding for 4 hours or one feeding to account for any external radiation and free Tc-99m pertechnetate in the product.

CT, computed tomography; MRI, magnetic resonance imaging; MUGA, multigated acquisition scan; Tc-99m MAA, technetium-99m macroaggregated albumin; PET, positron emission tomography; Tc-99m MAG3, technetium-99m mercaptate; Tc-99m DMSA, technetium-99m succimer; VQ, ventilation-perfusion.

(Mitchell et al., 2019)

- Academy of Breastfeeding Medicine (ABM) Clinical Protocol # 31
- Common radiologic studies are safe to continue breastfeeding
- Nuclear medicine studies may require interruption based on the radiopharmaceutical used



Who Should Not Breastfeed

 DO NOT BREASTFEED	 TEMPORARILY HOLD ALL BREAST MILK	 HOLD DIRECT BREASTFEEDING (EXPRESSED MILK MAY BE GIVEN)
 Infant has classic galactosemia (i.e., not Duarte variant)  Mother has HIV infection and: - Is not on ART - OR - Is on ART but does not have sustained viral suppression with confirmed undetectable viral load  Mother is infected with HTLV-I or HTLV-II  Mother is using illicit drugs (e.g., phencyclidine or cocaine)  Mother has suspected or confirmed Ebola virus disease	 Mother has untreated brucellosis  Mother is taking certain medications  Mother has an active HSV infection, with lesions present on the breast  Mother has monkeypox virus infection	 Mother has untreated active tuberculosis  Mother has active varicella that developed between 5 days prior to delivery and 2 days following delivery
 No direct breastfeeding or expressed breast milk	 Pump to maintain supply. Discard milk until it is safe to feed the infant.	 Expressed breast milk may be given to the infant.
 Clinical circumstances and exceptions apply. Consult current CDC guidance for full details.		
Source: Centers for Disease Control and Prevention (CDC). Contraindications to Breastfeeding. Last updated March 2024.		
 		



Support The Lactating Dyad



- Consider lactating status and goals in clinical decision making
- Protect physiology and avoid interruptions of breastfeeding
- Identify and treat lactation complications early
- Use evidence-based resources and lactation consultant expertise
- Recognize that supporting lactation supports the health of the mother-infant dyad



One Last Plug



Trash the pump and dump!





Resources That Make Us Better

- IABLE: [IABLE – The Institute for Breastfeeding and Lactation Education](#)
- Academy of Breastfeeding Medicine: <https://www.bfmed.org/>
- Physician's Guide to Breastfeeding: [Physician Guide to Breastfeeding for Parents, Physicians, Lactation Consultants, Doulas](#)
- AAP Breastfeeding: <https://www.aap.org/en/patient-care/breastfeeding/>
- LactMed (NIH): [Drugs and Lactation Database \(LactMed®\) - NCBI Bookshelf](#)
- Infant Risk: <https://www.infantrisk.com/>



Key Takeaways



- **Economics – Why does it matter?**

Breastfeeding has implications beyond the individual dyad, affecting maternal and infant health, healthcare utilization, and population health.

- **Biology – How does it work?**

Lactation is a dynamic physiologic relationship between mother and infant that continually adapts to promote growth and development.

- **Medicine – How can we help?**

Breastfeeding is a part of comprehensive care, and clinician knowledge and support is essential to protecting the mother-infant dyad.



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Questions?