CDC PUBLIC HEALTH GRAND ROUNDS

Maternal, Infant and Early Childhood Nutrition — The Thousand Day Window of Opportunity

June 18, 2019

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Nutrition in the First 1,000 Days: Laying the Foundation for Health and Development

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Division of Nutrition, Physical Activity and Obesity

National Center for Chronic Disease Prevention and Health Promotion, CDC

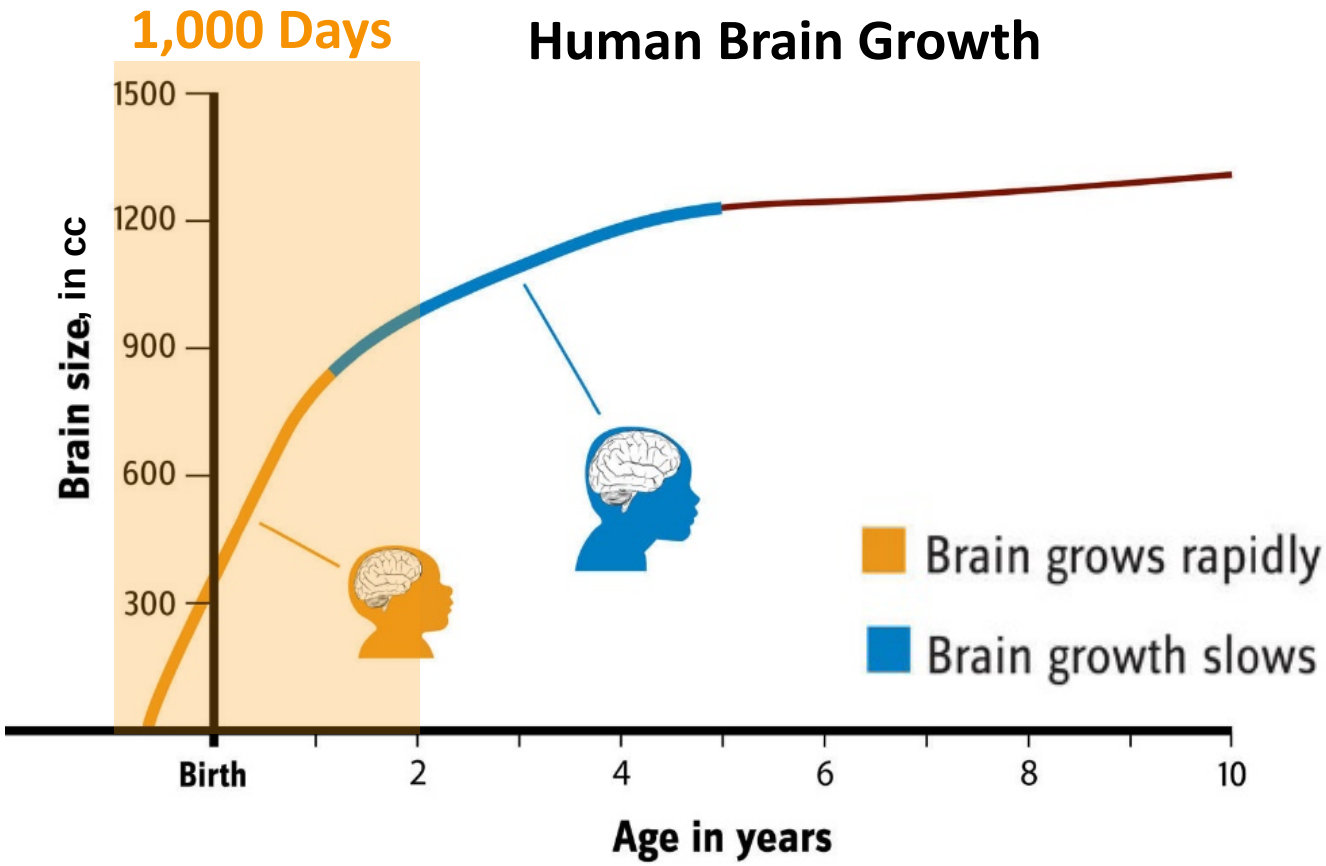
What Are the First 1,000 Days?

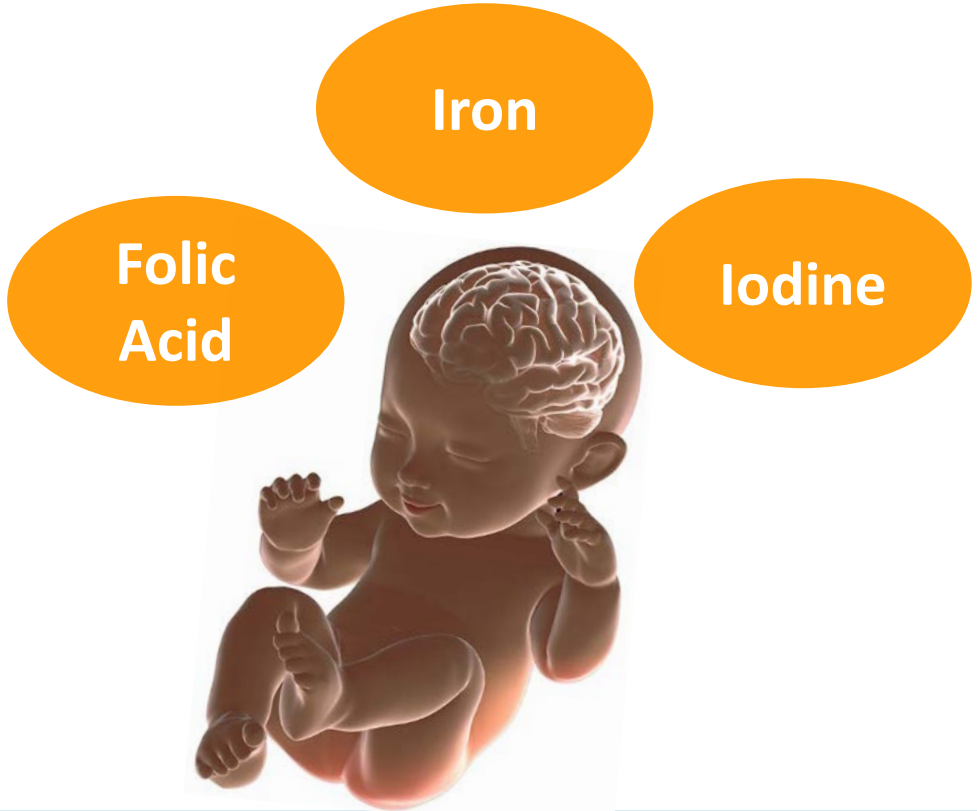
Pregnancy | **First Year** | **Second Year**

270 days + 365 days + 365 days = 1,000 days

- **1,000 days optimum nutrition essential for:**
  - Maternal health and child survival
  - Growth and neurodevelopment
  - Foundation of health

Nearly 80% of Brain Development Happens During the First 1,000 Days





humanorigins.si.edu/human-characteristics/brains

Image courtesy of Karen Carr Studios

Iron and Iodine Are Essential for Maternal Health and Child Growth and Brain Development

- **Iron**
  - Iron deficiency is a common cause of anemia (i.e., low levels of hemoglobin)
  - Key determinant of neural development
  - Iron preferentially used for hemoglobin
- **Iodine**
  - Required for synthesis of thyroid hormones, drivers of metabolism
- **Iron or iodine deficiency associated with:**
  - Poor birth outcomes and physical growth
  - Impaired cognitive and motor development
  - Poorer quantitative and language abilities

Recommended Daily Allowance

IRON

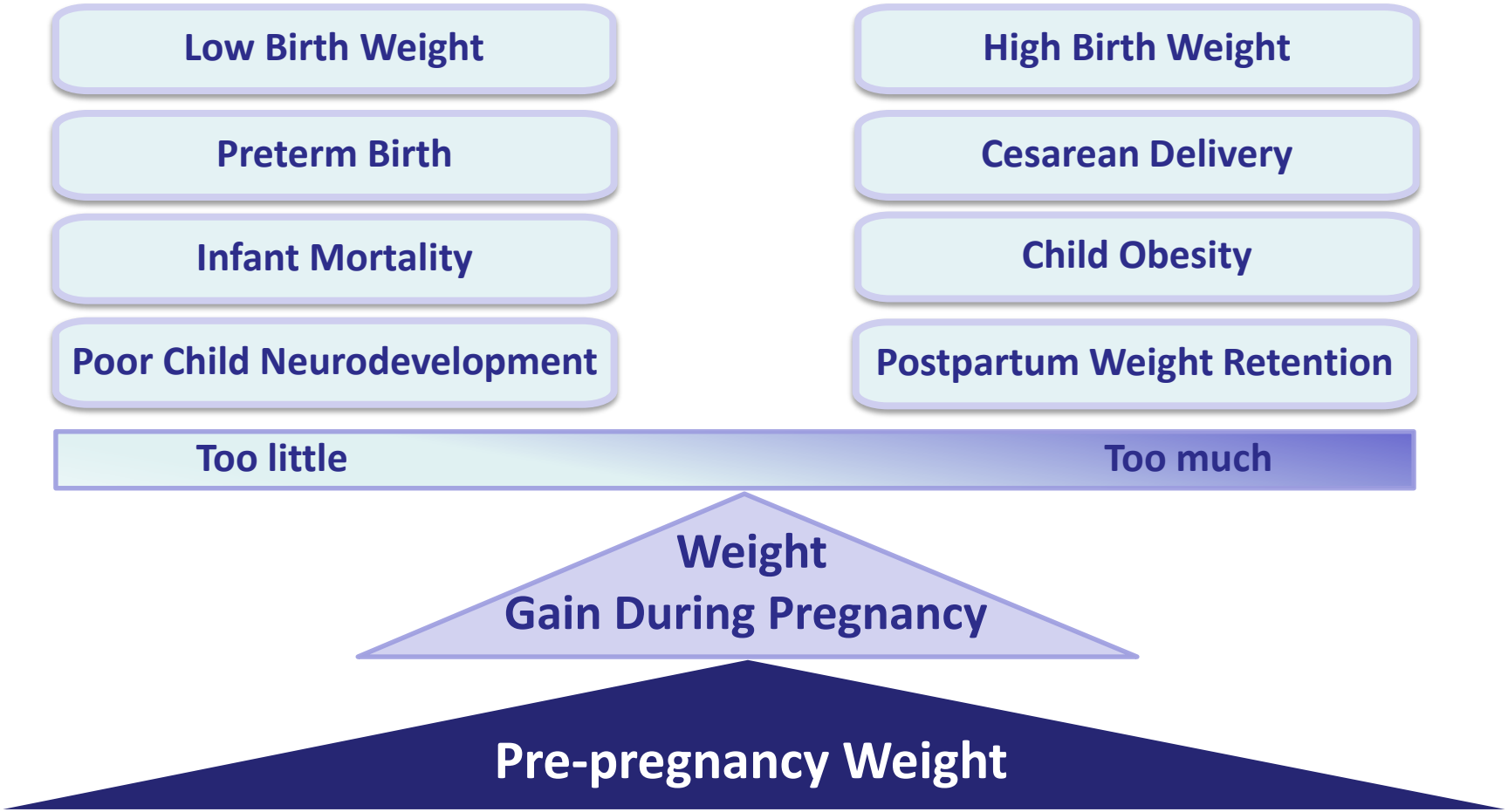
Adult women	18 mg
Pregnancy	**27 mg**

IODINE

Adult women	150 mcg
Pregnancy	**220 mcg**
Lactation	**290 mcg**

Pregnancy and Health Outcomes Are Affected by Weight Prior To and During Pregnancy

Pregnancy and Health Outcomes Associated with Weight Gain During Pregnancy



Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. National Academies Press; 2009

Healthy Weight Gain, Diet Quality and Quantity, and Prenatal Vitamins Are Important

- **Optimal maternal nutrition requires**
  - Healthy weight gain
  - Diet quality and quantity
  - Prenatal vitamins

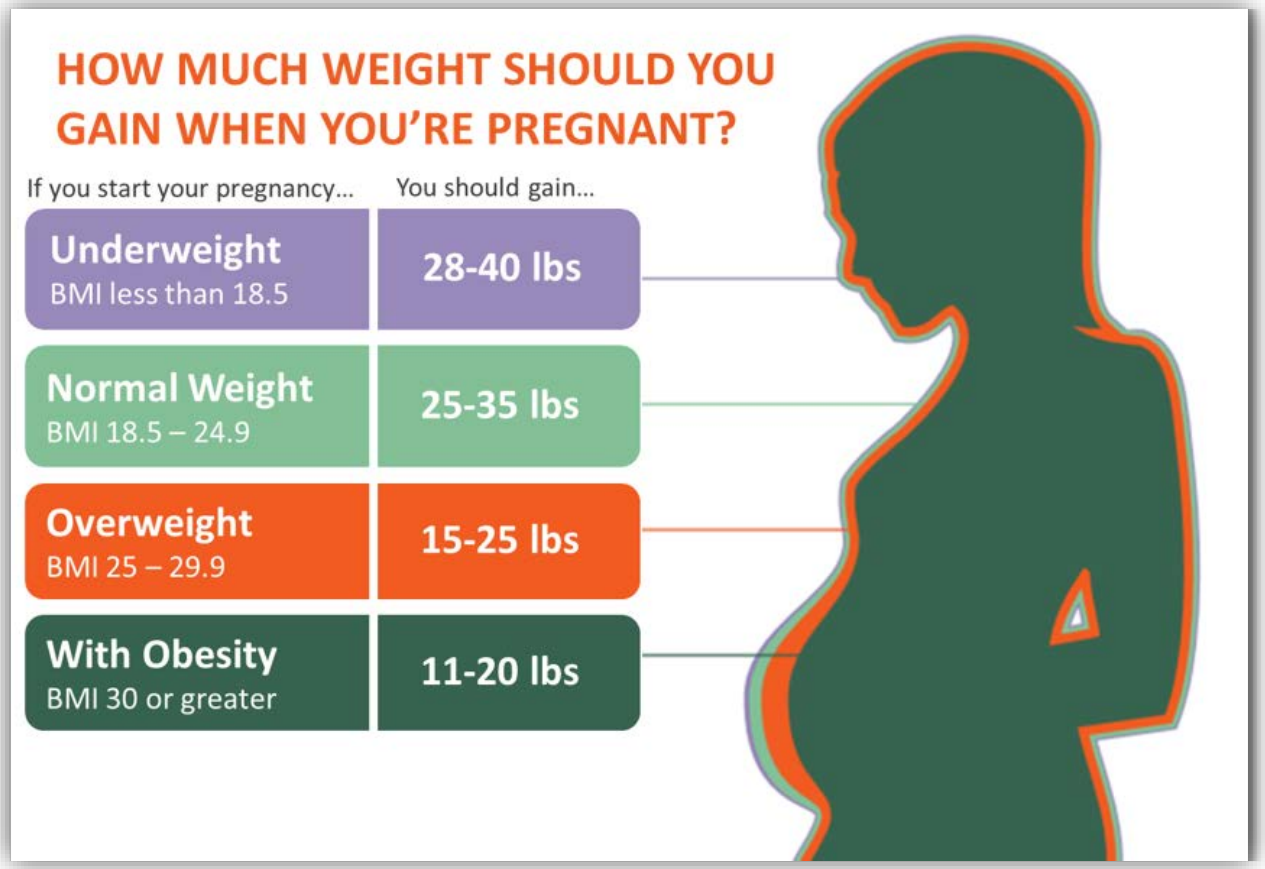


Image adapted from: Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. National Academies Press; 2009

Breastfeeding Is the Best Source of Nutrition for Most Infants

Breastfeeding reduces health risks and lowers medical costs

Baby

Ear and respiratory infections

Gastrointestinal infections

Sudden infant death syndrome (SIDS)

Asthma

Obesity

Mother

High blood pressure

Type 2 diabetes

Breast cancer

Ovarian cancer

WHO and AAP recommend that babies are fed only breast milk for about 6 months and as complementary foods are introduced, continue breastfeeding to at least age 1 year (AAP) or 2 years (WHO).

American Academy of Pediatrics (AAP, 2012) *Pediatrics*, 129(3), e827–e841

www.who.int/nutrition/publications/infantfeeding/9241562218

Bartick MC, Schwarz EB, Green BD, et al. *Mat Child Nut 2016*

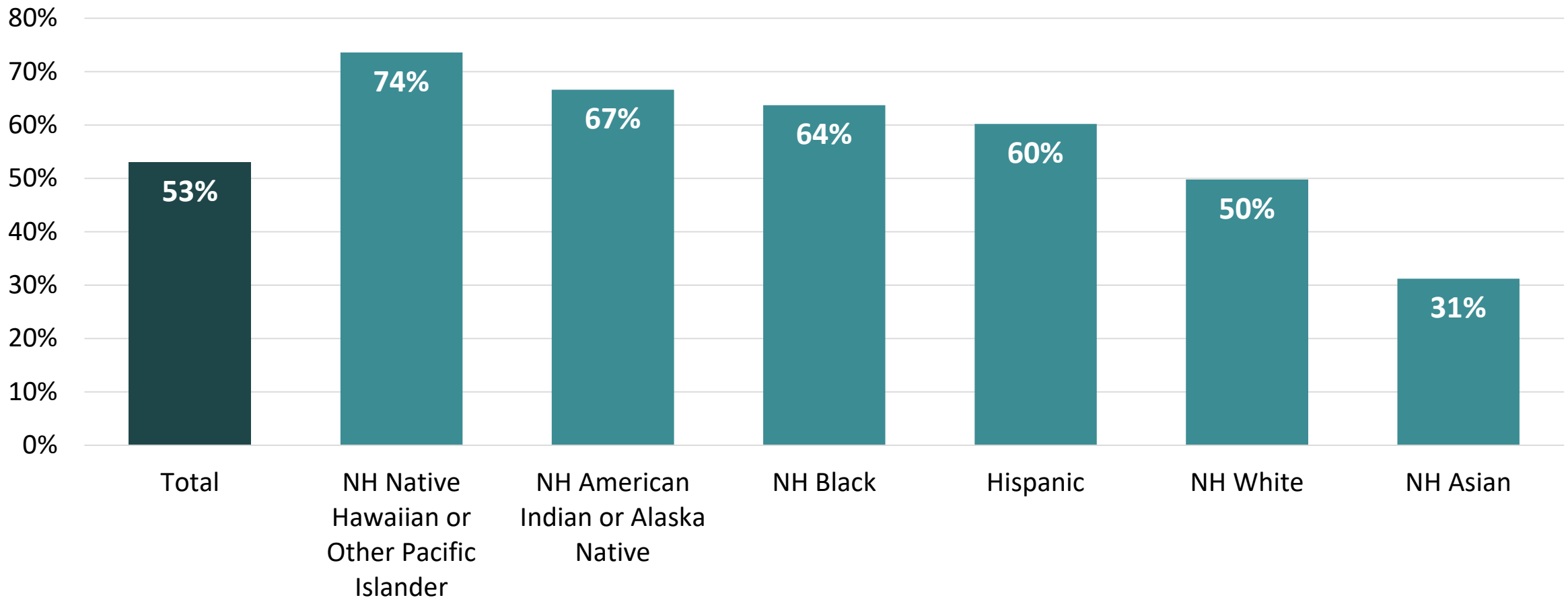
Diet Patterns Established in Infancy and Early Childhood Set Foundation for Healthy Eating Habits

- **At about 6 months of age, begin nutrient-rich complementary foods**
- **Taste, texture, and variety of foods are important**
- **Iron-rich foods essential to prevent iron deficiency**
- **Nutrient requirements high in young children**
  - Little room for high-calorie, non-nutrient dense foods

Pediatric Nutrition Handbook. 7th ed. Kleinman RE, and Greer, F. Elk Grove, Village, IL: American Academy of Pediatrics; 2014: chapter 6

Most U.S. Women Start Pregnancy Above A Healthy Weight (BMI ≥25)

Percent of Prepregnancy Overweight and Obesity by Race and Ethnicity, U.S., 2017



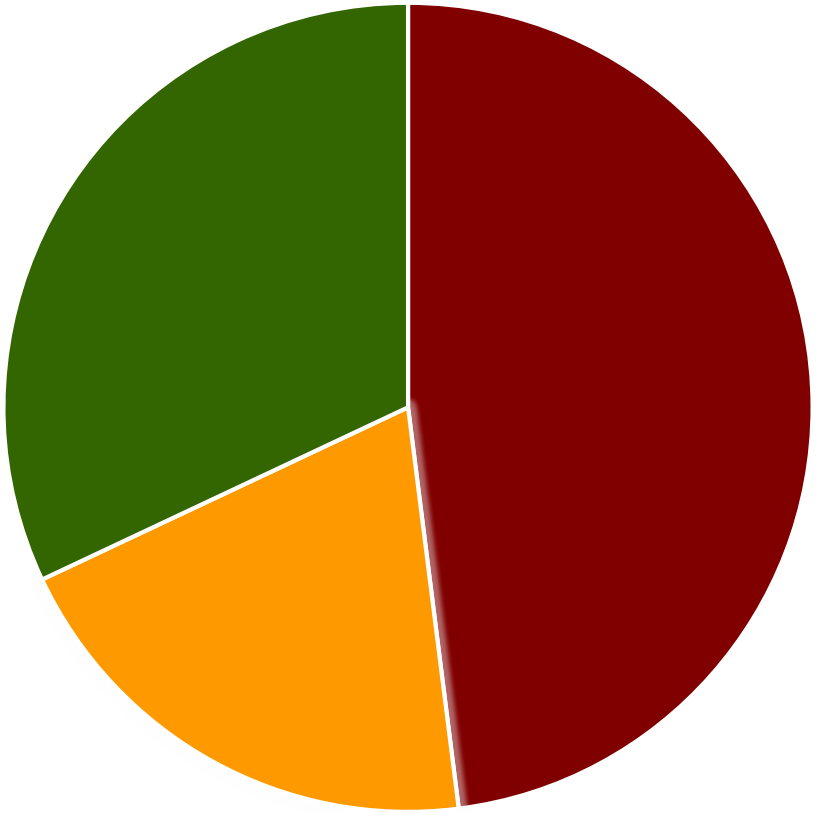
NH: Non-Hispanic

CDC National Vital Statistics Reports: Births 2017

Nearly Half U.S. Women Gain Weight Above Recommendations During Pregnancy

All Women with Full-term Singleton Births, 2015

Weight gain within recommendations 32%



Weight gain above recommendations 48%

Weight gain below recommendations 20%

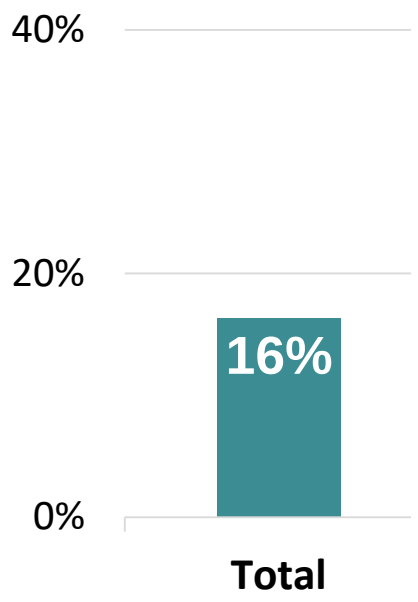
Weight gain above recommendations highest among women with prepregnancy overweight (61%) or obesity (55%)

CDC National Vital Statistics Reports: Births 2015. www.cdc.gov/mmwr/volumes/65/wr/mm6540a10.htm

1 in 6 U.S. Women is Iron Deficient During Pregnancy

Prevalence of Iron Deficiency among U.S. Pregnant Women

National Health and Nutrition Examination Survey, 1999–2010

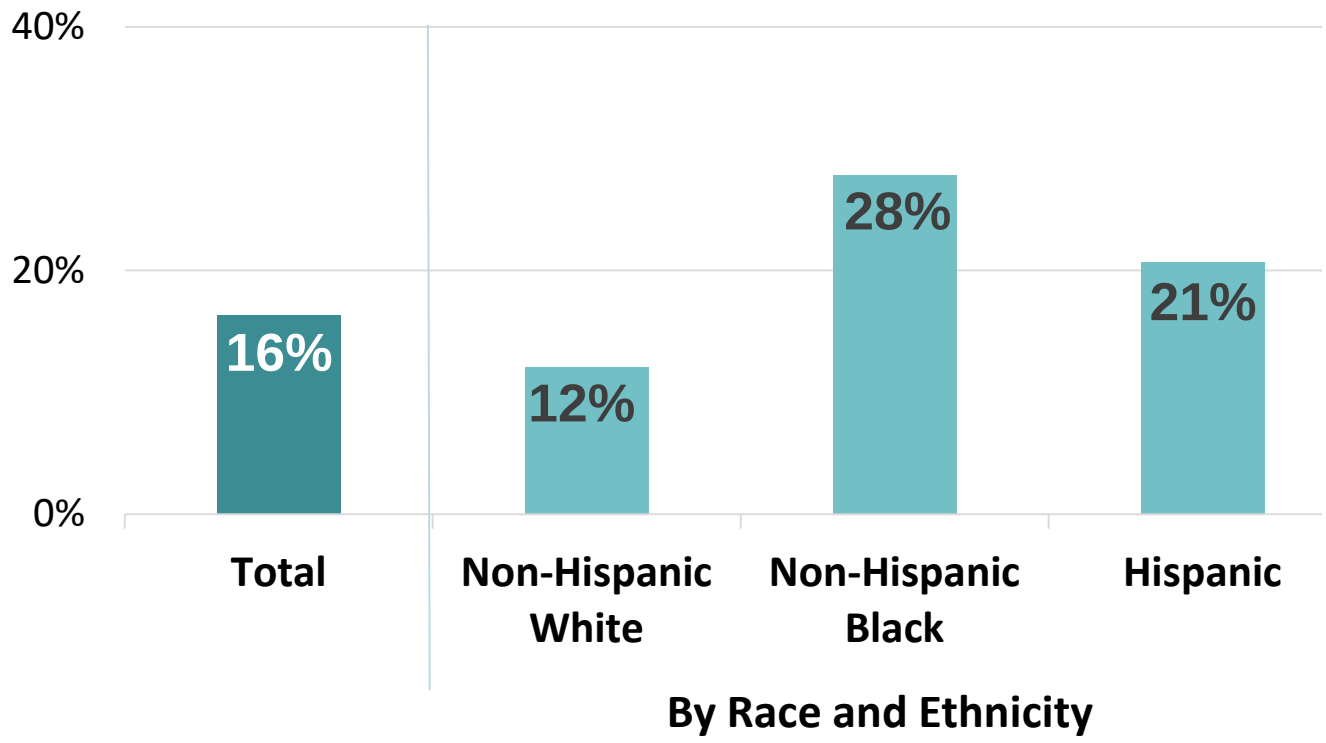


Gupta PM, Hamner HC, Suchdev PS, et al. *Am J Clin Nutr.* 2017 Dec;106(Suppl 6):1640S–1646S

During Pregnancy, Iron Deficiency Varies among Racial/Ethnic Groups in the U.S.

Prevalence of Iron Deficiency among U.S. Pregnant Women

National Health and Nutrition Examination Survey, 1999–2010

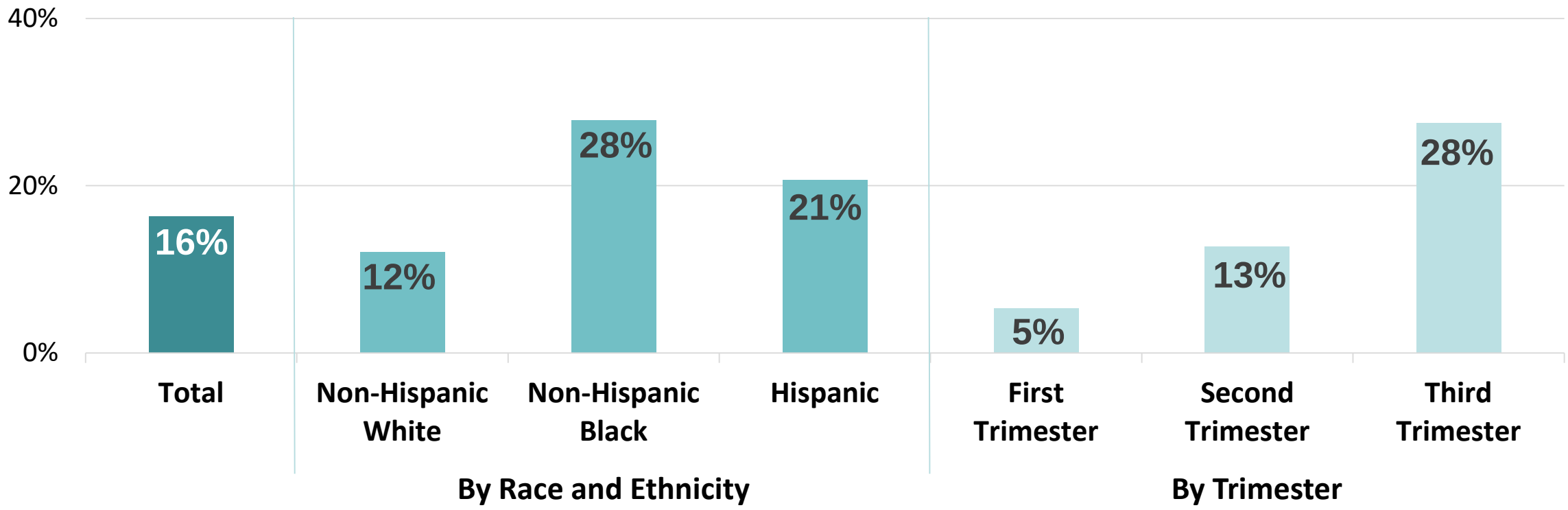


Gupta PM, Hamner HC, Suchdev PS, et al. *Am J Clin Nutr.* 2017 Dec;106(Suppl 6):1640S–1646S

Iron Deficiency Is Highest Late In Pregnancy

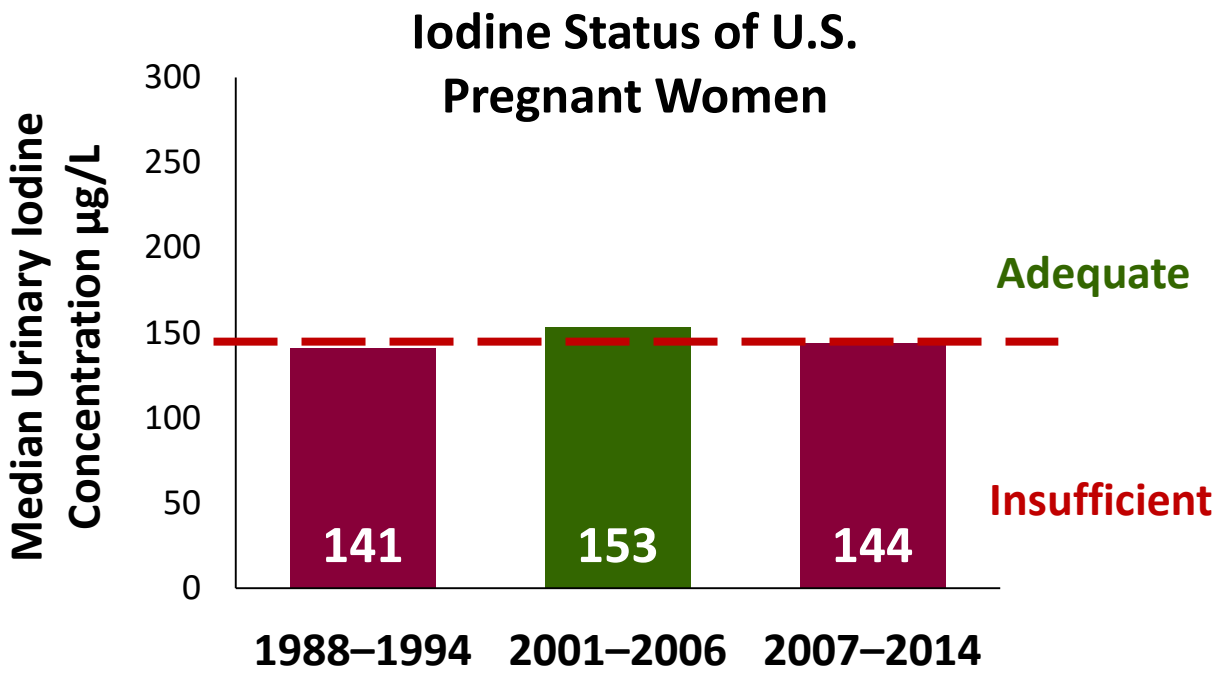
Prevalence of Iron Deficiency among U.S. Pregnant Women

National Health and Nutrition Examination Survey, 1999–2010

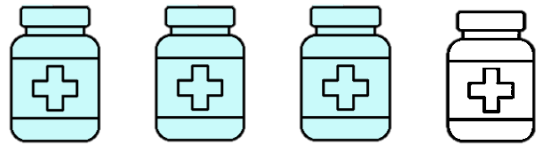


Gupta PM, Hamner HC, Suchdev PS, et al. *Am J Clin Nutr.* 2017 Dec;106(Suppl 6):1640S–1646S

Less Than 1 in 5 U.S. Women Take a Prenatal Vitamin Containing Iodine During Pregnancy



72% of pregnant women **took a dietary supplement** in past 30 days



18% of pregnant women took a dietary supplement in past 30 days **that contained iodine**

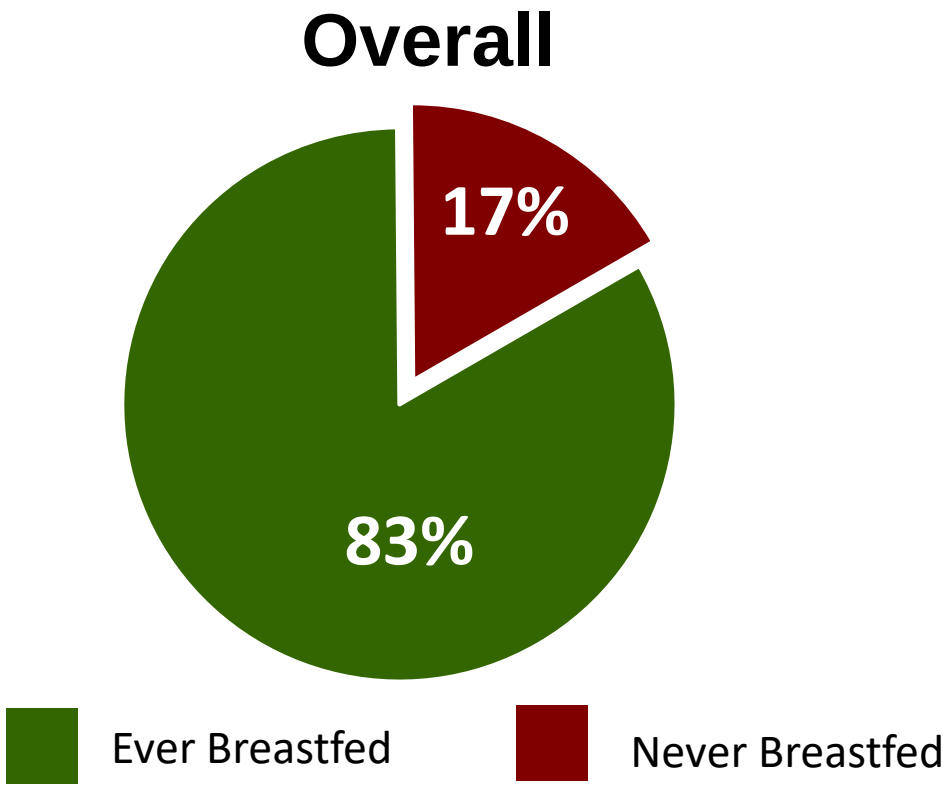
nhanes The Nation's Mobile Health Survey 2011–2014

Perrine CG, Herrick KA, Gupta PM, et al. *Thyroid* 2019 Jan;29(1):153–154

Gupta PM, Gahche JJ, Herrick KA, et al. *Nutrients* 2018 Mar 29;10(4). pii: E422 – m

We Have Made Progress, but Disparities Remain

Percentage of U.S. Infants Breastfed by Race and Ethnicity, 2015

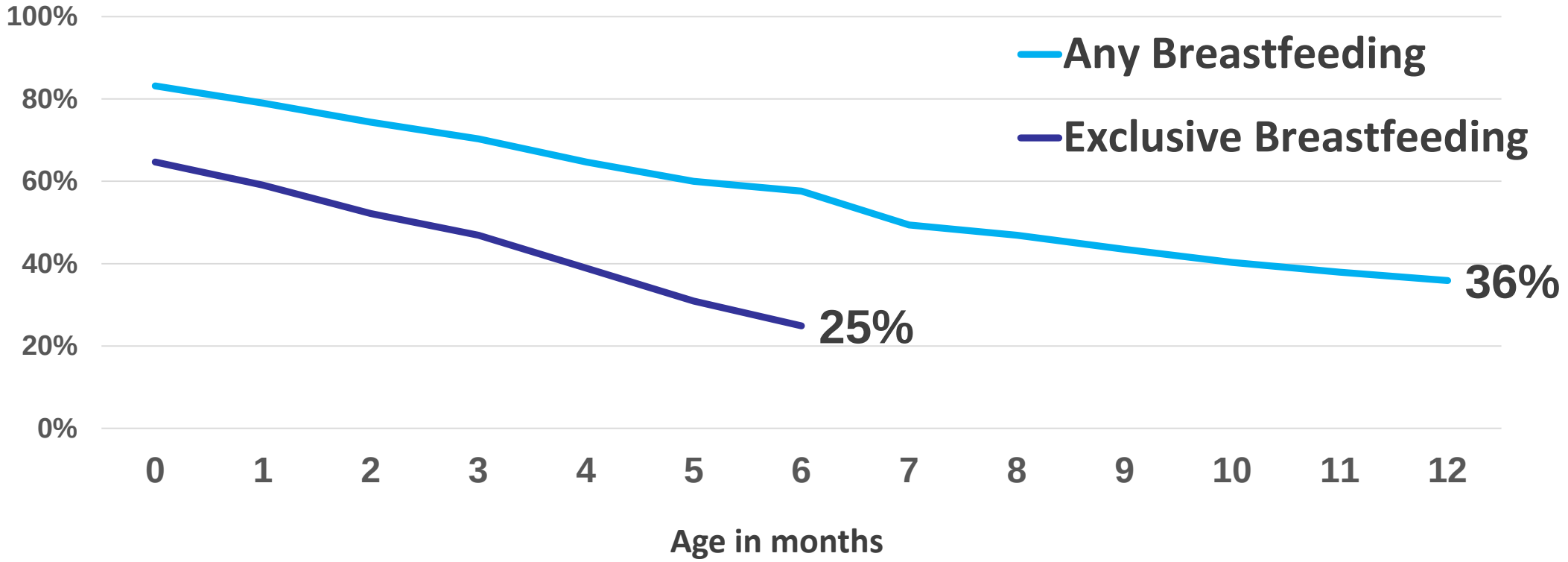


Race and Ethnicity	Percent Never Breastfed
NH Black	31%
NH Hispanic	15%
NH White	14%

2015 Births: National Immunization Survey. www.cdc.gov/nccdphp/dnpao/data-trends-maps

Breastfeeding Rates Remain Low in the U.S.

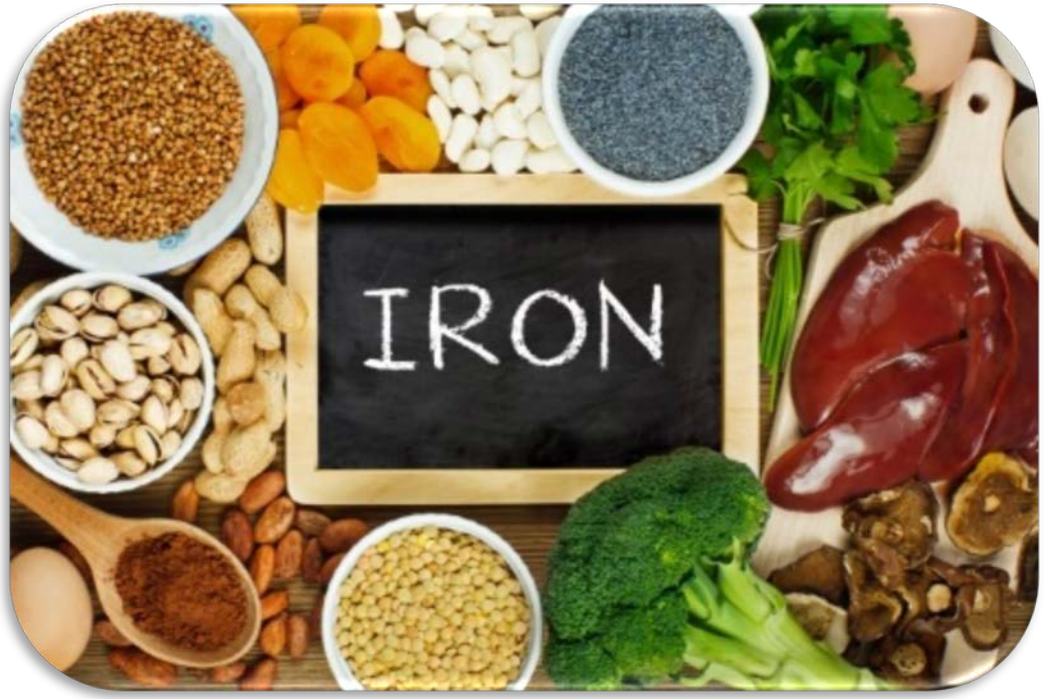
Percentage of U.S. Infants Breastfed Exclusively Through 6 Months or Breastfeeding at Age 12 Months, 2015



2015 Births: National Immunization Survey. www.cdc.gov/breastfeeding/data/nis_data/results

American Academy of Pediatrics (AAP, 2012). *Pediatrics*, 129(3), e827–e841

Iron Is Important for Healthy Development



Among U.S. children 12-23 months of age…

1 in 4 do not consume the recommended dietary allowance for iron.

15% of children have iron deficiency

Hamner HC, Perrine CG, Scanlon KS. *Nutrients* 2016 Jul 30;8(8). pii: E468

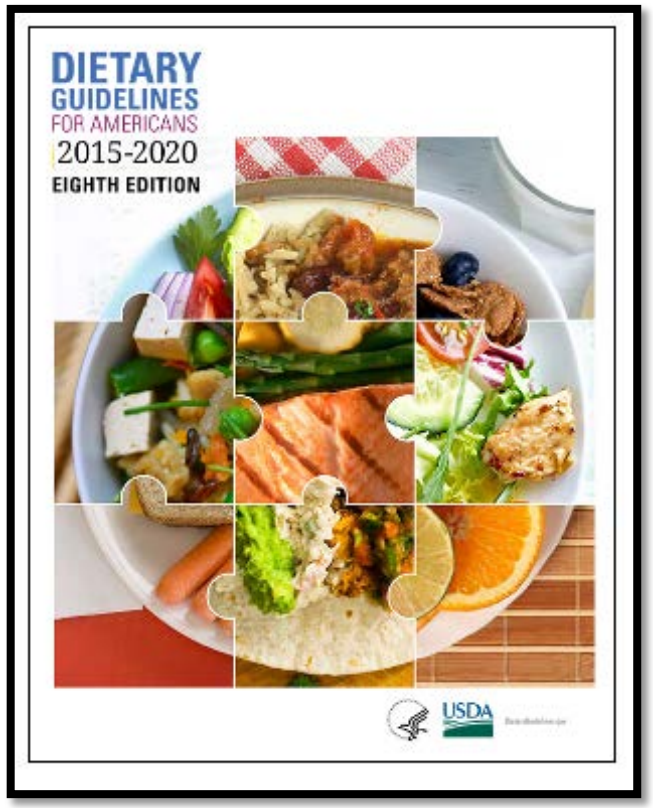
Gupta PM, Hamner HC, Suchdev PS, et al. *Am J Clin Nutr* 2017 Dec;106(Suppl 6):1640S–1646S

Early Nutrition Affects Growth

- **On a given day, among children aged 12–23 months:**
  - Fewer than half have eaten a vegetable
  - 1 in 3 drink a sugar-sweetened beverage
- **By 2–5 years of age, 14% of U.S. children have obesity**
- **Nearly 1 in 5 children under 6 years of age lives in food-insecure households**
  - Being without reliable access to a sufficient quantity of affordable, nutritious food

Hamner HC, Perrine CG, Gupta PM, et al. *Nutrients* 2017 Aug 26;9(9). pii: E942
Hales CM, Carroll MD, Fryar CD, et al. *NCHS data brief,* no 288. 2017
Coleman-Jensen A, Rabbitt MP, Gregory C, et al. *USDA Economic Research Service* 2016

Opportunities to Improve Nutrition in the First 1,000 Days



- **Establish dietary guidelines for pregnant women and children under age 2**
  - U.S. Departments of Agriculture and Health and Human Services working on the 2020–2025 edition of the Dietary Guidelines for Americans
  - To be released in 2020
- **Improve research and surveillance**
  - Fill data gaps on nutrient intake and deficiencies
  - Limited data by state, trimester, and high-risk groups

Conception to Birth: Maximizing Maternal & Fetal Nutritional Status

Michelle A. Kominiarek, MD, MS

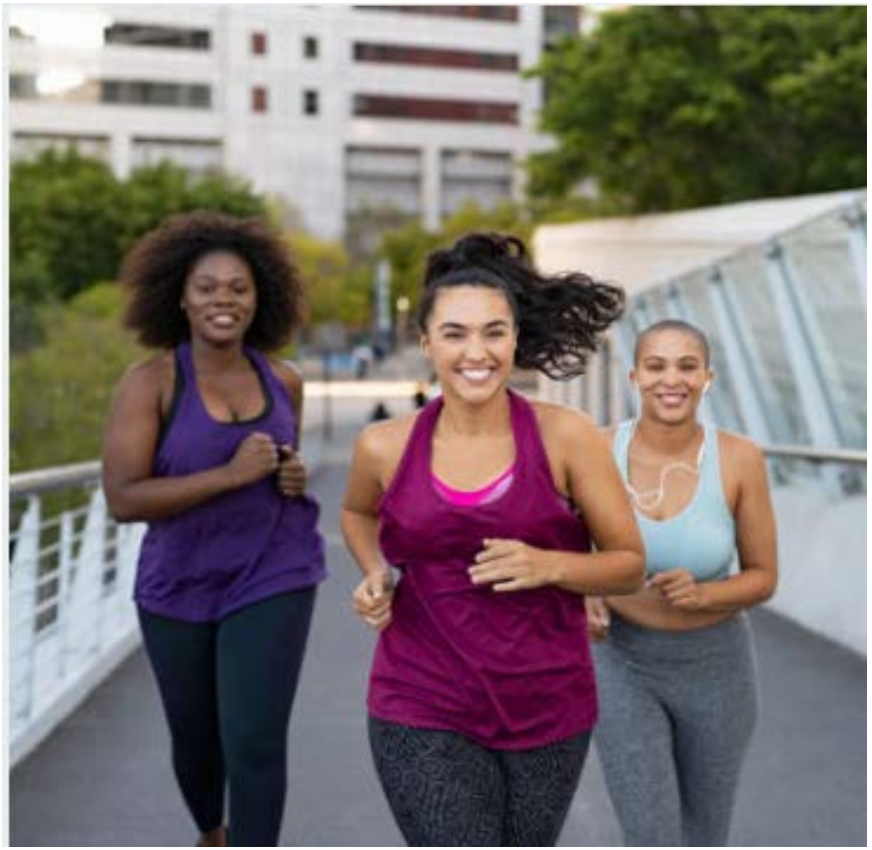
Physician, Maternal-Fetal Medicine, Northwestern Memorial Hospital

Associate Professor, Northwestern University Feinberg School of Medicine

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

It Is Best to Achieve Optimal Weight and Nutrition Prior to Pregnancy

- **Weight loss prior to pregnancy to improve perinatal outcomes**
  - Reach normal BMI vs. weight loss of 5%–7% from current weight
- **2012 U.S. Preventive Services Task Force (Grade B)**
  - Adults with BMIs ≥30 kg/m^2 should be offered or referred to intensive multicomponent behavior interventions



American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for Perinatal Care. 8th Edition. September 2017

www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/obesity-in-adults-interventions

Obesity Toolkit: Consistently Screen Women and Refer When Appropriate

- **Initial evaluation**
  - Screening
  - Readiness for weight loss
  - Obesity-related risk factors
- **Treatment options**
  - Lifestyle
  - Medications
  - Surgery
- **Coding and billing resources**

ACOG
The American College of Obstetricians and Gynecologists

www.acog.org/About-ACOG/ACOG-Departments/Toolkits-for-Health-Care-Providers/Obesity-Toolkit

Vitamins and Minerals are Important Prior to and During Pregnancy

- **Supplemental nutrients recommended**
  - Folate to reduce fetal structural defects
  - Iodine to promote brain development
  - Iron to improve maternal iron stores

- **Daily prenatal vitamin for at least 1 month prior to conception**
  - Contain folic acid, iodine, and iron

American Thyroid Association 2017 Guidelines www.liebertpub.com/doi/pdfplus/10.1089/thy.2016.0457

Gestational Weight Gain (GWG) in the United States

- **GWG guidelines based on a woman's pre-pregnancy BMI**
  - GWG associated with maternal and offspring outcomes
- **~50% of U.S. women exceeded their GWG goals in 2012–2013**

WEIGHT GAIN DURING PREGNANCY
REEXAMINING THE GUIDELINES

How much weight should you gain when you're pregnant?

If you start your pregnancy…	You should gain…
Underweight BMI less than 18.5	**28–40 lbs**
Normal Weight BMI 18.5–24.9	**25–35 lbs**
Overweight BMI 25.0–29.9	**15–25 lbs**
With Obesity (includes all classes) BMI greater than or equal to 30.0	**11–20 lbs**

www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-weight-gain.htm

Image adapted from: Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. National Academies Press; 2009

Deputy NP, Sharma AJ, Kim SY, et al. *Obstet Gynecol* 2015;125(4):773-781 Deputy, NP, A.J. Sharma, and S.Y. Kim, *MMWR* 2015. 64(43): p. 1215-20

Providers Need to Communicate Gestational Weight Gain (GWG) Goals

- **Providers cite inadequate training in nutrition and weight management**
- **Provider awareness of National Academy of Medicine gestational weight gain guidelines**
  - 1 in 5 do not adjust GWG goals for a woman's pre-pregnancy BMI
- **Disconnect between provider communication and patient reporting of GWG goals**
  - Providers often over- and under-estimate GWG goals
  - Women counseled with correct goals are more likely to achieve them

Kominiarek, M.A., F. Gay, & N. Peacock. *Matern Child Health J*, 2015

Power ML, Schulkin J. *J Womens Health* 2017;26:1169-1175

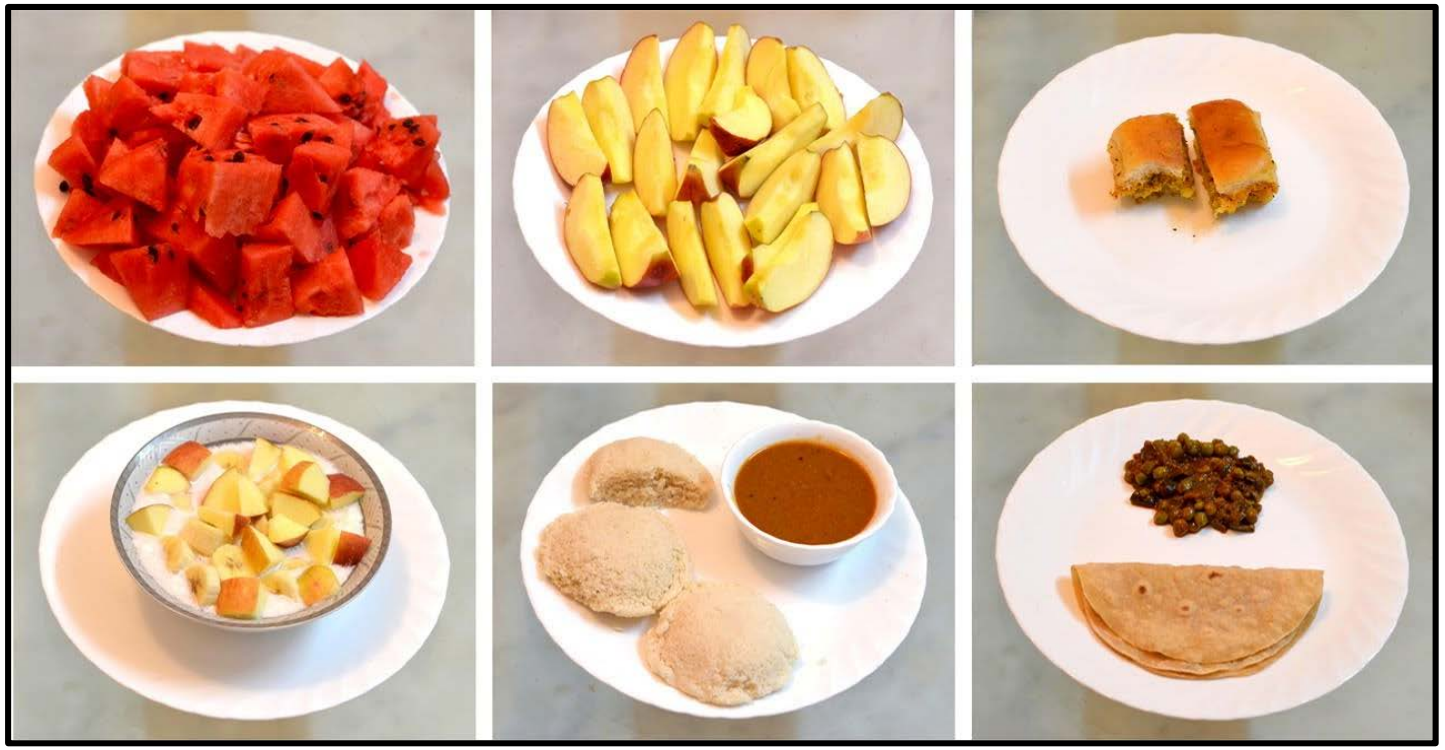
Stotland NE, Gilbert P, Bogetz A, et al. *J Womens Health* 2010 Apr;19(4):807-14

Deputy NP, Sharma AJ, Kim SY. Et al. J *Womens Health* 2018;27(5):552-560

Lopez-Cepero A, Leung K, Moore Simas T, et al. *Matern Child Health J* 2018 Aug;22(8):1127-34

Strategies to Help Women Meet Gestational Weight Gain Goals
Dispel Myths About Eating

- Eating "twice as healthy," not eating for two
- Only need an additional ~300 kcal per day in the 2nd and 3rd trimesters



Each serving example contains exactly 300kcal

Strategies to Help Women Meet Gestational Weight Gain Goals
Dispel Myths About Physical Activity

- **Physical activity is safe during pregnancy**
  - 150 minutes weekly of moderate-intensity aerobic activity (PA Guidelines for Americans)
  - 30 minutes every day of moderate-intensity aerobic activity (ACOG)

Examples of Safe and Unsafe Physical Activity During Pregnancy

Activities that are SAFE to start or continue:

- Low-impact aerobics
- Yoga, modified
- Pilates, modified
- Running or jogging
- Strength training
- Walking
- Swimming
- Stationary cycling
- Racquet sports

Activities that should be AVOIDED:

- Contact sports
  (e.g., ice hockey, boxing, soccer, and basketball)
- Activities with a high risk of falling
  (e.g., downhill snow skiing, water skiing, surfing, off-road cycling, gymnastics, and horseback riding)
- Scuba diving or sky diving
- "Hot yoga" or "hot Pilates"

U.S. DHHS. Physical Activity Guidelines for Americans, 2nd edition.

2018 ACOG Committee Opinion No. 650: *Obstet Gynecol* 2015;126(6):e135-142

Strategies to Help Women Meet Gestational Weight Gain Goals
Health Behavior Interventions

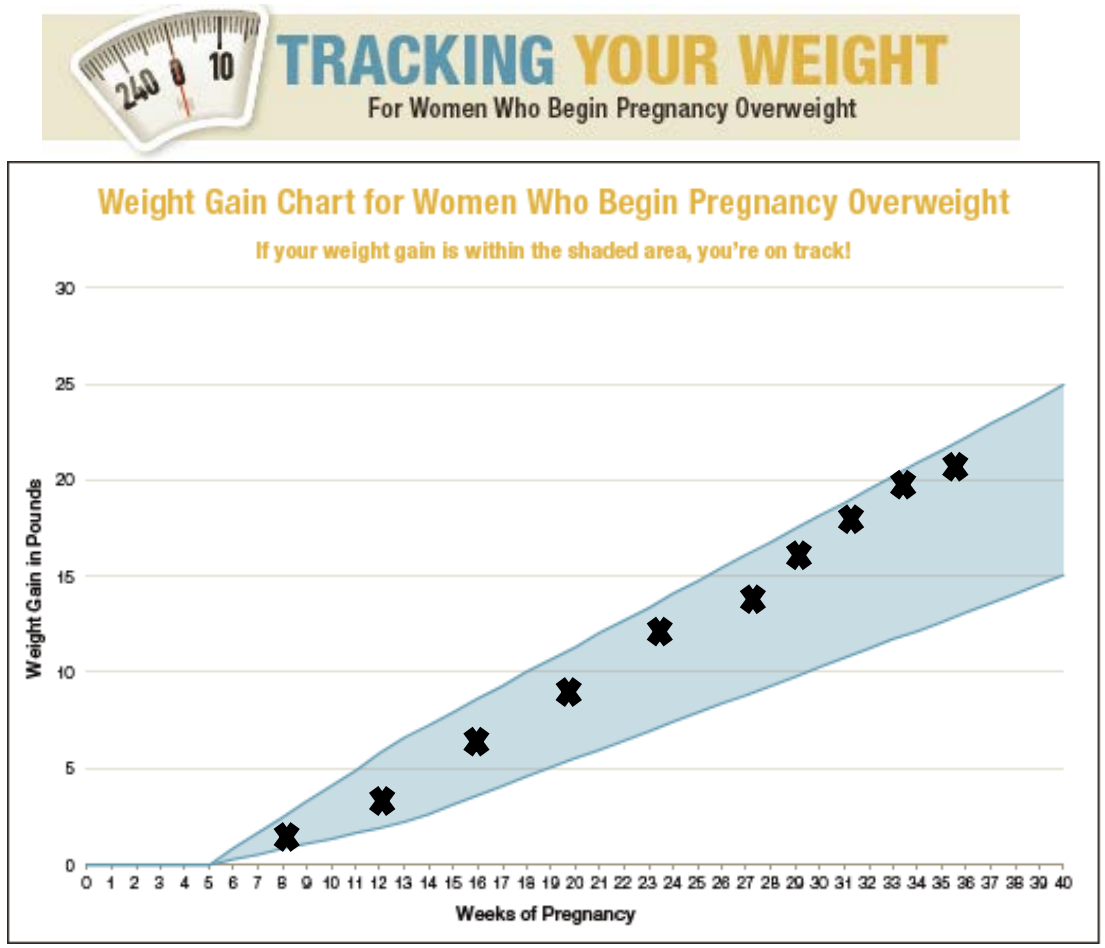
- **Health behavior interventions can help women meet gestational weight gain (GWG) goals**
- **Diet or exercise interventions during pregnancy reduced the frequency of excessive GWG by 20%**
  - Meta-analysis of 49 randomized controlled trials with 11,444 women
  - RR 0.8, 95% CI 0.73-0.87
- **Findings are encouraging, but…**
  - Not all women and providers have access to these resources
  - Studies have not shown positive findings for other important outcomes such as cesarean delivery and birthweight with these interventions

RR: Risk ratio CI: Confidence interval

Muktabhant B, Lawrie TA, Lumbiganon P, et al. *Cochrane Database Syst Rev*. 2015;6:CD007145

Strategies to Help Women Meet Gestational Weight Gain Goals
Providers and Women Track GWG

- **Providers can track gestational weight gain (GWG) with their patients**
- **Pregnant women can also track GWG between visits, empowering them to take ownership of their health care**
  - Self-monitoring can begin early to help women stay on track



Examples at: www.cdc.gov/reproductivehealth/maternalinfanthealth/pregnancy-weight-gain.htm

Aguilera M, Sidebottom AC, McCool BR. et al. *Matern Child Health J* 2017 Oct;21(10):1927-38

Nutrition and Nutrients: Targeting Anemia and Iron Deficiency

- **During pregnancy, iron needs increase**
  - Anemia associated with preterm birth, low birth weight, perinatal mortality
- **Standard of care**
  - Routine screening for anemia at the 1st prenatal visit and again in 3rd trimester
  - Treat with diet adjustments and oral iron supplements, initially
  - Parenteral iron is the next line of treatment if there is no response to oral iron supplements

American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for Perinatal Care. 8th Edition. September 2017
American College of Obstetricians and Gynecologists. Anemia in Pregnancy. Practice Bulletin Number 95, July 2008

Delayed Cord Clamping Can Reduce Anemia and Iron Deficiency

- **During delivery, delayed cord clamping (at least 30 seconds after birth)**
  - For term infants, improves hemoglobin levels at birth and iron stores for the 1st several months
  - For preterm infants, improves transitional circulation, decreased need for blood transfusion, and lower frequency of adverse outcomes (NEC, IVH)
  - Neurodevelopmental outcomes
    - Increased brain myelin at 4 months of age in a randomized controlled trial
    - An active area of research

NEC: Necrotizing enterocolitis IVH: Intraventricular hemorrhage

American College of Obstetricians and Gynecologists. Committee Opinion Number 684, January 2017
Mercer JS, Erickson-Owens DA, Deoni SCL, et al. *J Pediatr* 2018;203:266-272

Concerns for Maternal Nutrition and Weight Do Not End at Delivery

- **Nutrition after delivery**
  - If breastfeeding, still consume additional calories (~500 kcal/day)
  - Vitamin supplements if deficiencies noted
- **Weight after delivery**
  - Up to 75% of women weigh more than their pre-pregnancy weight at one year postpartum
  - Postpartum weight retention
    - Increases the risk for adverse outcomes in future pregnancies
    - Influences a woman's long-term health by increasing her risk for developing other conditions such as hypertension and diabetes

Endres LK, Straub H, McKinney C, et al. *Obstet Gynecol*. 2015;125(1):144-152

American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for Perinatal Care. 8th Edition. September 2017

Summary

- **Achieving optimal nutrition before and during pregnancy requires:**
  - Attention to diet quality and quantity
  - Vitamin and mineral supplements
- **Excessive weight gain is common for many women**
  - Meeting weight gain goals through health behavior changes is an active area of research
- **Approaches to improve anemia and iron deficiencies include:**
  - Routine screening for anemia during pregnancy
  - Delayed umbilical cord clamping

Infant Nutrition: Supporting Breastfeeding Right From the Start

Rafael Pérez-Escamilla, PhD

Professor, Epidemiology and Public Health

Director, Office of Public Health Practice

Director, Global Health Concentration

Yale School of Public Health

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Breastfeeding is Mother Nature's Personalized Medicine

- **Human milk is a complex biological substance**
- **Constellation of nutrients and other bioactive substances**
  - Stem cells
  - Human milk oligosaccharides
  - Antibodies
  - Live bacteria
  - Other
- **Human milk composition changes**
  - Within a single nursing episode
  - As the child develops
- **Strong variation in bioactive substances profiles among dyads**
  - Tailoring or "optimization" to dyads' environments
  - BF is personalized medicine

Victora CG, Bahl R, Barros AJ, et al. *Lancet* 2016; 387:475–90

Geddes & Kakulas Human milk: Bioactive components and their effects on the infant and beyond , 2018 Human Milk: Bioactive Components and Their Effects on the Infant and Beyond by Donna Geddes, Foteini Kakulas Breastfeeding and Breast Milk - From Biochemistry to Impact

Breastfeeding is Mother Nature's Personalized Medicine

- **Human milk is a complex biological substance**
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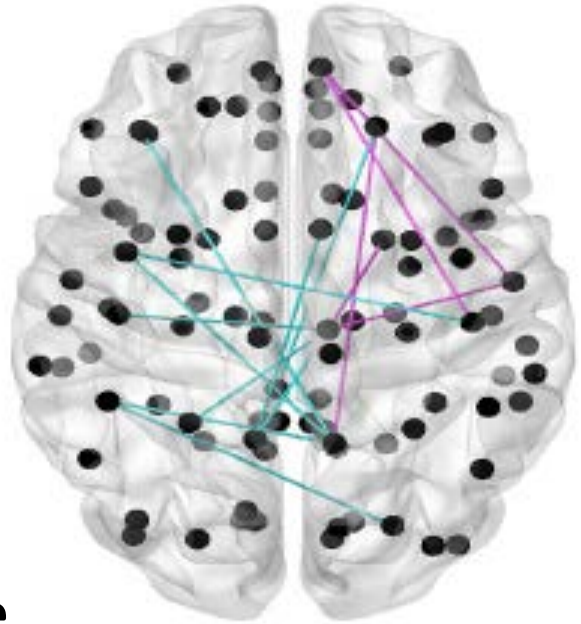
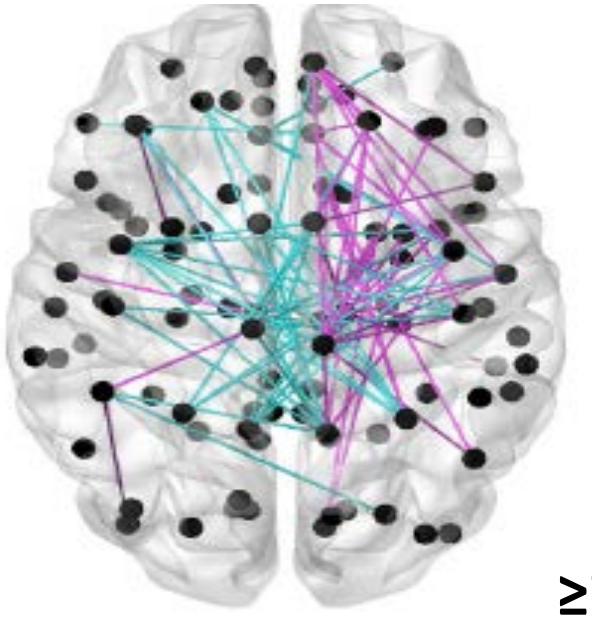
Victora CG, Bahl R, Barros AJ, et al. *Lancet* 2016; 387:475–90

Geddes D, Kakulas F. "Human Milk: Bioactive Components and Their Effects on the Infant and Beyond," in Breastfeeding and Breast Milk - From Biochemistry to Impact, Family Larsson-Rosenquist Foundation 2018

Breast Milk Feeding After Preterm Birth Improved Structural Connectivity

Neural Connections Inside Infants' Brain at Term-Equivalent Age





Interhemispheric connections

Intra-hemispheric connections

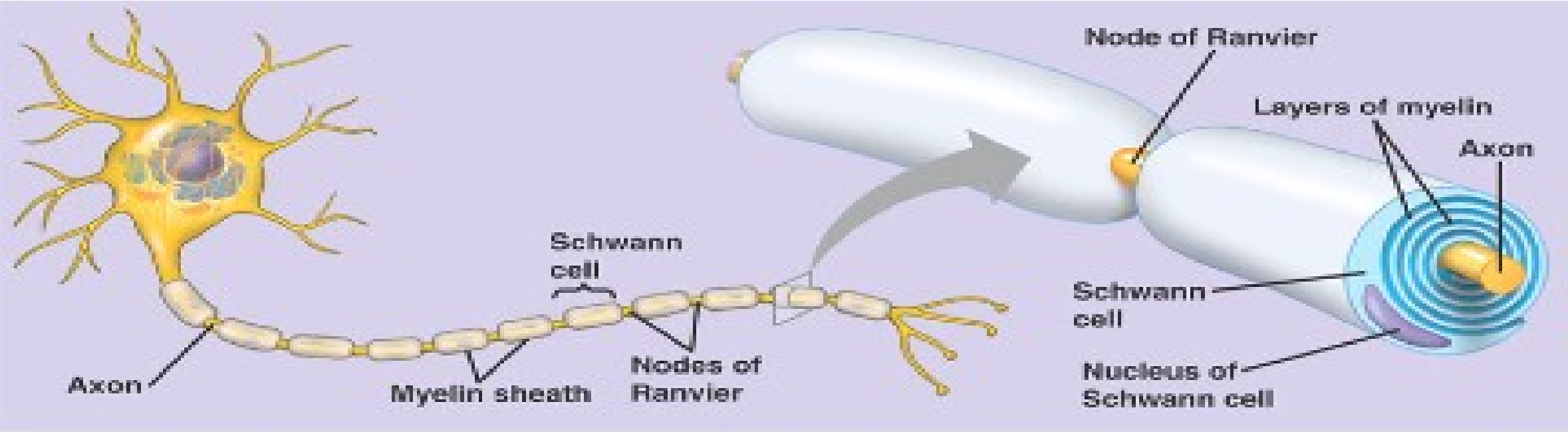
<75% Exclusive Breast Milk Feeds

≥75% Exclusive Breast Milk Feeds

Blesa M, Sullivan G, Anblagan D, et al. *Neuroimage*. 2019 Jan 1;184:431-439

Polyunsaturated Fatty Acids (PUFAs) Are Essential for the Myelination of the Neuronal Axons

Brain Cell with Myelin



Human milk is rich in PUFAs

theteenbrain.bravehost.com/Myelination.htm

Breastfeeding Gear Model

World Breastfeeding Week

Maternity Leave
Work Day Breaks
WHO Code

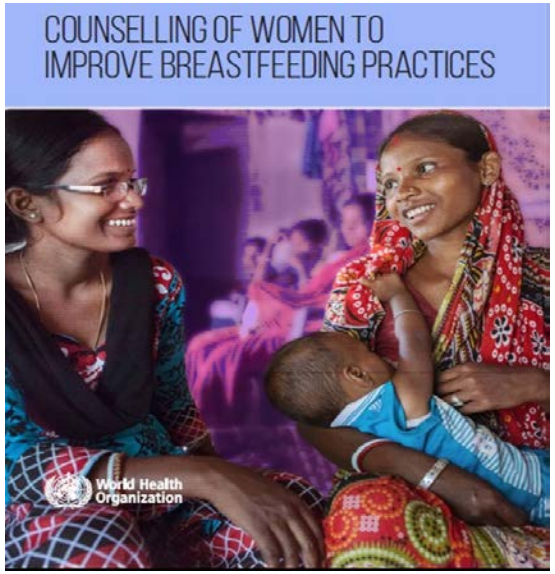
Baby Friendly Hospital and community breastfeeding support

Pérez-Escamilla R, Curry L, Minhas D, et al. *Adv Nutr* 2012 Nov 1;3(6):790–800

Three Areas Where Investments Can Have An Impact

Baby Friendly Hospital Initiative

Breastfeeding Counseling



Maternity Protection Policies

The Baby Friendly Hospital Initiative: Ten Steps (UNICEF & WHO, 2018)

Critical management procedures

1a. **Comply fully** with the *International Code of Marketing of Breast-milk Substitutes* and relevant World Health Assembly resolutions

1b. Have a **written infant feeding policy** that is routinely **communicated to staff and parents**

1c. Establish ongoing **monitoring and data-management systems**

2. Ensure **staff have sufficient knowledge, competence, and skills to support breastfeeding**

www.who.int/nutrition/publications/infantfeeding/bfhi-implementation-2018.pdf

unicef | World Health Organization

The Baby Friendly Hospital Initiative: "Ten Steps" (UNICEF & WHO, 2018)

Key clinical practices continued

3. Discuss **the importance** and management **of breastfeeding** with pregnant women and their families
4. Facilitate **immediate and uninterrupted skin-to-skin contact** and support mothers to **initiate breastfeeding as soon as possible** after birth
5. Support mothers to **initiate and maintain breastfeeding** and manage common difficulties
6. Do not provide breastfed newborns any food or fluids other than breast milk, unless medically indicated
7. Enable mothers and their infants to remain together and to **practice rooming-in 24 hours a day**
8. Support mothers to recognize and **respond to their infants' cues for feeding**
9. Counsel mothers on the use and **risks of feeding bottles, teats, and pacifiers**
10. Coordinate discharge so parents and their infants have **timely access to ongoing support and care**

www.who.int/nutrition/publications/infantfeeding/bfhi-implementation-2018.pdf

The Baby Friendly Hospital Initiative (BFHI) Works!

Maternal & Child Nutrition

DOI: 10.1111/mcn.12294

Review Article

Impact of the Baby-friendly Hospital Initiative on breastfeeding and child health outcomes: a systematic review

***Matern Child Nutr* 2016 Jul;12(3):402-17**

Rafael Pérez-Escamilla[*], Josefa L. Martinez[*] and Sofia Segura-Pérez[†]

[*]Department of Chronic Disease Epidemiology, Yale School of Public Health, New Haven, Connecticut, USA, and [†]Hispanic Health Council, Hartford, Connecticut, USA

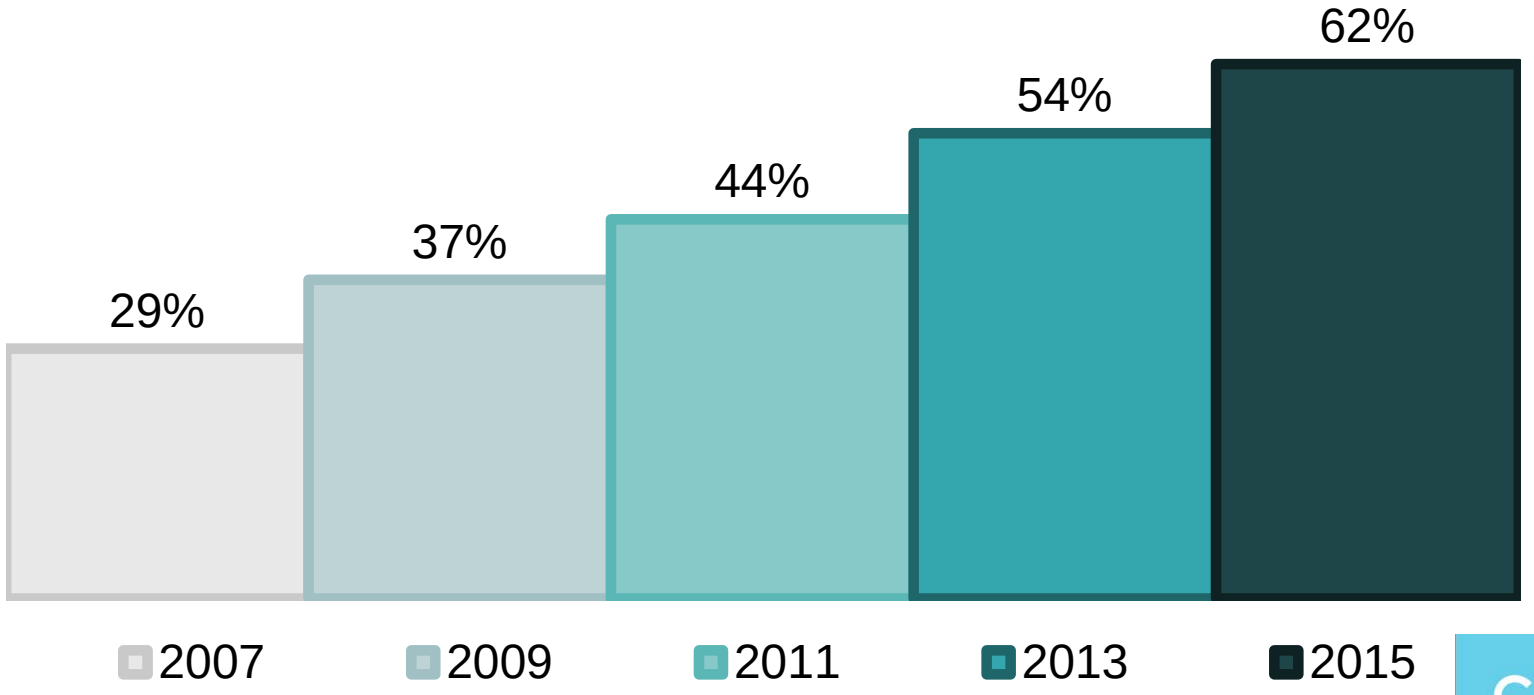
KEY FINDINGS

- BFHI Ten Steps has a positive impact on short-term, medium-term, and longer-term BF outcomes
- Dose–response relationship between the number of BFHI steps women are exposed to and the likelihood of improved breastfeeding outcomes
- Community support (step 10) is key for sustaining the short-term breastfeeding benefits obtained from BFHI

Perez-Escamilla R, Martinez, Jl, & Segura-Perez S. *Matern Child Nutr* 2016 Jul;12(3):402-17

Number of US Hospitals Implementing the *Ten Steps* Is Increasing

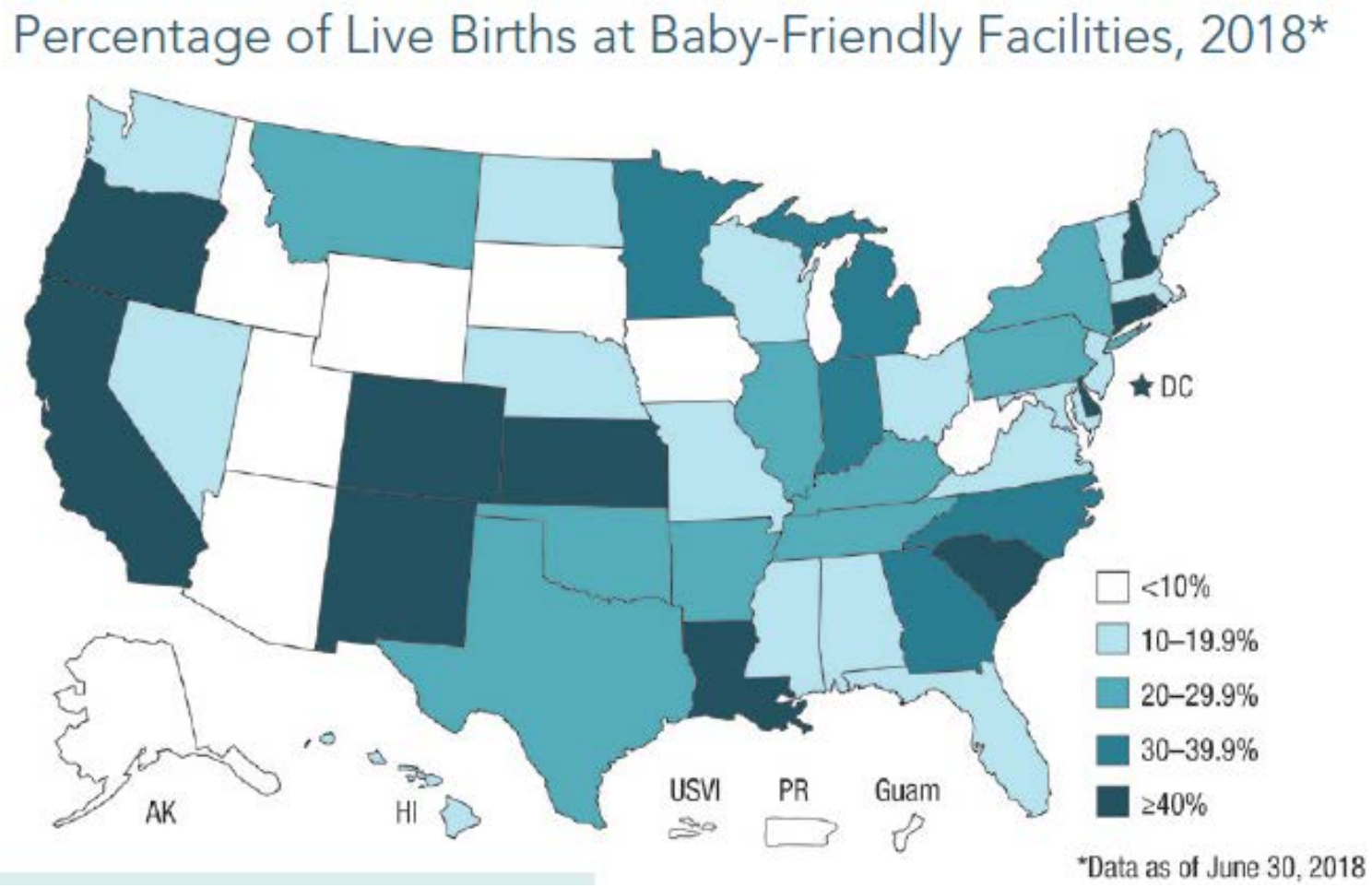
Percent of US Hospitals Implementing More than 5 of the *Ten Steps*, 2007–2015



CDC mPINC HOSPITAL SURVEY
Maternity Practices in Infant Nutrition & Care

www.cdc.gov/breastfeeding/data/mpinc/

The Baby Friendly Hospital Initiative: USA (CDC)



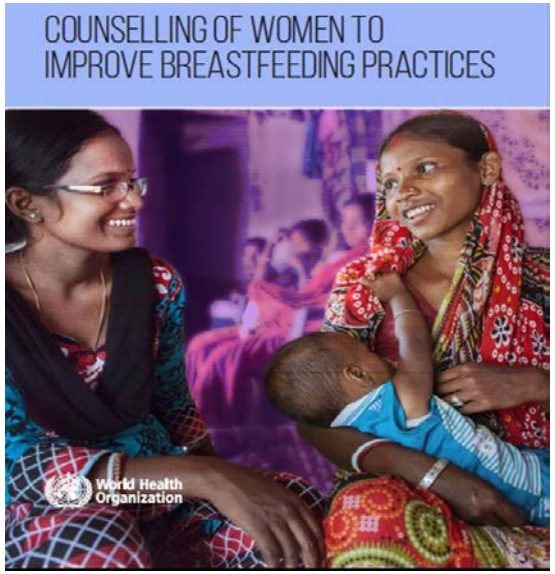
Only 26% of births occurred at baby-friendly facilities in 2018

www.cdc.gov/breastfeeding/data/reportcard.htm

Three Areas Where Investments Can Have An Impact

Baby Friendly Hospital Initiative

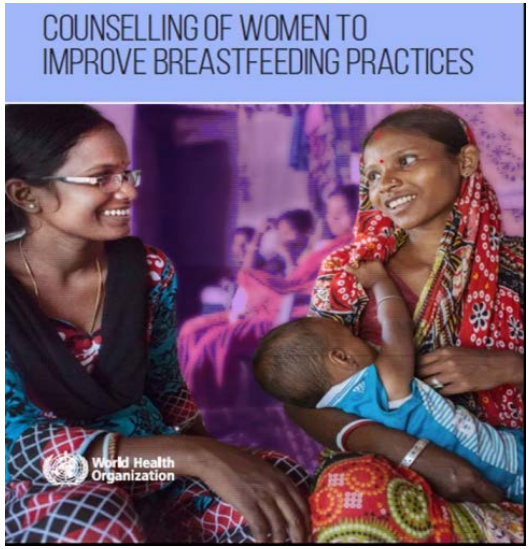
Breastfeeding Counseling



Maternity Protection Policies

Breastfeeding Counseling Guideline Recommendations (WHO 2018)

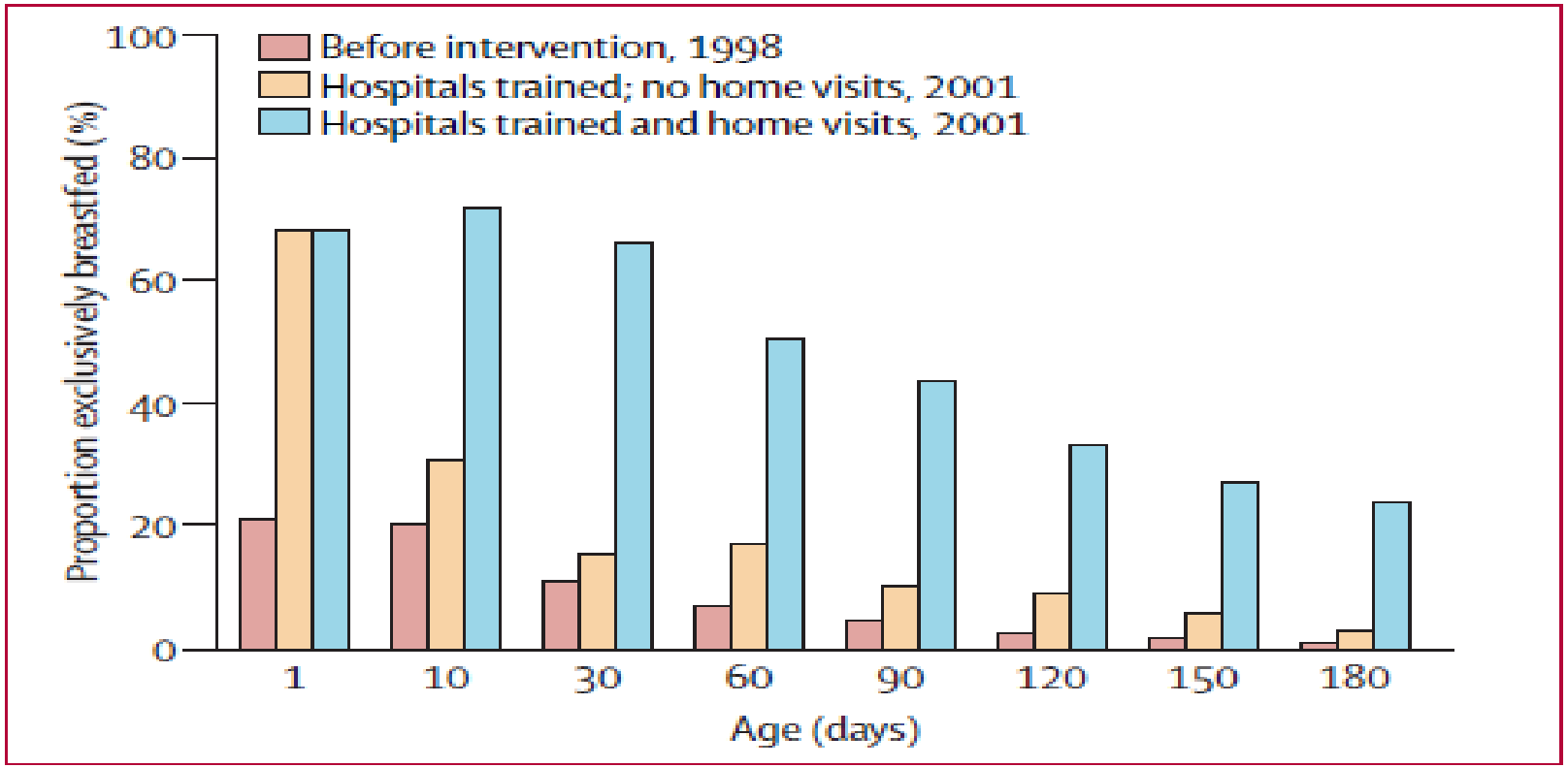
- **Breastfeeding counseling should be provided:**
  - To all pregnant women and mothers with young children
  - In both the antenatal and postnatal period, until child is age 24 months
  - At least six times and as needed
  - Through face-to-face counseling
  - As a continuum of care, by trained healthcare professionals and community-based lay and peer BF counselors
  - Anticipating and addressing important challenges and contexts for breastfeeding, and establishing skills, competencies, and confidence among mothers



www.who.int/nutrition/publications/guidelines/counselling-women-improve-bf-practices/en/

Breastfeeding Counseling and Home Visits Work

Proportions of Infants Exclusively Breastfed from Birth to 6 Months When Born in Hospitals Before Intervention (1998) and After Training (2001), with and without Home Visits



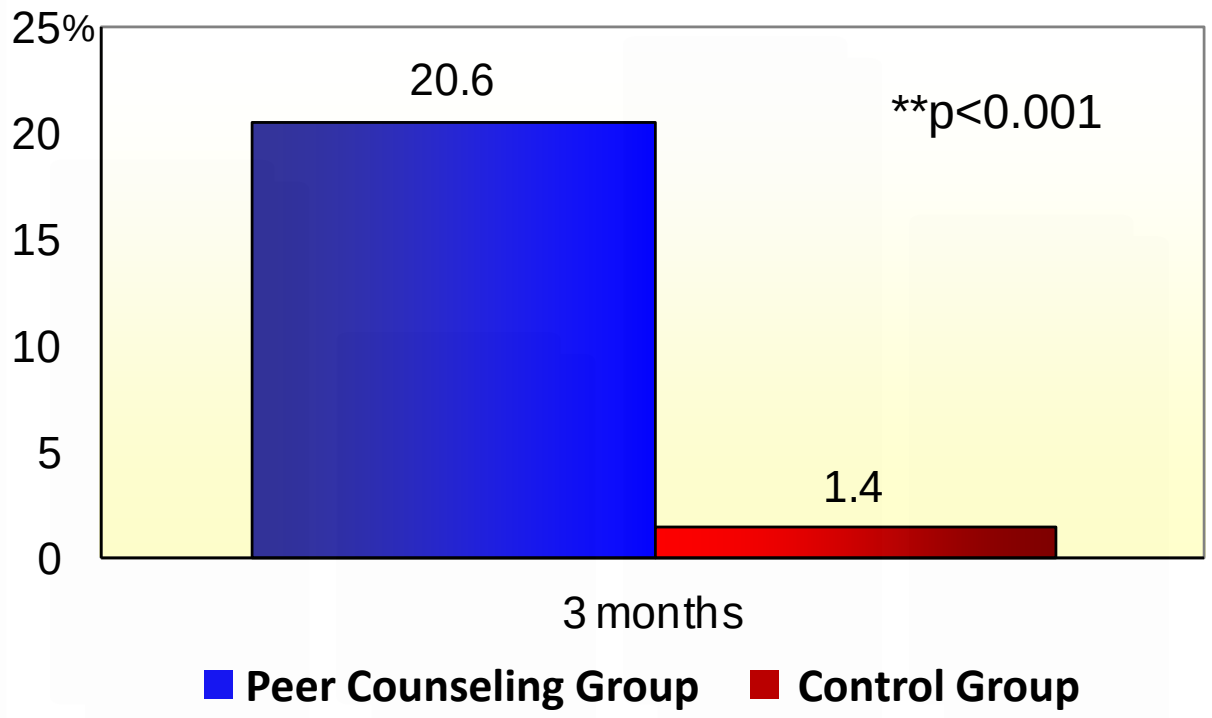
Coutinho SB, de Lira PI, de Carvalho Lima M, et al. *Lancet*. 2005 Sep 24-30;366(9491):1094-100

Breastfeeding Peer Counseling Intervention, 2003–2004
Hartford, CT, USA

Intervention's Timeframe and Type of Counseling

Pregnant women <36 weeks gestation	**3 Prenatal Home Counseling**
Mother-infant pairs 48 hours pp	**Perinatal/ Maternity ward Hands-on-Support**
Mother-infant pairs 1 to 6 weeks pp	**Postpartum Home BF Support**

Percent Exclusive Breastfeeding at Age 3 Months in a Predominantly Latina Low-Income Community



pp: Postpartum

Anderson AK, Damio G, Young S, et al. *Arch Pediatr Adolesc Med* 2005 Sep;159(9):836-41

Three Areas Where Investments Can Have An Impact

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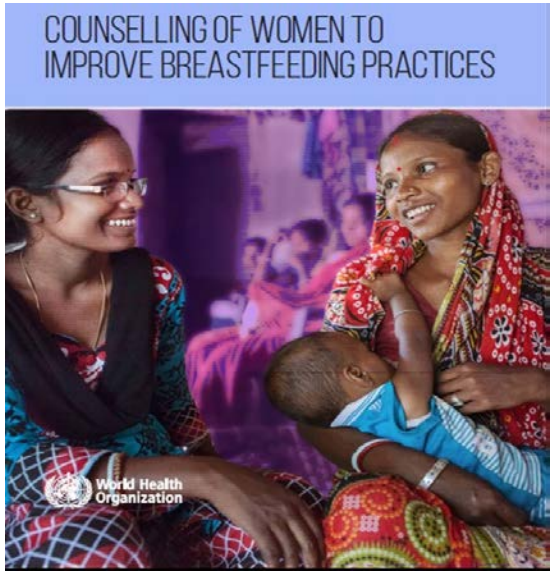


Maternity Protection Policies

Family Friendly Maternity Protection Policies

- **Paid maternity leave has been associated with improved breastfeeding outcomes and reduced infant mortality**
- **U.S. is only high-income country without paid maternity leave legislation**
  - In the U.S., 1 in 4 women return to work by 10 days after giving birth
- **When employed-women return, work supports should include**
  - Breaks during the workday
  - Lactation rooms for breast milk expression
  - Flexible work hours
  - Affordable high-quality childcare service near the workplace
- **Paternity leave also recommended by International Labour Organization**

Nandi A, Ashok A, Kinra S, et al. *Nutrition* 2016 Vol.16(1), pp.1-10
www.ilo.org/global/topics/equality-and-discrimination/maternity-protection/lang--en/index.htm
Flacking R, Dykes F, Ewald U. *Scand J Public Health*. 2010 Jun;38(4):337-43

Conclusion

- **Breastfeeding and human milk is a major cost-saving intervention**
- **Family friendly social and economic policies are needed to enable the breastfeeding environments**
  - The Baby Friendly Hospital Initiative works!
  - Community-based breastfeeding counseling works!

Photo courtesy of Hispanic Health Council

Thank you!

- Need better integration of facility- and community-based breastfeeding support (continuum of care for breastfeeding)
- Investing more in evidence-informed breastfeeding protection, promotion and support should be a top public health priority in the U.S and beyond

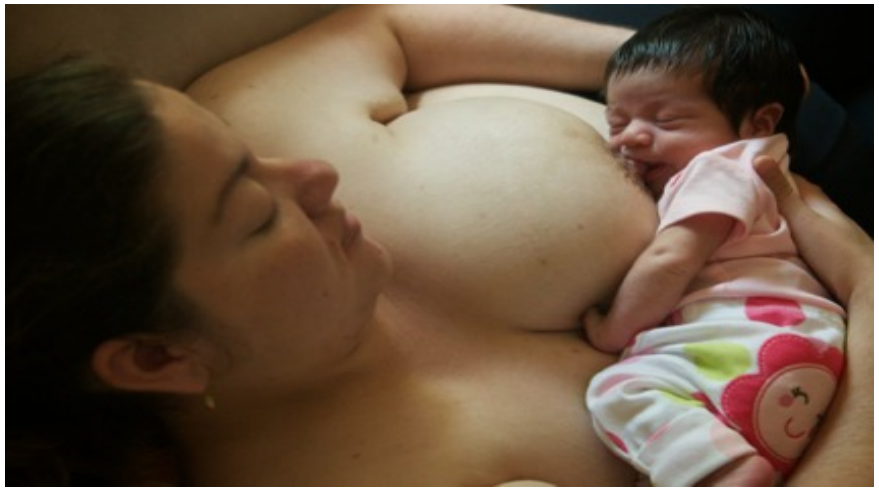


Photo courtesy of Hispanic Health Council

What Do We Know About the Timing of Introduction, Types and Amounts of Complementary Foods

Frank R. Greer, MD, FAAP

Professor Emeritus, Department of Pediatrics, University of Wisconsin School of Medicine

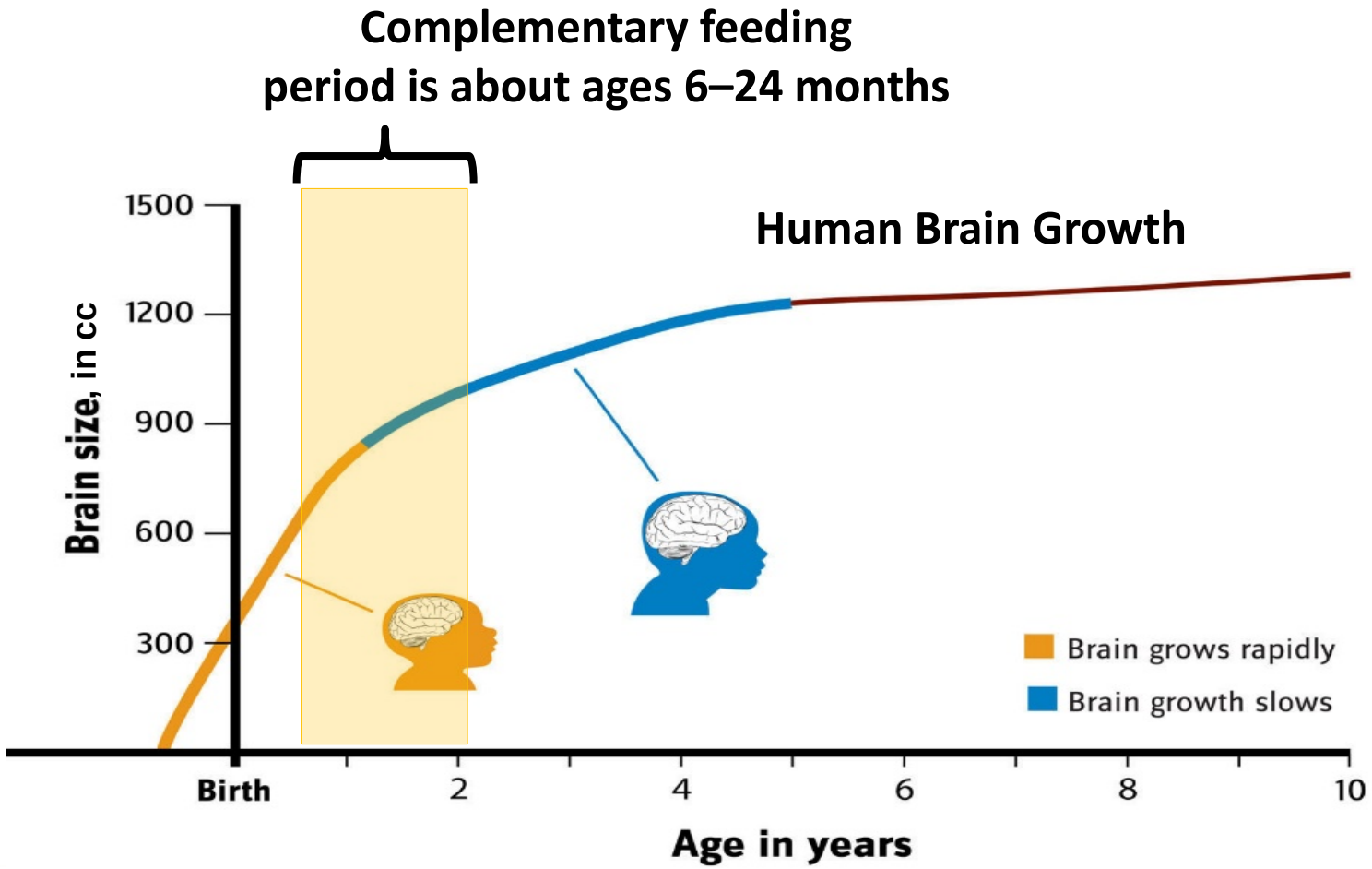
Past Chair, AAP Committee on Nutrition

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

Definitions

- **Complementary foods**
  - Refers to nutrient- and energy-containing solid, semi-solid, or liquid foods fed to infants in addition to human milk or formula
- **Complementary feeding period**
  - Generally occurs between 6 months and the child's second birthday with the progression from a fully liquid diet to the mixed diet of family foods

Complementary Feeding Period: Critical for Optimal Nutrition



Complementary feeding is critical to brain development

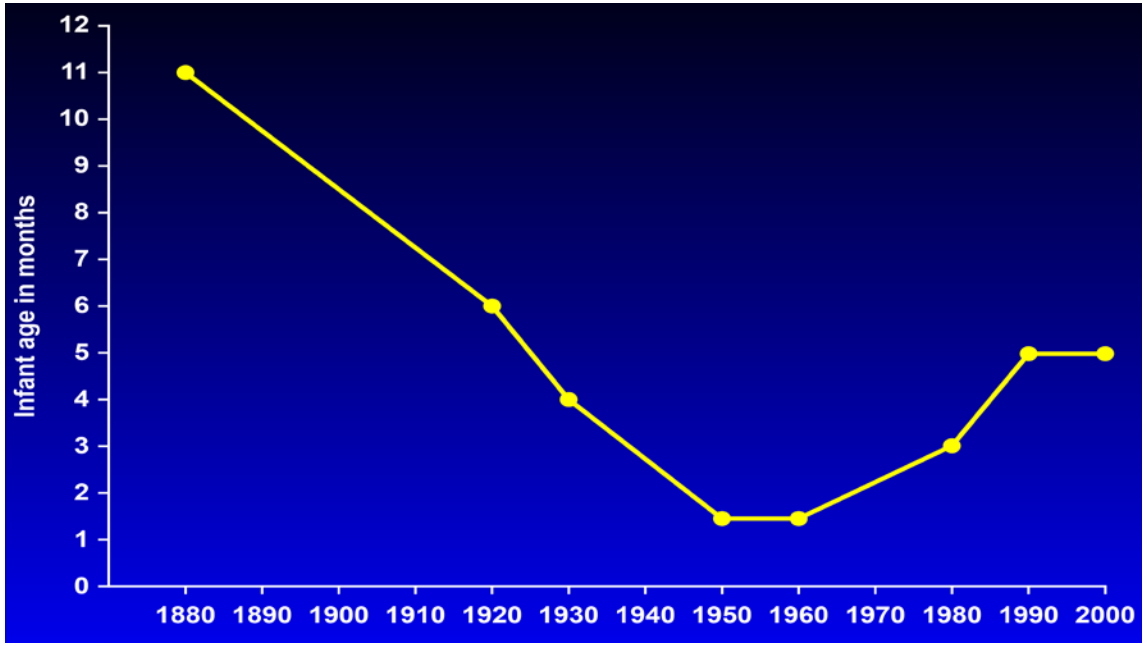
Human origins.si.edu/human-characteristics/brains

Image courtesy of Karen Carr Studios

History of Complementary Food Introduction

- **When to introduce complementary foods?**
  - Recommended age has changed dramatically over time and follows the decline of breastfeeding
  - 1958 Low point of breastfeeding (25% prevalence at 7 days)

Age of Complementary Food Introduction in Months, 1880–2000



Bentley A, Inventing Baby Food. Univ Calif Press, 2014

What Drives Timing of Introduction of Complementary Foods?
Nutritional Benefits vs Developmental Readiness

- **Nutritional benefits of exclusive breastfeeding**
  - Strongest evidence for first 4 months of life
- **Developmental readiness**
  - Varies widely but typically occurs between 4 and 6 months
  - Sitting upright with little or no support
  - Oral motor skills
- **Nutritional limitations of exclusive breastfeeding after 6 months**
  - Need for additional iron and zinc
  - Gradually increasing needs for additional calories and protein

When Are Complementary Foods (CF) Introduced Today?

- **16% of infants are introduced to CF earlier than 4 months (too early)**
- **13% introduced at 7 months or later (too late)**
- **The remaining infants are mainly introduced to CF between the beginning of the 4th month of life and the end of the 6th month of life**

Barrera CM, Hamner HC, Perrine CG, et al. *J Acad Nutr Diet* 2018 Mar;118(3):464-470

Macronutrient Intakes from Complementary Foods Toddlers Ages 12–23 Months

- **Protein—goal is 5%–20% of energy intake**
  - 94% of toddlers (ages 12–23 months) meet goals
- **Carbohydrate—goal is 45%–65% of energy intake**
  - 84% of toddlers meet goals
- **Fat—goal is 30%–40% of energy intake**
  - 28% of toddlers have less than recommended fat intake (not enough)
  - Fat intake is essential for brain growth and development

Ahluwalia N, Herrick KA, Rossen LM, et al. *Am J Clin Nutr* 2016;104:1167–1174

Complementary Foods and Micronutrients: Iron is the Most Important

- **Iron requirements relatively large**
- **Strong evidence supports consuming complementary foods with substantial amounts of iron (e.g., meat and cereals with iron) to maintain iron status**
  - Benefits for infants who consume iron-fortified formula (12mg/L) are less evident than for breastfed infants

Recommended Daily Allowance

IRON

Age 7–12 months 11 mg

Age 12–36 months 7 mg

Risk factors for insufficient iron stores include preterm birth and maternal anemia during pregnancy

Sauer PJJ. *Am J Clin Nutr*. 2019 Apr 1;109(4):1027-1028

What Is the Source of Iron in Complementary Foods?

- **Heme iron: Red meat and dark poultry best source (2mg/100g)**
  - Iron is bound to animal protein and absorbed intact
  - Absorption rate 25%–35%
  - Not common as a complementary food before 12 months
- **Non-heme iron: green vegetables, eggs**
  - Poorly absorbed, 10% or less
- **Iron salts: added to infant formulas and cereals**
  - Poorly absorbed, 2%–5%
  - Added in large amounts to offset poor absorption

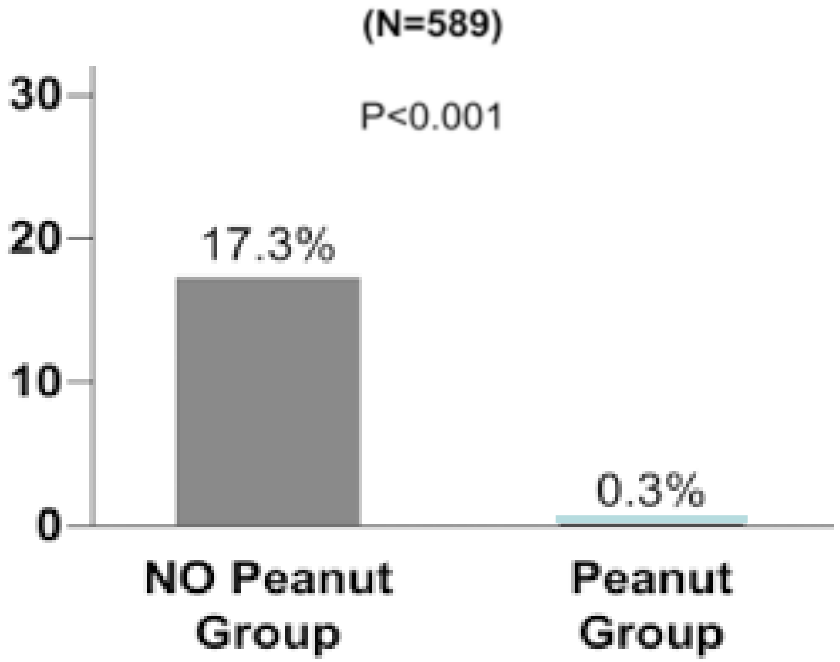
www.cdc.gov/nutrition/infantandtoddlernutrition/vitamins-minerals/iron.html

New: What Are the Benefits of Early Introduction of Allergenic Complementary Foods?

- **Allergenic foods (nutrient rich): includes peanuts, eggs, milk, fish, and wheat**
  - New evidence does not support delaying the introduction of allergenic foods beyond 6–11 months of age
- **Evidence is strongest for introducing peanut between 4 and 11 months of age in high-risk infants**
  - High-risk infants = severe eczema or egg allergy at time of peanut introduction
- **Reduces peanut allergy at 6 years by 80%**

Early Introduction of Peanut Protein Reduces Peanut Allergy by 80% (LEAP Trial)

Prevalence of Peanut Allergy, Age 6 Years



Peanut Group ate 2g of peanut 3 times a week, starting ages 4–11 months until 5 years old

NO Peanut Group avoided peanut exposure until 5 years of age

Du Toit G, Roberts G, Sayre PH, et al. *N Engl J Med*. 2015;372(9):803-13

Complementary Foods That Should NOT Be Introduced

- **100% fruit juices**
  - Not before 12 months
  - Limited to 4 oz per day thereafter
    - These displace nutrient rich foods (milk)
- **Sugar-sweetened beverages**
  - Not before 2 years, limited thereafter
  - Associated with weight gain and obesity later in life

Heyman MB, Abrams SA. *Pediatrics* 2017 Jun;139(6)

Vos MB, Kaar JL, Welsh JA, et al. *Circulation* 2017 May 9;135(19):e1017-e1034

Complementary Foods That Should NOT be Introduced Before 12 Months of Age

- **Cow's milk**
  - Not before 12 months—excess protein, calcium and phosphorus
  - No need for flavored cow's milk at any time (added sugar)
- **Plant-based milks**
  - Should be avoided with perhaps the exception of soy milk for vegan diet, or cow milk intolerance

Pediatric Nutrition Handbook. 7th ed. Kleinman RE, and Greer, F. Elk Grove, Village, IL: American Academy of Pediatrics; 2014: chapter 6

What Do We Know About the Process of Infant Feeding?

- **Repeated exposure of a fruit or vegetable every day for 8–10 days increases acceptability between ages 4 to 24 months**
- **Sequential introduction of food groups (e.g., vegetables before meat or fruits, etc.) is not supported by any evidence**
- **Infants with infrequent intakes of fruits and vegetables (i.e., less than 1 per day) at age 11 months are likely to continue this pattern at age 6 years**

Spill MK, Johns K, Callahan EH, et al. *Am J Clin Nutr*. 2019 Mar 1;109(Supplement_7):978S-989S

Preferred Feeding Practices
You Provide, Your Child Decides

- **Recognizing a child's hunger and satiety cues can support feeding practices that lead to healthy growth**
  - This includes all feedings beginning at birth through 2 years
- **Caregiver feeding practices are associated with children's weight**
  - Restricting food or pressuring a child to eat are associated with unhealthy weight

Common Hunger and Satiety Cues

Birth to 6 Months

Hungry…

- Puts hands to mouth
- Turns head toward breast or bottle
- Puckers, smacks, or licks lips
- Clenched hands

Full…

- Closes mouth
- Turns head away from breast or bottle
- Relaxes hands

6 to 24 Months

Hungry…

- Reaches to or points to food
- Opens mouth when offered spoon or food
- Gets excited upon sight of food
- Uses hand motions or sounds to indicate hunger

Full…

- Pushes food away
- Closes mouth when food is offered
- Turns head away from food
- Uses hand motions or sounds to show satiety

ihcw.aap.org/Pages/EFHALF.aspx

www.cdc.gov/nutrition/infantandtoddlernutrition/index.html

Complementary Feeding Process (continued)

Evidence suggests introducing a variety of foods across all food groups at routine meal times promotes good dietary habits later in life

Spill MK, Johns K, Callahan EH, et al. *Am J Clin Nutr*. 2019 Mar 1;109(Supplement_7):978S-989S

American Academy of Pediatrics Recommendations for Complementary Feeding: Key Points

- **Introduce complementary foods at about 6 months**
- **Introduce a variety of nutrient dense complementary foods**
  - Especially iron-rich foods
- **Do not introduce cow's milk or 100% fruit juices before 12 months**
- **Avoid foods and beverages with added sugar and salt**
- **Avoid plant-based milks in general**

Recommendations for Complementary Feeding: Key Points

- **Introduce allergenic complementary foods sooner rather than later**
  - No need to delay introduction beyond age 6 months
  - Exception for introducing peanuts between 4 and 6 months for infants with eczema or egg allergy
- **Encourage more high-quality research on timing of introduction, types, and amounts of complementary foods**

Opportunities to Improve Nutrition in the 1,000 Day Window

Promote 2020 Dietary Guidelines

Empower parents and care providers with understanding and best practices

Train healthcare providers and promote the use of best practices

Increase access to high quality prenatal care, and obesity prevention programs

The First 1,000 Days Matter

Implement breastfeeding-friendly practices and support breastfeeding in communities