Consensus Clinical Guidelines for Late Preterm Infant (LPI) Feeding

UCSF Northern California Neonatal Consortium

- **Goal**
  - Encourage and support human milk feeding with goal of exclusive breastfeeding for all LPIs.
  - Avoid co-morbidities of LPI associated with inadequate feeding.
  - Provide adequate intake of calories, protein and micronutrients to achieve optimal growth.

- **Criteria for Use of LPI Feeding Guideline**
  - Infants born at 34 0/7 to 36 6/7 weeks gestational age (GA)
  - Absence of severe congenital anomaly, need for critical care intervention, or contraindication for enteral feeding
  - Absence of contraindication for use of maternal breast milk (MBM)

- **Support for Breastfeeding**
  - Skin-to-Skin: Provide opportunity for skin-to-skin time after birth in all late preterm infants who are clinically stable and maternal post-partum status permits. Encourage first breastfeeding attempt within first hour after birth if possible.
    - Resource-intensive but many maternal & neonatal benefits (e.g. neonatal glucose stability)
  - Lactation Consultation: Should be offered to ALL mothers of late preterm infants.
    - Encourage breastfeeding attempts q 2–3 hours (8–12 times / 24 hour period), for 15–20 minutes / session
    - Mothers may skip a few breastfeeding / pumping sessions per 24 hour period in order to obtain sufficient rest
  - Milk Expression: Educate & encourage mothers to hand express or pump at least 8 times / 24 hour period, for 10-20 minutes / session
    - All LPIs (34-36 weeks): initiate milk expression within 4 hours after birth
  - Assessment of Breast Milk Transfer (for infants receiving supplementation):
    - Latch scoring / subjective nursing and lactation assessment of breastfeeding success
    - After day 3 (or when mother's volume of milk has increased / mother's breasts are softened after feedings), consider weighing diapered infant before and after breastfeeding + subtract transfer amount from the total supplemental feeding guideline for that day
  - Assessment of Hydration Status: daily weights, weighing / counting diapers, clinical assessment
  - Duration of Supplementation: Supplementation of breastfeeding is needed until LPI can feed effectively, empty mother's breasts, mothers' milk is abundant, and infant is maintaining/gaining weight (lactation specialists may assist with defining "successful / effective breastfeeding")

- **LPI Nutritional Needs / Goals**
  - Estimated Needs:

    34-36 weeks: 120 kcal/kg/day; 3.1 g protein/kg/day
    37-38 weeks: 115 kcal/kg/day; 2.5 g protein/kg/day
    < 3kg: 120-130 kcal/kg/day; >3 g protein/kg/day
    > 3 kg: 110-120 kcal/kg/day; >2 g protein/kg/day
  - Expected Weight Gain (after diuresis):

    >2kg or 34-38 weeks: 30-35 g/day
    0-3 months CGA: 25-35 g/day
    3-6 months CGA: 15-20 g/day
    *For specific goals per baby, see http://peditools.org/index.html

NOTE: For CATCH-UP GROWTH, increase expected weight gain, energy and protein goals by 10-20%

UCSF Multi-Site Neonatology Collaboration. Originated 03/2014. Revised 6/2014, 10/2014, 03/2018.
Approved by UCSF ICN Patient Safety Committee: 7/2018
Approved by UCSF Pharmacy and Therapeutics Committee: 8/2018

UCSF Benioff Children's Hospitals

LPI Supplemental Feeding Guidelines

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34 – 34 6/7 weeks		35 – 35 6/7 weeks	36 – 36 6/7 weeks
DEFINITIONS	**SGA <1800gm**	**AGA >1800gm**	***SGA <2000gm (SEE 34wk AGA)*** **AGA >2000gm**	***SGA <2200gm (SEE 35wk AGA)*** **AGA >2200gm**
ADMISSION	ICN/SCN, monitors		○ ICN/SCN, may leave for feedings ○ Transition to rooming in when clinically stable	Remain with mother, rooming in
ASSESSMENT	Daily: • Calculate wt loss from birth • Calculate wt gain once at nadir • Intake and output • Jaundice assessment • Lactation success (mom/baby)			
BREASTFEEDING SUPPLEMENTATION	DAY 1: Initiate breastfeeding, maximize skin-to-skin & maternal-infant bonding time (challenge = physical separation of mother & baby) DAY 2: Supplement ALL infants		DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (As, Bs &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<45 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs	DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (As, Bs &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<45 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs
METHOD OF SUPPLEMENTATION	May include supplemental nursing system (SNS), finger feeding (FF), bottle feeding, cup feeding, nasogastric or orogastric tube (NG/OG), IV fluids, or parenteral nutrition (for 34 week infants <1500gm) per hospital policy & staff expertise • Non-bottle feeding (SNS/FF) optimal for establishing early breastfeeding; logistics TBD @ each institution			
RATIONALE FOR SUPPLEMENTATION	• 50% require gavage feeds[1] • 51% have feeding problems[2] • Full feeds by ~10 days of life[3]		• 27% require gavage feeds[1] • 34% have feeding problems[2] • Full feeds by ~6 days of life[3]	• 9% require gavage feeds[1] • 22% have feeding problems[2] • Full feeds by ~3 days of life[3]

1. Stellwagon, L and Boies E. *CPQCC Care and Management of the Late Preterm Infant Toolkit: Section IV: Nutrition and Feeding of the Late Preterm Infant* February 2013.
2. Lubow et al. Am J Obstet Gynecol 2009;20(5):e30-33.
3. Vachharajani & Dawson 2009;48(4):383-388.

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34-34 6/7 weeks		35 – 35 6/7 weeks	36 – 36 6/7 weeks
IV *CRITERIA:* • *BW <1500gm* • *Persistent hypoglycemia* • *IUGR / SGA* • *Poor feeding cues* • *Non-vigorous* • *Parents decline formula*	• **<1500gm:** • PIV, UVC or PICC • Parenteral Nutrition (PPN/TPN) • Wean IVF/PN with increased enteral feeding + stable glucose	• **>1500gm** • If IVF needed: • PIV • D10W @ 60-80 ml/kg/day • Wean IVF with increased enteral feeding + stable blood glucose	If IVF needed: • PIV • D10W @ 60-80 ml/kg/day • Wean IVF with increased enteral feeding + stable blood glucose	If IVF needed: • PIV • D10W @ 60-80 ml/kg/day • Wean IVF with increased enteral feeding + stable blood glucose
NG / OG	Place NG or OG tube if poor / absent feeding cues, non-vigorous, hypoglycemia, or unable to meet volume goals			
TYPE	• Expressed breast milk • Preterm Formula 20 kcal/oz		• Expressed breast milk • Preterm Formula 20 kcal/oz	• Expressed breast milk • Standard Term Formula
FORTIFY	Fortify @ 60 ml/kg/day: • MBM 24 kcal/oz with HMF • Preterm Formula 24 kcal/oz		Fortify IF poor intake / poor wt gain at goal volume feeds: • MBM 24 kcal/oz with HMF • Preterm Formula 24 kcal/oz	Fortify IF poor intake / poor wt gain at goal volume feeds: • MBM 24 or Term Formula 22/24 kcal/oz • Preterm Discharge Formula (PDF) 22 kcal/oz
SUPPLEMENTAL ENTERAL VOLUMES *(NOTE: volumes = total feeding goals; modify volume of supplementation based on assessment of intake from breastfeeding)*	• DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 20-25 ml/feeding • DAY 5: 140-160 ml/kg/day OR 30-35 ml/feeding • DAY 6 (GOAL – fortified): 160 ml/kg/day OR 35 ml/feeding *NOTE: Advance supplementation ONLY if feedings are tolerated (heme (-) stools, stable abd girth / no visible bowel loops, residual <1/3 of feed, no persistent emesis)*		• DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 25-30 ml/feeding • DAY 5: 140-160 ml/kg/day OR 35-40 ml/feeding • DAY 6 (GOAL): 160 ml/kg/day OR 35 ml/feeding (fortified) to 180 ml/kg/day OR 45 ml/feeding (unfortified/no BF) *NOTE: Advance supplementation ONLY if feedings are tolerated (see adjacent box for details)*	• DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 25-30 ml/feeding • DAY 5: 140-160 ml/kg/day OR 40-45 ml/feeding • DAY 6 (GOAL): 160 ml/kg/day OR 45 ml/feeding (fortified) to180 ml/kg/day OR 50 ml/feeding (unfortified/no BF) *NOTE: Advance supplementation ONLY if feedings are tolerated (see adjacent box for details)*

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34 – 34 6/7 weeks	35 – 35 6/7 weeks	36 – 36 6/7 weeks
DISCHARGE READINESS	• >48 hours of successful feeding (8 good feedings/day; feeding volume sufficient) • Weight loss stabilized in infants ≥ 35-36 weeks and weight gain demonstrated at goal feedings in infants < 35-36 weeks • Temperature stability (≥ 36.5 C) in open crib >24 hours • Family competent to continue feeding plan (i.e. waking baby if necessary; recognize/respond to early feeding cues) • F/U appointment within 2 days • Discharge lactation plan in place • Nutritional supplements Rx • WIC referral completed PRN		

DISCHARGE
 	
(NOTE: Transition to home feeding plan 1-2 days prior to nursery discharge)
	BREASTFEEDING:
	• Minimum 8-10 feeds/day
	• BF ad lib + minimum 2 supplemental bottle feedings until 3.5 kg (expect 6-12 weeks post-discharge)
	• Supplemental feeds: MBM 24 OR PDF 24
	
	FORMULA FEEDING:
	• Continue PDF 22 or 24 until 3.5kg (expect 6-12 weeks post-discharge) then switch to regular term formula 20kcal/oz
	
	PMD VISITS:
	• Review rate of weight gain and detailed lactation and feeding history; lactation consult/increase supplementation PRN
		BREASTFEEDING:
		• Minimum 8-10 feeds/day
		• BF ad lib + minimum 2 supplemental bottle feedings until 3.5 kg (expect 6-12weeks post-discharge)
		• Supplemental feeds: MBM 24 OR PDF 24
		
		FORMULA FEEDING:
		• Continue PDF 22 or 24 until 3.5kg (expect 6-12weeks post-discharge) then switch to regular term formula 20kcal/oz
		
		PMD VISITS:
		• Review rate of weight gain and detailed lactation and feeding history; lactation consult/ increase supplementation PRN
			BREASTFEEDING:
			• Minimum 8-10 feeds/day
			• BF ad lib
			• Supplemental feedings (IF needed):
			  ○ MBM or Term Formula
			  ○ MBM 24 or PDF 22 (IF used in nursery for poor wt gain)*
			
			FORMULA FEEDING:
			• Term Formula
			
			PMD VISITS:
			• Review rate of weight gain and detailed feeding history; consider lactation consult/ supplementation PRN
			
			*PDF comes in 22kcal/oz in ready-made form.

GROWTH CHART	WHO plotted for corrected GA *IHDP curves NOT recommended*	WHO plotted for corrected GA *IHDP curves NOT recommended*	WHO plotted for corrected GA *IHDP curves NOT recommended*

*The reason for the difference in calories between MBM and formula for 36 week infants is that formula is premixed to 22 kcal, however if fortifying breastmilk it is probably only worth it to do so if you fortify to 24 kcal.

Vitamins & Nutritional Supplements

Vitamins / supplements may be started in nursery, at discharge, or as outpatient by 2 weeks of age

Exclusive Breastfeeding & >36 weeks OR Supplemented Breastfeeding / Fortified MBM	○ Infant multivitamin 1ml Qday* ○ Fe Sulfate 2 mg/kg elemental iron Qday if Hct <40
Full Formula Feeding	○ Discharge weight <3500 grams: Infant multivitamin 1ml Qday* ○ Discharge weight >3500 grams: Vitamin D 400 IU Qday (D-vi-sol)

Note: 1 ml Poly-vi-sol with iron contains 10 mg iron and no vitamin B12; it is not recommended for an infant of a vegan breastfeeding mother. In addition, it has too much iron for an infant weighing less than 5kg.

**We are discharging the patient on infant multivitamin 1ml q day. Note to pediatrician: After infant reaches 3.5kg, he or she should be switched to Vitamin D 400 IU daily. By 2 months, if not fully formula fed, the infant should also have an iron supplement to provide 10mg daily in their diet.*

References

Stellwagon, L and Boies E. *CPQCC Care and Management of the Late Preterm Infant Toolkit: Section IV: Nutrition and Feeding of the Late Preterm Infant* February 2013.

National Perinatal Association *Multidisciplinary Guidelines for Care of the Late Preterm Infant*

SFGH Late Preterm Infant Feeding Guidelines and Algorithm

Bhatia J et al. *Selected Macro/Micronutrient Needs of the Routine Preterm Infant J Pediatr 2013;162:S48-55.*

Lapillonne A et al. *Nutritional Recommendations for the Late-Preterm Infant and the Preterm Infant after Hospital Discharge J Pediatr 2013;162:S90-100.*

Danner E et al. *Weight Velocity in Infants and Children Nutr Clin Pract 2009 24:76-79.*

Institute of Medicine, Food and Nutrition Board. *Dietary Reference Intakes Dietary Reference Intakes-Adequate Intake for Infants 0-6 months;* Washington DC: National Academy Press, 1997-2002.

Brandt I et al. Catch-up Growth of Supine Length/Height of VLBW, SGA Preterm Infatns to Adulthood J Pediatr 2005;147:662-8.

Groh-Wargo, S, Thompson, M and Hovasi Cox, J Pocket Guide to Neonatal Nutrition, 2nd Ed. Chicogo, IL: Academy of Nutrition and Dietetics, 2016.

ADDENDUM 1: Nutrient Analysis

		2.5 kg			
Nutrient	**Adequate Intake (per day)**	**MBM**	**MBM 24 w/ Neosure**	**Similac 19**	**Neosure 22**
Volume (ml/kg)	**>140**	179	150	188	162
Kcal/kg	**120**	122	120	120	123
Protein (g/kg)	**3**	*1.9*	*2.1*	*2.5*	3.5
Volume (ml)	**180 ml/kg**	450	375	450	413
A IU	**1320**	*1013*	*1077*	*912*	*1079*
D IU	**400**	*9*	*46*	*228*	*216*
E IU	**6**	*1.8*	*3.5*	*4.6*	11.1
C mg	**40**	*18.4*	*23.1*	*33*	46.2
B1 mcg	**200**	*95*	*198*	304	539
B2 mcg	**300**	*156*	*209*	456	462
Niacin mcg	**2000**	*677*	*1617*	3193	6010
B6 mcg	**100**	*92*	130	182	308
B12 mcg	**0.4**	*0.21*	0.39	0.76	1.23
Iron mg	**2 mg/kg/d**	0.12	1.1	5.47	4.42
Zinc mcg	***2 mg***	*0.55*	*1.1*	*2.28*	*2.94*
Ca mg	***210 mg***	*126*	*160*	*237*	*324*
P mg	***100 mg***	*64*	*86*	*128*	*191*

ADDENDUM 2: Feeding & Supplementation Selection

Feeding Type	**Brand Name** *(NOTE: calories/oz dependent on recipe)*	**Manufacturer**
Human Milk	Maternal Breastmilk (MBM)	Mother
Human Milk Fortifier (HMF)	Similac Liquid HMF	Abbott
	Enfamil Liquid HMF	Mead Johnson
Preterm Formula	Similac Special Care	Abbott
	Premature Enfamil	Mead Johnson
	Gerber Goodstart Premature	Nestle
Preterm Discharge Formula (PDF)	Neosure	Abbott
	Enfacare	Mead Johnson
	Nourish	Nestle
Standard Term Formula	Variety – milk based (Soy formula not recommended for preterm infants)	Abbott / Mead Johnson / Nestle / Private Label