

Nutrition for the Late and Moderately Preterm Infant



Aneurin Young | Neonatal Nutrition Research Group

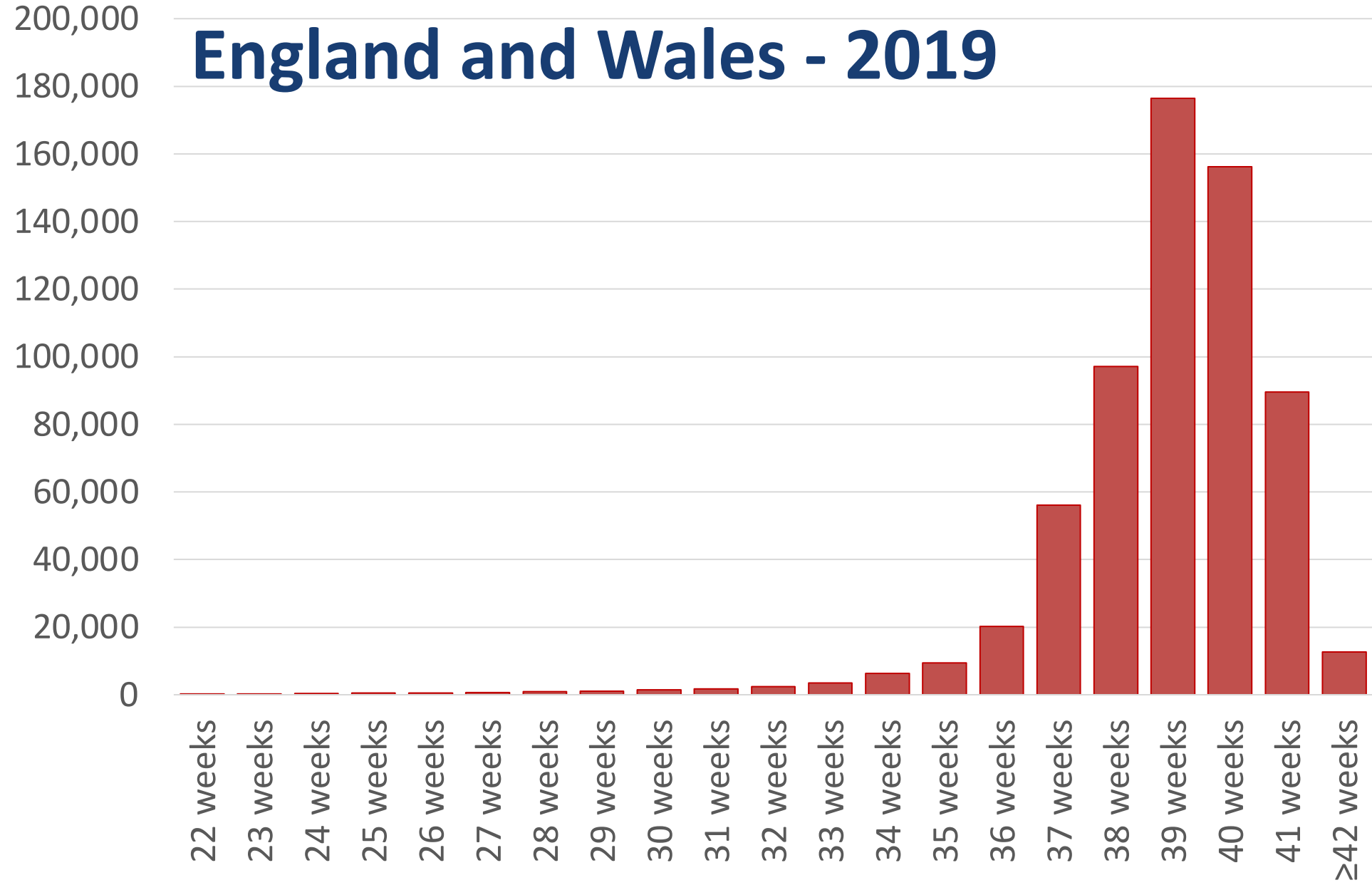
Nutrition for the Late and Moderately Preterm Infant

- Definitions
- Why late and moderately preterm infants matter
- Feeding strategies
- Reflux
- 30⁺⁰-31⁺⁶w – FEED1

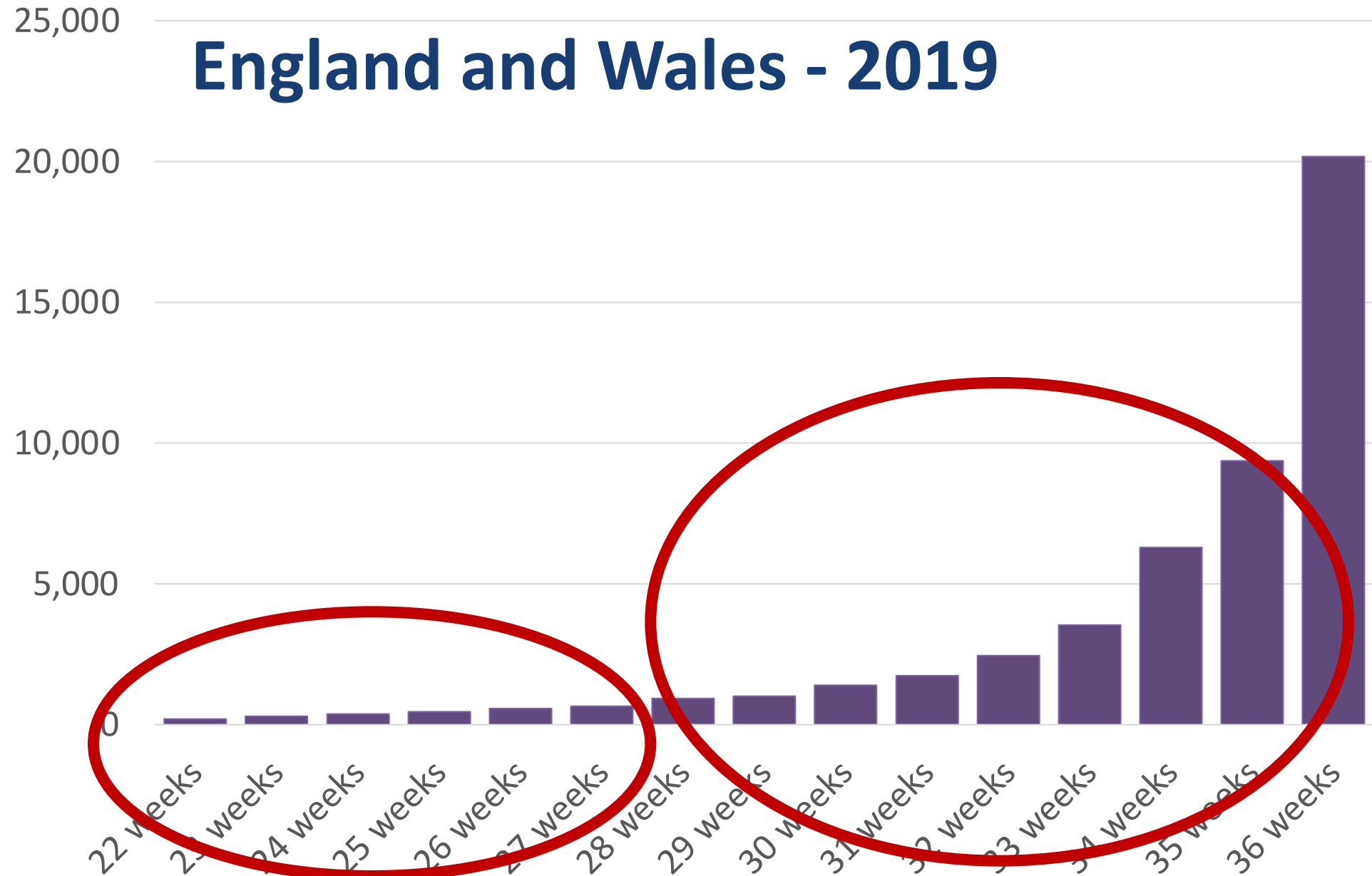
Definitions

- Late preterm (LPT): 34^{+0} - 36^{+6}
- Moderately preterm (MPT): 32^{+0} - 33^{+6}
- LMPT = MPT + LPT

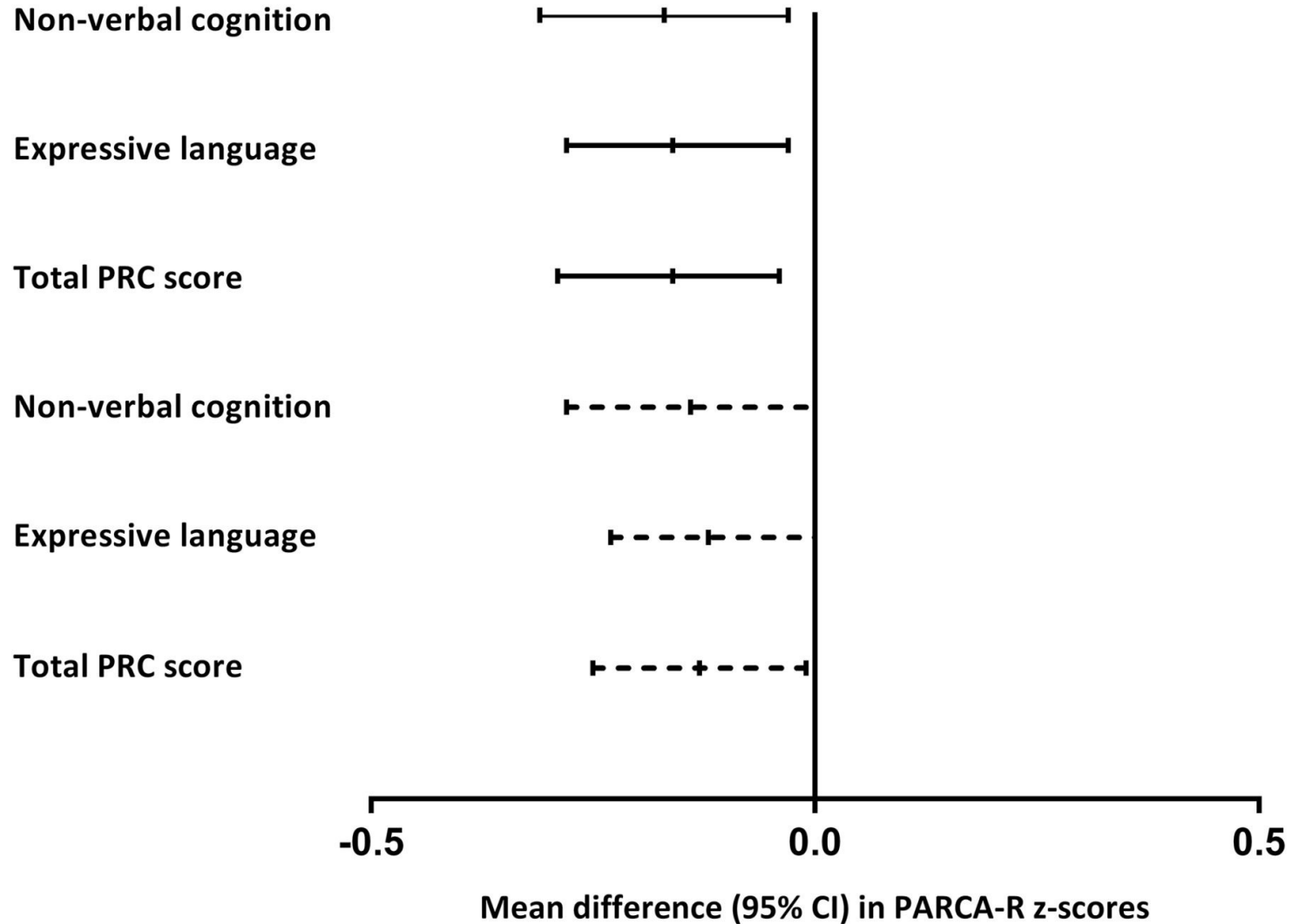
Data



Data



Outcomes for LMPT Infants



Neurodevelopmental outcomes following late and moderate prematurity: a population-based cohort study
Archives of Disease in Childhood - Fetal and Neonatal Edition 2015;**100**:F301-F308.

Outcomes for LMPT Infants

- Hypoglycaemia – 3-4x risk
- Abnormal body composition –

	Term newborns	LPT at TEA	p
Body weight (g)	3000	3012	ns
Body length (cm)	49	47	<0.05
Fat-free mass (g)	2794	2631	<0.0001
Fat mass (g)	287	384	<0.0001
Body fat (%)	8.1	12.3	<0.0001

- More oral motor and picky eating problems

Feeding Practices

- **ESPGHAN:**

Observed Nutritional Practices

Benchmarking or comparative studies often show that care of preterm infants, including nutritional practices varies greatly among countries and centres.

Likewise, there was a range in the type of formula recommended at discharge. Although nearly half (46%) of infants were discharged with advice to be fed with a formula containing more than 20 calories per ounce, this practice ranged from 4% to 72%.

ESPGHAN Guidelines

Breast-feeding for LMPT infants is strongly endorsed. Mothers of LMPT preterm infants should receive qualified, extended lactation support, and frequent follow-up.

The use of human milk fortifier, enriched formula and/or additional supplements, and parenteral nutrition may be appropriate for some LMPT infants taking into account factors, such as gestational age, birth weight, and significant comorbidities.

ESPGHAN Guidelines

LMPT infants are at risk of iron deficiency, which may impair neurodevelopment. LMPT infants weighing less than 2500 g at birth should receive 1 to 2 mg kg⁻¹ · day⁻¹ of iron up to 6 months age. LMPT infants weighing less than 2000 g should receive 2 to 3 mg kg⁻¹ · day⁻¹ of iron at least up to 6 months. LMPT infants require a daily vitamin D supplement of at least 400 IU/day throughout early childhood.

ESPGHAN Guidelines

- VLBW (<1500g):
 - Energy 110-130kcal/kg/day
 - Protein 3.5-4.5g/kg/day

ESPGHAN Guidelines

		ENTERAL FEEDING GUIDELINES		ENTERAL FEEDS				
		Koletzko et al.	ESPGHAN	Breastmilk (AAP ⁺)	Fortified Breastmilk	Preterm Formula	Preterm Follow-on Formula	Term Formula
Nutrient	Unit	(per kg/day)	(per kg/day)	(per 150ml)	(per 150ml)	(per 150ml)	(per 150ml)	(per 150ml)
Energy	kcal	110-130	110-135	~100	120-130	120	110	100
Macronutrients								
Protein / Amino Acids	g	3.5-4.5	4-4.5 (<1kg body weight) 3.5-4 (>1kg body weight)	~1.4	3-4.5	4-4.5	3	2-2.2
Lipid	g	4.8-6.6	4.8-6.6	~5	5-6	5.5-6	5.5-6	5
Carbohydrate	g	11.6-13.2	11.6-13.2	~12	13-16	12-13	10.5-11.5	11-12
Micronutrients								
Sodium	mg	69-115	69-115	~20-40	70-90	80-100	40-50	30-50
	mmol	1.2-2	1.2-3	~1-2	3-4	3.5-4.5	1.8-2.4	1-2
Potassium	mg	78-195	66-132	~60-80	120-150	120-170	120-130	100-140
	mmol	2-5	1.7-3.4	1.5-2	2.5-3.5	3-4.5	3-3.5	2.5-3.5
Calcium	mg	120-200	120-140	~30-40	130-150	150-180	125	70
	mmol	3-5	3-3.5	0.7-1	3.5-4	4-4.5	3.1	1.7
Phosphorus	mg	60-140	60-90	~20	80-90	100-120	70-75	40-50
	mmol	2-4.5	2-3	0.6	2.5-3	3-4	2-2.5	1.3-1.6
Iron	mg	2-3	2-3	~0.05-0.14	0-3**	2-2.5	1.1-1.8	0.5-0.8
Zinc	mg	1.4-2.5	1.1-2	~0.15-0.5	1-2	1.5-2	1.3	0.8
Vitamin A	µg RE	400-1100	400-1000	~50-90	400-600	500-550	100-150	90
Vitamin D	IU	400-1000	800-1000	~0.05	250-300	180-200	100	90
Vitamin E	mg α-TE	2.2-11	2.2-11	~0.5-1.2	5-7	5.5-7	1.3-3	1.7-2.1
Vitamin K1	µg	4.4-28	4.4-28	~0.3-0.5	10-15	9-10	6-9	5-7
Choline	mg	8-55	8-55	NG	3-3.5	30-40	35	33
DHA	mg	55-60	12-30	NG	2-2.5	30-40	30	25

ESPGHAN Guidelines

			ENTERAL FEEDS				
		ESPGHAN	Breastmilk (AAP+)	Fortified Breastmilk	Preterm Formula	Preterm Follow-on Formula	Term Formula
Nutrient	Unit	(per kg/day)	(per 150ml)	(per 150ml)	(per 150ml)	(per 150ml)	(per 150ml)
Energy	kcal	110-135	~100	120-130	120	110	100
Protein	g	3.5-4	~1.4	3-4.5	4-4.5	3	2-2.2
Lipid	g	4.8-6.6	~5	5-6	5.5-6	5.5-6	5
Carbohydrate	g	11.6-13.2	~12	13-16	12-13	10.5-11.5	11-12
Iron	mg	2-3	~0.05-0.14	0-3**	2-2.5	1.1-1.8	0.5-0.8
Vitamin D	IU	800-1000	~0.05	250-300	180-200	100	90

Southampton Guidelines

Moderate risk

- Preterm 28-31⁺⁶ weeks, otherwise well
- VLBW 1000 – 1500g
- Moderate IUGR (weight < 9th centile and AREDF) <35 weeks
- Baby on inotropes
- Baby on indomethacin/ibuprofen (NB avoid concomitant treatment with steroids)
- Baby >1500g with illness or congenital anomaly which may compromise feeding
- Perinatal hypoxia / ischaemia
- Symptomatic polycythaemia, with PCV \geq 70%

Low risk

- Preterm 32-36⁺⁶ weeks, otherwise well
- AREDF / IUGR \geq 35 weeks
- Term Infants >37 weeks

HIGH RISK AND MODERATE PRETERM INFANT

PARENTERAL NUTRITION

ENTERAL NUTRITION

AFTER BIRTH

Start Babiven Stock PN at 60-90ml/kg/day ideally within 6 hrs

Give colostrum as mouth care or trophic feeds

24-48 hours

Start Trophic Feeds at 1ml/kg 2-4 hourly with colostrum as available

48-72 hours

Consider Changing to 'Preterm Concentrated' Stock PN if able to give sodium

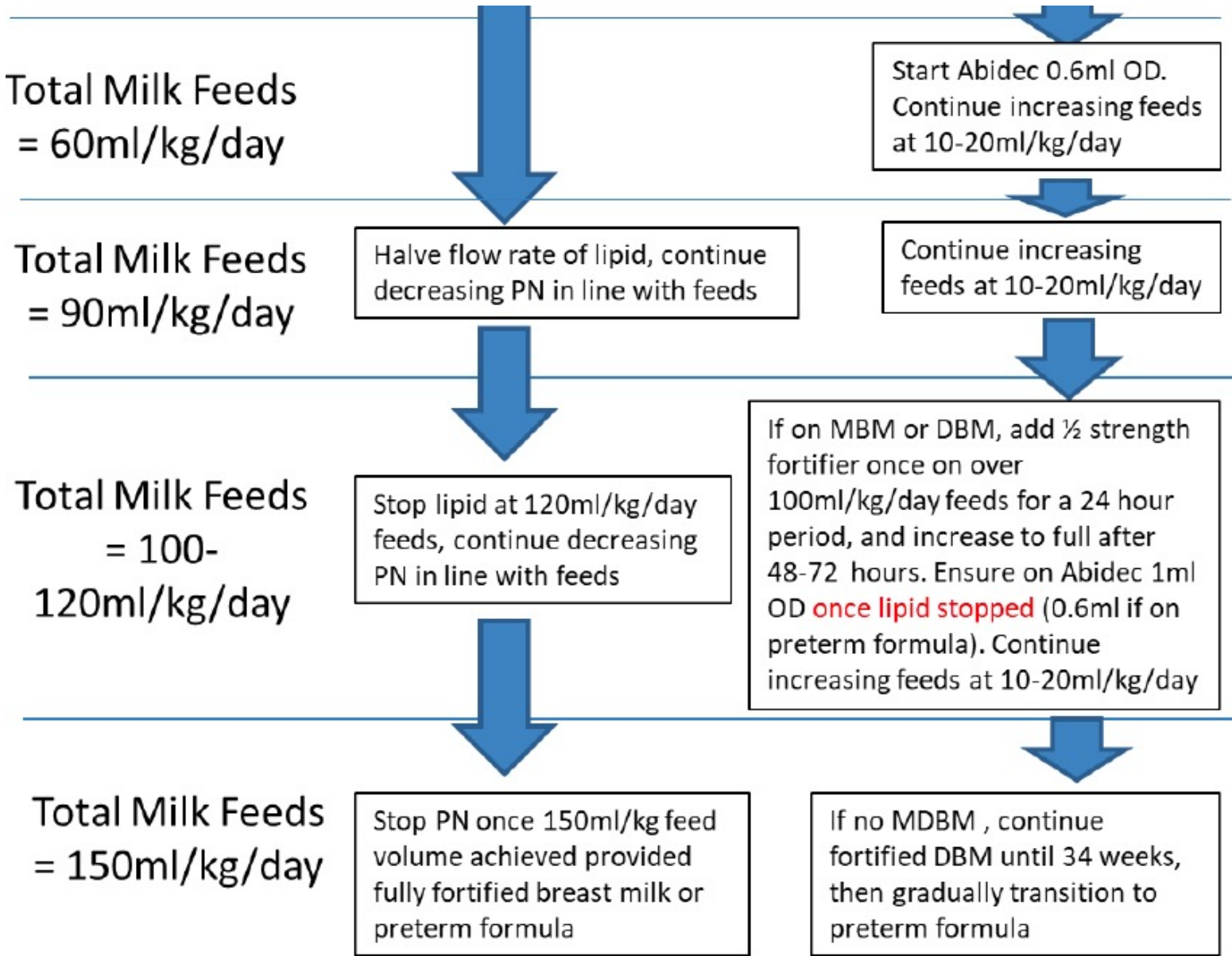
Increase milk by 10-20ml/kg/day

>72 hours

Total Fluids = 150ml/kg/day

Begin to decrease PN flow rate as feeds increase

Continue increasing feeds at 10-20ml/kg/day



Total Milk Feeds
= 60ml/kg/day

Start Abidec 0.6ml OD.
Continue increasing feeds
at 10-20ml/kg/day

Total Milk Feeds
= 90ml/kg/day

Halve flow rate of lipid, continue
decreasing PN in line with feeds

Continue increasing
feeds at 10-20ml/kg/day

Total Milk Feeds
= 100-
120ml/kg/day

Stop lipid at 120ml/kg/day
feeds, continue decreasing
PN in line with feeds

If on MBM or DBM, add ½ strength
fortifier once on over
100ml/kg/day feeds for a 24 hour
period, and increase to full after
48-72 hours. Ensure on Abidec 1ml
OD **once lipid stopped** (0.6ml if on
preterm formula). Continue
increasing feeds at 10-20ml/kg/day

Total Milk Feeds
= 150ml/kg/day

Stop PN once 150ml/kg feed
volume achieved provided
fully fortified breast milk or
preterm formula

If no MDBM, continue
fortified DBM until 34 weeks,
then gradually transition to
preterm formula

Southampton Guidelines – Low Risk

Low risk

First 24 hours	Commence milk feeds 30-60 ml/kg/day, supplemented by IV fluids if necessary
Beyond 72 hours	Increase milk feeds by 30 ml/kg/day as tolerated

Southampton Guidelines

Fortifier:

- It should be routine for all moderate and high risk babies together with those in the late preterm group who are less than 1.8kg at birth and who are exclusively breast fed
- It should also be considered for late preterm infants (<35 weeks gestation) whose mother's are intending to breastfeed or if growth is poor.

LBW Formula:

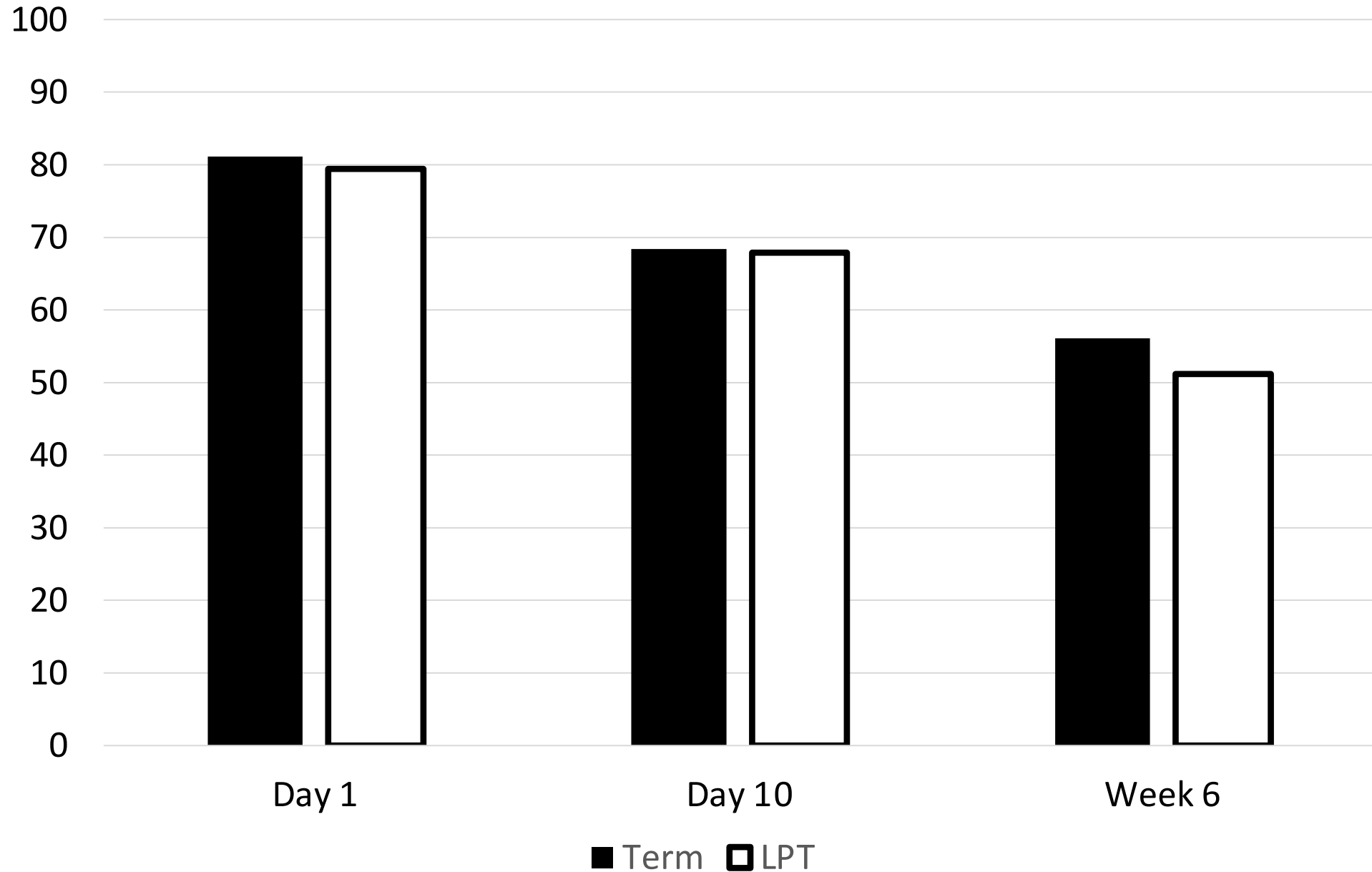
Preterm formula (Nutriprem 1) is indicated for infants with birth weight <1.8kg grams; Post discharge formula (Nutriprem 2) is indicated for preterm infants either as sole diet or in addition to breast-feeding from around 36 weeks (or discharge) up to 6 months corrected age.

Southampton Guidelines

Multivitamin: Abidec 1ml daily for breastfed or term formula, 0.6ml daily for LBW formula
– multivitamin to continue until 5

Iron: Sytron 1ml daily for breastfed infants until 6 months old

Breastfeeding



Breastfeeding



Breastfeeding - preterm infants

Assessing Readiness to feed / establishing breastfeeding

Breastfeeding is a normal physiological behaviour even for preterm infants. Early and frequent feeding opportunities will enhance the infant's ability to successfully breastfeed.

Readiness to feed is determined by infant's feeding cues. Readiness to breastfeed is not determined by age, gestation, weight or ability to take oral feeds by alternative methods. Some well preterm infants may have the ability to initiate breastfeeding as early as 28-30 weeks gestation. Infants at this gestation should be cardio-respiratory stable and mothers may need to express prior to offering the breast.

1. Observe for cues of readiness to suck, i.e. mouthing, rooting, gaping, brings hand to mouth. Note. Crying is a late sign of hunger and may result in uncoordinated sucking and fatigue, even in a term newborn.
2. Offer breast when baby shows cues for sucking.
3. Assess breastfeeding outcome. See Newborn Services RBP: Breastfeeding Score as a guide to baby's progress and guidelines to supplementation. Not all infants will require supplementation.
4. If the infant is unable to effectively breastfeed - refer to the following Newborn Services RBP
 - A. Preparing for Breastfeeding
 - B. Breastfeeding Score
 - C. Supplementary Feeding a Breastfed Infant
 - D. Expressing Breast Milk
5. No restrictions should be placed on the infant's opportunities at the breast unless there is a justified medical reason.
6. Document outcome and management plan in infants Care Plan.



Breastfeeding

UpToDate[®]

Gestational age — The earliest gestational age (based on postmenstrual weeks) at which preterm infants can successfully take oral feedings via breast or artificial nipple is variable. Oral feedings often are initiated at 32 to 34 postmenstrual weeks, an age at which suckling is similar to that of term infants, except that it occurs in shorter bursts. Some infants can take a portion of their feeds orally at an earlier age.

Gastro-oesophageal Reflux

American Academy
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

Diagnosis and Management of Gastroesophageal Reflux in Preterm Infants

Eric C. Eichenwald, MD, FAAP, COMMITTEE ON FETUS AND NEWBORN

Gastro-oesophageal Reflux

1. GER is almost universal in preterm infants. It is a physiologic process secondary to frequent TLESR, relatively large-volume liquid diet, and age-specific body positioning. As such, it is a normal developmental phenomenon that will resolve with maturation.
7. Preterm infants with clinically diagnosed GER are often treated with pharmacologic agents; however, a lack of evidence of efficacy together with emerging evidence of significant harm (particularly with gastric acid blockade) strongly suggest that these agents should be used sparingly, if at all, in preterm infants.

Gastro-oesophageal Reflux

Multicenter, Double-Blind, Randomized, Placebo-Controlled Trial Assessing the Efficacy and Safety of Proton Pump Inhibitor Lansoprazole in Infants with Symptoms of Gastroesophageal Reflux Disease

SUSAN R. ORENSTEIN, MD, ERIC HASSALL, MBChB, FRCPC, WANDA FURMAGA-JABLONSKA, MD, PhD, STUART ATKINSON, MBChB,
AND MARSHA RAANAN, MS

	Lansoprazole double-blind (≤4 weeks, n = 81)*	Placebo double-blind (≤4 weeks, n = 81)*	P value†
Primary efficacy: Responder rate, n (%)	44 (54%)	44 (54%)	NS
Discontinued due to nonefficacy, n (%)	28 (35%)	29 (36%)	NS
Individual symptoms‡			
Cry, % of feeds/week (Appendix 2)	−20	−20	NS
Regurgitate, % of feeds/week	−14	−11	NS
Stop feed soon, % of feeds/week	−7	−8	NS
Feed refusal, % of days/week	−14	−10	NS
Arching back, % of days/week	−20	−18	NS
Coughing, % of days/week	0	−9	NS
Wheezing, % of days/week	−5	−6	NS
Hoarseness	2	−5	NS
Global severity assessment§			
Parent: Improved at week 4	45 (56%)	41 (51%)	NS
Physician: Improved at week 4	44 (55%)¶	40 (49%)	NS

Gastro-oesophageal Reflux

	Lansoprazole double-blind (n = 81)	Placebo double-blind (n = 81)	P value*
Cumulative treatment exposure, subject-weeks	257	245	—
AE collection weeks, median, range†	8.3, 1-9	8.3, 1-9	NS
AEs‡	50 (62%)	37 (46%)	NS
Upper respiratory infections	18 (22%)	17 (21%)	NS
Constipation, GERD	9 (11%): 5,4§	3 (4%): 2,1§	NS
Dermatitis, eczema	8 (10%)	6 (7%)	NS
Ear infections	8 (10%)	5 (6%)	NS
Fever	8 (10%)	2 (2%)	NS
Lower respiratory tract infection	6 (7%)	2 (2%)	NS
Respiratory tract congestion	0	0	NS
Rhinorrhea	6 (7%)	4 (5%)	NS
Candidiasis	5 (6%)	3 (4%)	NS
Diarrhea (excluding infective)	4 (5%)	5 (6%)	NS
Vomiting	4 (5%)	1 (1%)	NS
Alkaline phosphatase increase	2 (2%)	5 (6%)	NS
Viral infection	2 (2%)	5 (6%)	NS
SAEs¶	10 (12%)	2 (2%)	.032
Lower respiratory tract infection	4 (5%)	1 (1%)	NS
Diarrhea	2 (2%)	0	NS
Ileus	1 (1%)	0	NS
Dehydration	1 (1%)	0	NS
Ear infection (otitis media)	0	1 (1%)	NS
Upper respiratory infection	1 (1%)	0	NS
Epididymal infection	1 (1%)	0	NS
Arachnoid cyst	1 (1%)	0	NS
Cellulitis	1 (1%)	0	NS
Febrile convulsion	0	0	NS
<i>Klebsiella</i> infection	0	0	NS

Breastfeeding

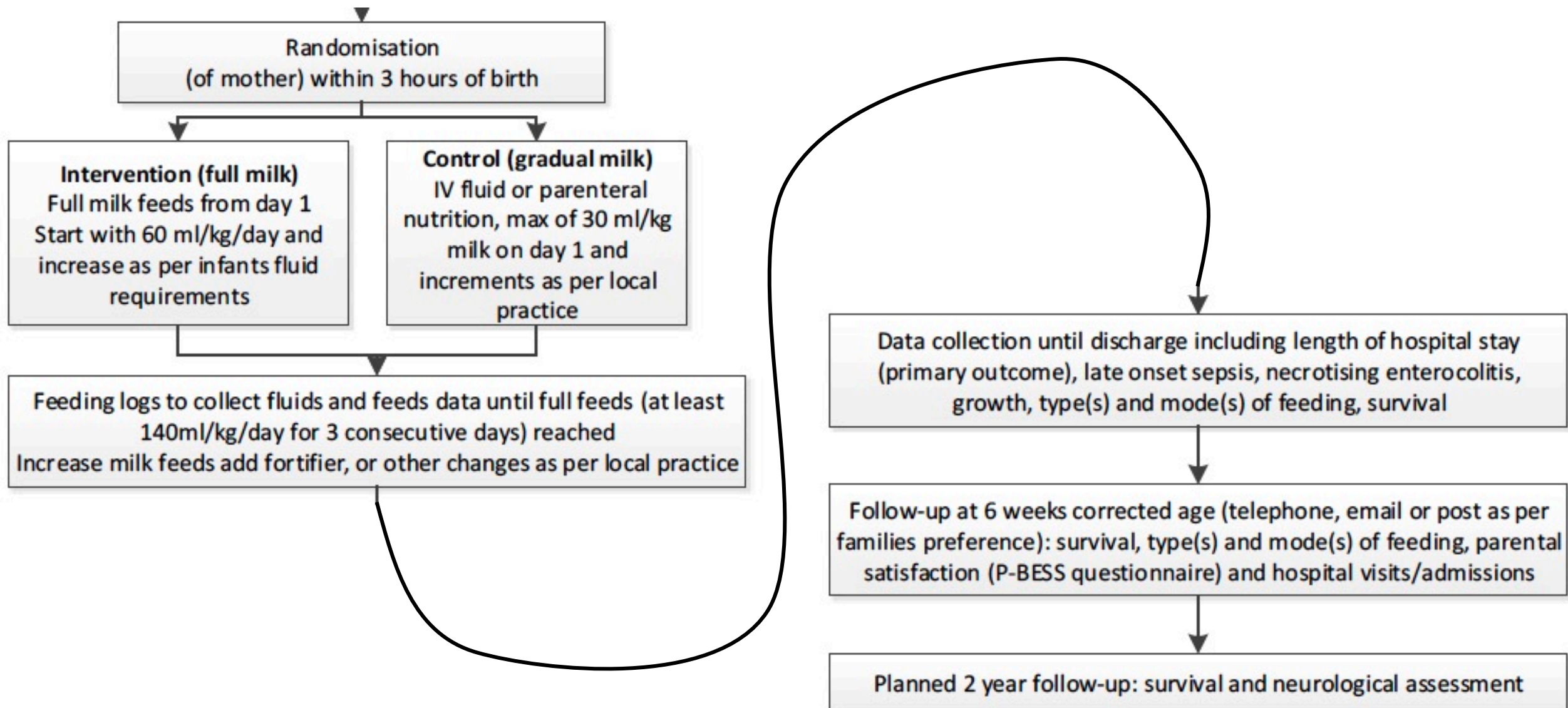


FEED1 Trial

Congratulations!



FEED1 Trial



Take Home Messages

Moderate and late preterm infants are not just small term babies!

Preterm infants have different nutritional requirements

Southampton guidance available

PPIs – think before you prescribe

Watch this space re: 30-32⁺⁶ weekers!