Kent Surrey and Sussex Neonatal Operational Delivery Network

Principles of Practice Post Discharge Formula in Neonatal Infants

Authors	KSS Neonatal Nutrition Group
Presented for approval to/on	KSS Clinical Governance Board January 2024
Last Reviewed	New document
Review date *(Max 3 years)*	January 2027
Distribution	Neonatal Units in KSS
Implications of race, equality & other diversity duties for this document	

Aim

- To standardise the use of Post Discharge Formula (PDF) on all units within KSS
- To ensure parents are fully informed of the benefits of post discharge formula for optimal growth if breast milk is not available.
- To ensure clinician' practice remains evidence based whilst on a rotation programme.

Background

The BAPM Late Preterm document describes the definition and terminology around preterm births close to term, as there are many discrepancies around the definition that affect the feed of choice. It is becoming recognised that dichotomous definitions that were used for preterm birth (< 37 weeks of gestation) and term birth (≥ 37 weeks of gestation) are no longer appropriate. This reflects relatively recent evidence that risks associated with preterm birth form a continuum that extends from extremely preterm to full term birth.

For the purposes of the document, the following terminology are used, along with a summary of the consideration for Post Discharge Nutrient Enriched Formula (PDNEF):

Definition	Gestation at birth	Birth weight	Consideration for PDNEF
Very pre-term	<32 weeks	<1.8kgs >1.8kgs	Pre-term formula: <1.8kgs SMA GP1/NP1 Post discharge formula: >1.8kgs SMA GP 2/NP2
Moderate	32 +0 - 34 weeks	<1.8kgs >1.8kgs >2.2kgs	Pre-term formula: SMA GP1/NP1 Post discharge formula: SMA GP 2/NP2 **Term formula** (Lapillonne, 2014, Nutrition, 2014/ appendix 1): 1. Commence term formula and monitor intake. 2. Plot weight and length on centile charts **Transition to NEPDF** **1. If** intake not 150mls/kg/ day (bottle or tube) **2. If** length and weight are not tracking within 2 centiles of each other
Late	34+0 – 36+6 weeks	<1.8kgs >1.8kgs >2.2kgs	Pre-term formula: SMA GP1/NP1 Post discharge formula: SMA GP 2/NP2 **Term formula** (Lapillonne, 2014, Nutrition, 2014/ appendix 1): 3. Commence term formula and monitor intake. 4. Plot weight and length on centile charts **Transition to NEPDF** **3. If** intake not 150mls/kg/ day (bottle or tube) **4. If** length and weight are not tracking within 2 centiles of each other

Term	37+0	<2.2kgs	Term formula: 1. Commence term formula and monitor intake. 2. Plot weight and length on centile charts 3. Refer to Infant Feeding Team/Dietitian i**f:** a. intake not 150mls/kg/day b. length and weight are not tracking within 2 centiles of each other. c. possible feed intolerance

The aim of the PDF is to support growth of non-breastfed or partially breast-fed preterm. Infants over 1.8kgs, born prematurely or small for gestational age, under medical supervision, until a standard term formula serves to sustain healthy growth.

Pre-Term Infants

Most babies born pre-term have higher fat mass and less fat free mass when compared with term infants, and therefore their need for protein is higher. Protein is required for brain and bone growth as well as weight gain. The Protein: Energy ratio is of crucial importance within preterm infant feeding, as it is a component in lean mass accretion (Ziegler, 2015). Studies have shown that a higher PER following discharge results in improved recovery of growth and body composition (Teller et al., 2016).

Preterm infants weighing between 1800 - 2200g require approximately 2.7 g protein per 100 kcal (Ziegler, 2011). This is reflected in the nutritional content of PDF, which provides approximately 75 kcal/100 ml and protein 2.1 g/100 ml.

Zinc, iron, folate and Vitamin A are also required to optimise bone growth and brain growth as well as protein, however the nutrient stores of these vitamins and minerals in pre-term infants is not known.

When considering the evidence for using a nutrient enriched post discharge formula (PDF), the findings are not conclusive. The latest review was a Cochrane review in March 2012. There were seven trials eligible for inclusion, 631 infants were studied, and they were generally good in methodological quality. The reviewers found that at 12-18 months of age there was no significant difference in growth or development following a period on post discharge infant formula and no long-term neurodevelopmental benefits.

The conclusions made from this review included:

- The differences in the way trials were measured and outcomes presented, limited the data assessment.
- There was not enough evidence that feeding preterm infants nutrient enriched formula compared with std. term formula affected either growth or neurodevelopment. Therefore, they were unable to support use of PDF over standard term formula.
- The evidence was not consistent to support PDF possibly due to the effect of infants reducing their intake relative to calorie-density of the milk.
- Further research is required focusing on effect of protein and mineral enriched formula rather than energy and reviewing lean mass and skeletal growth and development.

Another study looked at 31 published studies and mapped out the information on Participants, Intervention, Comparator and Outcomes (PICO). They did show an improvement in growth parameters at some point, particularly for boys. The results and conclusions from this review were:

- The found a significant improvement in all growth parameters at 12-18mo when comparing post discharge preterm formula to standard term formula.
- When energy requirements are achieved, the increased protein content of the feed can be used for increased growth and lean mass accretion.
- The high Protein: Energy ratios encouraged lean mass accretion and improved head circumference.
- No neurodevelopmental outcomes were seen.

Parameters around this guideline:

- Any recommendations within the guideline were for populations not for individuals.
- There isn't an agreed set of nutritional requirements for infants 1.8-3.5kgs
- There is no specific weight or age when transitioning from preterm to term nutritional requirements.
- The data informing the studies was varied and some were from some very small data sets.

It is to note that term and specialised formula are not designed to meet needs of preterm infants. Other strategies considered may lead to other complications:

1) *Increasing feed volumes* may need to be increased significantly (>180mls/kg/day) to meet nutritional requirements which may lead to other complications, for example increasing reflux.
2) *Concentrating the feed* may lead to feed intolerance, due to increased osmolality, or problems arising with feed preparation on the ward or at home.

SGA/IUGR

In the absence of congenital malformations or chromosomal abnormalities, small fetal size could be the consequence of two distinct processes: 1) constitutional smallness or 2) pathological growth restriction. Distinguishing one process from the other is challenging.

1) Traditionally, the term SGA has been used to describe a neonate whose weight and/or length at birth is at least 2 SD below the mean for the infant's gestational age, equivalent to the 2-3 percentile (appendix 1), based on the data derived from an appropriate reference population. Some publications define SGA newborn as those with birth weight or length below the 3rd, 5th, 9th or 10th percentiles for gestational age. The international SGA advisory panel chose the first definition because it likely includes the majority of patients with impaired fetal growth.

2) The term intrauterine growth retardation (IUGR) suggests the presence of a pathological process occurring in utero that inhibits fetal growth and diminishes growth velocity. Being born SGA does not necessarily mean that the infant is growth restricted in utero, and infants who are IUGR are not necessarily SGA at birth.

Unfortunately, the terms IUGR and SGA can be used interchangeably, creating confusion on the topic. The most common aetiology of being born SGA is placental insufficiency that impairs growth, particularly during the last trimester of pregnancy, leading to IUGR. Therefore, SGA is often used as a proxy for restricted growth combining both constitutionally small and pathologically growth restricted infants. Other causes of SGA may include exposure of the infants to toxins (smoking, alcohol, and drug abuse), chromosomal

anomalies (trisomy 13, Edward Syndrome, Turner Syndrome, and Prader-Willy Syndrome etc.), congenital infections (toxoplasmosis, rubella, and cytomegalovirus), metabolic disorders and maternal factors (both young and advanced age, maternal hypertension, placental and uterine abnormalities etc.). These infants may therefore at increased risk for neonatal morbidity and mortality.

In conclusion:

- There is some evidence that suggests that SGA infants (constitutionally small infants) are at increased risk for neonatal morbidity and mortality, and also evidence suggesting that SGA infants can have morbidity and mortality very similar to appropriate for gestational age infants, and considerably lower than pathologically growth restricted ones (IUGR).

- Poor growth is strongly associated with poor neurodevelopmental outcomes, but faster weight gain may be associated with an increased risk of overweight and obesity, higher body fat percentage, waist circumference and blood pressure and adverse long-term cardiovascular outcomes.

- Low birth weight (LBW) infants e.g., possibly being term SGA or IUGR may have different nutritional needs than premature infants after hospital discharge, which have not been defined.

Therefore, monitoring and ensuring optimal weight gain in ALL infants born <2.2kgs is essential throughout the entire spectrum of pre-term to term infants to prevent long-term complications.

Criteria/Indications for the use of PDF (Appendix 3)

- All babies < 34 weeks, receiving pre-term formula 1 and weighing >1.8kgs
- Al babies < 37 weeks and weight< 2.2kgs
- All babies < 37 weeks and weight >2.2kgs **and**
    - Taking <150mls/kg/day
    - Length plotted and > 2 centiles from weight.
    - Weight is not tracking the centiles 10-14days post birth.

Contraindications for use of PDF

- Mother would like to fully breast feed with further support and advice.
- Infant is >37+0 weeks and > 2.2kgs at birth.
- Cow's milk protein allergy suspected.
- Galactosaemia suspected.

When to Start PDF

- At the first feed after birth if appropriate criteria for age and weight and Mother is not able to breast feed her baby
- Mother has shown a preference to offer formula to her baby and meets the criteria as written above
- When Mother's breast milk volume is not meeting the demand of the infant or adequate to support weight gain despite adequate volume and fortification. The initiation of PDF should be following a consultation from lactation consultant/infant feeding lead.

Monitoring Biochemistry

- Whilst an infant is receiving post discharge formula, serum biochemistry should be monitored 1-2 weekly including urea, electrolytes and bone minerals if there are concerns regarding growth or nutritional related deficiencies.

Growth Monitoring

- Growth monitoring should take place at birth and then at least twice a week whilst the infant remains an inpatient.
- Following discharge, weights should be measured1-2 weekly until consistent weight gain is achieved.
- Length measurements should also be considered to monitor growth effectively.
- Once appropriate weight: length: age is consistently achieved over a period of 1-2 weeks; the infant should then be transitioned onto a standard term formula.

Administering Additional Vitamins and Minerals (to agree the consensus from the following options) (see KSS Vitamins and Additives Policy)

- Infants should continue 0.6mls of Abidec/DaliVit until they are 6months corrected age. Once the infant is over 6months of age and taking >500mls vitamins can be stopped until the age of one. At 1 year of age when on cows' milk, they should recommence and continue until 4-5years according to DoH guidelines.
- Iron should be stopped once the infant it is taking >50% of all feeds as post discharge formula or once weaning diet established.

Discontinuing PDF/Criteria to stop

The decision for the duration of prescribing nutrient enriched post discharge formula is the responsibility of the HCP and should be based on regular growth monitoring of the individual child as there is no consensus or evidence based on its use as previously discussed.

ESPGHAN 2006 recommends that children in need of growth recovery may receive nutritional support until **three months (12 weeks)** corrected age. This period may be extended up to between six- and twelve-months' corrected age with evidence of improved body composition at to six months of age.

The following points should be considered:

- **Once an infant has reached their birth centile**, infants who are on PDF, should be transitioned onto a standard term formula (i.e., after catch-up has been completed and in proportion with their length). Infants need to find their individual genetic potential that may be different from the size in utero, and this should be considered.

- **If weight gain is disproportionally faster than length gain**, the child should be switched from PDF to a standard formula for term infants, possibly in combination with supplementation of specific nutrients.

- It is not recommended to provide the PDF after the 50th weight percentile has been reached.

- If growth is still of concern at three month corrected age (12 weeks'), a Dietitian referral should be made for further nutritional management.

Key Points:

- PDF is indicated for pre-term infants born <37+0 weeks in need of recovery growth at discharge.
- Human milk and breastfeeding should be encouraged for as long as possible after discharge.
- Ongoing growth and monitoring are crucial post discharge to ensure weight gain is appropriate.
- PDF has a nutritional composition between a preterm formula and standard term formula to meet the requirements of a pre-term infant (appendix 2)

References

- Aggett et al., 2006, Feeding preterm infants after hospital discharge: a commentary by the ESPGHAN Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2006 May;42(5):596-603

- Johnson S. Evans T.A, Draper E.S.et al.. Neurodevelopmental outcomes following late and moderate prematurity: a population-based cohort study. Arch Dis Child Fetal Neonatal Ed. 2015; 100: F301-F308

- Mariana Muelbert, Jane E. Harding, and Frank H. Bloomfield* Nutritional policies for late preterm and early term infants - can we do better? Seminars in Fetal and Neontal Medicine, Volume 24, issue 1, p43-47, February 2019

- G Henderson, T Fahey, W McGuire; Calorie and protein-enriched formula versus standard term formula for improving growth and development in preterm or low birth weight infants following hospital discharge. Cochrane Database Syst Rev 2005 Apr 18;(2):

- Henderson G, Fahey T, McGuire W Nutrient-enriched formula versus standard term formula for preterm infants following hospital discharge. Cochrane Database Syst Rev. 2007 Oct 17;(4):CD004696. doi: 10.1002/14651858.CD004696.pub3

- Young L, Embleton ND, McGuire W. Nutrient-enriched formula versus standard formula for preterm infants following hospital discharge. .Cochrane Database Syst Rev. 2016 Dec 13;12(12):CD004696. doi: 10.1002/14651858.CD004696.pub5.

- S. Karger, Tsang RC, Uauy R, Koletzko BV, Lapillonne, 2014. Feeding the Preterm Infant after Discharge; Nutritional Care of the Preterm Infants; Scientific Basis and Practical Guidelines. Volume 110, Book Chapter pages 264-277

APPENDICES

Appendix 1:

Boys Centile charts: the highlighted areas suggest SGA/IUGR based on < 2nd-9th centile.

Number of weeks/weights in g	1.7	1.8	1.9	2.0	2.2	2.4	2.5
34	2nd-9th (7th)	9th-25th (11th)	9th-25th (17th)	9th-25th (24th)	25th-50th (42nd)	50th-75th (62nd)	50th-75th (72nd)
35	2nd-9th (2nd)	2nd -9th (4th)	2nd-9th (7th)	9th-25th (10th)	9th-25th (22nd)	25th-50th (39th)	25th-50th (48th)
36	0.4th-2nd (1st)	0.4th-2nd (1st)	2nd-9th (2nd)	2nd-9th (4th)	9th-25th (10th)	9th-25th (20th)	25th-50th (28th)
36+6	<0.4th	<0.4th	0.4th - 2ND (1st)	0.4th-2nd (1st)	2nd - 9th (4th)	9th-25th (12th)	9th-25th (17th)

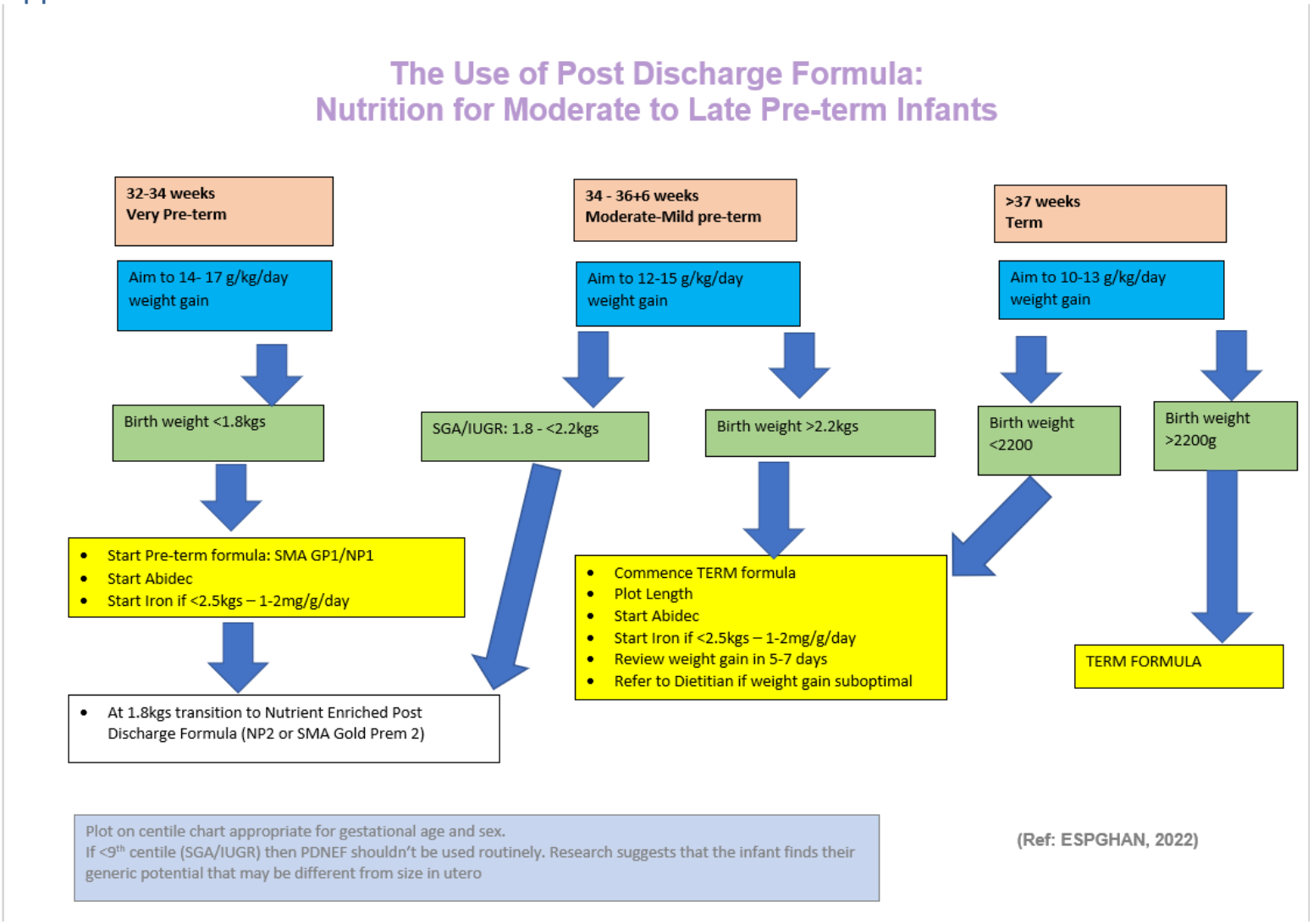
Girls Centile charts: the highlighted areas suggest SGA/IUGR based on < 2nd-9th centile.

Number of weeks/weights in g	1.7	1.8	1.9	2.0	2.2	2.4	2.5
34	9th-25th (11th)	9th-25th(17th)	9th-25th (24th)	25th-50th (33rd)	50th-75th (54th)	50th-75th (73rd)	75th-91st (81st)
35	2nd-9th (4th)	2nd- 9th (6th)	9th-25th (10th)	9th-25th (16th)	25th-50th (32nd)	(50th-75th 51st)	50th-75th (61st)
36	0.4th-2nd (1st)	0.4th-2nd (2nd)	2nd-9th (4th)	2nd-9th (6th)	9th-25th (15th)	25th-50th (30th)	25th-50th (38th)
36+6	<0.4th	0.4th-2nd (1st)	0.4th - 2ND (1st)	2nd-9th (2nd)	2nd - 9th (7th)	9th-25th (15th)	9th-25th (23rd

Appendix 2: The Nutritional Composition of a Variety of Milk Feeds used on a Neonatal Units

Nutrient per 100ml	Breast milk and FS NP Fortifier	Nutriprem 2	SMA Gold Prem 2	Standard term formula	Infatrini	Similac High Energy	SMA High Energy
Energy (kcal)	84	72	73	66	100	100	100
Protein (g)	2.9	2	2.0	1.3	2.6	2.6	2.6 (partially hydrolysed)
Sodium (mg)	61	26.5	36	22	32	35	37
Calcium (mg)	95	83	82	58	100	80	100
Phosphorous (mg)	52.5	48	50.0	33	50	42	60
Vitamin A (µg RE)	247.0	100	68	58	88	100	100
Vitamin D (µg)	5.7	1.8	1.8	1.5	2.4	2.2	2.5
Iron (mg)	0.1	1.2	0.8	0.53	1.2	1.1	1.0

Appendix 3


The Use of Post Discharge Formula:
Nutrition for Moderate to Late Pre-term Infants
32-34 weeks
Very Pre-term
34 - 36+6 weeks
Moderate-Mild pre-term
>37 weeks
Term
Aim to 14- 17 g/kg/day weight gain
Aim to 12-15 g/kg/day weight gain
Aim to 10-13 g/kg/day weight gain
Birth weight <1.8kgs
SGA/IUGR: 1.8 - <2.2kgs
Birth weight >2.2kgs
Birth weight <2200
Birth weight >2200g
Start Pre-term formula: SMA GP1/NP1
Start Abidec
Start Iron if <2.5kgs – 1-2mg/g/day
Commence TERM formula
Plot Length
Start Abidec
Start Iron if <2.5kgs – 1-2mg/g/day
Review weight gain in 5-7 days
Refer to Dietitian if weight gain suboptimal
TERM FORMULA
At 1.8kgs transition to Nutrient Enriched Post Discharge Formula (NP2 or SMA Gold Prem 2)
Plot on centile chart appropriate for gestational age and sex.
If <9th centile (SGA/IUGR) then PDNEF shouldn't be used routinely. Research suggests that the infant finds their generic potential that may be different from size in utero
(Ref: ESPGHAN, 2022)