PEDIATRIC MALNUTRITION MASTERCLASS



Wednesday, September 28, 2022 12:30 – 5:00 PM ET Location: Virtual Eligible for 4 CE hours



Neonatal and Pediatric Malnutrition: What's in Your Toolbox and Why Does it Matter?

Speaker: Patricia J. Becker, MS, RDN, CSP, FAND - Dayton Children's Hospital Medical Center Learning Objectives:

- Describe the use of tools for assessing pediatric malnutrition
- Summarize pediatric and neonatal malnutrition indicators
- Discuss challenges to adoption of the diagnosis of malnutrition by providers in inpatient and outpatient settings
- Explain importance of care plans for neonates, infants, and children with malnutrition



Beyond the Scale: Using Nutrition Focused Physical Exams (NFPE) to Assess Infants and Children for Malnutrition

Speaker: Caitlin M. Stewart, MS, RDN, CDN, CNSC, CLC – New York, NY Learning Objectives:

- Describe the need for conducting NFPE in infants and children
- Explain the role of NFPE in identifying malnutrition
- List at least three clinical signs of malnutrition



Optimizing Growth in Breastfed Infants with Failure to Thrive: An Interdisciplinary Approach

Speaker: Olivia Mayer, MPH, RD, CSP, IBCLC – Palo Alto, CA Learning Objectives:

- Identify current practices/challenges for feeding breastfed infants
- Discuss importance of a comprehensive approach to managing breastfed infants
- Explain options to support breastfed infants with failure to thrive who require additional nutrient intake



Recent Clinical Data and Real-world Cases: Feeding Infants with Growth Failure

Speakers: Madden Wilson, RDN, LDN – Knoxville, TN; Melanie Savoca, MS, RD, LDN – Philadelphia,

PA; Rob McCandlish, RDN – Nutricia North America

Learning Objectives:

- List outcomes of recent research on managing growth failure in infancy
- Explain when and how to use an energy- and nutrient-dense formula (ENDF)
- Describe real-world applications of ENDF for cardiac and non-cardiac cases of growth failure

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Pediatric and Neonatal Malnutrition What is in your toolbox?

Why does it matter?

Patricia J. Becker MS RDN CSP FAND Dayton Children's Hospital Medical Center September 28, 2022



Disclosures

No disclosures

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No conflicts of interest for this presentation

The opinions reflected in this presentation are those of the speaker and independent of Nutricia North America



Learning Objectives



- Participants in this activity will learn to:
 - Describe the use of tools for assessing Pediatric Malnutrition (PMN)
 - Summarize pediatric and neonatal malnutrition indicators
 - Discuss challenges to adoption of the diagnosis of malnutrition by providers in an inpatient and outpatient setting
 - Explain importance of care plans for neonates, infants, and children with malnutrition

Your Tool Box

- The Academy of Nutrition and Dietetic/American Society for Parenteral and Enteral Nutrition consensus-derived Indicators of malnutrition (AAIMp)
- The Preterm / Neonatal Recommended Indicators of Malnutrition
- The Up-dated Subjective Global Nutrition Assessment tool (pSGNA)
- Mid-upper arm circumference (MUAC)



The New Subjective Global Assessment Tool



- What makes a tool valid?
 - Comparison to a reference or "gold" standard
 - Outcomes that "validate" the tool's use for its purpose against that standard

Subjective Global Nutrition Assessment

Pediatric Subjective Global Nutrition Assessment(SGNA)

Medical history	A	в	С
Weight / WL change past 6 months: weight loss % 0-5% (A) 5-10% (B) >10% (C)			
Appropriateness of weight for height Ideal body weight = kg. > 90%.(A) 75-90%. (B) < 75% (C)			
Change in body weight: Stable on percentile growth curve (A) increased > 1 percentile / decreased > 1 percentile Changes in the past 2 weeks: No change – Increased - decreased			
Duration of change: > 2 weeks / < 2 weeks			
Appropriateness of height for age $> 3\%$ ile (A) at or just below the $3^{cd}\%$ ile (C)			
Appropriate considering mid-parental height? Yes - No			
Adequacy of nutrient intake Adequate (A) somewhat inadequate (B) very inadequate / starvation (C)			
Gastrointestinal symptoms No symptoms (A) one or more symptoms (not daily) (B) some or all symptoms – daily (C) Duration: < 2 weeks (A) > 2 weeks (B)			
Functional status: Normal ADLs (A) reduced ADLs (B) severely reduced / impaired ADLs (C) Change of functional status: < 2 weeks (A) > 2 weeks (B)			
Loss of subcutaneous fat mass No loss (A). Loss in some areas (B) loss in most areas (C)			
Loss of lean body mass No loss (A). Loss in some areas (B) loss in most areas (C)			
Edema: none (A) moderate (B) severe (C)			

Secker DJ, Jeejeebhoy KN. How to perform Subjective Global Nutritional assessment in children. J Acad Nutr Diet. 2012 Mar;112(3):424-431.

Revised pSGNA

Nutrition focused history		Normal	Moderate	Severe	
1.Appropriateness of height for age					
a.	Height for age z score (HAZ)	above - 2 z-score	- 2 to -3 z-score	below - 3 z-score	
a.	Serial growth	HAZ remains stable or trends upward on growth curve	HAZ shows a gradual downward trend	HAZ shows a sharp or rapid downward trend	
a.	Appropriate considering mid- parental height				
2. Ap for le	propriateness of current weight ngth or height BMI for age	above - 2 z score	- 2 to -3 z-score	below - 3 z score	
3. Un weigh	intentional change in body ht				
a.	Change in weight for age z-score	Remains stable on growth curve	Declined, but recovering	Trending downwards	
a.	Weight loss	5% usual body weight	5-10% UBW	>10% UBW	
a.	Changes in past 2 weeks	No change	Increased wt. loss	Decreased wt. loss	

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Adapted from from Carter L, Hulst JM, Afzal N, Jeejeebhoy K, Brunet-Wood K. Update to the pediatric Subjective Global Nutritional Assessment (SGNA). Nutr Clin Pract. 2022 May 20. https://doi: 10.1002/ncp.10859. doi: 10.1002/ncp.10859

Revised pSGNA



4. A	dequacy of diet intake			
e	a. Current vs. usual	Adequate intake	50-75% of need	<50% of needs
ł	b. Duration of change	short	moderate	prolonged
5. G	I symptoms			
a.	Presence of GI symptoms	No symptoms	1 or more but not daily	Multiple symptoms / daily symptoms
a.	Duration of symptoms	short	moderate	prolonged

Adapted from from Carter L, Huist JM, Afzal N, Jeejeebhoy K, Brunet-Wood K. Update to the pediatric Subjective Global Nutritional Assessment (SGNA). Nutr Clin Pract. 2022 May 20. https://doi: 10.1002/ncp.10859. doi: 10.1002/ncp.10859

Revised pSGNA



6. Functional capacity				
a.	Overall	Can perform normal age- appropriate activity, play	Increased fatigue, reduced play, light activity	Little play, confined to bed, increased sleep
b.	Function in past 2 weeks	Improved	Unchanged	Worsened
b.	Metabolic stress of disease	None	Moderate	Severe
7. Nutrition focused physical exam				
a.	Loss of subcutaneous fat	None	Some loss	Severe loss
a.	Muscle wasting	None	Some wasting	Severe wasting
a.	Edema	None	Moderate	Severe
Overall SGNA Score				

Adapted from from Carter L, Hulst JM, Afzal N, Jeejeebhoy K, Brunet-Wood K. Update to the pediatric Subjective Global Nutritional Assessment (SGNA). Nutr Clin Pract. 2022 May 20. https://doi: 10.1002/ncp.10859. doi: 10.1002/ncp.10859



Interpretation of Growth Charts



- Weight for age: Good growth: tracking-stable on a curve / Length for age: Tracking – stable on a curve.
- Growth Concerns: In children at risk for pediatric malnutrition related to undernutrition -Deceleration across Z score lines / centiles is suggestive of poor growth

Primary Indicators: Single Data Points Available



	Mild malnutrition	Moderate malnutrition	Severe malnutrition
Weight for height	-1 to -1.9 z score	-2 to -2.9 z score	-3 or greater z
z score			score
BMI for age z	-1 to – 1.9 z score	-2 to -2.9 z score	-3 or greater z
score			score
Length / height z	No data	No data	-3 z score
score			
Mid-upper arm	Less than – 1 z	Less than -2 z	Less than – 3 z
circumference	score for age/ 12.5-	score for age / <	score for age /
	13.4cm	12.5 cm	<11.5 cm.

Becker P, et al. Academy of Nutrition and Dietetics; ASPEN. Consensus statement of the Academy of Nutrition and Dietetics/ASPEN: indicators recommended for the identification and documentation of pediatric mainutrition (undernutrition). NCP. 2015 Feb;30(1):147-61.

Primary Indicators: Two or More Data Points Available



	Mild malnutrition	Moderate malnutrition	Severe malnutrition				
Weight gain velocity (< 2 years of age)	Less than 75% *of the norm⁺ for expected weight gain	Less than 50%* of the norm ⁺ for expected weight gain*	Less than 25%* of the norm ⁺ for expected weight gain*				
Weight loss (2-20 years of age)	5% usual body weight	7.5% usual body weight	10% usual body weight				
Deceleration in weight for length / height z score	Decline of 1 z score	Decline of 2 z score	Decline of 3 z score				
Inadequate nutrient	51-75% estimated	26-50% estimated	≤ 25% estimated				
intake	energy / protein need	energy / protein need	energy / protein need				
Becker P, et al. Academy of Nutrition and Dietetics; ASPE NCP. 2015 Feb;30(1):147-61.	Becker P, et al. Academy of Nutrition and Dietetics; ASPEN. Consensus statement of the Academy of Nutrition and Dietetics/ASPEN: indicators recommended for the identification and documentation of pediatric malnutrition (undernutrition). NCP. 2015 Feb:30(1):147-61.						

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Weight gain velocity

assessment for malnutrition: Boys 0-24 months

Age	Grams per day	Grams per	Mild malnutr	rition	Modera malnutr	te ition	Severe malnutr	ition
	median	month median	<75% e	xpected	<50% e:	xpected	<25% ex	cpected
0-30 days	30	880	22 g/d	660 g/mo	15 g/d	440 g/mo	7.5 g/d	220 g.mo.
30-60 days	34	1012	25	760	17	506	8.5	253
2-4 months	24	720	18	540	12	360	6	180
4-6 months	15	445	11	334	7.5	223	4	111
6-9 months	10	310	8	232	6	173	3	86
9-12 months	8	240	6	180	4	120	2	60
12-18 months	7	200	5	150	3.5	100	2	50
18-24 months	7	195	5	146	3	98		49

Adapted from the WHO weight gain velocity tables:https://www.who.int/tools/child-growth-standards/standards/weight-velocity



vere malnutritio

	day median	month median	expected		<50% expe	cted in	<25% exp	ected
0-30 days	35	1025	26 grams per day	770 grams per month	17 grams per day	513 grams per month	9 grams per day	256 grams per month
30-60 days	40	1200	30	900	20	600	10	300
2-4 months	25	815	20	611	13.5	407	7	204
4-6 months	16	475	12	356	8	238	4	120
6-9 months	11	330	8	250	6	165	3	83
9-12 months	9	254	7	191	4.5	127	2	64
12-18 months	7	200	5	150	3.5	100	2	50
18-24 months	7	195	5	147	3.5	98	2	49

Age Grams per Grams per Mild malnutrition <75% Moderate malnutrition

Adapted from the WHO weight gain velocity tables:https://www.who.int/tools/child-growth-standards/standards/weight-velocity

Primary Indicators of Neonatal and Preterm Malnutrition



	Mild malnutrition	Moderate malnutrition	Severe malnutrition	Use of indicator
Indicators that require a single indicator:				
Decline in weight-for-age z-score	Decline of 0.8-1.2 SD	Decline of 1.2-2.0 SD	Decline of >2.0 SD	Not appropriate for the first 2 weeks of life
Weight gain velocity	<75% of expected rate of weight gain to maintain growth rate	<50% of expected rate of weight gain to maintain growth rate	<25% of expected rate of weight gain to maintain growth rate	Not appropriate for the first 2 weeks of life
Nutrient intake	≥ 3-5 consecutive days of protein/energy intake ≤ 75% of estimated needs.	 ≥ 5-7 consecutive days of protein/energy intake ≤ 75% of estimated needs. 	>7 consecutive days of protein/energy intake ≤ 75% of estimated needs.	Preferred indicator for the first 2 weeks of life

Goldberg DL, Becker PJ, et al. Identifying Malnutrition in Preterm and Neonatal Populations: Recommended Indicators. J Acad Nutr Diet. 2018 Sep;118(9):1571-1582.

Primary Indicators of Neonatal and Preterm Malnutrition



Indicators that re	quire 2 indicators:			
Days to regain birth weight	15-18 days	19-21 days	>21 days	Use in conjunctions with nutrient intake
Linear growth velocity	<75% of expected rate of linear gain to maintain growth rate	<50% of expected rate of linear gain to maintain growth rate	<25% of expected rate of linear gain to maintain growth rate	Not appropriate for the first 2 weeks of life
Decline in length- for-age z-score	Decline of 0.8-1.2 SD	Decline of 1.2-2.0 SD	Decline of >2.0 SD	Not appropriate for the first 2 weeks of life. Use in conjunction with another indicator. Ensure length measurement is accurate.

Goldberg DL, Becker PJ, et al. Identifying Malnutrition in Preterm and Neonatal Populations: Recommended Indicators. J Acad Nutr Diet. 2018 Sep;118(9):1571-1582.

Weight Indicators



- Weight gain velocity
- Days to regain birth weight*
 - Should be used in combination with adequate nutrient intake

Starred items require 2 or more positive indicators to confirm malnutrition diagnosis

- Linear growth velocity
- Decline in length-for-age z-scores
 - Requires a 2nd positive indicator to determine malnutrition such as adequate nutrient intake





Length



Primary Indicator	Mild Malnutrition	Moderate Malnutrition	Severe Malnutrition	Use of Indicator
Indicators requiring a	a single indicator to diagno	se malnutrition		
Decline in weight- for-age z- score	Decline of 0.8–1.2 SD	Decline of >1.2–2 SD	Decline of > 2 SD	Not appropriate for the first 2 weeks of life
Weight gain velocity*	<75% of expected rate of weight gain to maintain growth rate	<50% of expected rate of weight gain to maintain growth rate	<25% of expected rate of weight gain to maintain growth rate	Not appropriate for the first 2 weeks of life
Nutrient Intake	≥3–5 consecutive days of protein or energy intake ≤75% of estimated needs	≥ 5–7 consecutive days of protein or energy intake ≤75% of estimated needs	>7 consecutive days of protein or energy intake ≤75% of estimated needs	Preferred indicator during the first two weeks of life
Indicators requiring t	wo indicators to diagnose	malnutrition		
Days to regain birth weight	15-18	19-21	>21	Use information with nutrient intake
Linear growth velocity ^a	<75% of expected rate of linear gain to maintain expected growth rate	<50% of expected rate of linear gain to maintain expected growth rate	<25% of expected rate of linear gain to maintain expected growth rate	Not appropriate for the first2 weeks of life. Use with a 2nd indicator and an accurate length measurement
Decline in length- for-age z-score ^a	<75% of expected rate of linear gain to maintain expected growth rate	<50% of expected rate of linear gain to maintain expected growth rate	<25% of expected rate of linear gain to maintain expected growth rate	Not appropriate for the first2 weeks of life. Use with a 2nd indicator and an accurate length measurement

Abbreviations: SD, Standard Deviation Note: Expected weight linear growth velocity and z scores can be determined using the online calculator Pedi Tools <u>www.peditools.org</u> Goldberg DL, Becker PJ, et al. Identifying Malnutrition in Preterm and Neonatal Populations: Recommended Indicators. J Acad Nutr Diet. 2018 Sep;118(9):1571-1582.

Poll Question 1

Respond in the right-hand panel in the live event - Click 'SUBMIT' when done

What are some types of indicators you use in your pediatric
malnutrition assessment?Choose all that apply

A. Height- and weight-for-age Z-scores

- **B.** Nutrient intake
- C. Weight gain velocity
- D. I measure mid-upper arm circumference
- E. I currently do not work with this population

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Mid upper arm circumference





'© UNICEF UN0318650/Almahbashi'.

WHO classifications used for assessing nutritional status using MUAC



Classification		
WHO 1983 (age and sex independent)	MUAC <12.5 cm – severe PMN	12.5 cm – 13.5 cm - mild to moderate PMN
WHO 1995	Boys (norms)	Girls (norms)
2+ years	13.6	13.4
3 + years	13.8	13.6
4 + years	14.1	13.9
5 + years	14.2	14.1
WHO 2006		
Undernutrition	Boys (MUAC z score < - 2 SD)	Girls (MUAC z score < - 2 SD)
Severe undernutrition	Boys (MUAC z score < - 3 SD)	Girls (MUAC z score < – 3 SD)

UNICEF MUAC tape



Cut-off poin	ts of S0145620:	
Red:	0 - 11.5 cm	
Yellow:	11.5 cm - 12.5 cm	
Green:	from 12.5 cm	
(+	S0145620
0	cm 6 7 8	13 14 15 16 17 18 19 20 21 22 23 24 25 26 →
	1	

Children's Mercy Tape







Mother-MUAC: Teaching mothers to screen for malnutrition - Guidelines for training of trainers. Alima. Manual and guideline. July 2016.

Validity and Reliability of Pediatric Nutrition Screening Tools



for Hospital, Outpatient, and Community Settings: A 2018 Evidence Analysis Center Systematic Review

- □ The pediatric MNRS systematic review found:
- MUAC, which is used around the world as a malnutrition screening tool, was underutilized in the US for this purpose

Becker PJ, et al. J Acad Nutr Diet. 2020;120(2):288-318.e2

MUAC in children with diarrhea



- Conclusions: MUAC and MUACZ were the most accurate predictors of undernutrition in children with diarrhea.
- WAZ and WLZ were significantly affected by dehydration status, lead to misdiagnosis of patients on admission with low WAZ

Modi P, et al. Mid-upper Arm Circumference Outperforms Weight-Based Measures of Nutritional Status in Children with Diarrhea. J Nutr. 2015 Jul;145(7):1582-7.

MUAC in Cystic Fibrosis

- The authors found that MUAC detected a higher % of malnutrition than BAZ (47% vs 10%)
- □ The study showed improvement in MUAC to be more sensitive than BAZ or weight changes in response to nutrition intervention
- □ There is a need for evidence-based recommendations on frequency of MUAC measurements
- as well as expected improvement in body composition over time
 - Currently there are no standardized practices

Phong RY, et al. Nutr Clin Pract. 2020;35(6):1094-1100.

MUAC in Anorexia Nervosa



Results

- Authors report that between weekly weight and MUAC assessments
 - MUAC and weight follow similar trends over time
- data indicated that participants felt more relaxed, less angry, scared or embarrassed during MUAC measurements vs. weighing and skin fold measurement
- MUAC emerged as the measurement that was most preferred by participants

Lam PY, Marshall SK, Devi Harjit G, Coelho JS, Cairns J. Pinch, cinch or step: Evaluating the effectiveness and acceptability of mid upper arm circumference measurements in adolescents with eating disorders. Eat Behav. 2016

MUAC in Anorexia Nervosa



Conclusion

 MUAC measurements are a useful adjunct to measurements of weight, and are perceived to be less distressing than routinely used measurement techniques of weight and skinfold measurements

Lam PY, Marshall SK, Devi Harjit G, Coelho JS, Cairns J. Pinch, cinch or step: Evaluating the effectiveness and acceptability of mid upper arm circumference measurements in adolescents with eating disorders. Eat Behav. 2016

MUAC in Cerebral Palsy



- The Pediatric Subjective Global Nutrition Assessment (SGNA) classifies more children with cerebral palsy as malnourished compared with anthropometrics
- Among the anthropometric variables; the authors found the highest agreement between pSGNA and MUAC for age z scores

Bell KL, et al. J Acad Nutr Diet. 2020;120(11):1893-1901.

Current Practices Using Pediatric Malnutrition Indicators: A Survey of Dietitians Working in Pediatrics



- In a survey of dietitians working in pediatrics, the survey found, infrequent use of MUAC and a need for further education on interpreting MUAC results
 - Specifically, the survey indicated educational opportunities for instruction on measuring and interpreting MUAC as an pMNRS and diagnosis tool

Bellini SG. Nutr Clin Pract. 2020;35(6):1080-1086.

Key take aways



- MUAC has been used to assess and diagnose malnutrition for many years
- It offers both short-term and long-term monitoring advantages vs. weight and height
- It is easy to obtain in the clinical setting in almost all children
- MAZ offers broad application

Poll Question 2

Respond in the right-hand panel in the live event - Click 'SUBMIT' when done

How often do you use MUAC in your practice?

A. Daily

B. Weekly

C. Monthly

D. Yearly

E. I do not currently use MUAC in my practice



Weight Gain Velocity



- Q1. How are weight gain velocity goals established?
- A: Weight gain velocity tables are available for term infants who are not neonates (greater than 30 days of life)



Simplified field tables

Interval	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD	
0 - 4 wks	123	358	611	879	1161	1453	1757	
4 wks - 2 mo	251	490	744	1011	1290	1580	1880	
2 - 3 mo	105	297	502	718	944	1178	1421	
3 - 4 mo	14	192	383	585	796	1016	1244	
4 - 5 mo	-62	108	293	489	695	911	1134	
5 - 6 mo	-132	31	210	401	604	815	1036 982	
6 - 7 mo	-185	-24	153	344	547	760		
7 - 8 mo	-224	-64	116	311	519	738	967	
8 - 9 mo	-259	-101	77	273	482	702	933	
9 - 10 mo	-286	-131	48	245	456	679	913	
10 - 11 mo	-307	-151	31	233	451	682	924	
11 - 12 mo	-324	-166	22	232	458	699	953	

Calculating Usual Body Weight



- Q2 How do you calculate "usual body weight" in a growing child?
- □ Answer:
 - In older children last most stable weight is often the best weight to choose
 - In younger children last highest weight is often the best choice

Transitioning from one Criteria to Another

- Preterm/neonatal to pediatric
- □ 1-24 month to 2-18 years
- Pediatric to adult

Transitioning from one Criteria to Another

- If malnutrition is unresolved
 - Continue to utilize the original diagnostic criteria
 - Regardless of the child's age
- □ If malnutrition occurs between age criteria periods
 - Use best clinical judgement for most appropriate criteria
- If malnutrition reoccurs during the admission
 - Utilize the criteria for the child's current age



Challenges of Malnutrition Coding

In an Inpatient and Outpatient Setting Challenges of





Reimbursement: Medicare Severity Diagnosis – Related Groups (MS-DRG)

- Organization receives \$ based on the diagnosis
- Regardless of the LOS or resources used
- Assigned based on principal diagnosis and any secondary diagnosis
 - Complication conditions or co-morbidities
 - Result in the assignment of a higher DRG
 - Major complicating conditions or co-morbidities
 - Result in the assignment of the highest DRG

ICD 10 / 9 Codes





SOI & ROM: Severity DRGS



for the Hospital.

- SOI is the extent of physiologic decompensation or organ system loss of function
- ROM is the likelihood of dying
- Secondary diagnosis are assigned 1 of 4 levels for SOI and ROM:
- SOI and ROM are dependent on the patient's underlying conditions:
 - A higher SOI and ROM are characterized by multiple serious diseases and the interaction among those diseases
 - Documentation specificity of diagnoses is important in accurately reporting the SOI and ROM



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Word Game



Code	Description	Affect	MCC	CC	501	ROM	Sort
J210	Principal Acute bronchiolitis due to respiratory syncytial virus	1			2	1	
E43	Unspecified severe protein-calorie malnutrition	1	1		3	2	
E441	Mild protein-calorie malnutrition			1	3	1	
E440	Moderate protein-calorie malnutrition			1	3	1	
E46	Unspecified protein-calorie mainutrition			1	3	1	
R1311	Dysphagia, oral phase			1	3	1	
R1312	Dysphagia, oropharyngeal phase				3	1	
R1310	Dysphagia, unspecified				P	P	
P0738	Preterm newborn, gestational age 35 completed weeks				1	1	
P929	Feeding problem of newborn, unspecified		1	-	1	1	
P599	Neonatal jaundice, unspecified				1	1	
P925	Neonatal difficulty in feeding at breast				1	1	
P923	Underfeeding of newborn				1	1	
E639	Nutritional deficiency, unspecified				1	1	
R633	Feeding difficulties				1	1	
L704	Infantile acne				1	1	
R05	Cough			-	1	1	

Every October the rules change, this year mild malnutrition's severity increased.

Coding Accurately

Case Study: Six month old with seizure disorder and failure to thrive has T 38.6, HR 158, RR 34, and WBC 24.6. Nutrition note documents protein calorie malnutrition, severe.

Sepsis	Sepsis
Failure to thrive	Protein calorie malnutrition
Seizure disorder	Seizure disorder
Severity of Illness: Moderate	Severity of Illness: Major
Risk of Mortality: Minor	Risk of Mortality: Moderate
Reimbursement: \$8,440	Reimbursement: \$14,487



Impact Scenario: HSV



Scenario 1	Scenario 2
Principal Dx: Disseminated herpesviral disease	Principal Dx: Disseminated herpesviral disease
Secondary conditions: Neonatal melena Herpesviral keratitis Thrombocytopenia Lactose intolerance SGA 2000-2499 grams	Secondary conditions: Neonatal melena Herpesviral keratitis Thrombocytopenia Lactose intolerance SGA 2000-2499 grams ADD: Mild malnutrition ADD: Dysphagia ADD: Neutropenia d/t acyclovir
APR-DRG 720.2 (2/2) : Septicemia & disseminated infections	APR-DRG 720.4 (4/2) : Septicemia & disseminated infections
Expected LOS: 3.29 days Expected Reimbursement: \$ 5,727.18	Expected LOS: 8.35 days Expected Reimbursement: \$ 19,637.30

LOS: 21 days Charges 133.750.43 12 day old admitted w/ HSV infection, skin/eye cultures +HSV as well as blood culture, CSF negative. Pt treated for disseminated HSV infection. PT's ANC noted to be decreased, possibly d/t acyclovir. Mild malnutrition noted by Dietitian. Swallowing difficulty noted by SLP.

Impact Scenario: Hypothermia

Scenario 1	Scenario 2
Principal Dx: Hypothermia of newborn	Principal Dx: Hypothermia of newborn
Secondary conditions: Feeding problem of newborn Neonatal jaundice	Secondary conditions: Feeding problem of newborn Neonatal jaundice ADD: Moderate malnutrition
APR-DRG 640.2 (2/1) Neonate BW > 2499 g, normal newborn or neonate w/ other problem	APR-DRG 639.1 (1/1) Neonate BW > 2499g w/ other significant condition
Expected LOS: 1.91 days Expected Reimbursement: \$ 1,663.94	Expected LOS: 7.878 days Expected Reimbursement: \$ 8,752.16

<u>LOS: 8 days</u> <u>Charges: 46,200.44</u>

PT admitted for hypothermia, poor feeding, and r/o sepsis. Dietitian note on admission: "Moderate malnutrition related to breast feeding difficulty as evidenced by inadequate energy/protein intake for 5-7 consecutive days."

Results:

- STRONGkids score correlated with adverse clinical outcomes: longer stay, higher hospital expenses, and need for nutrition support
- □ 12.8% at high risk
- □ 45% at moderate risk
- □ 42% at low/no risk

Gambra-Arzoz M, et al. Nutrition Risk in Hospitalized Pediatric Patients; Higher Complication Rate and Higher Costs Related to Malnutrition. Nutr Clin Pract. 2020 Feb;35(1):157-163.



Four Steps



- □ Step one
- A thorough nutrition assessment of the child
- This should include an assessment of all relevant indicator of malnutrition
- As well as other pertinent nutrition status data (medical conditions, treatment that effect nutritional status, NFPE, etc.)
- This should be documented to support the nutrition diagnosis and the need for nutrition intervention and monitoring

Indicators To Include In Assessing For Pediatric Malnutrition

Children 1-24 months	Children 2-18 years
Weight for length z-score (WHZ)	BMI for age z-score (BAZ)
Length for age z score	Height for age z score
Mid-upper arm circumference	Mid-upper arm circumference
Weight gain velocity	Weight loss percent usual body weight
Decline in WHZ	Decline in BAZ
Inadequate nutrient intake compared to estimated need	Inadequate nutrient intake compared to estimated need





- Documentation of the nutrition diagnosis of malnutrition
- PESS statement

PESS Statement(s)



- Moderate malnutrition related to inadequate energy & protein intake with increase nutrient losses as evidenced by decline in weight for age z score between – 1.2 and 2 standard deviation (-1.6 SD).
- Severe malnutrition related to critical illness and inadequate nutrient intake as evidence by BAZ (BMI for age z score) below -3 (-3.45 z score).

Step 3



Adoption of the nutrition diagnosis of malnutrition as a medical diagnosis by the licensed independent practitioner

Phillips W, Becker PJ, et al. Comprehensive Application of the Malnutrition Quality Improvement Initiative (MQII) Toolkit to Pediatric Malnutrition Care. J Acad Nutr Diet. 2021 Jun;121(6):1021-1034.

Education



- Dietitian team
- □ House staff / residents
- Physician assistant and Nurse practitioner staff
- Billing and coding staff

Suggested Approaches to Educate the Medical Team on Pediatric Malnutrition



Verbal	Written			
Grand rounds lecture on Pediatric Malnutrition	Blog post for organization on topic of PMN			
Resident lecture on PMN	Hospital wide newsletter article on topic of PMN			
Lunch and learn on PMN / journal club on original	Topic literature "Brief" on PMN handout for staff. Copy of			
publication.	article provided to team members.			
Team meeting chat with providers on PMN	Malnutrition trifold for providers with criteria - nutrition			
	focused physical assessment info - interventions			
Poster / abstraction presentation for team	Poster / abstract posted in unit			
Pre-rounds presentation on PMN	Creation of Peds & Preemie Malnutrition Criteria Badge			
	Cards			

Communication

- Verbal
 - RDNs can communicate with teams both formally or informally
 - In patient care rounds
 - In team meetings
 - In care conferences
- Written
 - In patient documentation
 - By automated notification of the PMN diagnosis
 - Through the EMR messaging systems

Strategies To Increase The Adoption Of The Malnutrition Diagnosis By Providers

RDN to provider communication

RDN messaging through the EMR

RDN notification of nutrition diagnosis in provider EPIC EMR sticky note

RDN notification of patient malnutrition diagnosis to team in rounds

RDN notification of patient malnutrition to team in weekly patient care conference

RDN notification of the patient's malnutrition to the family after rounds

Team mentor supporter created to relate to medical providers concerned over diagnosing malnutrition

RDN and Med Provider responded to queries from coding team improved communication

Clinical Nutrition Director and Medical Director obtained clearance for RDN to add diagnosis to problem list

RDN Order Writing Privileges



- Medical providers must include diagnoses in their progress notes and plans of care
- RDNs with order writing privileges can facilitate treatment and communicate the nutrition plan of care for malnutrition to providers
- RDNs with order writing privileges often can be granted the ability to add diagnoses to the patient problem list

Provider Malnutrition Documentation

- Documentation must include
 - Severity/acuity
 - Chronicity
 - etiology
- Malnutrition must be documented by the provider
 - Within the provider notes
 - Admission
 - Progress
 - Discharge
 - Problem list alone is insufficient

ASPEN: Malnutrition Matters / Pediatric 2018

The Final Step



The documentation into an appropriate diagnosis code added to the billing claim by the medical coders

The Medical Record / Billing – Coding Team



- Partner with the electronic health record and revenue cycle/billing team
- crucial to adopting the RDN malnutrition diagnosis into provider documentation
- These teams can ID components of RDN and provider documentation required for billing of the encounter



The Importance Of Care Plans For Children With Malnutrition

The Benefits Of Protocols And Pathways





How a Malnutrition Quality Improvement Initiative Furthers Malnutrition Measurement and Care: Results From a Hospital Learning Collaborative

The greatest improvements were achieved due to timely nutrition assessment and diagnosis. Patients who were diagnosed and treated had lower readmission rates than those without nutrition plans of care.

Valladares AF, Kilgore KM, Partridge J, Sulo S, Kerr KW, McCauley S.. How a Malnutrition Quality Improvement Initiative Furthers Malnutrition Measurement and Care: Results From a Hospital Learning Collaborative JPEN J Parenter Enterial Nutr. 2021 Feb:45(2):366-371.
Malnutrition Pathways





Malnutrition Pathways



Mild Malnutrition Intervention Protocol



- □ Offer 125 150 % of energy needs
- High calorie-high protein diet (1.25-1.5 x estimated energy-protein needs) 3 meals/1-2 scheduled snacks per day
- Oral nutritional supplements (to provide 50% of estimated energy-protein needs)
- Obtain a 3-day analysis of nutrient intake (calorie count)
- Provide education on increasing intake of high calorie, high protein foods and ingredients added to foods to increase the energy and protein content of foods

Dayton Children's Hospital Malnutrition Feeding Protocol

Ensuring Adequate Intake



- Total energy intake from foods and ONS and compliance with ONS were associated with improvement of WHP and HAP
- Study results: multi-nutrient supplement supported recovery growth & maintenance of both weight and height
- □ The long-term nutritional intervention:
 - dietary counselling and continued ONS promoted and sustained adequate intake of nutrients, and recovery from mild to moderate undernutrition

Impact of long-term use of oral nutritional supplement on nutritional adequacy, dietary diversity, food intake and growth of Filipino preschool children. Huynh DT, et al. J Nutr Sci. 2016 May 13;5:e20.

Benefit Of Oral Nutritional Supplements For Children



- In acute lymphoblastic leukemia during remission-induction chemotherapy: a quasiexperimental study
- Children who received ONS had ↓ incidence of infection, treatment gastro-intestinal complication & lower hospital cost

Liang R, et al. Asia Pac J Clin Nutr. 2018;27(1):144-147.

Moderate Malnutrition Intervention Protocol

- Implement Mild malnutrition intervention protocol
- Consider appetite enhancing medications
- Re-assess for improvement in recommended indicators
 - Weight gain velocity
 - Adequacy of intake as percentage of estimated need
 BAZ / WHZ
- If all indictors unchanged, consider providing nutrition support at 50% of measured (or estimated) energy and protein need until the child improves and meets nutrition care goals, growth goals or mild malnutrition criteria

Severe Malnutrition Intervention Protocol

- Provide / administer 100% of the child's measured (or estimated) energy and protein needs either by mouth or nutrition support
- Re-assess nutritional status by recommended indicators frequently until the child improves and meets nutrition care goals, growth goals or moderate malnutrition criteria, at which time Moderate malnutrition therapy protocol may be implemented

Dayton Children's Hospital Malnutrition Feeding Protocol

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Beyond the Scale: Using Nutrition Focused Physical Exam to Assess Infants and Children for Malnutrition

Caitlin Stewart, MS, RDN, CDN, CNSC, CLC Senior Pediatric Clinical Nutritionist



Disclosures

DINLC

- Honorarium provided by Nutricia
- Consultant for Academy of Nutrition & Dietetics NFPE Trainer
- Consultant for DM&A

None pose any conflict of interest for this presentation

The opinions reflected in this presentation are those of the speaker and independent of Nutricia North America

Learning Objectives

Describe the need for conducting NFPE in infants and children
 Explain the role of NFPE in identifying malnutrition
 List at least 3 clinical signs of malnutrition such as muscle wasting, fat loss, and micronutrient deficiencies

Pediatric AND/ASPEN Consensus Statement

	Evidence-based consensus driven indicators	
'	Universally available	1
	Reproducible and applicable in numerous settings	
	Inexpensive Can be properly used with minimal training	
	Allows clinicians to track changes in nutritional status]
	Identify and trend severity	
	Focus on undernutrition]

Becker et al. J Acad Nutr Diet. 2014.

Be

Pedia	tric Malnutrition Indicators	ļ	MLC	
0	Growth parameters & trends			
0	Mid-upper arm circumference (MUAC)			
0	Weight loss			
0	Weight gain velocity			
G	Adequacy of intake compared to estimated needs			
et al. J Acad	J Nutr Diet. 2014.			



Perceived Barriers to Com	oleting NFPE	
() Time Constraints	Lack of training/confidenc	e in
Concern that patients do not want to be examined	Believe that it is not in o scope of practice	ur
Stankorb SM, et al. Topics in Clinical Nutrition. 2010.		

Poll Q Respond in	ues the rig	tion #1 ht-hand panel in the live event – Click 'SUBMIT' when done	
What	is the	e main barrier to incorporating NFPE into your p	oractice?
	A	Time constraints	
	B	Lack of training/confidence in performing exam	
	С	Concern that patient does not want to be examined	
	D	Believe that it is not in our scope of practice	
	E	No barriers	
	F	Does not apply	



Importa	ance of NFPE to Malnutrition Diagnosis
1	Identify malnutrition quickly and more accurately
2	May help determine severity
3	Helps identify crucial micronutrient deficiencies
4	Provides additional documentation/support for the diagnosis
Corkins K. NCP. 2015.	



Growth Charts Do	on't Tell Whole Picture	
<5 th %	~50 th %	>95 th %
z-score -	z-score	z-score
2.20	+0.06	+2.51

M	N	IC
BUT BOOM D		CONTR.

Pediatric Nutrition Focused Physical Exam







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Mid-Upper A	Arm Circumference	
	Z-score trends available for children >2 months	
	Predicts malnutrition related mortality	
	Easy to learn and replicate; minimal tools required	
	Reflects 1:1 change in body mass	
		J
	Plot on peditools org: WHO (2007) - 3 months to 5 years WHO or CDC (2017) - >5 years	
 Abdei-Rahman et al. Aut Can Practice 2017, 32 49 (%). Franksho AK. And Can Aut. 1011 342340 2018. Frisandro, A. F. Banita L, et al. BMJ 2017/388(342). 	Roberts. 2028. Ann Aduct Unif Mungae Press.	

Mid-Upper Arm Circumf	erence	
1 Identify acromion and olecranon process		
2 Mark midpoint then release arm		
3 Measure circumference		
4 Avoid: pinching, loose tape measure		
DeTallo C, ed. American Society for Parenteral and Enteral Nutrition; 2	019.	



Infant/Toddler Specific Nutrition Focused Physical Exam





No Wasting/Losses	
Full cheeks	
Building in extremities	
Rolls in joints, thighs, and triceps	
Round belly	
Baby rolls!	

Mild	/Moderate Wasting/Loss
	Narrowing around waist; pants loose
	Ribs visible
	Diminished bulbing in extremities
	Some knee prominence
	No bulbing in calf
	No rolls in thighs or around knee/ankle

Severe Wasting/Losses	
Temporal wasting & sunken eyes	Minimal fat around ribs and waist
Clavicle prominence	Knee prominence
Ribs visible, able to count each rib	Sagging skin (neck, thighs, buttocks)

Mic	ronutrient Sta		
	Hair	Thinning, depigmentation	
	Eyes	Vision changes, pale conjunctiva	0
	Oral Cavity	Poor dentition, redness or bleeding in lips, gums, or tongue	0
	Nails	Easily breaking, spoon shaped	O
	Skin	Color, texture, poor wound healing	-

Corkins K. NCP, 2015.



Pediatric Micronutrients of Focus

DINLC



Corkscrew hair, petechiae, bleeding gums • Picky eating behaviors • Very limited diet • High intake of cow's milk Hair loss, taste changes, seborrheic dermatitis

Hair loss, taste changes, seborrheic dermatitis • Prolonged exclusive breastfeeding (>6 months of age) without zinc from complementary foods • Malabsorption





Academy of Nutrition and Dietetics Pediatric NFPE Pocket Guide, 2015



Additional Considerations	
Tanner Stage – may influence fat stores/exam	
Alternatives for traditional anthropometrics	
Disease-specific growth charts	
Condition-associated weakness or hypotonia	
Consider utilizing MUAC with larger age range [z-scores now available 2 months to 18 years]	
When in doubt, use child as their own control	

Poll Ques Respond in the ri					
How do physical exams inform your practice?					
A	Requesting labs				
В	Communicating severity of malnutrition				
C	C Monitoring malnutrition overtime				
D	All of the above				
E	I currently do not perform NFPE				
F	I do not work in patient care				

Incorporating Into Malnutrition Diagnosis

Add NFPE findings as supportive evidence to PES statement

Moderate malnutrition in setting of chronic illness related to inadequate intake, insensible losses as evidenced by BMI/age z-score -2 to -2.9, MUAC z-score -1 to -1.9, 9.6% weight loss, inadequate intake meeting <50% of estimated needs, *mild-moderate fat loss (orbital, buccal, triceps, ribs/mid-axillary line)* and *mild-moderate muscle wasting (pectoralis, deftoid)*. Physical findings suggestive of iron-deficiency anemia, possible zinc deficiency.

Mild malnutrition in setting of acute illness related to inadequate intake, hypermetabolism as evidenced by weighUlt z-score -1 to -1.9, growth velocity <75% of low-end goal for age, decline in wUlt z-score by 1, *mild-moderate fat loss (buccal pads, triceps*).

Summary Slide	
NFPE is a key component of any assessment & malnutrition diagnosis	
Engage caregiver to assess for changes from baseline	
Declines in infant and children can happen quickly • Reassess NFPE at each visit as able	
Be aware of disease specific limitations Use child as own control when unsure 	
Partner with team members to examine patients together to build confidence	

NFPE Trainings Available	
Comprehensive 8-hour training by the Academy of Nutrition & Dietetics [options: live and virtual])
Pediatric and adult specific trainings available)
Overview of all components of NFPE, malnutrition diagnosis, coding, documentation and in-depth case studies)
For more information: WWw.teatruphpio.org	L

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Optimizing Growth in Breastfed Infants with Failure to Thrive: An Interdisciplinary Approach

Olivia Mayer, MPH, RD, CSP, IBCLC Palo Alto, CA



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MINLC

Nutricia North America supports the use of breast milk wherever possible

Learning Objectives						
Participants in this activity will be able to:						
X S X S X	Identify current practices/challenges for feeding breastfed infants					
	Discuss importance of a comprehensive approach to managing breastfed infants					
¢ ļ ¢	Explain options to support breastfed infants with failure to thrive (FTT) who require additional nutrient intake					





























MINLC



Mother-Baby dyad may be more likely to experience failure to thrive when exclusive breastfeeding Image: Constraint of the image is a straint of the image



DEMAND						
Challenges	Intervention					
"Sleepy baby" Back to work soon	 Feeding Schedule Pumping schedule Identifying place to pump at work Neuro Evaluation Gastrointestinal Specialist Evaluation 					

Challenges and Interventions

DINLC

SUPPLY

Medications

- Blood loss at delivery
- Other

- Pump foremilk, feed hind milk
- : Hand Massage Breast Shells
- Medications &/or Supplements .

Challenges and Interventions					
FEAR and PERCEPTION					
Challenges	Interve	ention			
Fear of breastfeeding	 Focus on the factor Counseling 	cts			





Galactagogue

DINLC

What is a galactagogue?

• "any substance that increases milk supply"

https://medical-dictionary.thefreedictionary.com/galactogogue

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Poll Question Respond in the right-hand panel in the live event - Click 'SUBMIT' when done	
Galactagogue options come from which categor Choose all that apply	y/ies?
A. Herbal/food	
B. Prescription	
C. Other (acupuncture/laser therapy)	





Buntuchai, et al. J Hum Lact. 2017. Drugs and Lactation Database (LactMed); 2006. Image by Freepik on Flaticon.com















Images: https://lansinoh.com/products/silicone-breast-pump | https://www.amazon.com/Breast-Nursing-BPA-Free-Reusable-Collect/dp/B078NY26GL/ref=pd_lpo_3?pd_rd_i=B078NY26GL&psc=1









Images: https://breastfeeding.support/what-is-finger-feeding/ | https://mamasmilknochaser.com/2015/10/07/can-you-skip-the-bottle-cup-feed-yournewborn/ https://mamasmilknochaser.com/2015/10/07/can-you-skip-the-bottle-cup-feed-your-newborn/





MILC

Feeding Options when Supporting Breastfed Infants with Growth Failure

Poll Question Image: Constraint of the right-hand panel in the live event - Click 'SUBMIT' when done What is your current primary practice to fortify/supplement breast milk? Choose one A. ADD POWDER: Add formula powder to expressed milk for consistent, higher concentration at every feed B. HINDMILK: Have mom pump then feed baby directly at the breast for hindmilk as the primary milk ingested

C. ALTERNATE FEEDS: Encourage direct breastfeeding most feeds, plus a few bottle: of higher calorie formula each day D. NOT APPLICABLE: I don't currently work with this patient population

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Considerations when formula is needed							
CONSIDERATIONS			"Sprinkles" - expressed milk enriched with	Supplemental bottle feedings of high-calorie			
	Feedings at the		formula powder	formula			
	Dreast		Cost Mixing instructions				
	Low cost						
	 Maintain maternal supply 		Time to pump				
	Mom's own milk		Time to prepare				
	Minimal quilt		Tailored nutrients provided				
	Tolerated		Additional caregivers can feed & bond				
	Tolerated		Predictable nutrition				
Cohen, et al.	2015. Groh-Wargo, et al. 2014.						

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Cohen, et al. 2015.

Nutrition Comparison						
Breastmilk + Formula Added to Bottle @ 170 ml/kg/day			Mom's Milk (pumped or direct breastfeeding) + 3 Term Formula Feeds/day @ 170 ml/kg/day			
EBM + Formula	Kcal/kg	Grams PRO/kg	Formula kcal/oz	Kcal/kg	Grams PRO/kg	
00	<104	4.7	22	~118	~2	
22	≤124	~1.7	24	~122	~2.1	
24	≤136	~2	26	~126	~2.2	
26	≤147	~2.2	28	~131	~2.3	
28	≤159	~2.5	30	~135	~2.4	
30	≤170	~2.7	50	155	*Assuming 8 feeds/day	
Breastmilk: 20 kcal/oz and 0.9 grams protein/dL						

Kcal = kilocalories; oz = ounce; kg = kilogram; pro = protein Adapted from American Academy of Pediatrics Committee on Nutrition: Pediatric Nutrition Han 7ª ed. 2014

Formula option: Energy- and proteinenriched infant formula (EPEF)



MINLC EPEF preserves gastric volume Ratios of breast milk to supplemental EPEF, in feedings: 00 mL* Breast milk Breast milk 24 kcal/fl oz Protein: 1.8 grams/100 mL* 20% less formula volume 26 kcal/fl oz Protein: 2.1 grams/100 mL* -27 kcal/fl oz Protein: 2.2 grams/100 mL* Ready-to-feed EPEF Ready-to-feed 24 24 kcal/fl oz 500 kcal = ~21 fl oz rgy and protein-28 kcal/fl oz Protein: 2.4 grams/100 mL* nriched formula. mature human milk of 1.1 g/100 mL



Summary

- Many Variables
- □ More than 2 ways to feed
- Use The Tools Available
- Utilize Interdisciplinary Approach

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Recent Clinical Data and Realworld Cases: Feeding Infants with Growth Failure







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2020 Survey Revealed Shortcomings

Simental, 2020. Partial data shown: publication of full results pending, N=45

DINLC What is an ENDF / EPEF? ENDF 30 kcal/oz term infant formula Energyand High protein/nutrient content Nutrient-Osmolality <400 mOsm/kg Dense EPEF Formula Energy-Ready to feed/sterile and Nutritionally complete Protein-Enriched Supported by clinical evidence Formula ASPEN 2022 Fact Sheet

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GROW-IN Trial	- G	oday et al.	2022	
N=30			Sup Sup	pports catch- growth
	1°	Improved weight	gain	
ENDF	2°	Anthropometrics	Tolerance	Safety 🔿
Birth 0 19 mean WAZ Baseline 2.92 CHD = congenital heart disease, WAZ = weigh	+0 (p=0.	.86 0001) 	Well-tolera in infants w growth fail	Safe in infants with growth failure due to CHD & other causes

GROW-UP Study: F		
3 surveys per child a) Enrollment b) Caregiver 4-week c) Clinician 4-week SITES:	ENDF 4-8 weeks REASONS FOR ECCMMENDIAS Full restriction Full restriction F	Happy with growth Less time to prepare Better quality of life Would recommend
Preliminary results, publication pending.		


Disclosures

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Case ScenariosCase 1• 2-month-old male• Cleft Lip and Palate• Malnutrition• Feeding tube dependence• History of NEC• Malnutrition

MPA = milk protein allergy; NEC = necrotizing enterocolitis

Case 1 – Pa	tient history	
Age and sex	2-month-old, full-term male	
Diagnosis	Cleft palate Bilateral Cleft Lip	
Feeding history	Standard infant formula 20 kcal/oz PO/GT Trialed extensively hydrolyzed formula + calorie modular	
Nutritional problem(s)	 Dysphagia - MBSS at 6 months of age showed aspiration with liquids Severe Malnutrition (weight gain velocity <25% of norm, length for age z score -4.26 SD, weight for age z score -3.47 SD, weight for length z score -1.44 SD) 	
Factors which may have impacted growth	 Interruption to feeds/NPO status due to multiple procedures Increased needs for healing post surgery Dysphagia, limited PO acceptance 	

Case 1 - Nutritional management		
Intervention	Energy- and nutrient-dense formula (ENDF)	
Introduction	Previous regimen: Extensively hydrolyzed formula at 20 kcalloz 190 mL 4x/day + 480 mL overnight, oral diet + powdered calorie modular Introduction of ENDF (full strength on Day 1): 180 mL 5x/day, oral diet	
Route(s)	G-tube	
Intake targets	130-140 kcal/kg/day 3 g Protein/kg (10% of total calories)	
Use	ENDF to provide >90% of calorie needs, PO solids to provide <10% of calorie needs	

Case	1 - Growth & Outo	omes	
Nutrient targets achieved	130-140 kcal/kg3.2 g protein/kg		
Growth recovery notes	Weight-for-age z score change: • -3.47 SD $\rightarrow -2.58$ SD in 5 weeks Growth Velocity: • 23 g/day weight gain in the first 3 weeks • 25 g/day weight gain overall while on ENDF • 1 cm length increase while on ENDF		ENDF started
		B Ng B T	



Case 1 - Summary		DINLC
Why ENDF was chosen over other options	 Higher calorie and protein intake to help support weight gain, linear growth Patient was close to 1 year of age; formula choic minimal change of formula during needed period Minimize delay in optimal enteral nutrition 	catch-up e allowed
How ENDF helped this patient	 Higher kcal/oz allowed patient to wean off overni Decreased volume via G-tube encouraged increatintake Malnutrition resolved 	ght feeds ased oral
Key learnings	 Tolerated well; constipation was reported to be in Demonstrated significant catch-up growth and im scores to address malnutrition 	nproved Iproved z-

ENDF = energy- and nutrient-dense formula

Case 2 - Pat	DINLC	
Age and sex	6-month-old female, twin born at 29 weeks gestation	
Diagnosis	PDA (patent ductus arteriosus) s/p closure on its own NEC; treated with antibiotics, TPN (total parenteral nutrition) TPN cholestasis (resolved)	, and gut rest
Nutritional problem(s)	Suspected MPA Moderate Malnutrition (weight for length z score -2.27 SD) Delayed gastric emptying	
Feeding history	TPN at birth then transitioned to breast milk via oral gastric tr EBM fortified to 22, 24 kcal/oz Extensively hydrolyzed hypoallergenic formula 20, 22, 24 kca Amino acid hypoallergenic formula 24 kcal/oz Discharged from NICU on oral diet	ube al/oz
Factors which may have impacted growth	Prematurity NPO status Formula intolerance, delays in formula fortification Low oral volume tolerance	

EBM = expressed breast milk

Case 2 - Nu	tritional management
Intervention	ENDF
Introduction	 Half strength on Day 1 Increase to 75% ENDF on Day 3 Full strength on Day 5
Route	• Oral, goal 20 oz/day
Intake targets	120 kcal/kg/day2.5-3 g protein/kg/d
Use	Sole source of nutrition, MCT oil to provide additional calories

ENDF = energy- and nutrient-dense formula

Case 2 - Growth & Outcomes			
Nutrient targets achieved	 120-130 kcal/kg 3 g protein/kg 	H - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1	•
Growth recovery notes	$\begin{array}{l} \mbox{Weight-for-adjusted age z score change:}\\ \cdot .3.4 SD \rightarrow 2.4 1SD ln 25 weeks\\ \mbox{Growth Velocity:}\\ \cdot <2 g(day prior to starting ENDF\\ (less than 20% of goal for age)\\ \cdot lnitially improved to 5 g(day\\ (about 50\% of goal for age)\\ \cdot Finally improved to 9.3 g/day\\ \end{array}$		ENDF started

Case	2 - Growth & Outcomes	
Nutrient targets achieved	 120-130 kcal/kg 3 g protein/kg 	
Growth recovery notes	Weight-for-length z score change: • -2.27 SD → -1.05 SD in 25 weeks	
Caregiver impact	Happy to have premixed formula after multiple trials of fortified EBM and concentrated powdered formula Able to transition to standard pediatric formula + some table foods	10 4 Image: Constraint of the second

Case 2 - Summary		
Why ENDF was chosen over other options	 Inability to take goal volume of formula due to i difficulties and delayed gastric emptying Need for increased calories due to malnutrition poor growth despite fortifying infant formula to 	ieeding ; continued 24 cal/oz
How ENDF helped this patient	 By switching to ENDF, patient was able to avoid feeding tube placed Eventually able to increase total volume per dat tolerance Catch up growth achieved; malnutrition improv Determined patient did not have MPA 	d having ay with good ed
Key learnings	Able to use ENDF to avoid aggressive interver feeding tube	ition such as

Choosing ENDF in Practice

DINLC

- Malnutrition
 - Poor feeding skills
 - Increased energy needs related to medical conditions
- Gastroparesis or Reflux
 - Volume intolerance
- Milk Protein Allergy (MPA)
 - Often can trial whole milk protein between 10-12 months of age
 - Sometimes MPA misdiagnosed



Disclosures

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Case Scenarios	
Case 1	Case 2
16-week-old male	4-month-old female
Ventricular Septal Defect	Postnatal diagnosis of CHD
Gastroesophageal reflux	Heart failure
Feeding tube dependence	Severe malnutrition
Poor wound healing postop	
CHD = congenital heart disease	

Case 1 – Patient history		
Age and sex	16 week old, full term male	
Diagnosis	Ventricular Septal Defect (VSD), complete tracheal rings VSD repair (10 weeks), Slide tracheoplasty (15 weeks), c/b sternal wound dehiscence & debridement (16 weeks)	
Feeding history	Standard infant formula 22 cal/oz by bottle prior to surgery Gastro-esophageal reflux: trialed several infant formulas	
Nutritional problem(s)	Respiratory failure requiring postpyloric tube feeding dependency ↑ 27-29 cal/oz after surgery, but not tolerating enteral feeds Hyponatremia and hypophosphatemia (on diuretics)	
Factors which may have impacted growth	Frequent interruptions to feeds due to procedures and feeding intolerance Increased needs for wound healing Fluid restrictions	

Case 1 - Nutritional management		
Intervention	Energy- and Nutrient-Dense-Formula (ENDF)	
Introduction	Full strength from Day 1 Continuous at 1 mL/kg/hr x 24 hr Advanced to goal over 4 days	
Route(s)	Nasoduodenal	
Intake targets	120-140 kcal/kg/day 3-3.5 g Protein/kg	
Use	Sole source nutrition x 4 months	

Case	1 - Growth & Outcomes	
Nutrient targets achieved	 130 kcal/kg/day (720 kcal/day) 3.4 g protein/kg 	
Growth recovery notes	Weight-for-Age z score: • -2.34 to -1.09 in 6 weeks • +1.44 kg x 6 weeks, avg 35 g/d Length-for-Age z score: • -1.52 to 0.30 in 4 months • Avg +3 cm/month x 4 months	ENDF
		started

Case	1 - Growth & Outcomes	
Nutrient targets achieved	 Feeds weight-adjusted to maintain 120-130 kcal/kg/day until catch-up growth goals achieved 	
Growth recovery notes	Weight-for-Length z score change: • -2.31 \rightarrow -0.40 in 6 weeks	
Caregiver impact	 Relieved to see positive growth trend Improved wound healing Easily able to convert from duodenal to gastric feeds 	ENDF started
		4 m

Case 1 - Summary		
Why ENDF was chosen over other options	 Higher calorie and protein intake to promote ca gain, linear growth Avoided delays in optimizing nutrition postoper 	atch-up weight ratively
How ENDF helped this patient	Nutrient intake supported wound healing Growth helped to contribute to successful extu Resolved hyponatremia, hypophosphatemia Helped minimize nutrition deficits due to NPO procedures and extubation	bation time around
Key learnings	 Tolerated well both ND and NG/G-tube despite having significant reflux Demonstrated significant catch-up growth while supporting increased needs for wound healing 	historically e also

Case 2 - Patient history		
Age and sex	4 month old, full term female	
Diagnosis	New diagnosis of ALCAPA s/p urgent operation for coronary c/b severely diminished function requiring VA ECMO x 5 day +Rhinovirus and adenovirus	reimplantation s postop
Nutritional problem(s)	 Poor oral intake and poor weight gain between 2-4 months of severe malnutrition (wt gain velocity <25^m%ile, wt/length z wt/age z score -4 SD) Required post-pyloric feeding after ECMO decannulation 	of age score -3 SD,
Feeding history	Standard lactose-free infant formula 20 cal/oz by bottle	
Factors which may have impacted growth	Undiagnosed CHD and heart failure contributed to poor oral Diaphoretic during bottle feeds, increased emesis 5 days PT	intake 'A

ALCAPA = Anomalous Left Coronary Artery from the Pulmonary Artery VA ECMO = Veno-Arterial Extracorporeal Membrane Oxygenation

Case 2 - Nu	tritional management
Intervention	ENDF
Introduction	 Full strength from Day 1 Received trophic feeds x 2 days, advanced to goal in 5 days
Route	Nasoduodenal > Nasogastric > Oral
Intake targets	• 130-150 kcal/kg/day • 3-4 g Protein/kg
Use	Sole source of nutrition for 2.5 months

Case	2 - Growth & Outcomes	
Nutrient targets achieved	 130-155 kcal/kg 3.4-4 g Protein/kg 	
Growth recovery notes	Weight-for-Age z score: • -4.96 → -3.22 (4 wks) → -1.68 (8 wks) Length-for-Age z score: • -2.42 → -1.48 (8 wks) • Avg 1 cm/week	end ENDF started

Case	2 - Growth & Outcomes	
Nutrient targets achieved	 130-155 kcal/kg 3.4-4 g Protein/kg 	Bit to 1 human low may and may any mark the second
Growth recovery notes	Head Circumference • 0%ile → 43 ^{cd} %ile (8 wks) • Avg 0.5 cm/week Weight-for-I ength z score:	
	 -3.07 → -0.96 (8 wks) 	
Caregiver impact	 Relieved to see positive growth trend Able to have feeding tube removed by meeting goal nutrition by mouth 	ENDF

Case 2 - Summary		
Why ENDF was chosen over other options	 Severe malnutrition on admission Fluid restriction with high-dose diuretic requiren Minimize delay in optimizing enteral nutrition 	nent
How ENDF helped this patient	 w ENDF helped By starting with ENDF postop, she was able to weat parenteral nutrition earlier Demonstrated catch-up weight gain, linear growth circumference growth 	
Key learnings	 Well tolerated trophic feeds while slowly weaning and sedation postoperatively Seamless transition from nasoduodenal > naso Able to wean off feeding tube earlier by meeting calories with ENDF 	ng milrinone gastric feeds g goal

ENDF = energy- and nutrient-dense formula

Choosing ENDF in Practice

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- Malnutrition
 - Challenges to optimal nutrition in the ICU
- Achieve goal nutrition in less volume
 Fluid restricted in ICU
 - Avoid G-tube when able to meet goals by mouth
- □ More than "High Calories"
 - Catch-up growth
- Wound healing

ENDF = energy- and nutrient-dense formula

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