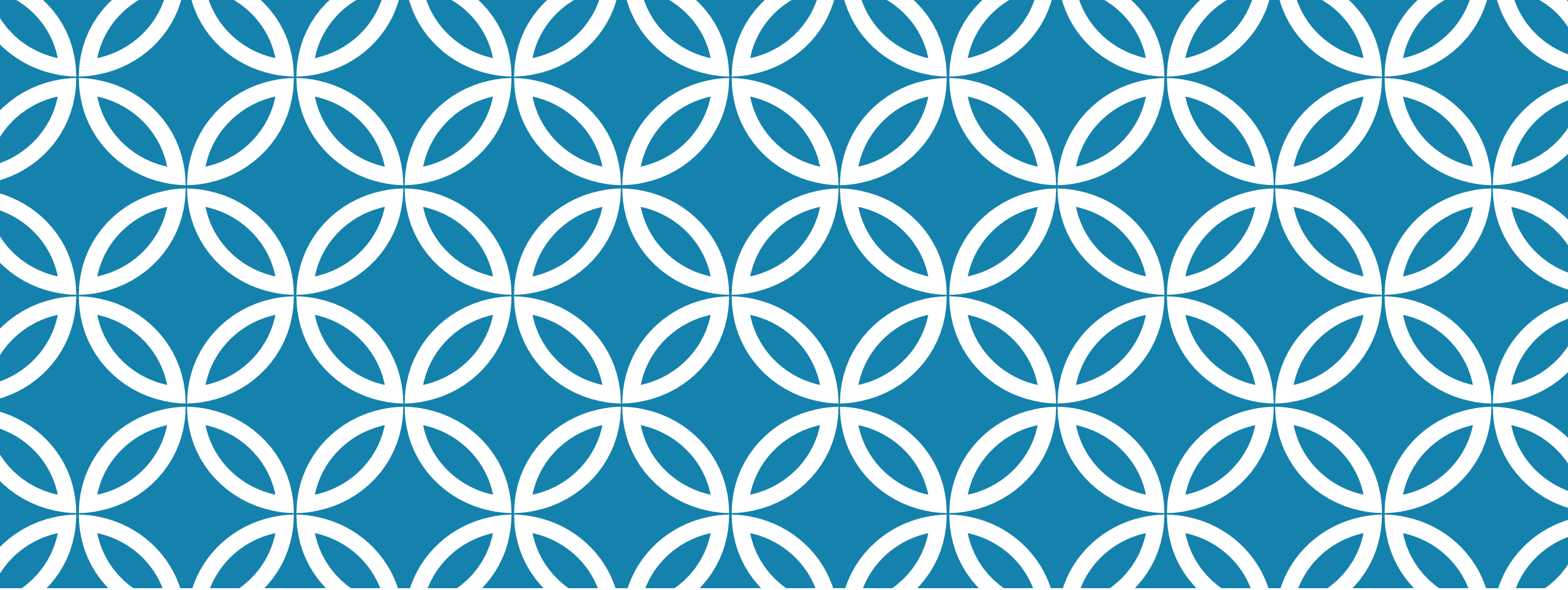


FEEDING THE PRETERM INFANT

Anna Busenburg, RD, CSP, CD

FUN FACTS ABOUT ME

Just had my first child in December, his name is William.

I have a Chihuahua, named Einstein.

I love running and I find it relaxing.

I graduated from Purdue University with a dual bachelor's degree.

I have been working in the field of pediatrics for 5 ½ years.

OUTLINE

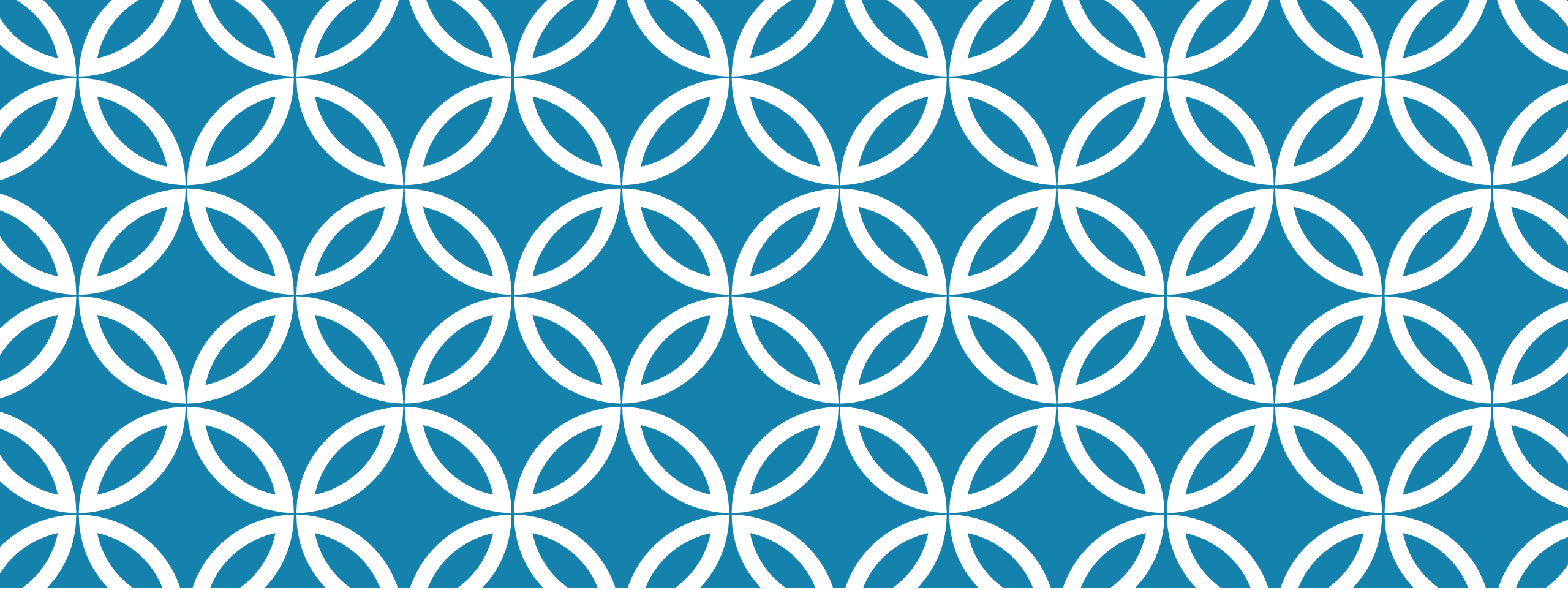
Brief history of neonatology and infant feeding.

What is the role of a dietitian in the NICU?

What does nutrition support look like in a neonate?

Common diagnoses.

Role of the dietitian in the formula room.



WHERE WE HAVE COME FROM

History of medical practice with babies

HISTORY OF NEONATOLOGY

Neonatology began with French midwives and obstetricians.

- Pierre-Constant Budin – pioneer for at risk babies and promoted the use of breastmilk.

"Incubator Baby Side Shows" at the World's Fair and at all large expositions.

- Dr. Couney had a side show at Coney Island. Paid 25 cents to see tiny babies in incubators. Incubators were not allowed in hospitals until after Dr. Couney's death in 1950.

Highest rate of infant mortality in 1870 = 230 out of 1,000 births.

HTTP://STATIC.ABBOTTNUTRITION.COM/CMS-PROD/ANHI.ORG/IMG/NURSE%20CURRENTS%20NICU%20HISTORY%20JUNE%202010.PDF;
HTTP://WWW.PBS.ORG/NEWSHOUR/UPDATES/CONEY-ISLAND-SIDESHOW-ADVANCED-MEDICINE-PREMATURE-BABIES/

HISTORY OF NEONATOLOGY

Hospitals for newborn infants were not started until after World War II.

Realized premature infants needed:

- Heat
- Oxygen
- Humidity

By 1940s the modern (plastic walled) incubator was standard in NICU units to assist with thermoregulation.

- Infants lack brown fat, they struggle to maintain their temperature. This humidified and warm environment helped to decrease energy expenditure and allow for growth.

In 1967, Lulu Lubchanco introduced the SGA, AGA, LGA classification for infants.

HTTP://STATIC.ABBOTTNUTRITION.COM/CMS-PROD/ANHI.ORG/IMG/NURSE%20CURRENTS%20NICU%20HISTORY%20JUNE%202010.PDF;
HTTP://WWW.NICUAWARENESS.ORG/BLOG/A-BRIEF-HISTORY-OF-ADVANCES-IN-NEONATAL-CARE

HISTORY OF NEONATOLOGY

Infants were fed via tubes as early as 1850s. In the 1950s polyethylene tubing was introduced.

The composition of human milk (carbohydrates, protein and fat) was discovered in 1890. By 1920, infant formula was created and being introduced to infants. The WIC program was enacted by Congress in 1972. Whey-predominant formulas for preterm infants were introduced in the 1980s.

Parenteral nutrition was a major turning point for the care of preterm infants. Initially this intravenous nutrition was in the form of glucose.

HTTP://STATIC.ABBOTTNUTRITION.COM/CMS-PROD/ANHI.ORG/IMG/NURSE%20CURRENTS%20NICU%20HISTORY%20JUNE%202010.PDF

HISTORY OF INFANT FEEDING

1800s and earlier – The Wet Nurse

1845-1846 – The invention of the rubber nipple and baby bottle.

1867-1888 – Infant formula was created.

1890-1907 – Homemade baby formula used.

1908-1950 – Evaporated milk was used to feed infants.

1951-1970 – Push to market commercial formula from infant formula companies.

1971-1990 – Complications from infant formula (death and raising public awareness)

1997-Present – Formula versus Breast feeding Debate.

HTTP://DOMESTICGEEKGIRL.COM/HEALTH-HOME/HISTORY-BABY-FORMULA-EMERGENCY-BABY-FOOD-BECAME-EVERYDAY-MEAL-BABIES-AMERICA/

NICU – LEVELS OF CARE

Level I – Well baby nursery (basic).

- Near term infants (35-37 weeks gestation)

Level II – Moderately ill infants.

- Infants ≥32 weeks or ≥1500 grams (may require increased respiratory support)
- Can provide convalescent care.

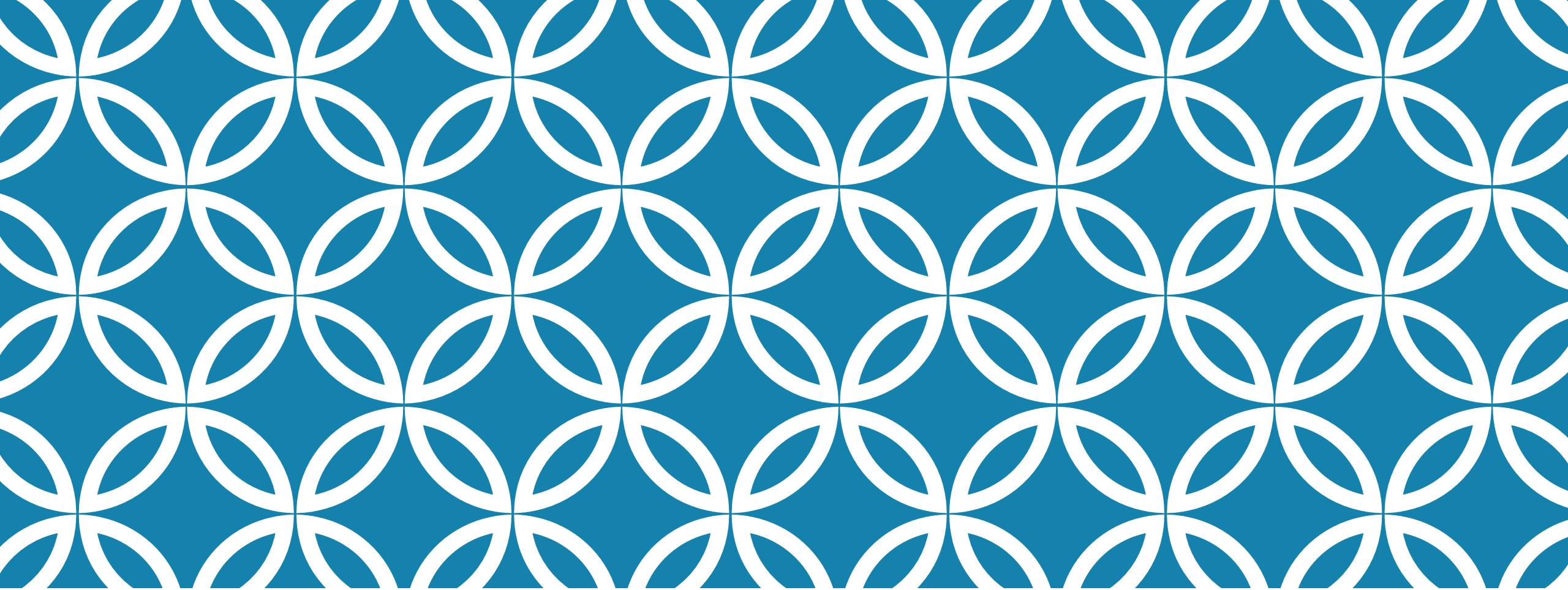
Level III – Critically ill infants.

- Provide sustained life support and care for infants <32 weeks and <1500 grams (all forms of respiratory support).
- Readily available access to subspecialists.

Level IV – Critically ill infants requiring surgical repair of complex congenital or acquired conditions.

- Immediate on-site access to all subspecialists.

HTTP://PEDIATRICS.AAPPUBLICATIONS.ORG/CONTENT/114/5/1341; HTTP://WWW.AMCHP.ORG/CALENDAR/WEBINARS/WOMENS-HEALTH-INFO-SERIES/DOCUMENTS/LEVEL%20OF%20NEONATAL%20CARE.PDF



ROLE OF THE RD

Management of nutrition care

JOB DESCRIPTION OF A NICU RD

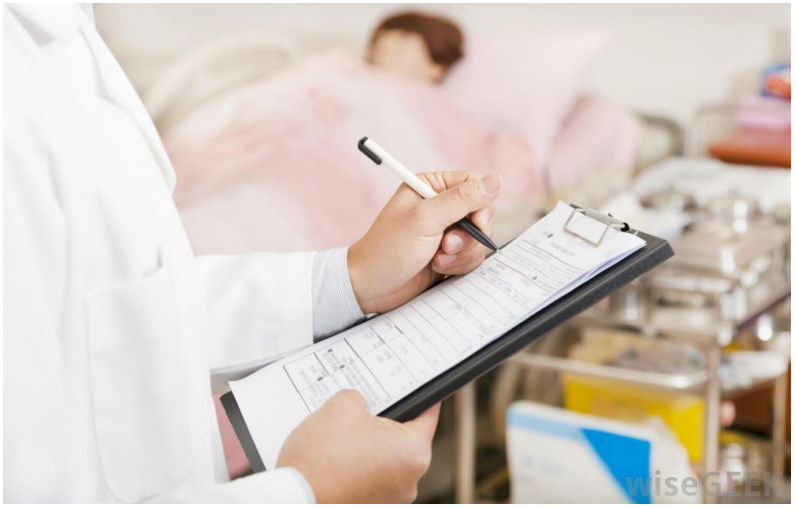
Able to work with a multi-disciplinary medical team.

Familiar with TPN and Tube Feeding calculations.

Flexible to deal with a rapidly changing work environment and handle complex medical cases.

Familiar with various types of feedings for infants (breastmilk and formula) to determine the best nutrition plan for each patient.

TYPICAL DAY



Multi-Disciplinary Rounds on all patients each week

Gather information weekly to chart on all patients.

Use spreadsheets for daily tracking of bowel patients.

Graph/track growth on growth charts.

Work closely with MD, RN, SLP and Formula Tech to provide the best care.

Attend meetings (safety and breast feeding).

DATA SHEETS

NAME:								*EDC:*
DOB:		Diagnosis:			Mom: ___ yrs G__ P__		Meds:	Birth Wt:
GA:					complications:			Birth Lt:
M / F								Birth OFC:
		Resp:		Gluc:	C/S Vag	APGAR's:		SGA / AGA / LGA
Feeds:						_____ ml/kg/d	_____ kcal/kg/d	_____ gPRO/kg/d
TPN/IVF:						Stools/Ostomy:		
Recommendations:								
☐ KBC								
today's date:		Diagnosis:			Na/K	Meds:		Wt:
					Hct			Lt:
DOL:					BUN			OFC:
GA:					D/Bili			SGA / AGA / LGA
					AlkP			_____ % below BW **or**
MD _____		Resp:			Ca P			_____ g/d wt gain
Feeds:								
TPN/IVF:						_____ ml/kg/d	_____ kcal/kg/d	_____ gPRO/kg/d
%PO:						Stools/Ostomy:		
Recommendations:								
☐ KBC								

NUTRITION NOTES

Reason for Assessment : Former 28+1 weeks gestation being followed for Tube Feeding support

Lilly (twin A) is currently at DOL#39 and at 33+5 weeks gestation. Current Dx: BPD (on vapotherm 2L), Apnea, Multiples, PDA, Anemia Meds: Caffeine, Glycerin chip PRN, Poly-Vi-Sol with Fe 0.5mL Labs: Hct 34% Stools: WNL Mom is pumping and we are using her breastmilk Weight was up 15g/day.

Enteral/Parenteral Feeding : 24kcal Fortified Breastmilk or Donor Breastmilk made with Human Milk Fortifier 31mL Q3 (over 30 minutes on the pump, no PO intakes) 147mL/kg/day & 118kcal/kg/day & >4g PRO/kg/day

10 to 25th percentile for weight, based on 1685g

25 to 50th percentile for length, based on 42cm

10th percentile for head circumference, based on 28cm

Growth Chart Used : Fenton 2013

NUTRITION NOTES

PES: Increased nutrient needs (specify) NI-5.1 (Energy and Protein) related to and as evidenced by Prematurity (immature organ function) as evidence by dependence on tube feeding support, requiring fortified feedings and less than optimal weight gain.

Total Calories : ~120, total calories/kg/day

Protein : 3.6, total grams/kg/day

Fluid : 130-150 total fluid mL/kg/day

Weight Used : 1.685kg

Dietician/Nutrition Interventions : (1) Weight was up 15g/day. Weight gain goals are ~25g/day or 15g/kg/day. (2) Infant is on 24kcal fortified breastmilk at 31mL Q3. Mom has stopped pumping and the milk she has left is going to Beau (twin B). Currently using Donor breastmilk. This now needs to be discontinued since the infant is just about >34 weeks gestation and >1500g. Recommend changing to 24kcal Neosure/Enfacare. Total fluid goals are 130-150mL/kg/day and currently getting 147mL/kg/day. Weight gain is appropriate. Continue with current plan of care. (3) Continue with Pol-Vi-Sol with Fe at 0.5mL daily.

GESTATIONAL AGE CATEGORIES

Gestational age is estimated prenatally by the obstetrician using maternal date for expected delivery based on her last menstrual period and/or on fetal characteristics (uterine fundal height, fetal heart rate).

Preterm: ≤ 37 weeks gestation

Term: 37+1 weeks through 42 weeks gestation

Postterm: > 42 weeks gestation

FILE:///C:/USERS/CHAS/DOWNLOADS/TXGUIDELINES.PDF

BIRTH WEIGHT CATEGORIES

When evaluating premature infants, birth weight is a parameter that is can help predict outcomes.

Low birth weight (LBW): < 2500 grams

Very low birth weight (VLBW): <1500 grams

Extremely low birth weight (ELBW): < 1000 grams

FILE:///C:/USERS/CHAS/DOWNLOADS/TXGUIDELINES.PDF

TYPES OF FORMULA

Term Formula
- 19 or 20kcal/oz

Soy Formula (Galactosemia)
- 20kcal/oz - Prosobee, Isomil

Preterm Formula (33-36 weeks gestation at birth)
- 22kcal/oz - Neosure, Enfacare

Partially Hydrolyzed Formula
- 20kcal/oz - Pregestimil, Nutramigen

Elemental Formula
- 20kcal/oz - Elecare, Neocate

MODULARS

Protein

- Liquid protein, Powdered protein additives

Fat

- Microlipid, Fish oil, MCT oil

Carbohydrate + Fat

- Duocal

Human Milk Fortifier

Oat Cereal

GROWTH ASSESSMENT

Tanis Fenton Growth Charts for Preterm Infants

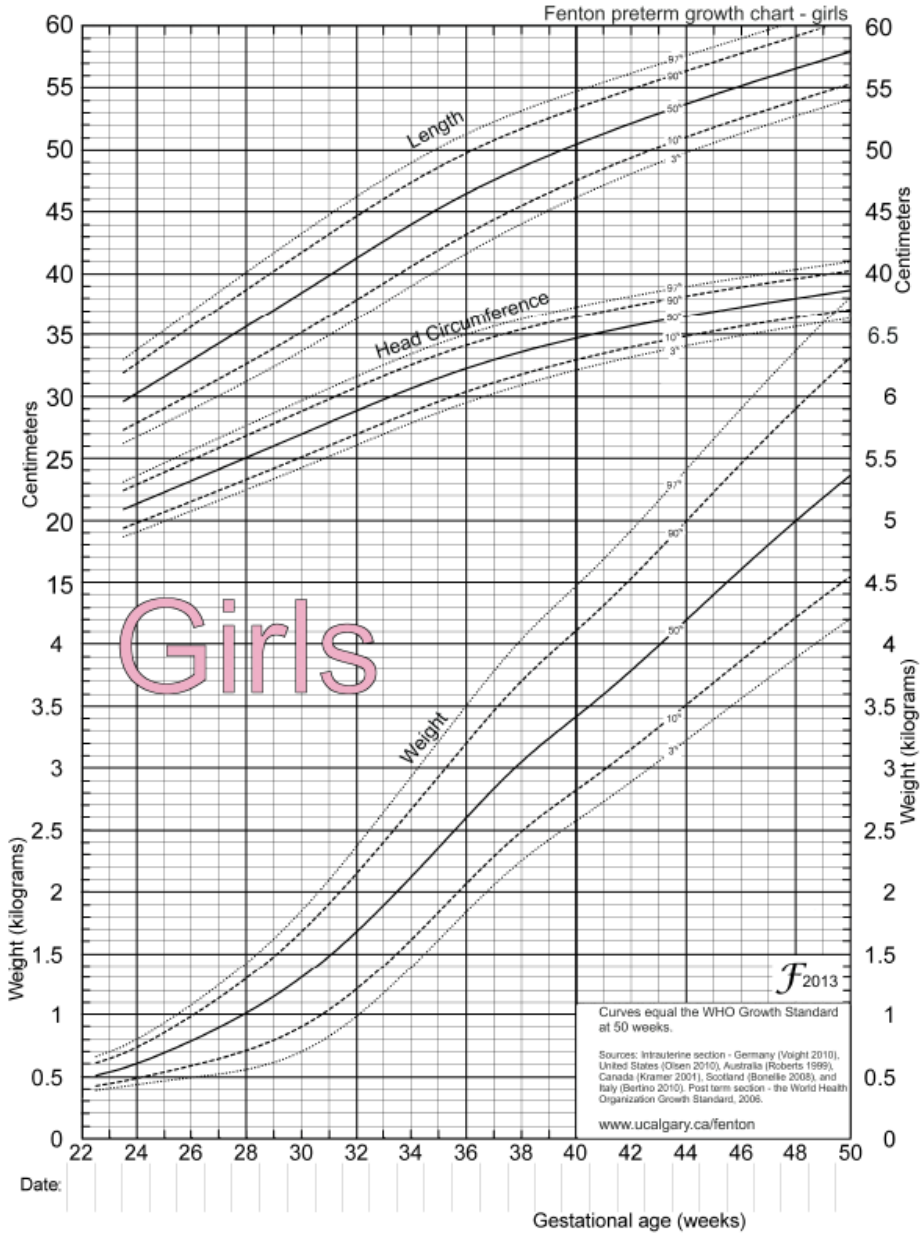
- Developed by a Canadian Dietitian.
- Updated in 2013
- Goes all the way to 22 weeks gestation through 50 weeks gestation.

WHO Growth Charts for Term Infants

- Commonly use the birth through 2 years growth grids.
- Accounts for growth rates of breast fed infants appropriately.

CDC Growth Charts for Children > 2 Years of Age

- Used for children ages 2-19 years.

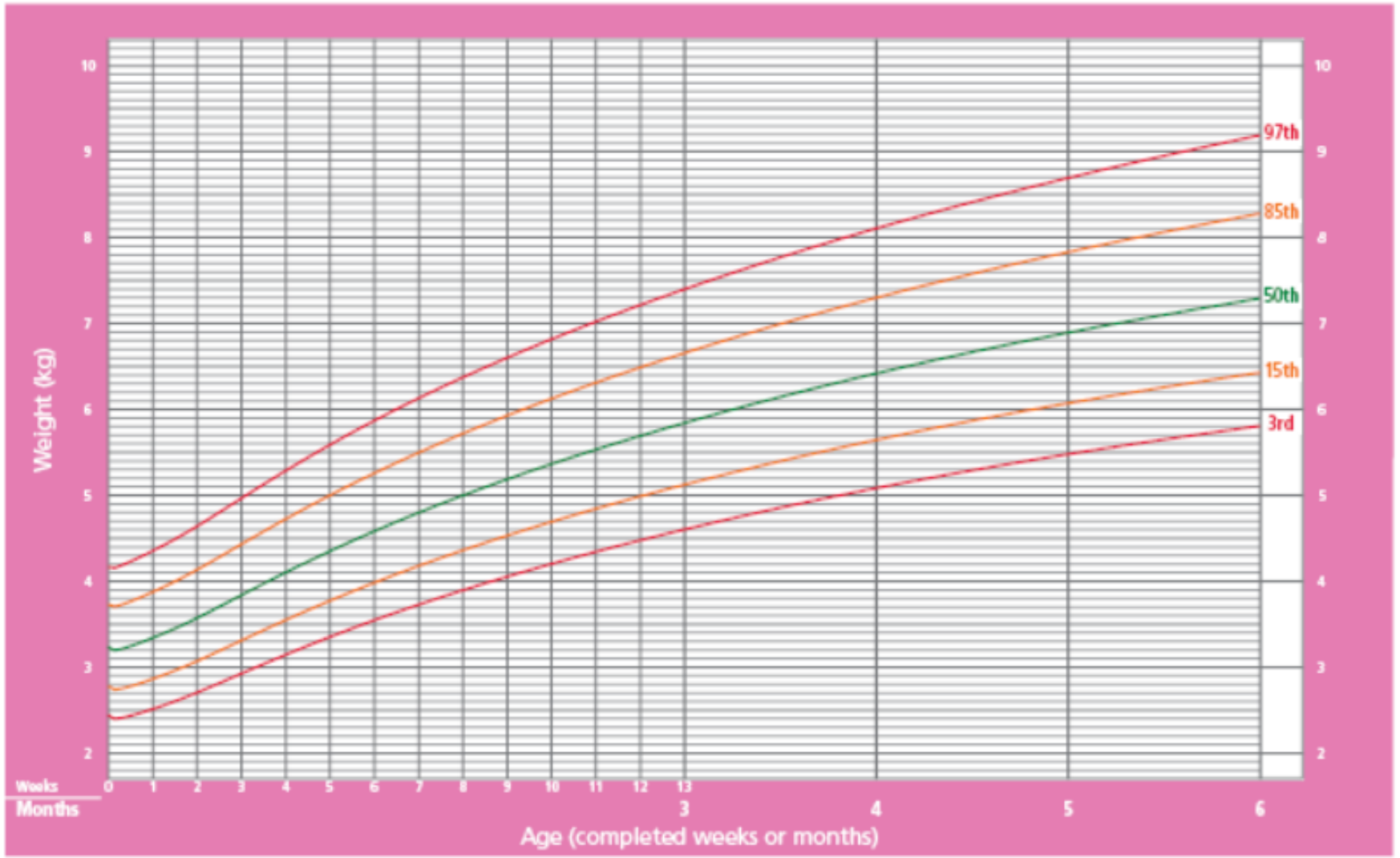


HTTPS://WWW.CDC.GOV/GROWTHCHARTS/WHO_CHARTS.HTM; HTTP://WWW.UCALGARY.CA/FENTON/2013CHART

Weight-for-age GIRLS

Birth to 6 months (percentiles)

World Health Organization

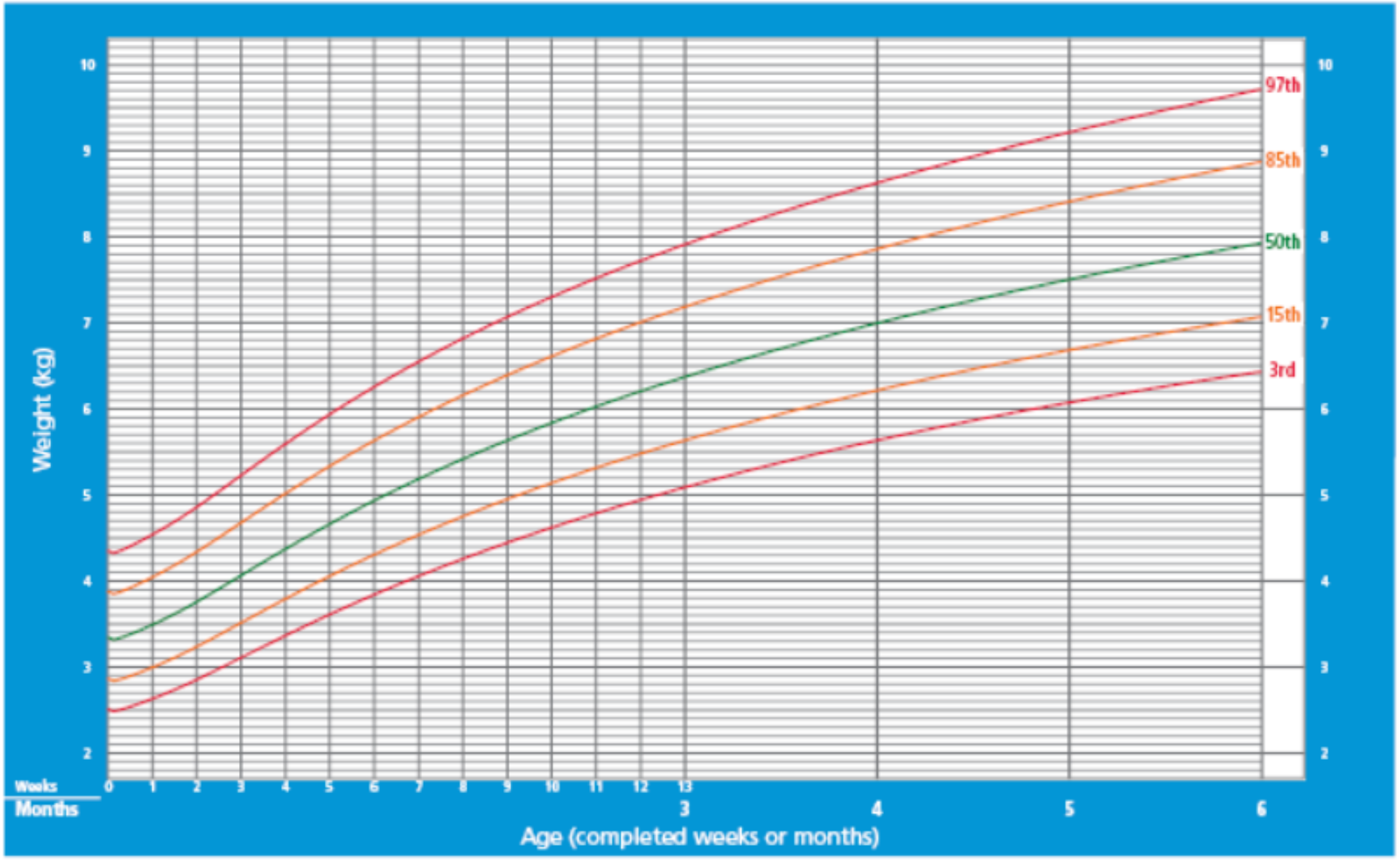


WHO Child Growth Standards

Weight-for-age BOYS

Birth to 6 months (percentiles)

World Health Organization



WHO Child Growth Standards

GROWTH ASSESSMENT

Weights are taken daily and length/OFC are measured weekly.

Look at daily weight trends and weekly trends to determine if appropriate growth velocity is being met.

Plot measurements and use curve to show trends.

<u>Case study:</u>

Baby girl born at 32 weeks gestation on 12/19. Birth weight was 1500g, birth length was 38cm and birth OFC was 29cm.

Where does she plot?

GROWTH ASSESSMENT

Size for Gestational Age: (based on ager-for-weight)

Small for gestational age (SGA) < 10th percentile.

Average for gestational age (AGA) between the ≥10th percentile to ≤ 90th percentile.

Large for gestational age (LGA) > the 90th percentile.

Case study:

Baby girl born at 32 weeks gestation on 12/19. Birth weight was 1501g, birth length was 38cm and birth OFC was 29cm.

What is her gestational age and what is her size for gestational age?

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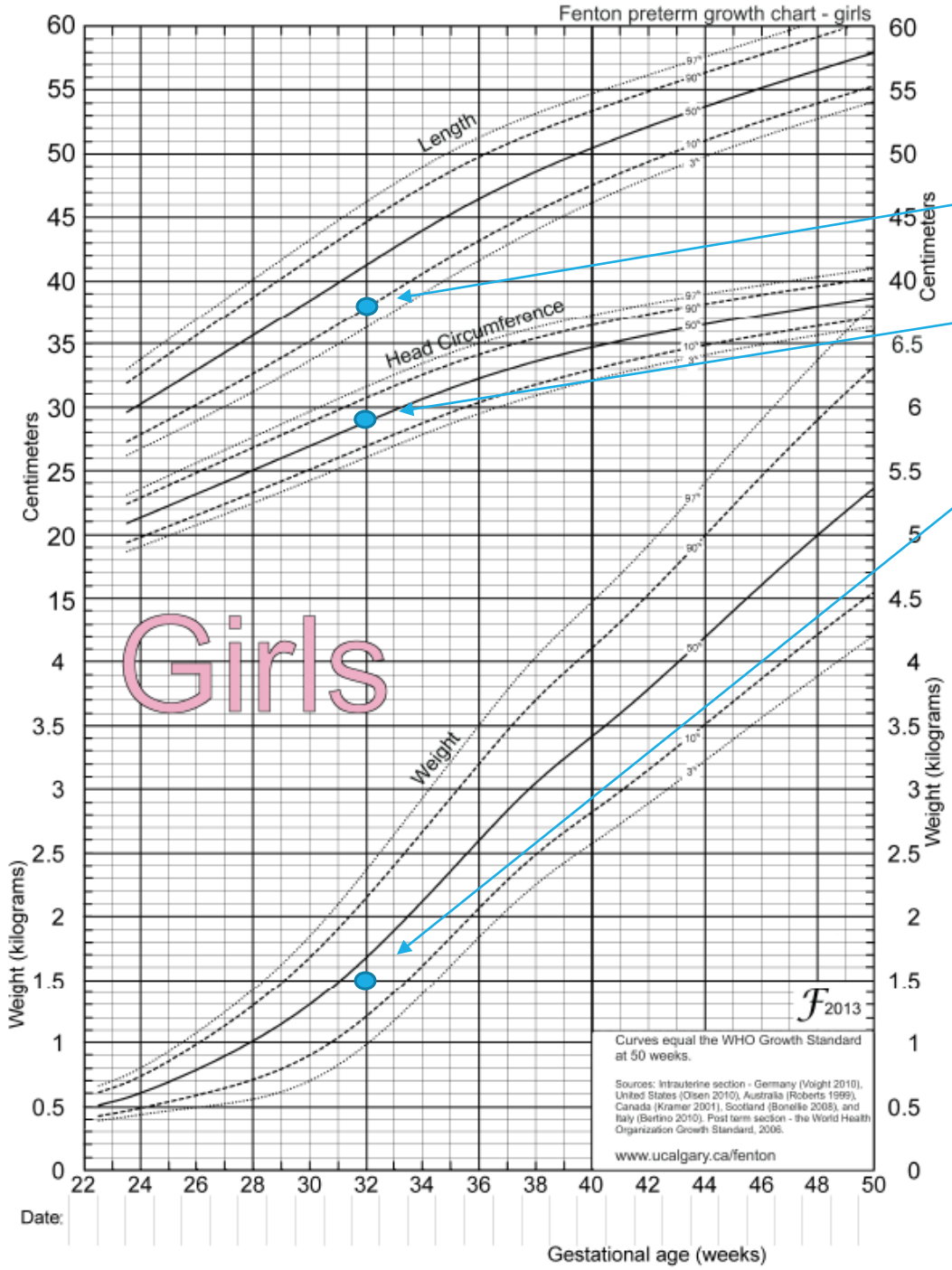
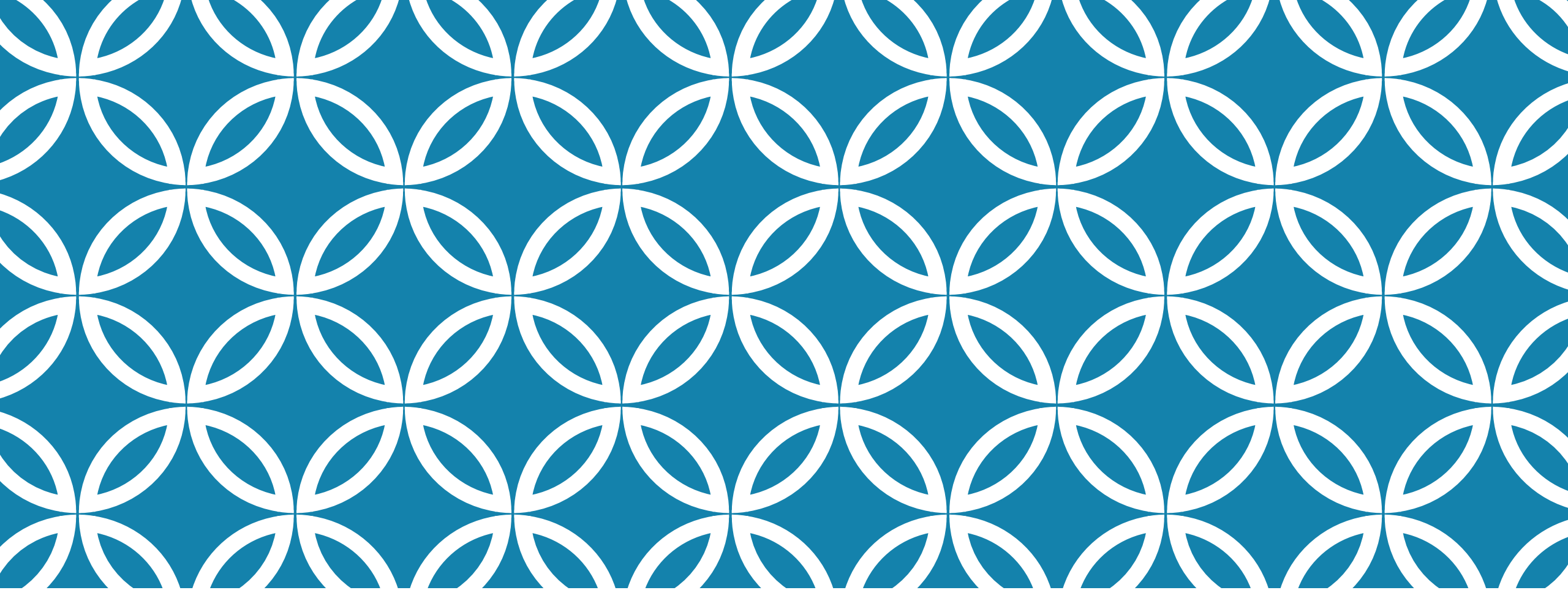


Length – 10th percentile

OFC - 50th percentile

Weight – 25-50th percentile (AGA infant)



MEETING NUTRITION NEEDS

Tube feedings, TPN and Oral feedings

CALCULATING ENTERAL NUTRITION

Birth weight and gestational age determine the nutrition plan of care for infants.

Infants ≤ 1500g are started on minimal enteral nutrition (MEN) within 24hrs of birth at 20mL/kg/day for 3 days. Advance up by 20-30mL/kg/day.

- In combination with TPN support.

Infants 1501-2000g or 33-36 weeks are started on enteral feedings at 40mL/kg/day.

Infants ≥ 37 weeks and > 2000g are started on breastmilk or term formula and advanced as tolerated.

CALCULATING TPN

Most infant's are started on TPN immediately (all those < 1500g).

If not full TPN, then IVFs are common to prevent hypoglycemia.

Review TPN orders to make sure they are meeting desired nutrition goals.

MD will write the daily TPN orders.

Work with MD and pharmacy to make changes in the micronutrients based on different disease state.

ORAL FEEDINGS

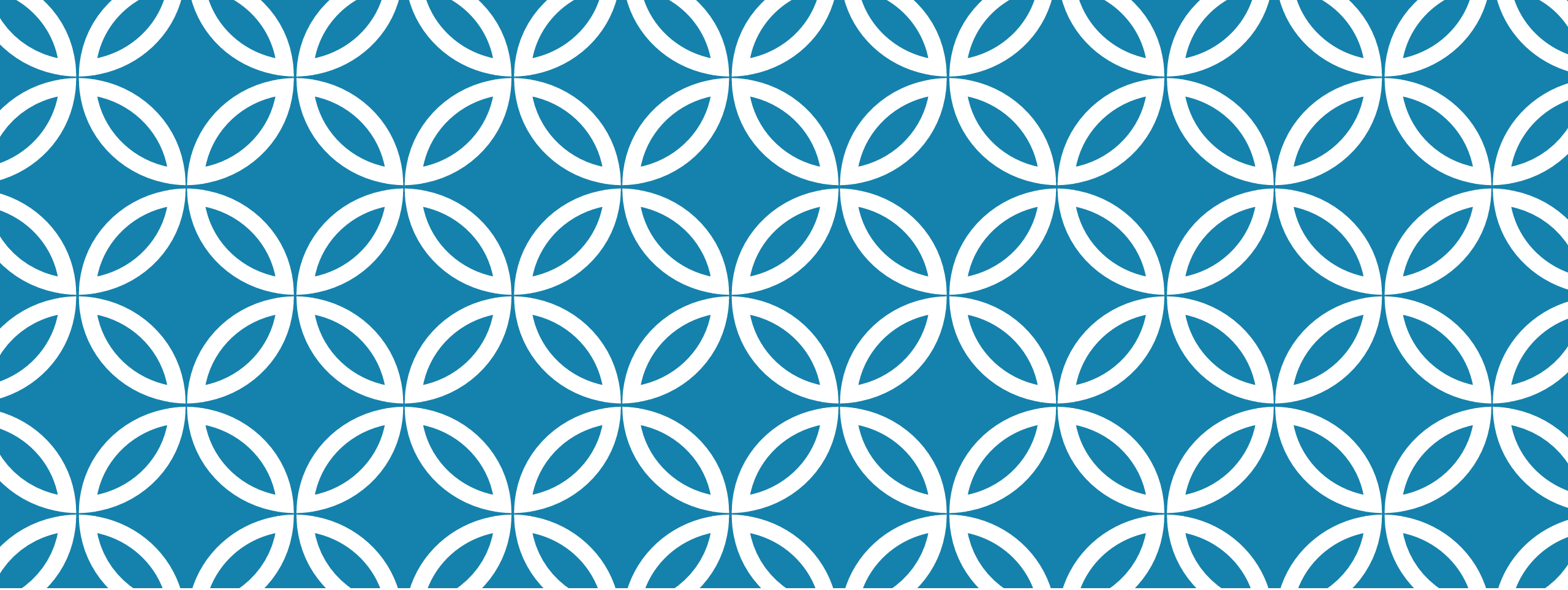
Oral feeding skills are able to be initiated at 34 weeks gestation.

If there are any feeding aversions or issues with feedings, consult the SLP.

- Apnea or bradycardia with feedings
- Issues with pacing
- Choking episodes

Video swallow study can be done to determine safety with feedings and if thickening agent is needed.

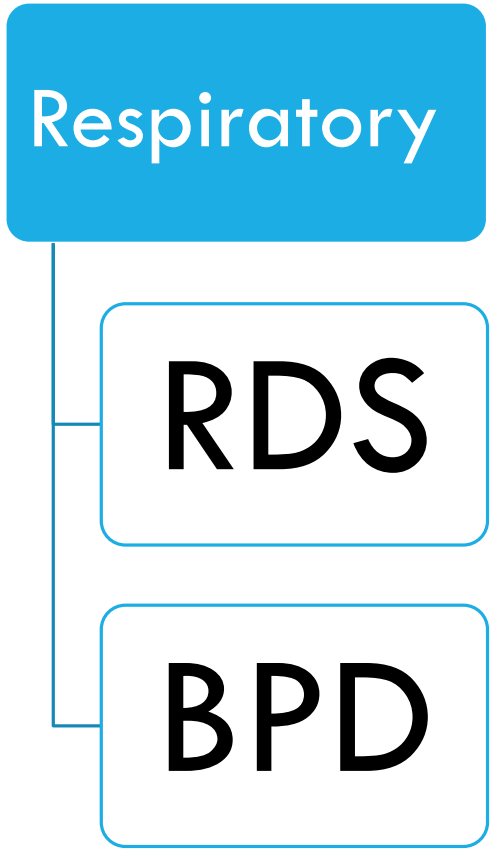
- Looking for aspiration or penetration.
- Use oat cereal to thicken formula.
- Nectar or honey consistency



COMMON DIAGNOSES

In the NICU

COMMON NICU DIAGNOSES



RDS – Respiratory Distress Syndrome

- Deficiency of surfactant coating the interior part of the lungs, failure of lungs to expand/contract appropriately.

BPD – Bronchopulmonary Dysplasia

- Abnormal development of lung tissue/under-developed lungs (>DOL#30)

- Often require respiratory support.

COMMON NICU DIAGNOSES

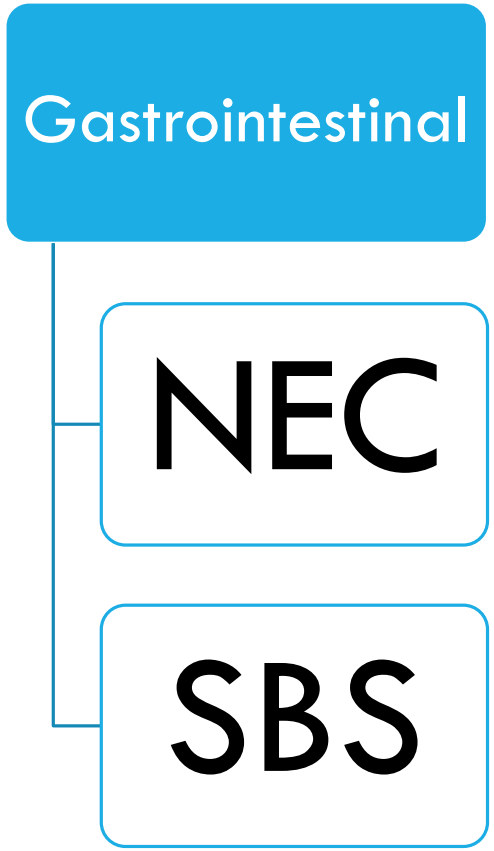
Neurological

IVH

IVH – Intraventricular Hemorrhage

- Bleeding into the fluid-filled ventricles of the brain. Blood vessels are fragile and can easily break.
- Common in premature babies. The smaller babies are at higher risk.
- Grades I-IV (least to most severe).

COMMON NICU DIAGNOSES



NEC – Necrotizing Enterocolitis

- Necrosis of the bowel. Intestine becomes injured and dies off.
- Most common and serious intestinal illness in premature babies.
- Requires bowel rest and in some case bowel resection.

SBS - Short Bowel Syndrome

- Consequence of small intestine loss, bowel resection, mucosal enteropathies, motility disorders.
- Creates issues with absorption and growth.

FEEDING PREPARATION

NICU Formula Rooms

FORMULA ROOMS

A clean room to thaw, mix and prepare feedings for infants.

Nurses come in/out of the room to obtain each feeding for each patient.

Feedings are thawed, mixed and prepared by a formula room technician.

All breast milk is stored in freezers and prepared feedings are in refrigerators.

Each patient has their on bin.

FORMULA ROOMS

Formula room technicians follow recipes to prepare formula or fortified breast milk feedings.

Order and use donor breast milk as well for certain patients.

Feedings are good for 24 hours once prepared.

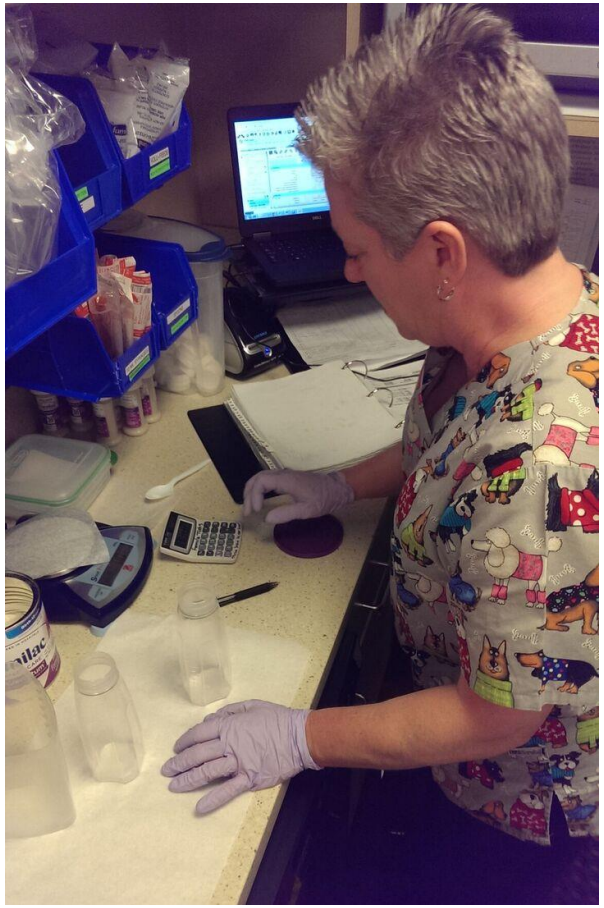
ROLE OF DIETITIAN IN THE FORMULA ROOM

Work closely with formula techs to make sure that the feedings are being mixed appropriately.

Creates the recipes for the feedings.

Oversees any safety issues.

Helps with the staffing/schedule.



CALCULATOR

Patient Name:		Bed Spot:	359-03		
Weight:	1.56 kg	MR#		DOB:	2/27/2017
Order:	39 ml	Q	3 hrs	donor if no mbm	
Continuous:	ml/hr	**order: 36mL/pump**			

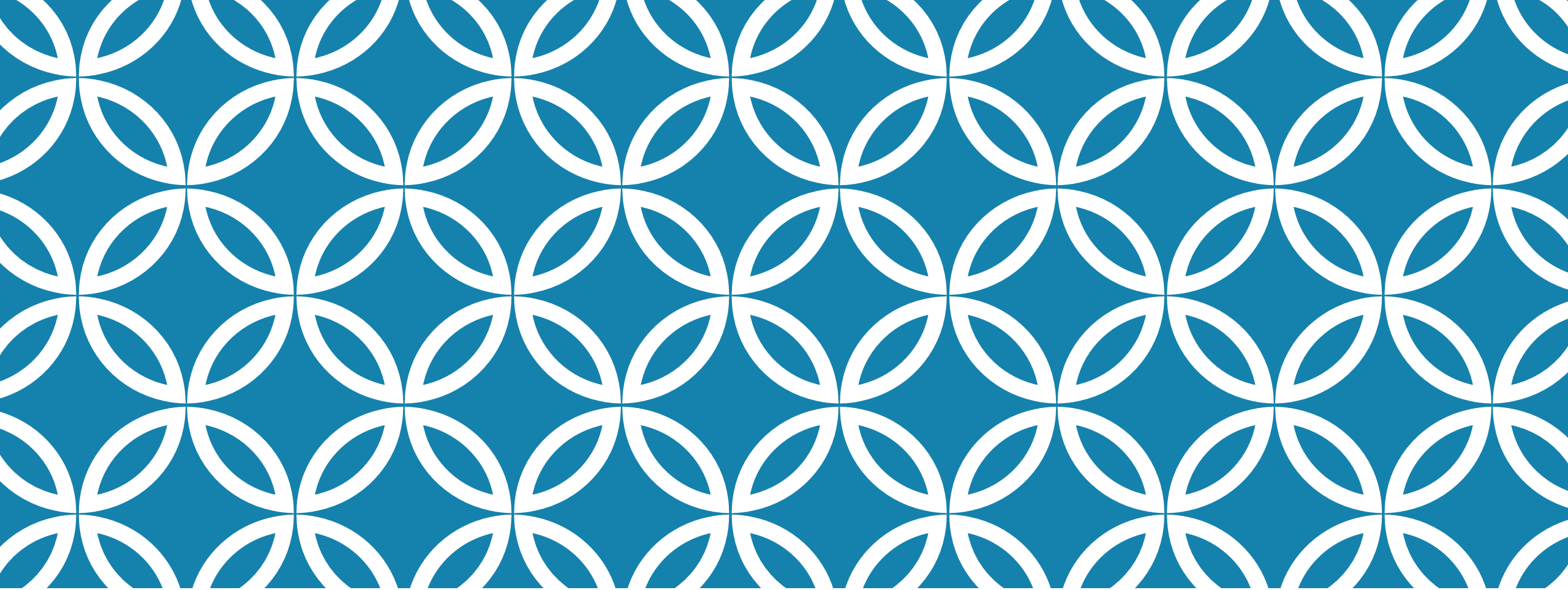
24kcal FBM using Similac Liquid HMF (5ml/vial)

kcal conc ordered	24	kcal/oz	total kcal	## kcal
			total HMF in vials	##
bolus volume	312	ml		
continuous volumes	0	ml		
total volume	312	ml		
total volume in ounces	10.40	oz		
Mix	259	ml Breastmilk		
with	53	ml HMF		
subTotal	312	ml		

To prepare with 12% overfill:

			2 bottles:	
Mix	290	ml Breastmilk	_____	mL bm
with	59	ml HMF	_____	mL HMF
TOTAL	349	ml		

Similac Liquid Human Milk Fortifier provides 7.5 kcal/vial and 5ml/vial.
Breastmilk (mom's or donor) is assumed to provide 20 kcal/oz.



WRAPPING IT UP

Final thoughts

BEING A NICU DIETITIAN . . .

Very rewarding, but challenging patients.

Get to see changes happen quickly.

Amazing to see these little 24 week babies, grow and get to go home.

Some patients stay awhile and you develop a relationship with them and their families.

Constantly learning more and more about this population.

CONCLUSION

Hopefully you have an idea about …

- The history of neonatology
- Feeding products for infants
- How to plot growth
- More about what a RD in the NICU does on a daily basis
- Familiar with common NICU diagnoses
- The role of the RD in the formula room

QUESTIONS