

Newborn Glucose Management Clinical Decision Support System

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Objectives

1. Describe a newborn hypoglycemia risk protocol to assess, monitor and assure glucose homeostasis
2. Measure the value of Clinical Decision Support Systems that automate newborn glucose management and reduce human error



Health System Summary

- **3 Hospitals**
 - 3700 births/year
 - 500 NICU admissions/year
 - 17,300 admissions/yr
 - 45,500 ED visits/yr
- **21 Clinics**
 - 500,000 clinic visits/yr
- **Staff**
 - Medical 1,150
 - Mid level 250
 - All other 2,800

Newborn Hypoglycemia



- Current evidence does not support a specific concentration of glucose that can discriminate normal from abnormal or can potentially result in acute or chronic irreversible neurologic damage. (Adamkin, 2011)
 - Ranges from $<28\text{mg/dL}$ to $<45\text{mg/dL}$. (Cornblath, 2000, Kalhan, 2000)

Newborn Hypoglycemia



- **Definition**

- Dr. Adamkin and the Committee on Fetus and Newborn state “a rational definition of [newborn] hypoglycemia must account for the fact that acute symptoms and long-term neurologic sequelae occur within a continuum of low plasma glucose values of varied duration and severity (Adamkin, 2011)
- Early identification of the at-risk infant and institution of prophylactic measures to prevent neonatal hypoglycemia are recommended since there is no consistent definition of hypoglycemia in the literature (Adamkin, 2011)

Newborn Hypoglycemia



- Affects 3-43% of all full term newborns (Johnson, 2003)
 - Prolonged and untreated hypoglycemia in the newborn may result in acute systemic effects and serious, long term adverse neurologic sequelae. (Cornblath, 2000)
- Literature
 - American Academy of Pediatrics suggests that routine screening for hypoglycemia in newborns should first include an assessment of the mother and infant for risk factors and not be performed in the absence of such factors. (Hoops, 2010)
 - This approach is also supported in the Clinical Report produced in March, 2011 on “Postnatal Glucose Homeostasis in Late-Preterm and Term Infants”

Newborn Hypoglycemia



- Risk Factors

- Most commonly occurs in infants with impaired glucogenesis and/or ketogenesis
- Newborn hypoglycemia occurs most often in the following infants:
 - Small for gestational age
 - Infants born to mothers who have diabetes
 - Late-preterm infants
- Infants who are large for gestational age are also at risk

Newborn Hypoglycemia



- Clinical Signs
 - Not specific
 - Include a wide range of local or generalized manifestations that are common to sick newborns
 - Signs & Symptoms include:
 - Jitteriness
 - Cyanosis
 - Seizures
 - Apneic episodes
 - Tachypnea
 - Weak or high-pitched cry
 - Floppiness or lethargy
 - Poor Feeding
 - Eye rolling

Newborn Hypoglycemia



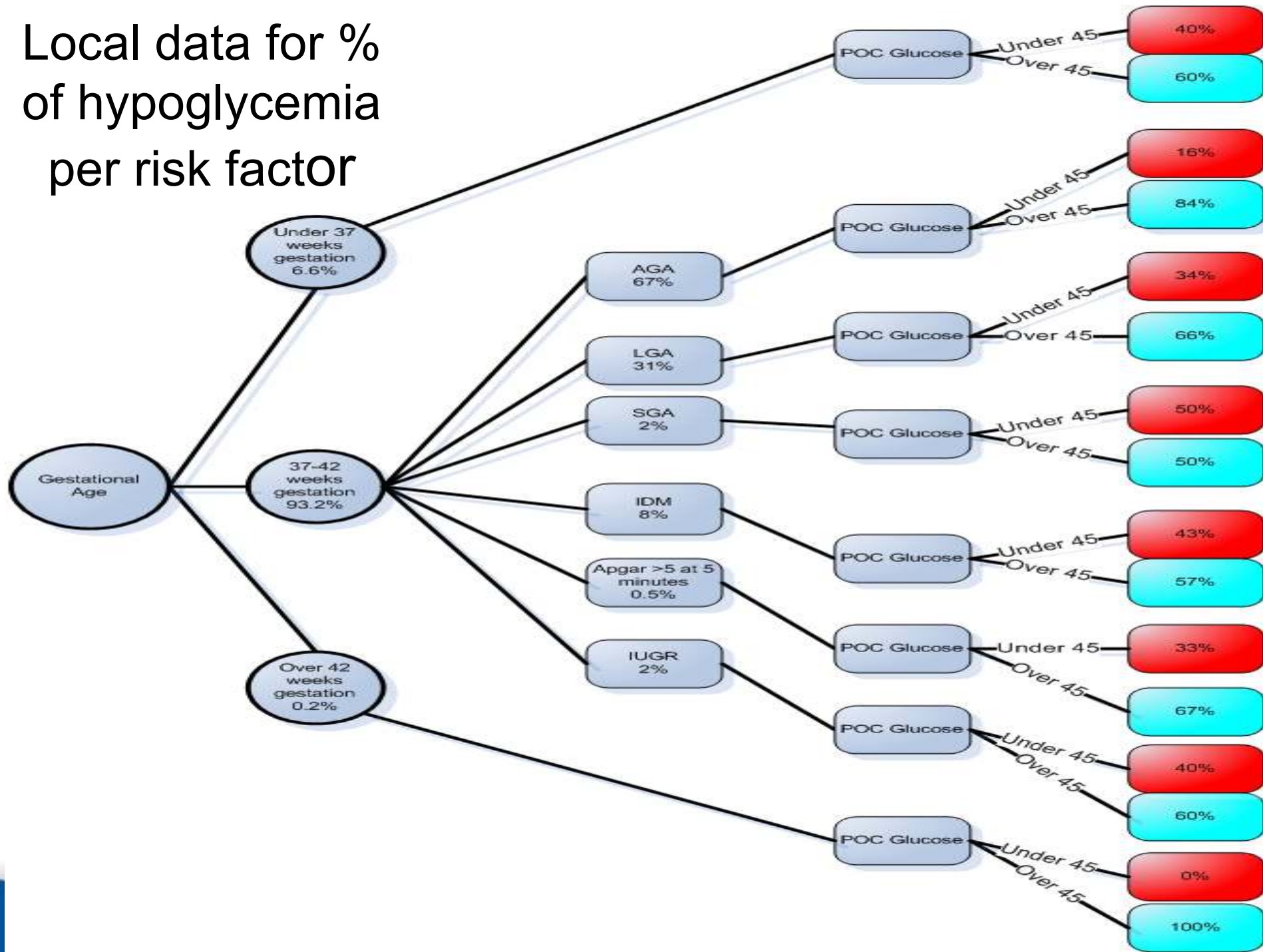
- When to screen and for how long?
 - Data on optimal timing and intervals for glucose screening are limited
 - What we do know
 - Normal transition of newborn glucose values
 - 1-2 hours after birth: values can go as low as 30 mg/dL
 - Increase to higher and more stable concentrations (generally > 45 mg/dL) by 12 hours of age
 - Controversy
 - Do we screen the asymptomatic at-risk infants during the normal physiologic nadir period?

Newborn Hypoglycemia



- Bottom Line...
 - At-risk infants should be screened for newborn hypoglycemia with a frequency and duration related to risk factors specific to the individual infant. (Adamkin, 2011)
 - The point at which interventions are indicated needs to be tailored to the clinical situation and the particular characteristics of a given infant. (Adamkin, 2011)
 - Prompt intervention is necessary for infants who manifest clinical signs and symptoms.

Local data for % of hypoglycemia per risk factor



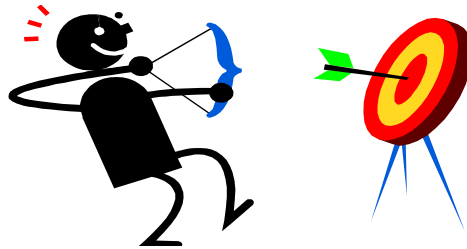
Protocol Development

- POC Glucose 30-60 minutes after birth
- Identification of infant risk factors
 - High Risk
 - SGA/IUGR
 - Prematurity (< 37 weeks by dates or exam)
 - 5 minute Apgar < 5
 - Infant of a Diabetic Mother (includes Gestational Diabetesw, Type 1 and Type 2)
 - LGA or Postdates
 - Large for Gestational Age
 - Postdates (> 42 weeks gestation)
- Protocol with low risk, high risk, and LGA/Postdates blood sugar frequencies
- **Assessment of risk factors done by nursing**
- **Selection and initiation of appropriate protocol done by nursing**
- **Protocols on paper**

6 months after initiation
Medical Staff Dissatisfaction with
protocol process

Problem Addressed

- **Dissatisfaction** with current protocol process **validated**
- **21% error rate**
 - The breakdown of errors included:
 - no protocol orders entered when indicated=43 34%
 - >30 minutes before orders entered=37 29%
 - wrong protocol orders entered=26 21%
 - duplicate protocol orders entered=10 8%
 - POC glucose not collected=6 5%
 - risk factors not recorded=4 3%

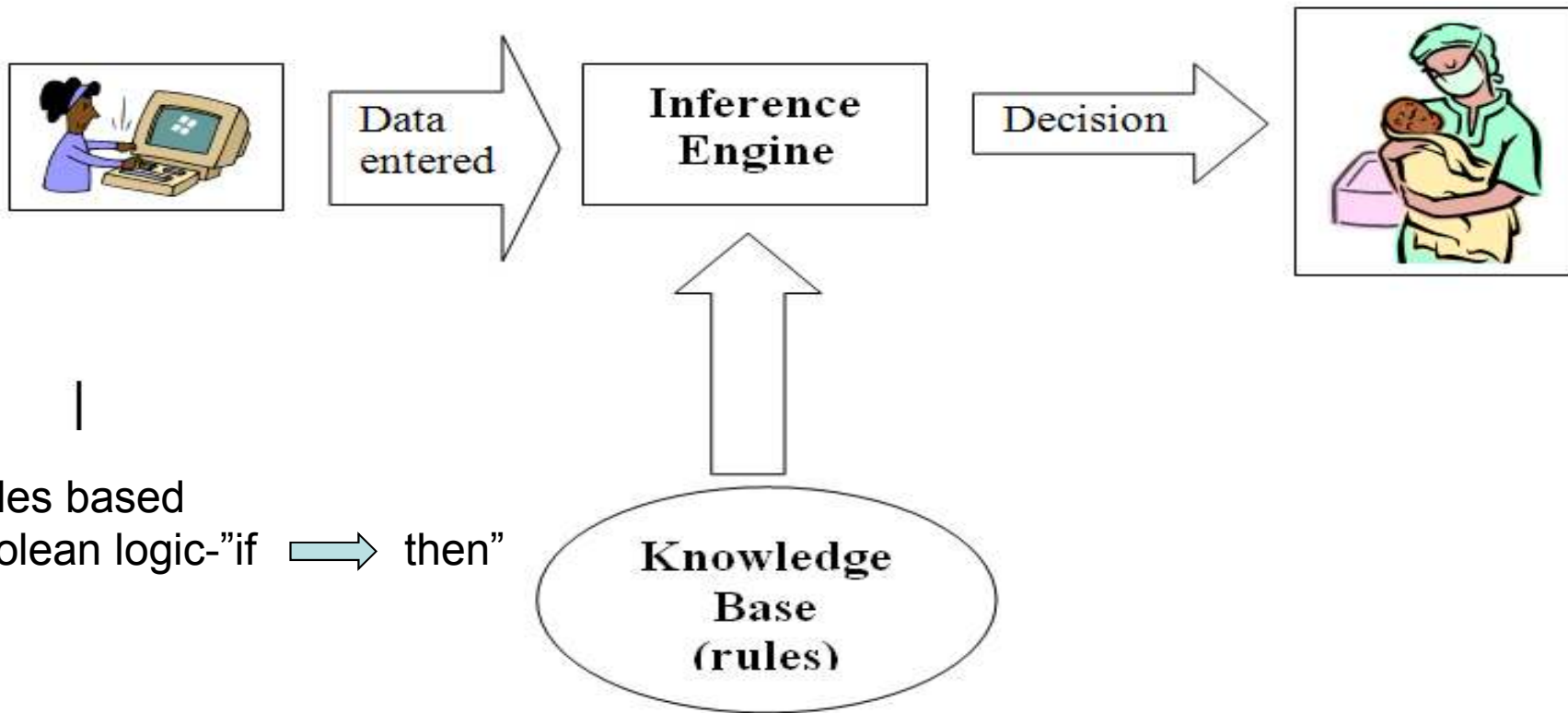


Develop a method to support the appropriate newborn hypoglycemia risk assessment, protocol selection and protocol initiation by nursing

Intervention/Change implemented

- Automation of newborn glucose protocol based on hypoglycemia risk factors rather than relying on human factor.
- Automation via Clinical Decision Support in Electronic Medical Record (EMR)
 - Hypoglycemia Subcommittee and Pediatric department approval for the Clinical Decision Support automated in EMR
 - Medical Executive approval for Clinical Decision Support automated in EMR

Newborn Glucose Management Clinical Decision Support System



EMR Changes

- Moved documentation to baby chart
- Required fields guide documentation
- Logic included to avoid duplication in the event multiple risk factors evoked multiple protocols.
- Protocol orders directly entered into the chart.
- Protocol orders printed for provider signature

Original Risk Factor Documentation on mother's Chart

Pregnancy Information

LMP Status
 Known
 Unknown
 Other:

LMP 01/05/2010

EDD 10/05/2010

Gestational Age by Dates 40

Total Pregnancies 9
Full Term Births 4
Preterm Births 0
Spontaneous Abortions 1
Induced Abortions 3
Living Children 4
Pre Pregnancy Weight 130 lb

Gestation Number
 Singleton
 Twin
 Triplet
 Other:

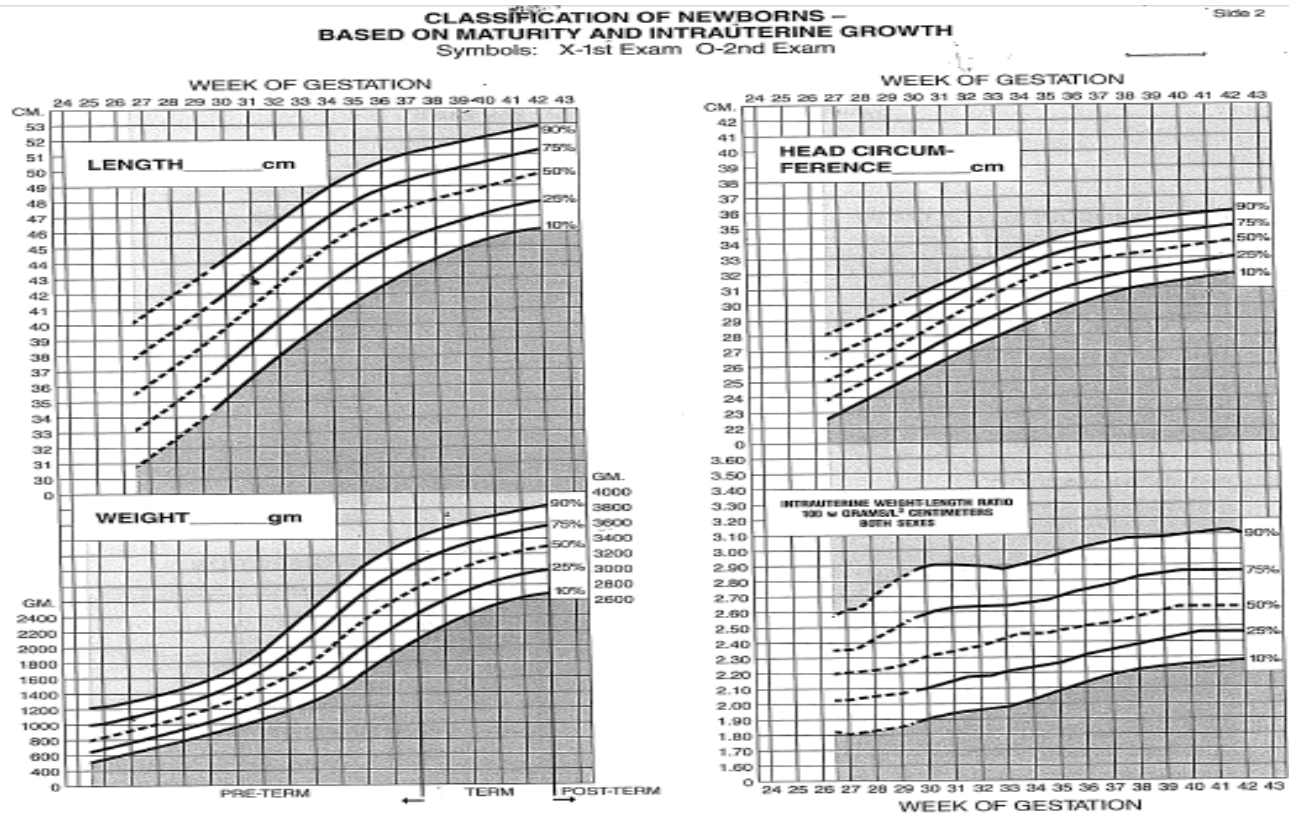
Recent Fetal Activity Normal

Complications Affecting this Pregnancy/Birth At JE- any items (other than "None") will generate a referral to OB Care Manager

<input checked="" type="checkbox"/> None	<input type="checkbox"/> Fetal Anomaly	<input type="checkbox"/> Insulin Controlled	<input type="checkbox"/> Premature Rupture of Membranes
<input type="checkbox"/> Advanced Maternal Age	<input type="checkbox"/> Fetal Version	<input type="checkbox"/> IUGR	<input type="checkbox"/> Preterm Labor
<input type="checkbox"/> Bleeding	<input type="checkbox"/> GBS Bacteruria	<input type="checkbox"/> Late/Inadequate Prenatal Care	<input type="checkbox"/> Previous Uterine Surgery
<input type="checkbox"/> Breech	<input type="checkbox"/> GBS (Group Beta Strep)	<input type="checkbox"/> Macrosomia	<input type="checkbox"/> Torch
<input type="checkbox"/> Cervical Cerclage	<input type="checkbox"/> Gestational Diabetes	<input type="checkbox"/> Mitral Valve Prolapse	<input type="checkbox"/> Uterine Anomaly
<input type="checkbox"/> Cervical Surgery	<input type="checkbox"/> Gestational Hypertension	<input type="checkbox"/> No Prenatal Care	<input type="checkbox"/> Other:
<input type="checkbox"/> CMV	<input type="checkbox"/> HELLP Syndrome	<input type="checkbox"/> Oligohydramnios	
<input type="checkbox"/> Chicken Pox	<input type="checkbox"/> Herpes	<input type="checkbox"/> Placental Abruption	
<input type="checkbox"/> Diabetes-Type I	<input type="checkbox"/> Hyperemesis	<input type="checkbox"/> Placenta Previa	
<input type="checkbox"/> Diabetes-Type II	<input type="checkbox"/> Hypertension	<input type="checkbox"/> Polyhydramnios	
<input type="checkbox"/> Diet Controlled	<input type="checkbox"/> Infertility	<input type="checkbox"/> Pre-eclampsia	

Apgar Score 8

Manual graphing on paper growth chart



	1st Exam (X)	2nd Exam (O)
LARGE FOR GESTATIONAL AGE (LGA)		
APPROPRIATE FOR GESTATIONAL AGE (AGA)		
SMALL FOR GESTATIONAL AGE (SGA)		
Age at Exam	hrs	hrs
Signature of Examiner	M.D./R.N.	M.D./R.N.

Adapted from Lubchenco LO, Hansman C, and Boyd E: *Pediatr.* 1969; 37:403; Battaglia FC, and Lubchenco LO: *J Pediatr.* 1967; 71:159.

Documentation moved to baby chart

Newborn/Infant Weight and Measurements

Newborn/Infant Weight and Measurement

Weight in Kg <input type="text" value=""/> kg	Weight in gm <input type="text" value=""/>	Gestational Age <input type="radio"/> Per Prenatal Record
Length in inches <input type="text" value=""/> in	Length in cm's <input type="text" value=""/>	
Head Circ in inches <input type="text" value=""/> in	Head Circ in cm's <input type="text" value=""/>	Chest Circumference <input type="text" value=""/> in

- Newborn Physical
- Allergies
- Head/Eye Assessment
- Neurological Assessment
- Respiratory Assessment
- RDS Assessment
- Newborn Oxygenation
- Cardiovascular Assessment
- Integumentary Assessment
- Gastrointestinal Assessment
- Genital/Urinary Assessment
- Musculoskeletal Assessment
- NIPS
- Gestational Age
- NB Maturity Rating
- NWI
- Newborn Charge
- Newborn Cord Blood
- Newborn Screening
- Newborn Hypoglycemia

- Lips and Palate Intact
- Anterior and Posterior Fontanels Soft/Flat
- Molding Present
- Focused Assessment

- Absence of Tremors
- Cry Present, Normal Pitch, and Consolable
- Suck/Rooting Reflex Present
- Focused Assessment

Respiratory

- Nares Patent, Bilaterally
- Chest Movement Symmetric
- Lung Sounds Clear, Bilaterally
- Respirations Regular, Unlabored
- Focused Assessment

Cardiovascular

- Heart Sounds Regular and Distinct
- Pulses Present/Strong, All Extremities
- Capillary Refill < 3 Seconds
- PMI-Lower Left Sternal Border, 4th Intercostal Space
- Focused Assessment

Integumentary

- Color Appropriate for Ethnic Origin
- Acrocyanosis Present
- Gums/Mucus Membranes Moist and Pink
- Skin Warm and Intact
- Umbilical Cord with 3 Vessels
- Focused Assessment

Gastrointestinal

- Anus Patent by Visual Exam
- Abdomen Soft/Nondistended
- Bowel Sounds Present
- Focused Assessment

Genital/Urinary

- Genitalia Appropriate for Gender
- Focused Assessment

Musculoskeletal

- Clavicle Intact
- Spine Straight, Easily Flexed
- Hip Click Absent
- Gluteal/Leg Folds Symmetric
- Digits All Present
- 4 Extremities Present
- Extremities Symmetric in Length and Development
- Focused Assessment

Pain

- Non-Verbal Pain Assessment

Immediate Transfer to NICU

- See NICU Documentation

Gestational Age

- Per Exam

Hypoglycemia Risk Factors

-

MH ONLY

- Newborn Cord Blood
- N/A JE patient

- Newborn Hepatitis B Screening
- N/A JE patient

Newborn Hypoglycemia Risk Factors

Infant of Diabetic Mother (IDM)?

- No
 Yes

An Infant of a Diabetic Mother Includes:

- Gestational Diabetes (Including Diet Controlled)
- Type 1 Diabetes
- Type 2 Diabetes

Was 5 Minute Apgar less than 5?

- No
 Yes

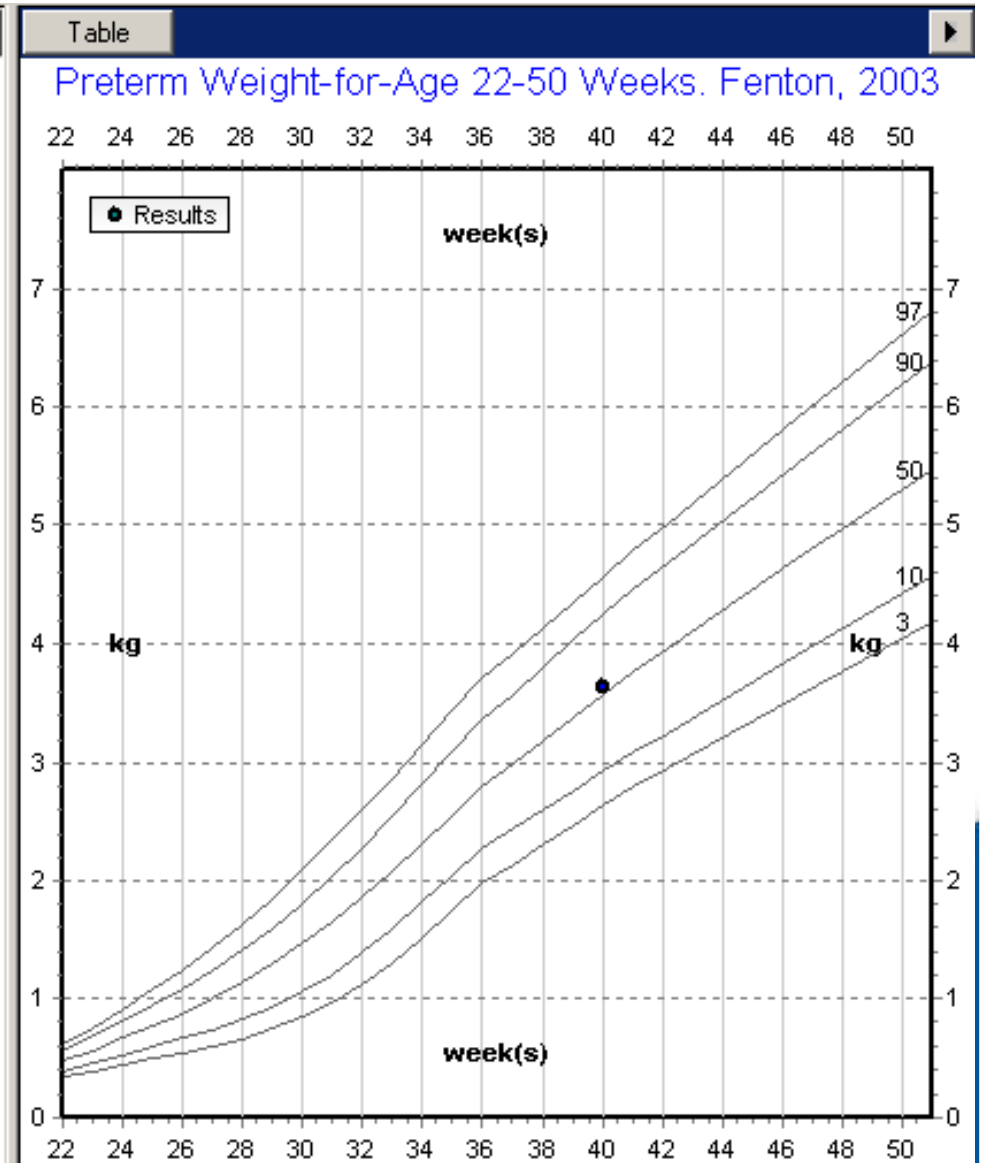
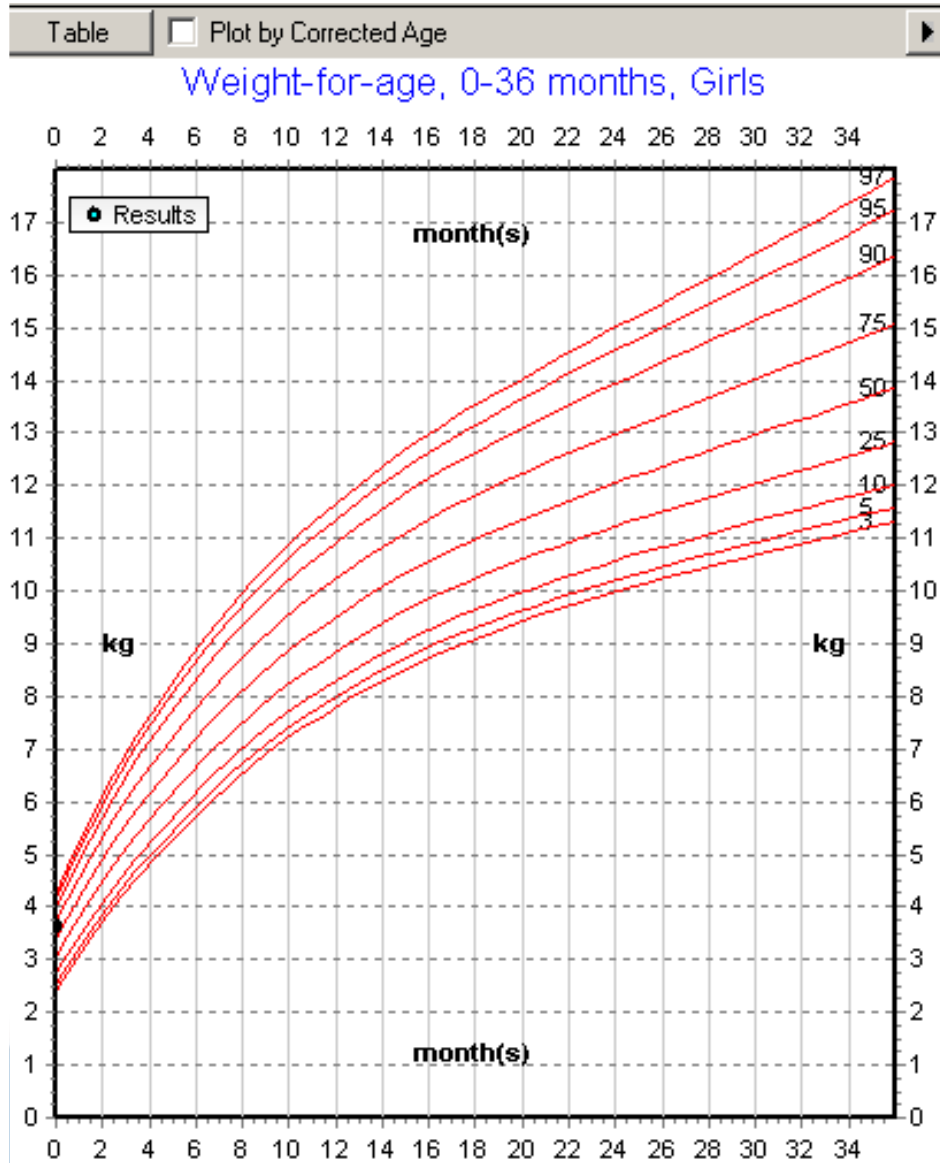
Intrauterine Growth Restricted (IUGR)?

- No
 Yes




Intrauterine Growth Restriction (IUGR) is a Physician Diagnosis Prenatally. After Birth, Determine if the Infant Still Meets This Criteria (i.e. SGA). If Not, Clarify With MD That This is No Longer a Risk Factor.

Online growth chart in EMR


Standardize determination of Weight per Gestational Age



Clinical Decision Support Automates Orders directly into EMR

	Ordered	Newborn Glucose Management - IDM	08/30/11 14:40:54, Feed newborn by 1 hour of life. Offer feeds a minimum of every 3 hours. Ordered from Rule
	Completed	Glucose POC - RN	08/30/11 19:40:54, Q3H, 3, Dose(s)/Time(s), 08/31/11 4:59:00, 1, do AC glucose every 2-3 hours x 3 f... Ordered from Rule
	Completed	Glucose POC - RN	08/30/11 16:40:54, DNCE AT, 08/30/11 16:40:54, 1 Ordered from Rule

Orders auto
print and are
placed on
chart for
provider co-
signature



METHODIST HEALTH SYSTEM
Newborn High Risk Hypoglycemia Protocol
Page: 1

Newborn Glucose Management 05/19/11 13:24:26, Feed newborn by 1 hour of life.
Offer feeds a minimum of every 3 hours.
Ordered from Rule

Glucose POC – RN 05/19/11 15:24:26, ONCE AT, 3, Dose(s)/Time(s), 05/19/11
15:24:26, 1
Ordered from Rule

Glucose POC – RN 05/19/11 18:24:26, Q3H, 3, Dose(s)/Time(s), 05/20/11 3:59:00,
1, do AC glucose every 2–3 hours x 3 feedings or for 1st 12 hours of life
(whichever is longer).
Ordered from Rule

Glucose POC – RN 05/20/11 13:24:26, ONCE AT, 3, Dose(s)/Time(s), 05/20/11
13:24:26, 1
Ordered from Rule


Location: WH 5-FLR 5201

Ordered by: Dawn M Gary, MD

Signature: _____ Date: _____ Time: _____ AM PM

dcp_nmhs_newborn_hypogly sent to 13:24 on 05/19/11 13:24

Permanent part of patient record



Staff Education

- Scenario training included in annual nursing competency education
- Target audience L&D and Mother/Baby staff nurses
- Ongoing monitoring and follow up education provided as needed
- Development of support tools



Outcomes

- Decrease in error rate
- Increased awareness by nursing of hypoglycemia risk factors and associated protocols for follow up
 - Proactive surveillance vs reactive care based upon signs/symptoms

Improvements Noted

		Before	After
Overall Error Rate		21%	7%
Breakdown		Before	After
Omission		34%	0%
Timing over 30 minutes		29%	62%
Wrong Protocol		21%	0%
Duplicate		8%	23%
Glucose not drawn		5%	0%
Risk factors not documented		3%	15%

Lessons Learned



- While automation of hypoglycemia protocol assured a higher level of care and surveillance for the newborn, changing nursing documentation behavior is challenging and real time monitoring of documentation error leading to CDS error is essential to change behavior.

Next steps



- Ongoing monitoring to validate effectiveness of protocol
- Standardization across health system
- Automation of orders for electronic provider signature

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Questions



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