Nursery/Infant Workshop:

Common Problems
and
Best Practices in the Newborn Nursery

TIPQC
Tennessee Initiative for Perinatal Quality Care

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Who are You?

a. RNs
b. Attending Physician
c. Advanced Practice Provider (APP)
d. Leadership/Administration
e. Trainee (Student/Resident/Fellow)
f. Other

Who are You?

In which setting do you primarily work?

a. Large hospital (>3000 deliveries/year)
b. Medium sized hospital (1000-3000 deliveries/year)
c. Small hospital (<1000 deliveries/year)

- Rural setting?
- Suburban/Urban setting?

Who are You?

What is the highest level of nursery at your hospital?

a. Level 1 Well Newborn Nursery
b. Level 2 Special Care or Intermediate Care Nursery
c. Level 3 or 4 NICU

Who are You?

What is your experience with Newborns?

a. Tons
b. Fair amount
c. Not much
d. What's a newborn?

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Case Presentation

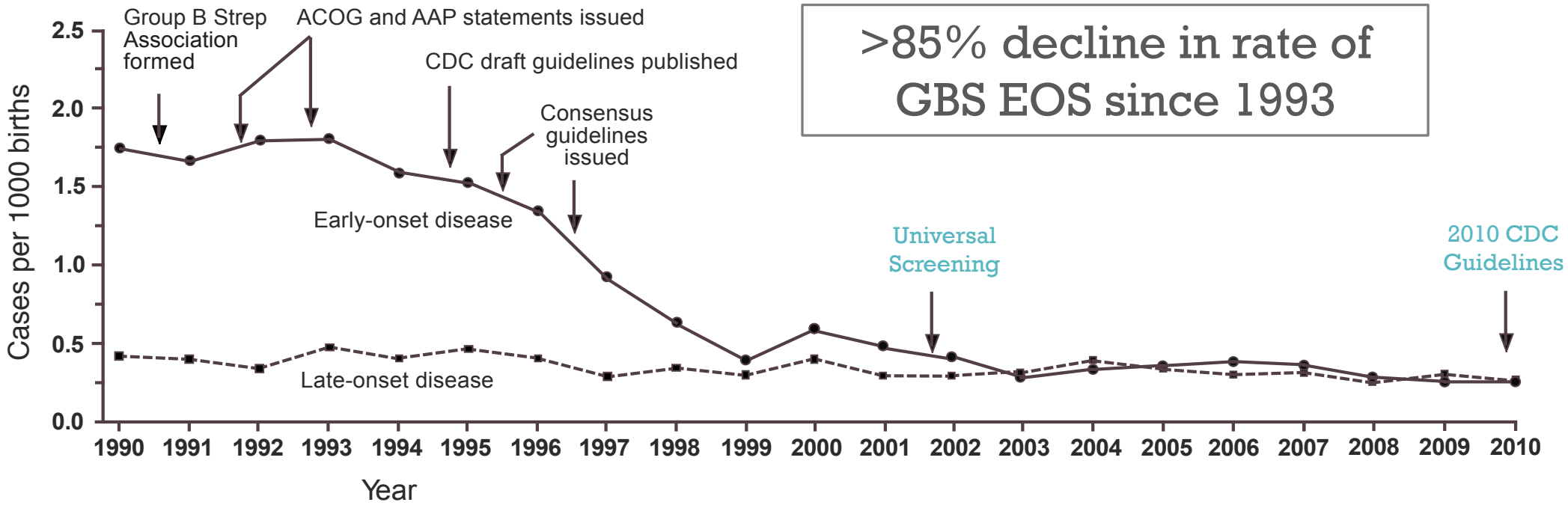
- Baby delivered at 36+4 weeks gestational age
- Mother with temperature up to 38.1 degrees Celsius prior to delivery and was diagnosed with chorioamnionitis.
- Rupture of membranes occurred 12 hours prior to delivery. She received broad spectrum antibiotics prior to delivery.
- At 1 hour of age, baby had some mild tachypnea but was otherwise stable. By 2 hours of age, these symptoms resolved and she was doing well.
- How should this infant be managed?
  - Should we get labs?
  - Should we start antibiotics and admit to the NICU?
  - Should this baby be allowed to stay and room in with her mother?

Early Onset Sepsis (EOS) - Background

- Neonatal Early Onset Sepsis
  - Onset of sepsis during *first 72 hours of life*
  - Often caused by vertical transmission of bacteria during intrapartum period
  - Can be associated with maternal and perinatal risk factors
  - Infants typically symptomatic at birth, or within the first 12-24 hours of life

Changing EOS Landscape in U.S.: GBS Screening and Intrapartum Antibiotic Prophylaxis

GBS Sepsis



>85% decline in rate of GBS EOS since 1993

Intrapartum Antibiotic Prophylaxis (IAP) highly effective

CDC Active Bacterial Core Surveillance Reports (1999-2010)

EOS challenging as a provider

- Low-incidence, high-consequence disease
  - EOS incidence 0.4-0.6 cases per 1000 live births for term/late preterm infants
  - But, in those infected → potential for significant morbidity and mortality
- Previous studies showed:
  - Up to ~8-10% of well appearing term & late preterm infants often started on antibiotics due to risk factors alone (including chorioamnionitis)
- Yet, even in these “higher-risk” infants, incidence of EOS is still low

Mukhopadhyay S, et al. J Perinatol. 2013;33(3):198-205

Mukhopadhyay S, Puopolo KM. Semin Perinatol. 2012;36(6):408-15

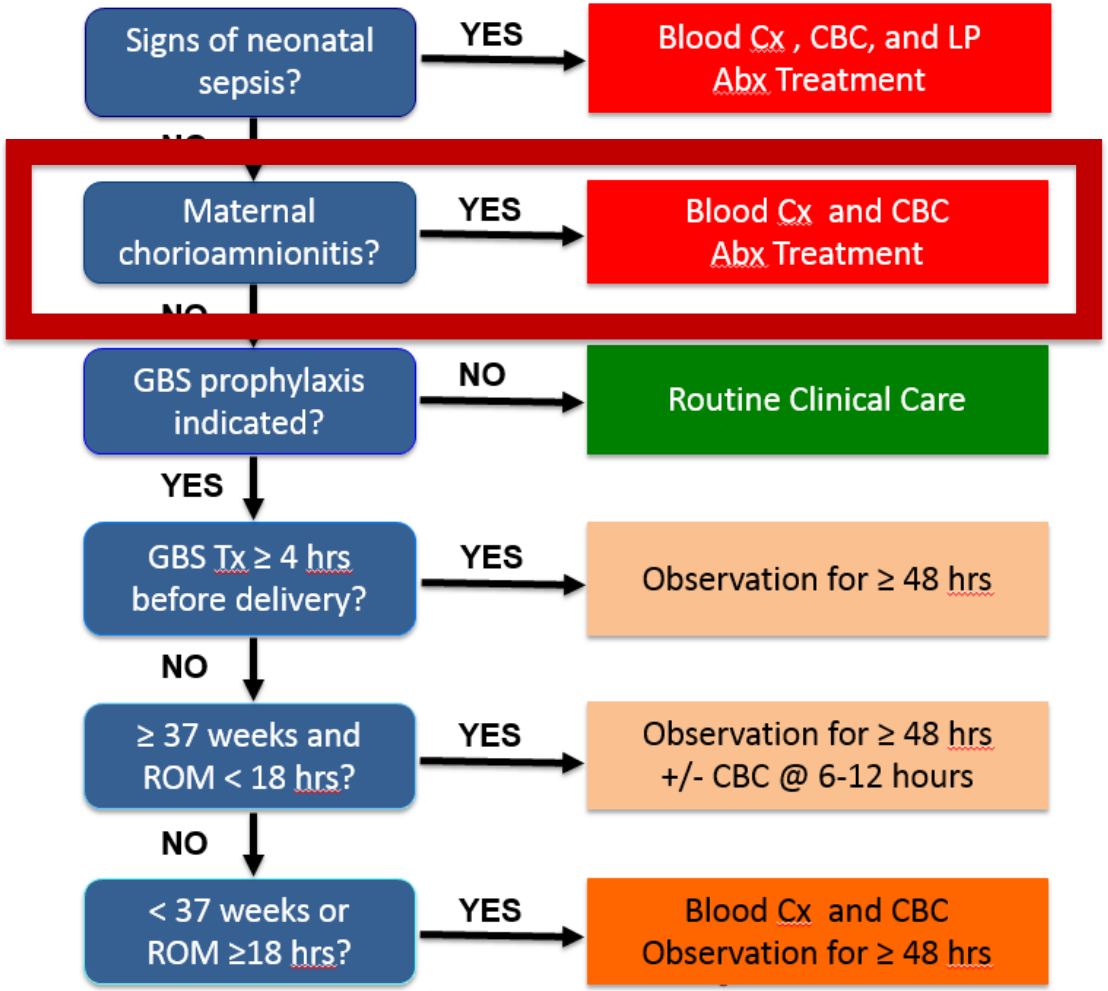
Consequences to Treatment

- Potential admission to Neonatal ICU
- Potential separation of mother-infant
    - Disruption of maternal bonding
    - Decreased breastfeeding
- Laboratory draws
- IV placements
- Exposure to IV antibiotics
    - Antimicrobial Resistance
    - Alteration of Gut Microbiome
    - Risk of developing asthma, allergic/autoimmune diseases

How Can We Identify Those Infected?

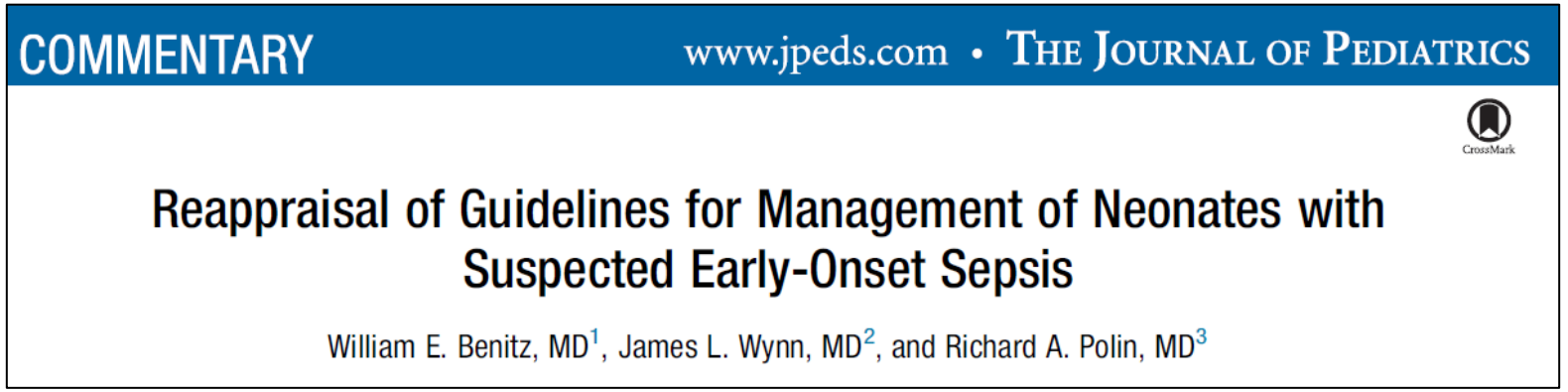
2010 CDC Guidelines

- Categorical Risk Based Assessment
- 'Yes/No' dichotomous classifications
- Emphasis given to diagnosis of chorioamnionitis
  - Chorioamnionitis = Antibiotic Treatment



Verani JR, McGee L, Schrag SJ, Division of Bacterial Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention (CDC). MMWR Recomm Rep. 2010 Nov 19;59(RR-10):1-36.

Need for Updated Approach



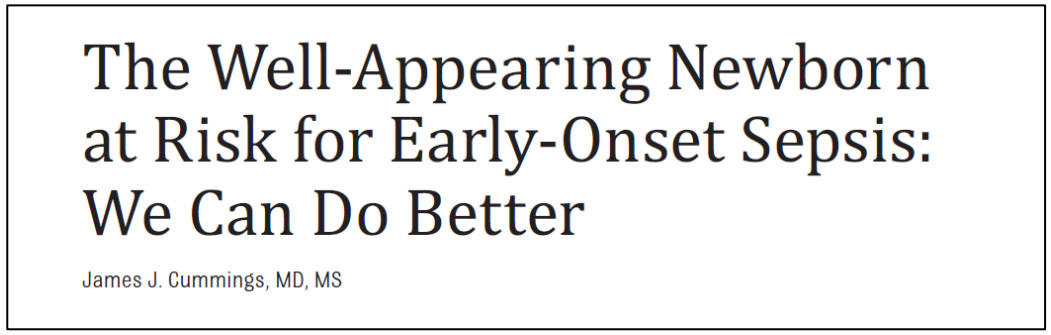
COMMENTARY www.jpeds.com • THE JOURNAL OF PEDIATRICS

CrossMark

Reappraisal of Guidelines for Management of Neonates with Suspected Early-Onset Sepsis

William E. Benitz, MD[1], James L. Wynn, MD[2], and Richard A. Polin, MD[3]

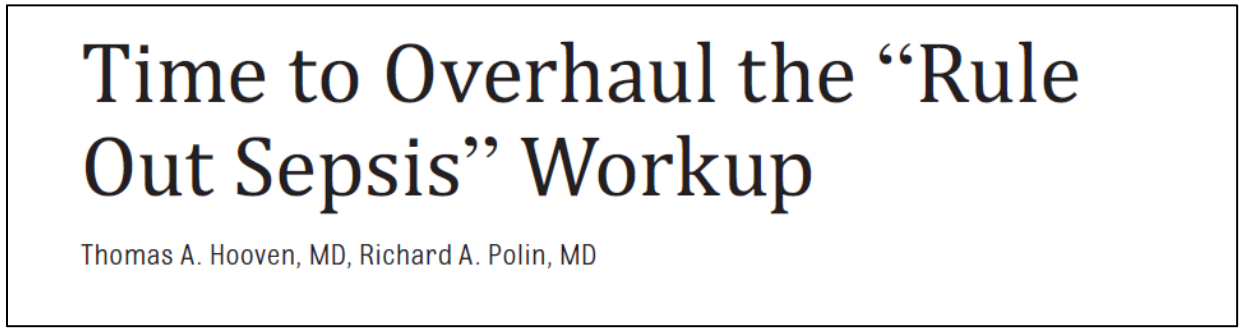
Benitz W, Wynn J, Polin R. "Reappraisal of Guidelines for Management of Neonates with Suspected Early-Onset Sepsis". J Peds April 2015. 166 (4):1070-1074



The Well-Appearing Newborn at Risk for Early-Onset Sepsis: We Can Do Better

James J. Cummings, MD, MS

Cummings JJ. The Well-Appearing Newborn at Risk for Early-Onset Sepsis: We Can Do Better. *Pediatrics.* 2017;139(3):e20164211



Time to Overhaul the "Rule Out Sepsis" Workup

Thomas A. Hooven, MD, Richard A. Polin, MD

Hooven TA and Polin RA. Time To Overhaul the "Rule Out Sepsis" Workup. *Pediatrics.* 2017; 140(1):e20171155

Using the EOS Calculator

JAMA Pediatrics | Original Investigation

A Quantitative, Risk-Based Approach to the Management of Neonatal Early-Onset Sepsis

Michael W. Kuzniewicz, MD, MPH; Karen M. Puopolo, MD, PhD; Allen Fischer, MD; Eileen M. Walsh, RN, MPH; Sherian Li, MS; Thomas B. Newman, MD, MPH; Patricia Kipnis, PhD; Gabriel J. Escobar, MD

European Journal of Pediatrics (2018) 177:741–746
https://doi.org/10.1007/s00431-018-3113-2

ORIGINAL ARTICLE

Sepsis calculator implementation reduces empiric antibiotics for suspected early-onset sepsis

Niek B. Achten[1] · J. Wendelien Dorigo-Zetsma[2] · Paul D. van der Linden[3] · Monique van Brakel[1] · Frans B. Plötz[1]

The Joint Commission Journal on Quality and Patient Safety

Tool Tutorial

Development and Implementation of an Early-Onset Sepsis Calculator to Guide Antibiotic Management in Late Preterm and Term Neonates

Readers may submit Tool Tutorial inquiries and submissions to Steven Berman, sberman@jcrinc.com.

Michael W. Kuzniewicz, MD, MPH; Eileen M. Walsh, RN, MPH; Sherian Li, MS; Allen Fischer, MD; Gabriel J. Escobar, MD

RESEARCH ARTICLE

Implementation of the Sepsis Risk Calculator at an Academic Birth Hospital

Miren B. Dhudasia, MBBS, MPH,[a,b] Sagori Mukhopadhyay, MD, MMSc,[a,b,c] Karen M. Puopolo, MD, PhD[a,b,c]

JAMA Pediatrics | Original Investigation

Association of Use of the Neonatal Early-Onset Sepsis Calculator With Reduction in Antibiotic Therapy and Safety
A Systematic Review and Meta-analysis

Niek B. Achten, MD; Claus Klingenberg, MD, PhD; William E. Benitz, MD; Martin Stocker, MD; Luregn J. Schlapbach, MD; Eric Giannoni, MD; Robin Bokelaar, MD; Gertjan J. A. Driessen, MD, PhD; Petter Brodin, MD, PhD; Sabita Uthaya, MD; Annemarie M. C. van Rossum, MD, PhD; Frans B. Plötz, MD, PhD

Using a Clinical Exam Based Approach (Enhanced Observation)

WJCP World Journal of Clinical Pediatrics

Submit a Manuscript: http://www.wjgnet.com/esps/
Help Desk: http://www.wjgnet.com/esps/helpdesk.aspx
DOI: 10.5409/wjcp.v5.i4.358

World J Clin Pediatr 2016 November 8; 5(4): 358-364
ISSN 2219-2808 (online)

ORIGINAL ARTICLE

Retrospective Cohort Study

Serial physical examinations, a simple and reliable tool for managing neonates at risk for early-onset sepsis

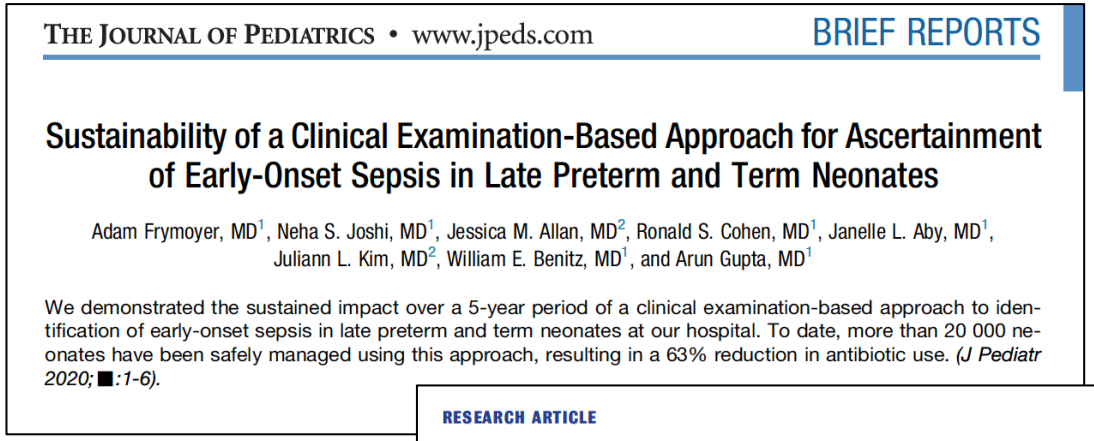
Alberto Berardi, Anna Maria Buffagni, Cecilia Rossi, Eleonora Vaccina, Chiara Cattelani, Lucia Gambini, Federica Baccilieri, Francesca Varioli, Fabrizio Ferrari

REVIEW

CURRENT OPINION

Serial clinical observation for management of newborns at risk of early-onset sepsis

Alberto Berardi[a], Luca Bedetti[b], Caterina Spada[c] Laura Lucaccioni[a], and Adam Frymoyer[d]

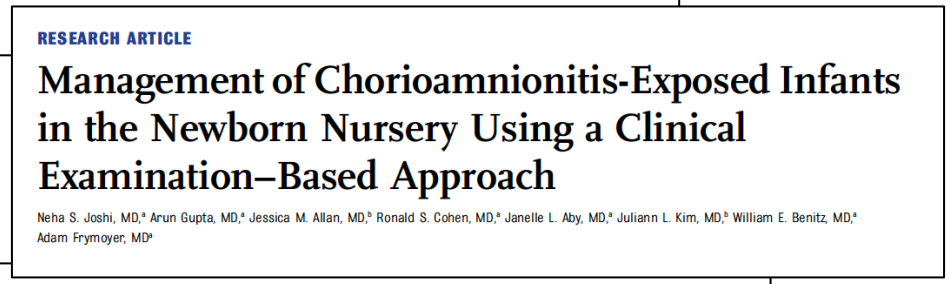


THE JOURNAL OF PEDIATRICS • www.jpeds.com BRIEF REPORTS

Sustainability of a Clinical Examination-Based Approach for Ascertainment of Early-Onset Sepsis in Late Preterm and Term Neonates

Adam Frymoyer, MD[1], Neha S. Joshi, MD[1], Jessica M. Allan, MD[2], Ronald S. Cohen, MD[1], Janelle L. Aby, MD[1], Juliann L. Kim, MD[2], William E. Benitz, MD[1], and Arun Gupta, MD[1]

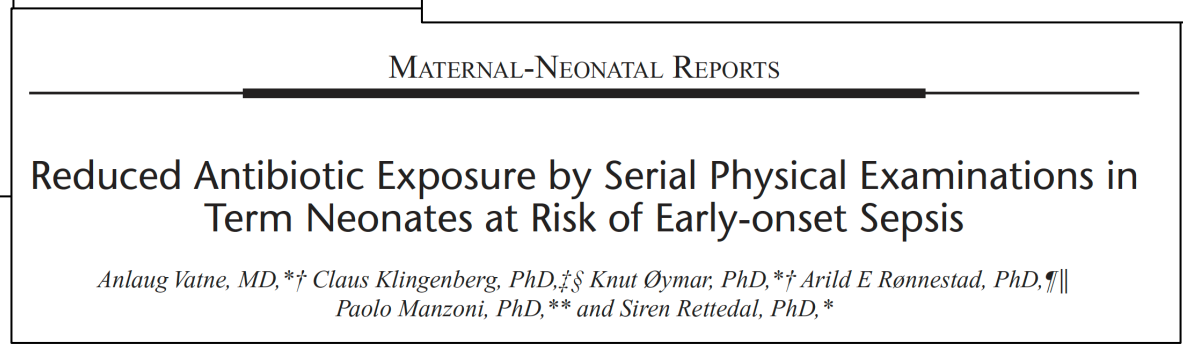
We demonstrated the sustained impact over a 5-year period of a clinical examination-based approach to identification of early-onset sepsis in late preterm and term neonates at our hospital. To date, more than 20 000 neonates have been safely managed using this approach, resulting in a 63% reduction in antibiotic use. *(J Pediatr 2020; ■:1-6).*



RESEARCH ARTICLE

Management of Chorioamnionitis-Exposed Infants in the Newborn Nursery Using a Clinical Examination–Based Approach

Neha S. Joshi, MD,[a] Arun Gupta, MD,[a] Jessica M. Allan, MD,[b] Ronald S. Cohen, MD,[a] Janelle L. Aby, MD,[a] Juliann L. Kim, MD,[b] William E. Benitz, MD,[a] Adam Frymoyer, MD[a]



MATERNAL-NEONATAL REPORTS

Reduced Antibiotic Exposure by Serial Physical Examinations in Term Neonates at Risk of Early-onset Sepsis

Anlaug Vatne, MD,† Claus Klingenberg, PhD,‡§ Knut Øymar, PhD,*† Arild E Rønnestad, PhD,¶‖ Paolo Manzoni, PhD,** and Siren Rettedal, PhD,**

Updated AAP COFN Guidelines on EOS

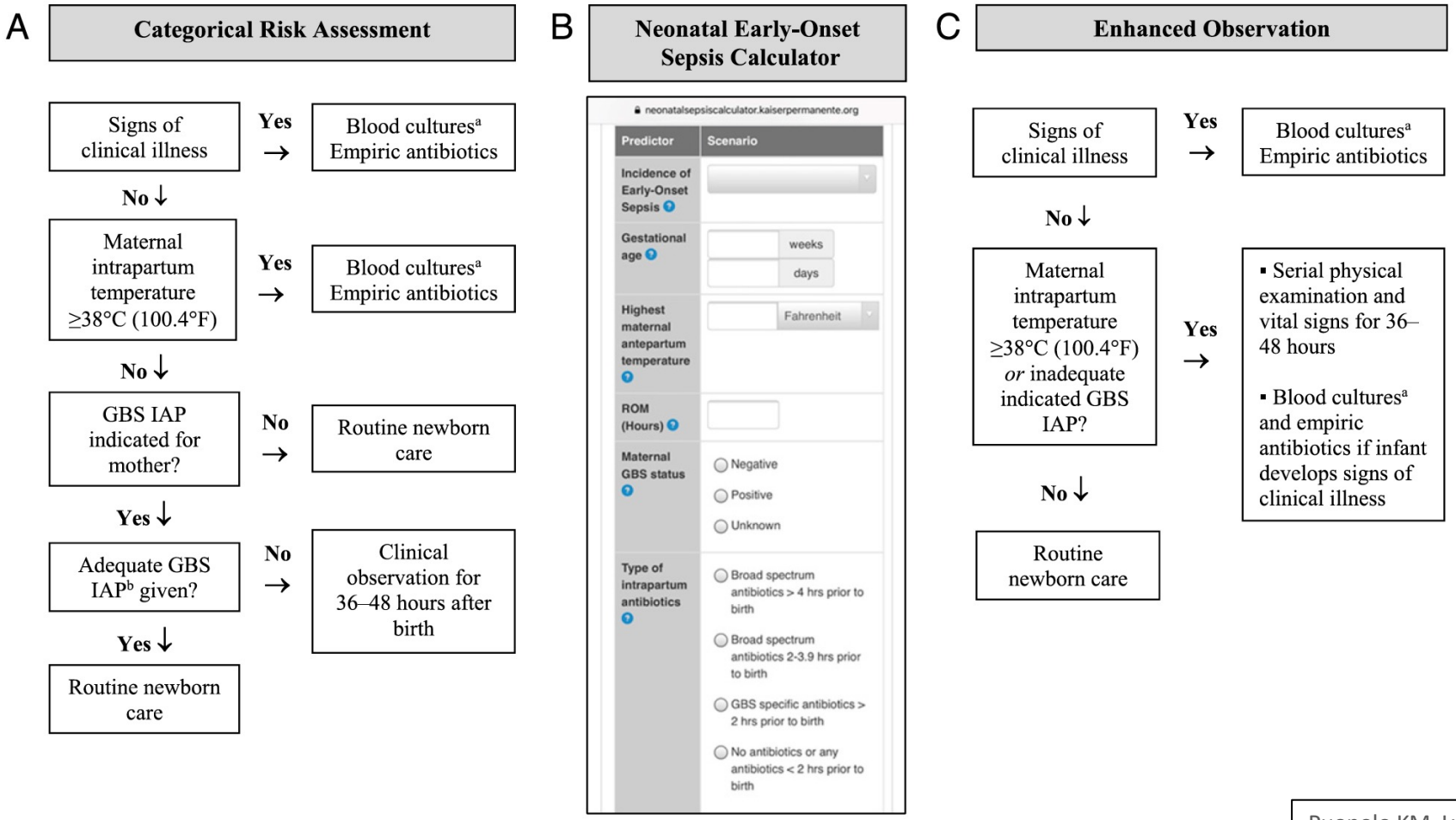
- Separate statements for 1) preterm and 2) late preterm/term infants
- Include 3 options
  1) **Traditional Categorical Risk Assessment approach:** Previous CDC guidelines (if risk present, treat)
  2) **Multivariate Risk Assessment approach:** Kaiser Neonatal Sepsis Calculator (if risk exceeds threshold, treat)
  3) **Enhanced Observation:** Clinical exams to identify infants with signs of illness (if clinical symptoms, treat)

- Each approach has benefits and challenges
- Selection of management requires assessment of available resources, capabilities and risk contexts for ***each center***

SCAN ME

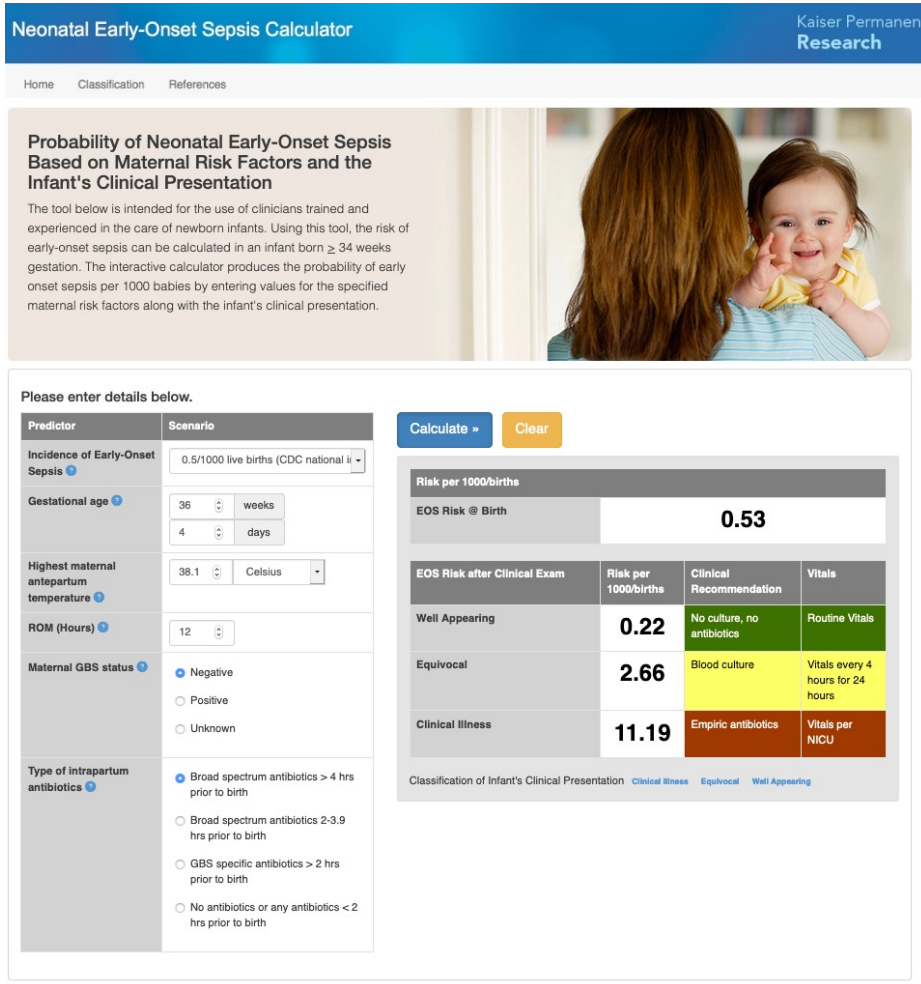
Puopolo KM, Benitz WE, Zaoutis TE; Committee on Fetus and Newborn; Committee on Infectious Diseases. Management of neonates born at 35 0/7 weeks' gestation with suspected or proven early-onset bacterial sepsis. Pediatrics. 2018;142(6): e20182894

AAP COFN Guidelines



Puopolo KM, Lynfield R, Cummings JJ, AAP Committee on Fetus and Newborn, AAP Committee on Infectious Diseases. Management of Infants at Risk for Group B Streptococcal Disease. Pediatrics. 2019;144(2): e20191881

Neonatal Sepsis Risk Calculator



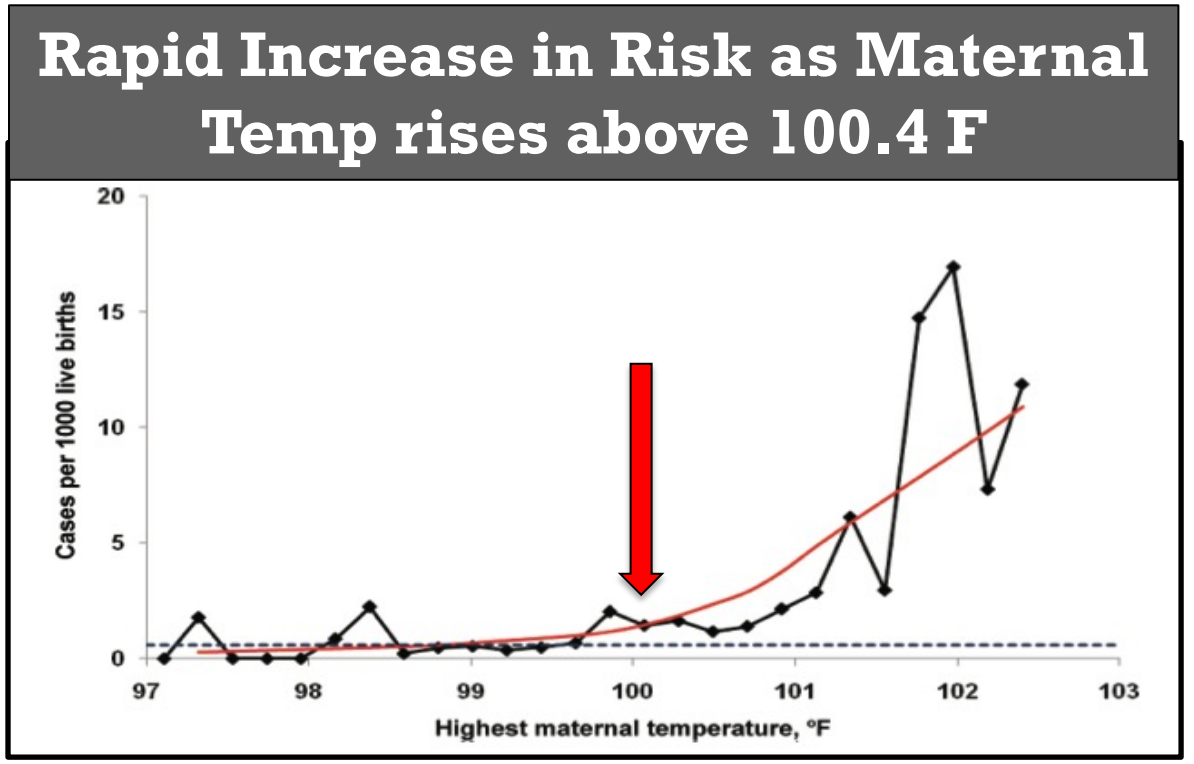
https://neonatalsepsiscalculator.kaiserpermanente.org/

SCAN ME

EOS Calculator: Maternal Risk Factors

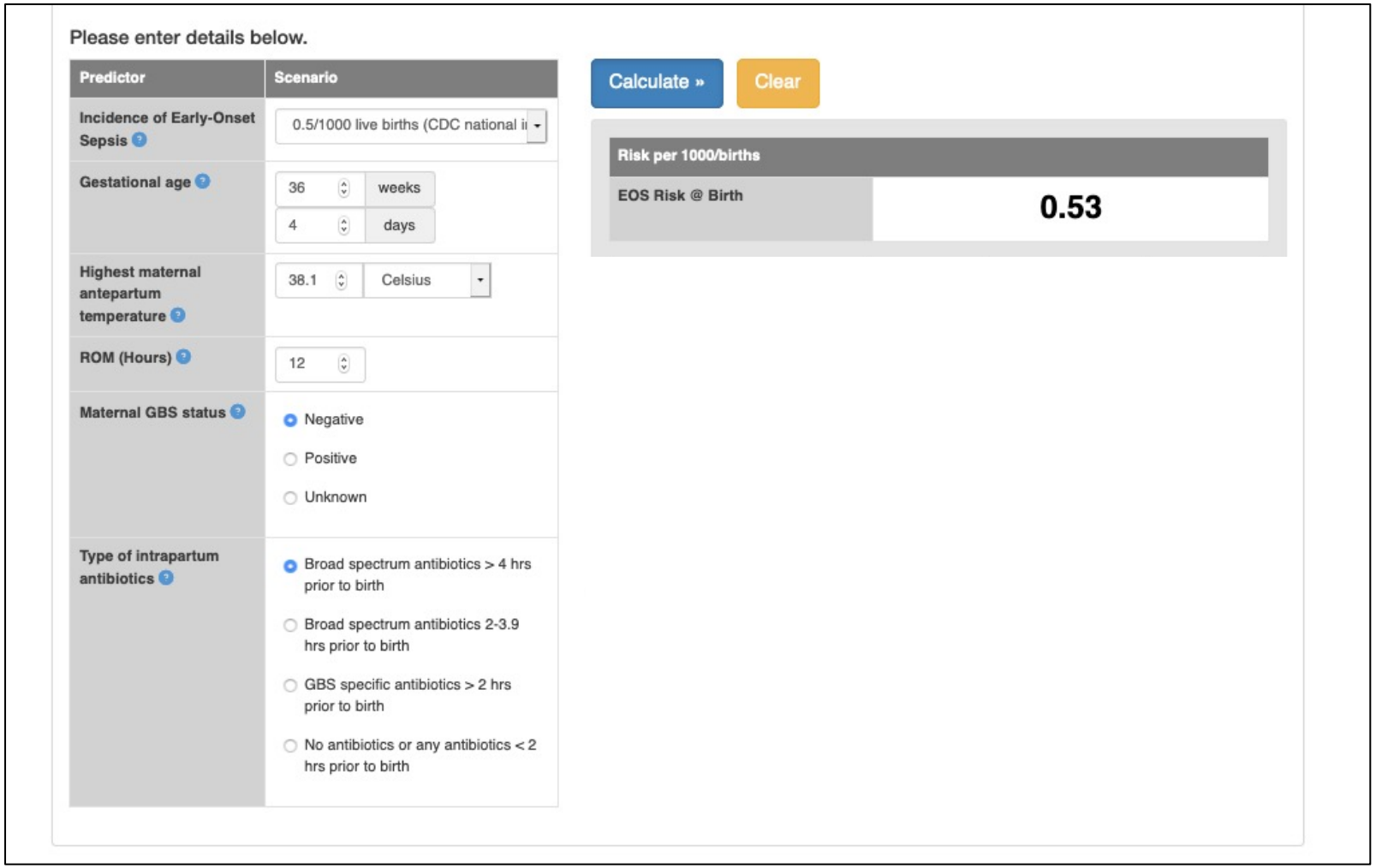
- Risk factors are continuous instead of 'yes/no'
- What maternal factors drive calculator score?

1) Maternal Temp	**58%**
2) Gestational Age	17%
3) ROM	13%
4) Intrapartum Abx	10%
5) GBS status	2%



Puopolo et al. Estimating the Probability of Neonatal Early Onset Infection on the Basis of Maternal Risk Factors. Pediatrics. 2011; 128(5):e1155-63.

EOS Calculator: Initial Risk



EOS Calculator: Clinical Exam

↑ >20 fold

↑ 5 fold

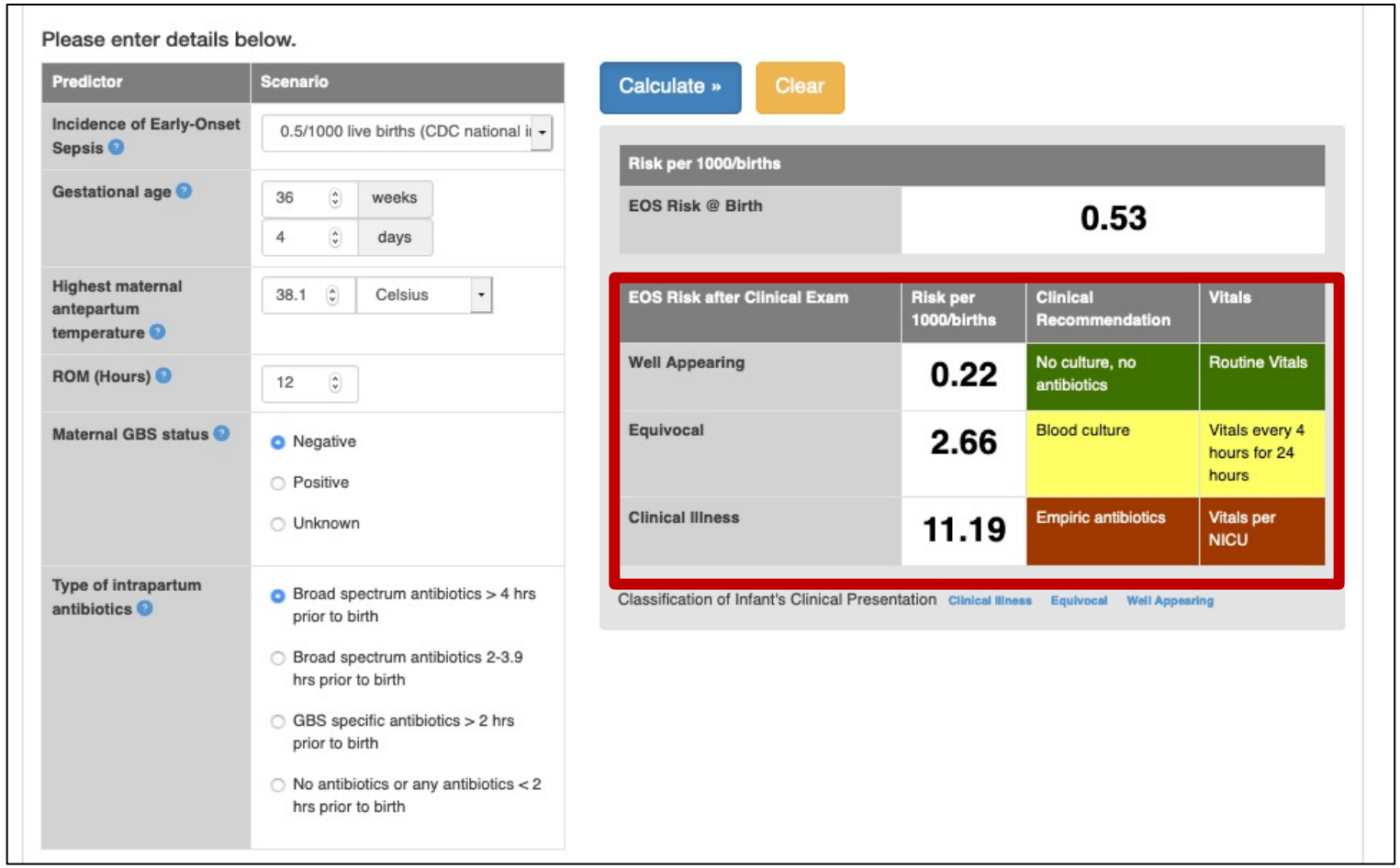
↓ 59%

Clinical Presentation	Description
Clinical illness	1. Persistent need for NCPAP / HFNC / mechanical ventilation (outside of the delivery room) 2. Hemodynamic instability requiring vasoactive drugs 3. Neonatal encephalopathy /Perinatal depression • Seizure • Apgar Score @ 5 minutes < 5 4. Need for supplemental O_2 > 2 hours to maintain oxygen saturations > 90% (outside of the delivery room)
Equivocal presentation	1. Persistent physiologic abnormality > 4 hrs • Tachycardia (HR > 160) • Tachypnea (RR > 60) • Temperature instability (> 100.4°F or < 97.5°F) • Respiratory distress (grunting, flaring, or retracting) not requiring supplemental O_2 2. Two or more physiologic abnormalities lasting for > 2 hrs
Well appearing	• No persistent physiologic abnormalities

Clinical Exam major driver of EOS risk in Sepsis Calculator

EOS Calculator: Treatment Thresholds

- Risk < 1/1000 Live Births
  - Routine Care
- Risk ≥ 1/1000 Live Births - NNT <1000
  - Culture and follow q4h vitals
- Risk ≥ 3/1000 Live Births - NNT <333
  - Empiric Antibiotics



Please enter details below.

Predictor	Scenario
Incidence of Early-Onset Sepsis	0.5/1000 live births (CDC national i
Gestational age	36 weeks, 4 days
Highest maternal antepartum temperature	38.1 Celsius
ROM (Hours)	12
Maternal GBS status	Negative / Positive / Unknown
Type of intrapartum antibiotics	Broad spectrum antibiotics > 4 hrs prior to birth / Broad spectrum antibiotics 2-3.9 hrs prior to birth / GBS specific antibiotics > 2 hrs prior to birth / No antibiotics or any antibiotics < 2 hrs prior to birth

Calculate » Clear

Risk per 1000/births	
EOS Risk @ Birth	0.53

EOS Risk after Clinical Exam	Risk per 1000/births	Clinical Recommendation	Vitals
Well Appearing	0.22	No culture, no antibiotics	Routine Vitals
Equivocal	2.66	Blood culture	Vitals every 4 hours for 24 hours
Clinical Illness	11.19	Empiric antibiotics	Vitals per NICU

Classification of Infant's Clinical Presentation Clinical Illness Equivocal Well Appearing

Kuzniewicz MW, et al. Development and Implementation of an Early-Onset Sepsis Risk Calculator to Guide Antibiotic Management in Late Preterm and Term Neonates. The Joint Commission Journal on Quality and Patient Safety. 2016 May;42(5):232-9

Enhanced Observation

- All infants are potentially at risk for EOS, regardless of risk factors
- All infants receive serial standardized exams and vital signs at frequent, defined intervals
- Routine labs not done and antibiotics not given solely based on risk factors if infant is well-appearing
- Development of symptoms and clinical exam determines management
- Common symptoms include:
  - Respiratory distress
  - Tachypnea
  - Poor perfusion

Case Presentation

- Baby delivered at 36+4 weeks gestational age
- Mother with temperature up to 38.1 degrees Celsius prior to delivery and was diagnosed with chorioamnionitis.
- Rupture of membranes occurred 12 hours prior to delivery. She received broad spectrum antibiotics prior to delivery.
- At 1 hour of age, baby had some mild tachypnea but was otherwise stable. By 2 hours of age, these symptoms resolved and she was doing well.
- How should this infant be managed?
  - Should we get labs?
  - Should we start antibiotics and admit to the NICU?
  - Should this baby be allowed to stay and room in with her mother?

Take Home Points: Early Onset Sepsis

- Latest AAP COFN guidelines now provide alternative strategies in the management of late preterm and term infants at risk for EOS
- The Early Onset Sepsis Calculator and Enhanced Observation approach are both useful strategies to safely target antibiotic use in this population
- These strategies can lead to significant decreases in antibiotic use in infants
- The clinical exam is a central component to any strategy and approach to EOS

Discussion/Worksheet

- How does your hospital manage newborns at risk for sepsis?
- How does your hospital currently provide parent/caregiver education on risk/signs/symptoms of sepsis?
- Any opportunities for improving this care at your hospital? Barriers to making changes? How to overcome?

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Case presentation

- You are in the nursery and evaluating a 3 hour old, ex-36 week late preterm infant.
- The infant has been skin to skin with mother and attempting to breastfeed. The baby appears to be latching well and is asymptomatic. After an initial glucose of 26 and a feed – the latest glucose check was 31 mg/dL.

- What should be the next step in managing this infant?

Neonatal Hypoglycemia

- Can affect ~5-15% of newborns
- Which babies are “at-risk”?
  - Infant of diabetic mothers
  - Late preterm infants (<37 wks)
  - LGA infants
  - SGA infants
- Other risk factors may include:
  - Perinatal stress; Maternal medications (Beta Blockers, Betamethasone, etc.)
- Most infants have a transitional state with a nadir that occurs in the first 1-2 hrs of life; Glucose levels then increase and eventually stabilize by ~12-48 hrs of life
- Limited evidence and consensus on definition of neonatal hypoglycemia and the thresholds at which to treat

Screening and Management of Postnatal Glucose Homeostasis in Late Preterm and Term SGA, IDM/LGA Infants

(LPT) Infants 34 – 36$^{6/7}$ weeks and SGA (screen 0-24 hrs); IDM and LGA ≥34 weeks (screen 0-12 hrs)]

Symptomatic and <40 mg/dL ⟶ IV glucose

ASYMPTOMATIC

Birth to 4 hours of age		4 to 24 hours of age	
INITIAL FEED WITHIN 1 hour Screen glucose 30 minutes after 1st feed		Continue feeds q 2-3 hours Screen glucose prior to each feed	
Initial screen <25 mg/dL		Screen <35 mg/dL	
Feed and check in 1 hour		Feed and check in 1 hour	
<25 mg/dL ↓ IV glucose*	25–40 mg/dL ↓ Refeed/IV glucose* as needed	<35 mg/dL ↓ IV glucose*	35 – 45 mg/dL ↓ Refeed/IV glucose* as needed

Target glucose screen ≥45 mg/dL prior to routine feeds

* Glucose dose = 200 mg/kg (dextrose 10% at 2 mL/kg) and/or IV infusion at 5–8 mg/kg per min (80–100 mL/kg per d). Achieve plasma glucose level of 40-50 mg/dL.

Symptoms of hypoglycemia include: Irritability, tremors, jitteriness, exaggerated Moro reflex, high-pitched cry, seizures, lethargy, floppiness, cyanosis, apnea, poor feeding.

AAP COFN Guidelines

SCAN ME

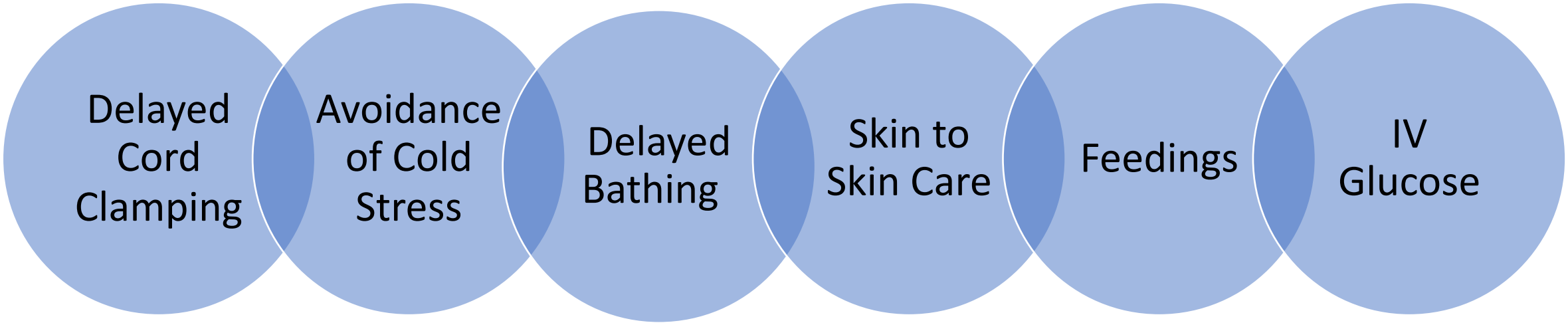
Adamkin DH. Postnatal glucose homeostasis in late-preterm and term infants. Pediatrics. 2011;127:575–9.

AAP vs PES guidelines

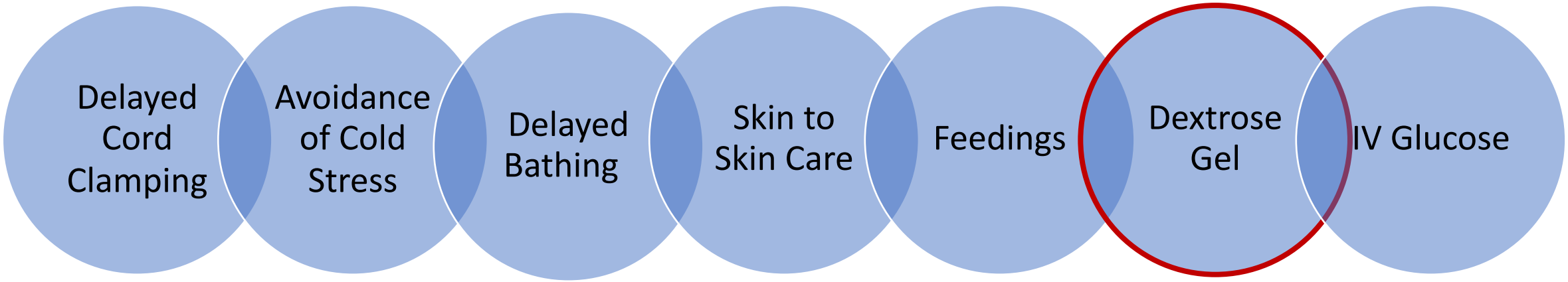
Time	0-4 hrs	4-24 hrs	24-48 hrs	>48 hrs
AAP	If asymptomatic: - Maintain glucose >40 mg/dL - IV glucose if <25 mg/dL; as needed if 25-40 mg/dL	If asymptomatic: - Maintain glucose >45 mg/dL - IV glucose if <35 mg/dL; as needed if 35-45 mg/dL		
PES	(First 48 hours): Maintain blood glucose >50 mg/dL (during first 48 hours)			(After 48 hours): Blood glucose >60 mg/dL recommended; If persistent hypoglycemia, infants should have fast challenge with blood glucose maintained >70 mg/dL

Adapted from:
Thompson-Branch A, Havranek T. Neonatal Hypoglycemia. Pediatrics in Review April 2017, 38 (4) 147-157.

Treating/Preventing Hypoglycemia



Treating/Preventing Hypoglycemia



Use of Dextrose Gel

ORIGINAL ARTICLES

www.jpeds.com • THE JOURNAL OF PEDIATRICS

What Happens to Blood Glucose Concentrations After Oral Treatment for Neonatal Hypoglycemia?

Deborah L. Harris, PhD[1,2], Greg D. Gamble, MSc[2], Philip J. Weston, MBChB[1], and Jane E. Harding, DPhil[2]

ORIGINAL ARTICLES

www.jpeds.com • THE JOURNAL OF PEDIATRICS

Outcome at 2 Years after Dextrose Gel Treatment for Neonatal Hypoglycemia: Follow-Up of a Randomized Trial

Deborah L. Harris, PhD[1,2], Jane M. Alsweiler, FRACP, PhD[2], Judith M. Ansell, PhD[2], Gregory D. Gamble, MSc[2], Benjamin Thompson, PhD[3], Trecia A. Wouldes, PhD[4], Tzu-Ying Yu, PhD[3], and Jane E. Harding, FRACP, D Phil[2], on behalf of the Children with Hypoglycaemia and their Later Development (CHYLD) Study Team*

Original research

Outcome at 4.5 years after dextrose gel treatment of hypoglycaemia: follow-up of the Sugar Babies randomised trial

Deborah L Harris ,[1,2] Greg D Gamble,[2] Jane E Harding ,[2] on behalf of the CHYLD Study Group

Dextrose gel for neonatal hypoglycaemia (the Sugar Babies Study): a randomised, double-blind, placebo-controlled trial

Deborah L Harris, Philip J Weston, Matthew Signal, J Geoffrey Chase, Jane E Harding

Use of Dextrose Gel

Review

Oral Dextrose Gel Reduces the Need for Intravenous Dextrose Therapy in Neonatal Hypoglycemia

Munmun Rawat Praveen Chandrasekharan Stephen Turkovich
Nancy Barclay Katherine Perry Eileen Schroeder Lisa Testa
Satyan Lakshminrusimha

Division of Neonatology, Department of Pediatrics, Women and Children's Hospital of Buffalo, Buffalo, N.Y., USA

Glucose Gel in Infants at Risk for Transitional Neonatal Hypoglycemia

Kartikeya Makker, MD[1] Rana Alissa, MD[1] Christopher Dudek, MD[1] Laura Travers, DO[1]
Carmen Smotherman, MS[2] Mark L. Hudak, MD[1]

[1]Division of Neonatology, Department of Pediatrics, University of Florida College of Medicine–Jacksonville, Jacksonville, Florida
[2]Center for Health Equity and Research, University of Florida College of Medicine–Jacksonville, Jacksonville, Florida

Address for correspondence Kartikeya Makker, MD, Division of Neonatology, Department of Pediatrics, University of Florida College of Medicine–Jacksonville, 655 West 8th Street, Box C3, Jacksonville, FL 32209 (e-mail: kartikeya.makker@jax.ufl.edu).

Am J Perinatol 2018;35:1050–1056.

Original article

Incorporating dextrose gel and feeding in the treatment of neonatal hypoglycaemia

Katherine Gregory,[1,2] Daria Turner,[1] Charis Nicole Benjamin,[1] Carmen Monthe-Dreze,[1,2]
Lise Johnson,[1,2] Shelley Hurwitz,[1,2] Joseph Wolfsdorf,[2,3] Sarbattama Sen[1,2]

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Better health.

Cochrane Database of Systematic Reviews

[Intervention Review]

Oral dextrose gel to prevent hypoglycaemia in at-risk neonates

Joanne E Hegarty[1,2], Jane E Harding[2], Caroline A Crowther[2,3], Julie Brown[2], Jane Alsweiler[1,4]

Dextrose Gel

- 40% Dextrose Gel (400 mg/mL) – different formulations available
- Weight based dosing– (though recent studies looking at single standard dose regimens)
    - Sample weight-based dosing chart (~200 mg/kg = 0.5 ml/kg):

Birthweight (kg)	Dextrose Gel (ml)
<2.5 kg	1 ml
2.5-3.49 kg	1.5 ml
3.5-4.49 kg	2 ml
≥4.5 kg	2.5 ml

- Administer to buccal mucosa prior to feeding
- Maximum of 3 doses may be administered
- Potential to decrease interventions (blood draws, supplemental formula, need for IV dextrose and NICU admission, etc)

Case presentation

- You are in the nursery and evaluating a 3 hour old, ex-36 week late preterm infant.
- The infant has been skin to skin with mother and attempting to breastfeed. The baby appears to be latching well and is asymptomatic. After an initial glucose of 26 and a feed – the latest glucose check was 31 mg/dL.

- What should be the next step in managing this infant?

HypoEXIT study

- Multicenter, randomized, non-inferiority trial
- Healthy newborns >35 weeks, >2000 grams
- Low threshold (<36 mg/dl) vs traditional threshold (<47 mg/dl)
  - Treatment interventions: oral feedings, tube feedings, IV glucose
- Primary outcome: psychomotor development at 18 months
  - Mean cognitive and mean motor scores (on Bayley-III-NL) similar in both groups
  - Lower threshold (<36) was NON-INFERIOR to traditional threshold (<47)
- Traditional threshold group (<47 mg/dl)
  - Fewer and less severe hypoglycemic episodes
  - More invasive diagnostic and treatment interventions

van Kempen AAMW, Eskes PF, Nuytemans DHGM, et al. Lower versus traditional treatment threshold for neonatal hypoglycemia. N Engl J Med 2020;382:534-544.

Take Home Points: Neonatal Hypoglycemia

- Management of neonatal hypoglycemia continues to remain controversial with sometimes conflicting guidance from major medical societies
- Further research is needed with respect to long term neurodevelopmental outcomes – to help inform the optimal management strategy and thresholds at which to intervene for infants with hypoglycemia
- Dextrose gel appears to be an effective, non-invasive, inexpensive treatment for managing asymptomatic neonates with hypoglycemia when used in conjunction with feedings
- Dextrose gel may reduce rates of maternal-infant separation, NICU admissions, and need for IV dextrose - though ongoing research is still needed

Discussion/Worksheet

- What is your current management of neonatal hypoglycemia at your institution?
- Does your institution have an algorithm? Do you use dextrose gel?
- Any opportunities for improving this care at your hospital? Barriers to making changes? How to overcome?

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

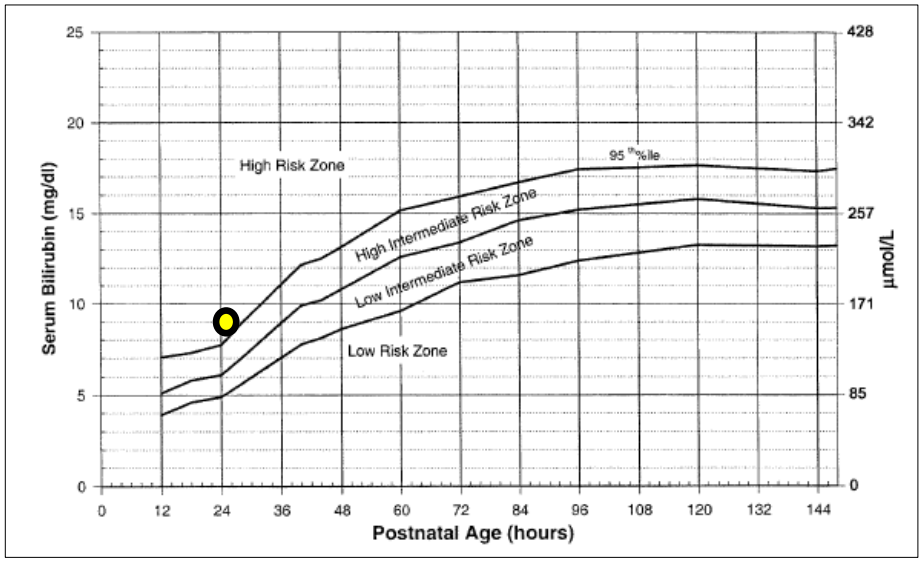
NAS/NOWS

Car Seat Challenges

Case Presentation

- Infant born at 38 weeks gestation to a mother who has blood type O+.
- Infant found to be A+, DAT positive after birth
- His bilirubin level is 9.0 at 24 hours of life
- How would you manage this infant?
  - Which bilirubin nomogram would you use?
  - When would you start phototherapy? When would you stop phototherapy?
  - When would you recheck a bilirubin level?

2004 AAP Guidelines



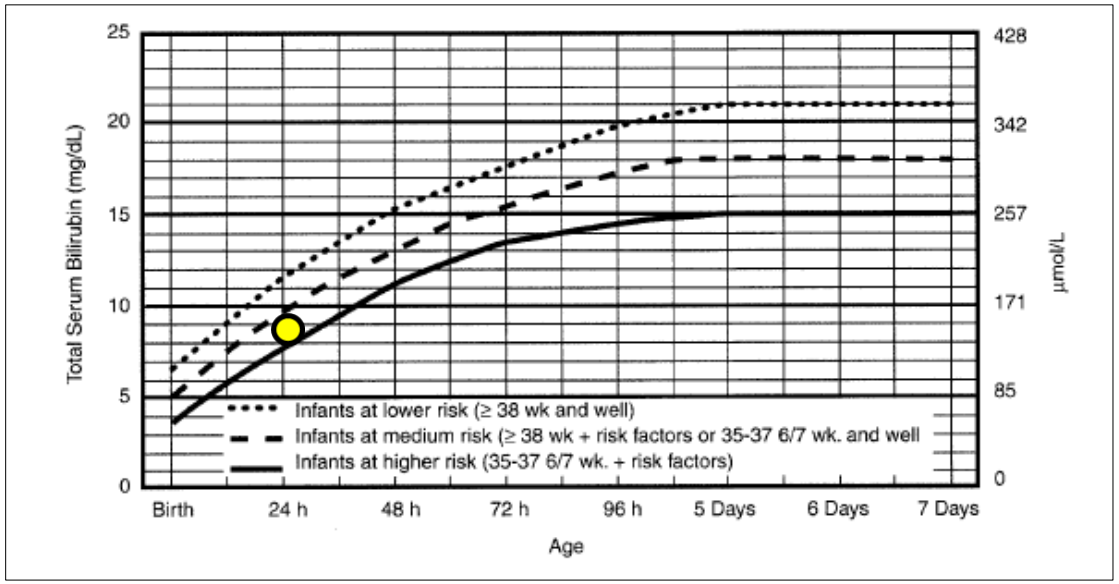
AMERICAN ACADEMY OF PEDIATRICS

CLINICAL PRACTICE GUIDELINE

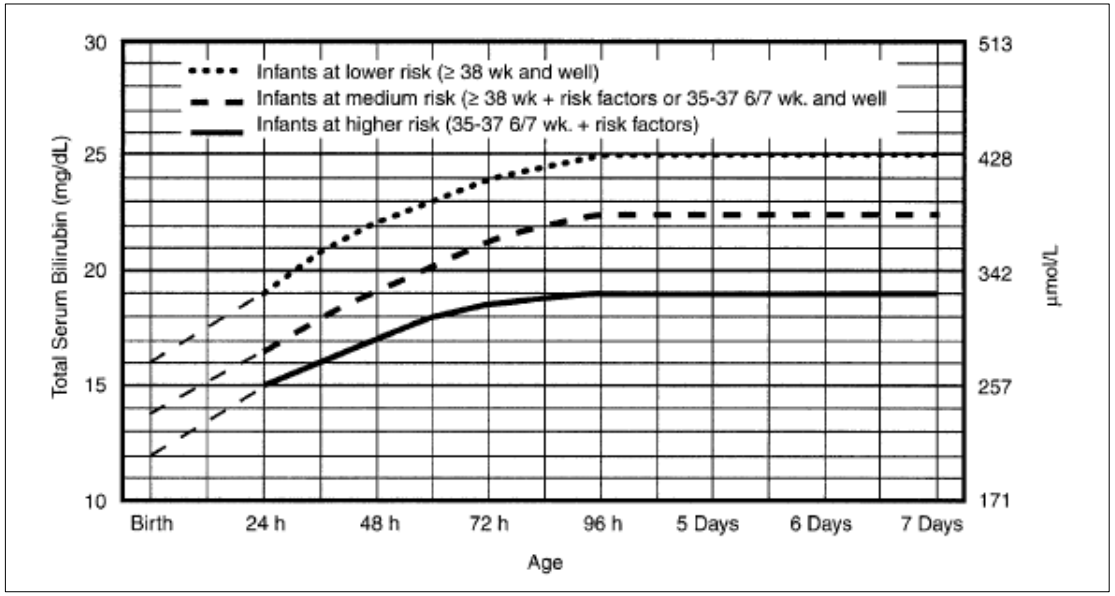
Subcommittee on Hyperbilirubinemia

Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

PEDIATRICS Vol. 114 No. 1 July 2004

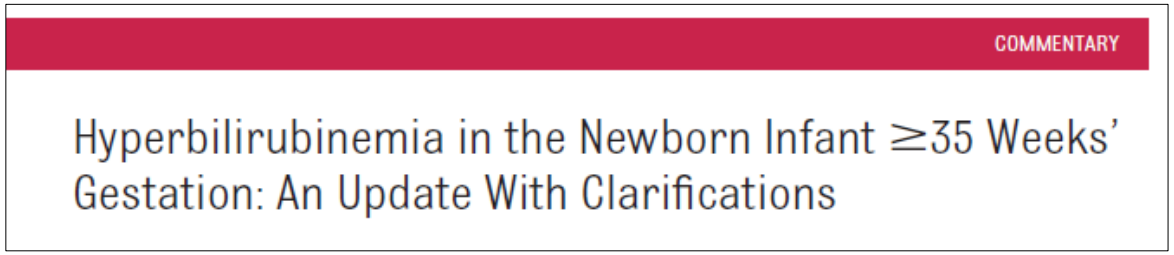


Guidelines for Phototherapy



Guidelines for Exchange Transfusion

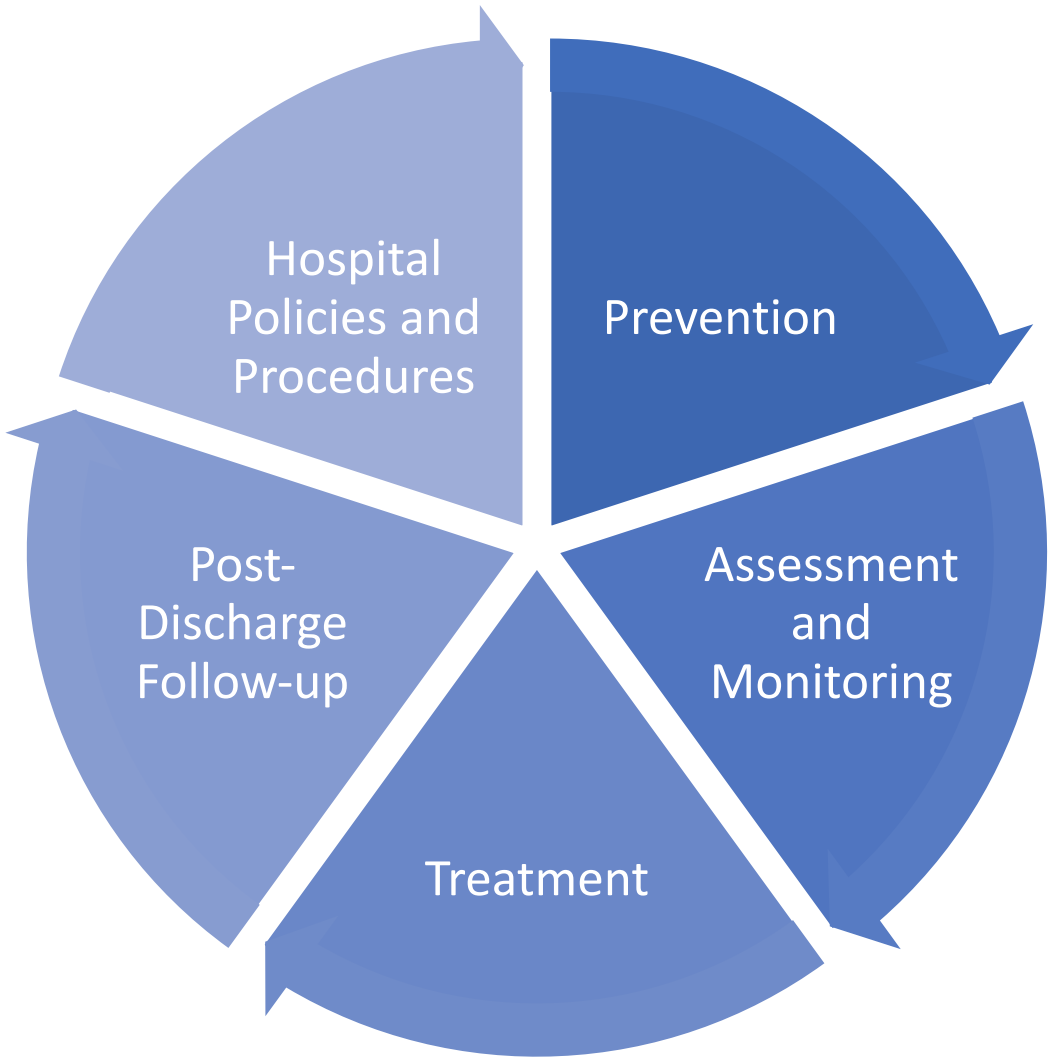
2009 AAP Update

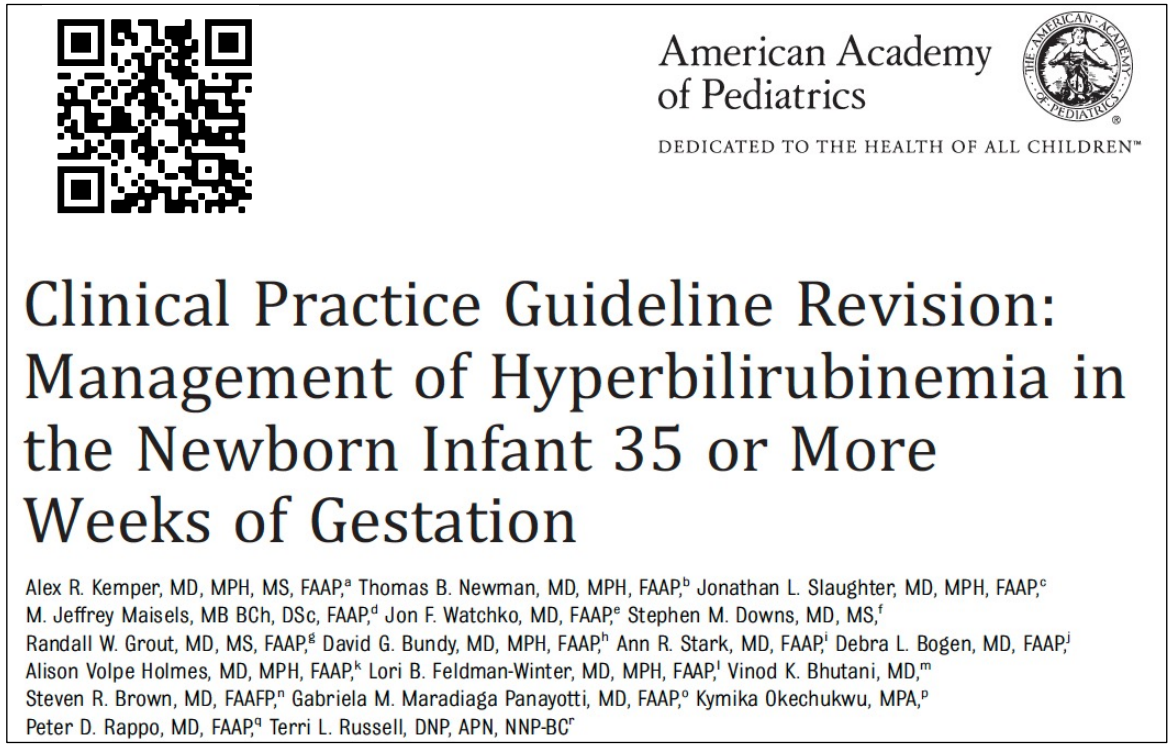


Pediatrics, October 2009

- New recommendations:
  - Universal pre-discharge bilirubin screening (with TsB or TcB)
  - More structured approach to management and follow-up
    - Specific recommendations for follow-up based on:
      - Pre-Discharge Bilirubin level
      - Gestational Age
      - Risk Factors for subsequent hyperbilirubinemia

2022 AAP Hyperbilirubinemia Guidelines





American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation

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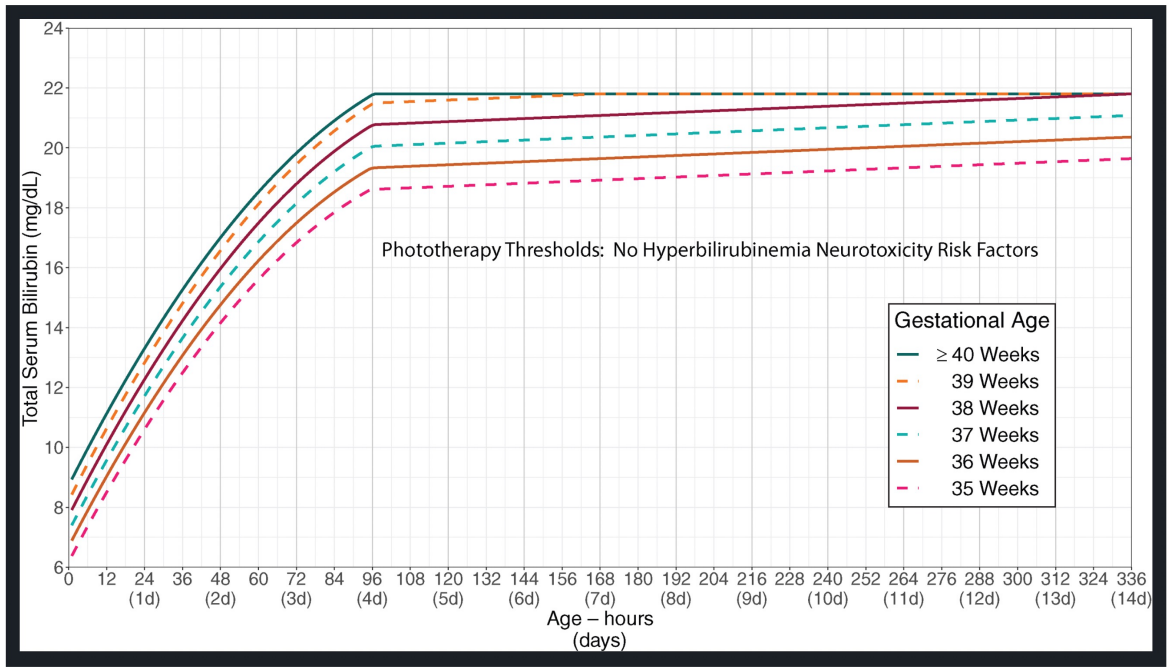
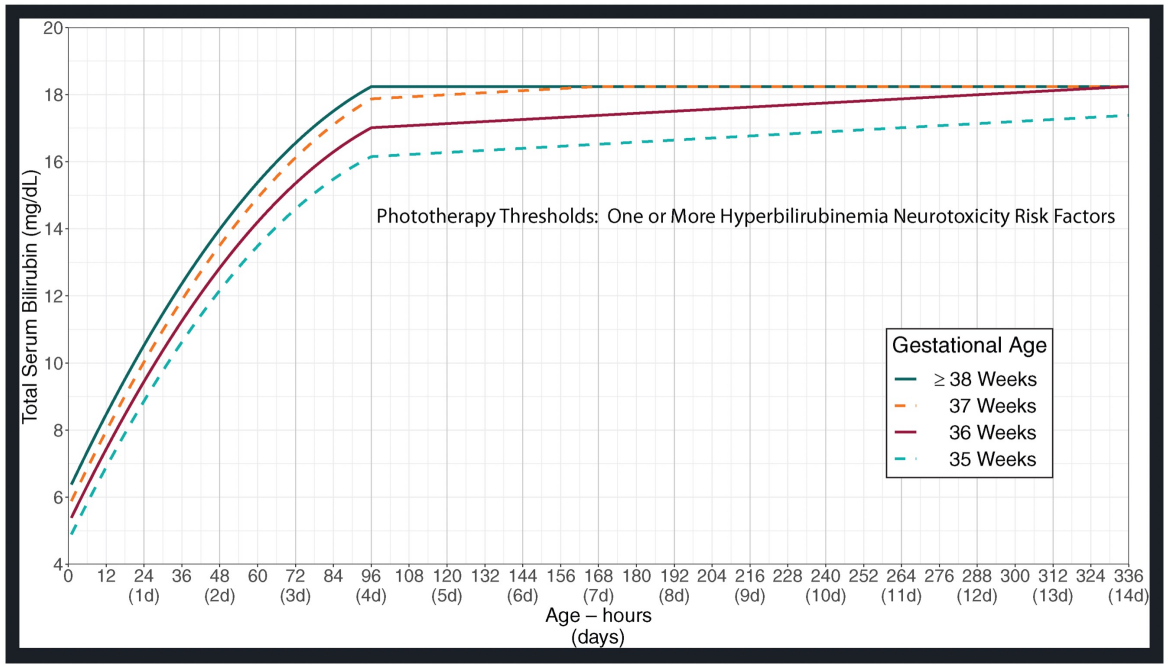
2022 AAP Hyperbilirubinemia Guidelines

- Increased treatment thresholds focusing on gestational age & neurotoxicity risk factors
- Identifying highest risk infants
- Escalation of care guidelines
- Elimination of risk zones for determining follow-up → now based on distance from phototherapy threshold

2022 AAP Hyperbilirubinemia Guidelines Thresholds and Graphs



No Neurotoxicity Risk Factors



+ Neurotoxicity Risk Factors

Risk Factors for Developing Significant Hyperbilirubinemia

- Lower gestational age
- Jaundice in the first 24 hours of life
- Predischarge TcB/TSB close to threshold
- Hemolysis
- Phototherapy before discharge
- Parent or sibling requiring phototherapy or exchange transfusion
- Family history or genetic ancestry suggestive of inherited red blood cell disorders (e.g., G6PD deficiency)
- Exclusive breastfeeding with suboptimal intake
- Scalp hematoma or significant bruising
- Down syndrome
- Macrosomic infant of a diabetic mother

Neurotoxicity Risk Factors

Gestational Age < 38 weeks

Isoimmune hemolytic disease, G6PD, or other hemolytic conditions

Albumin < 3 g/dL

Sepsis

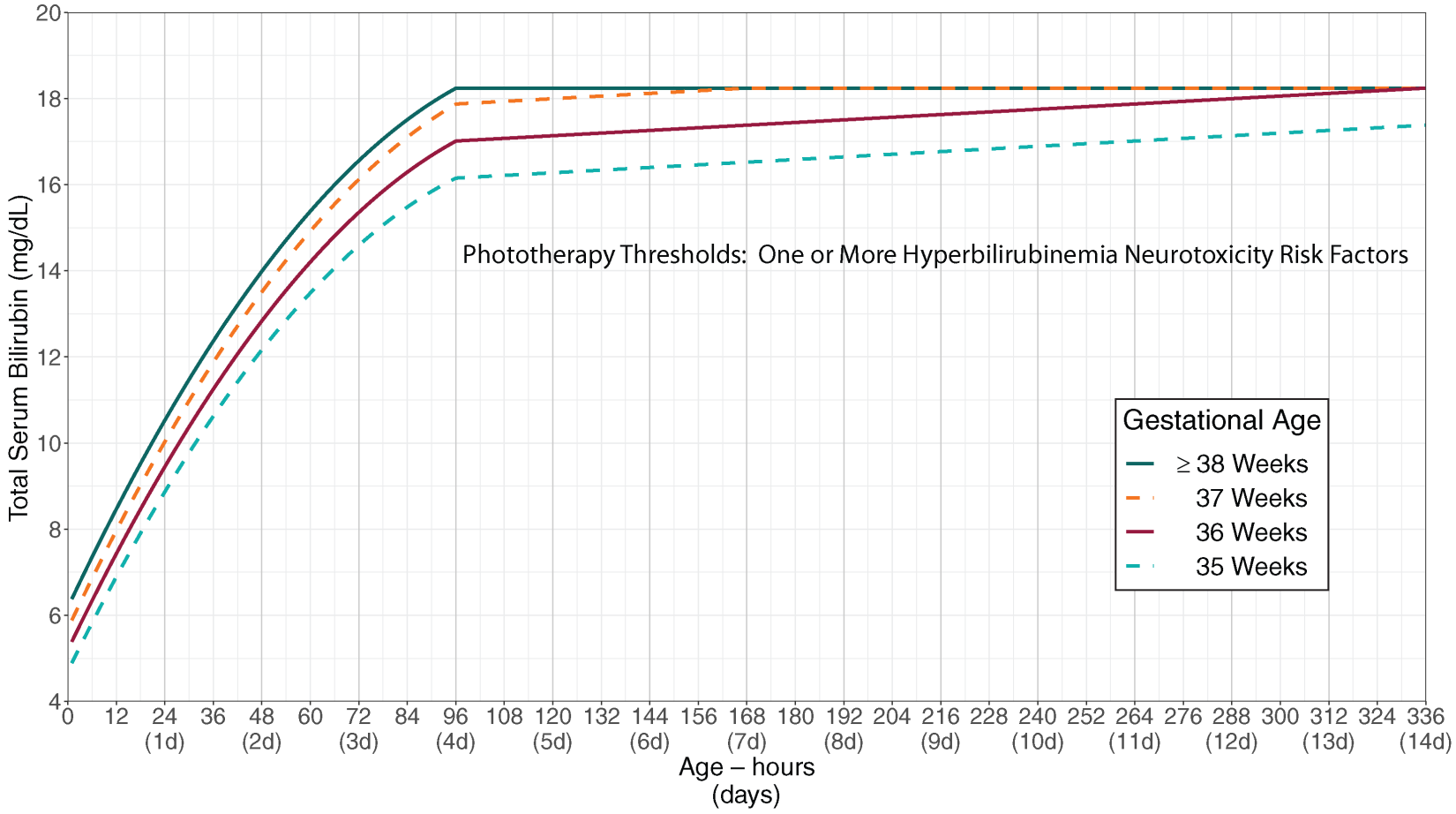
Significant clinical instability in past 24 hours

Case Presentation

38 wk GA infant

Mom O+

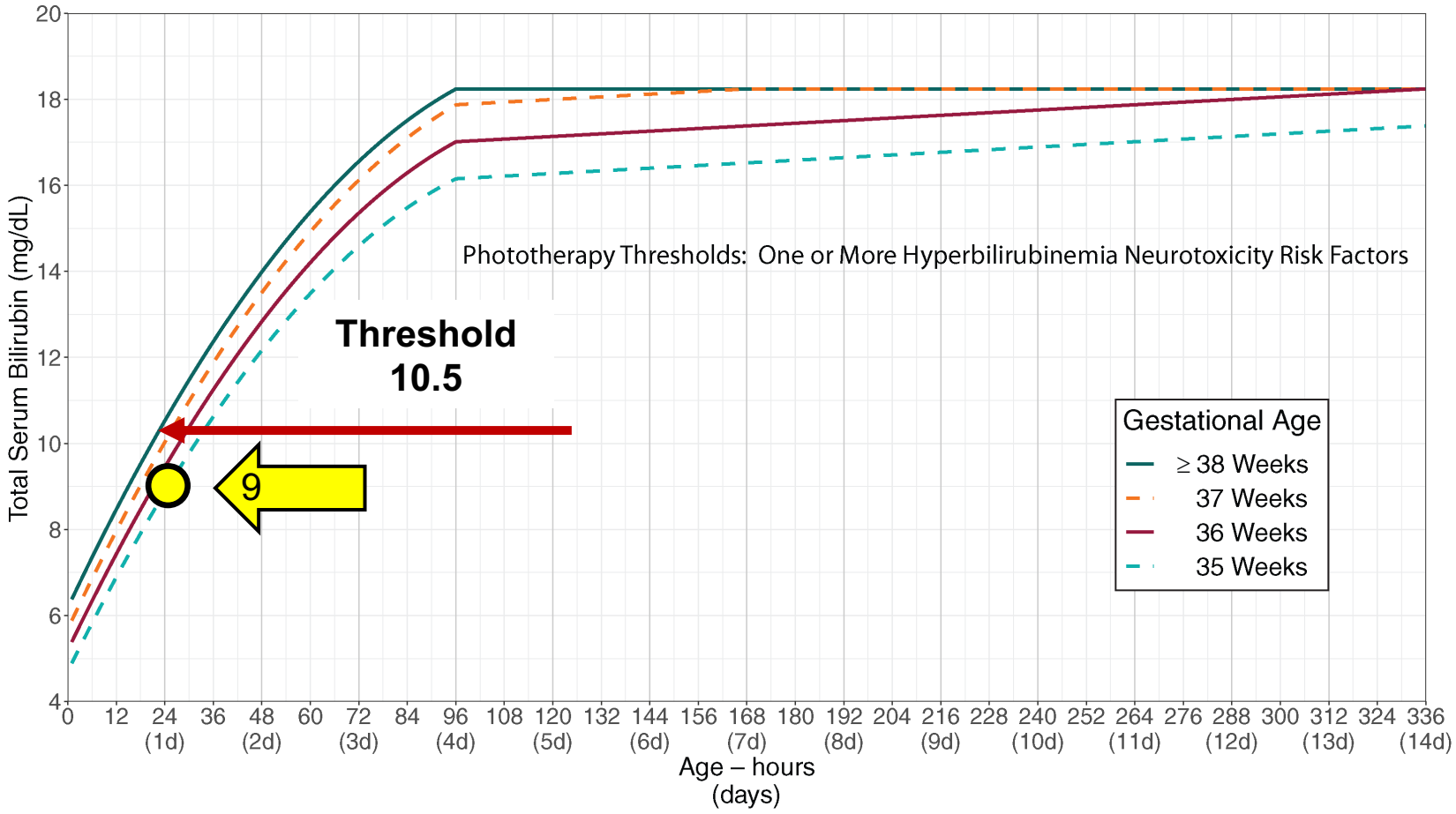
Baby A+, DAT+



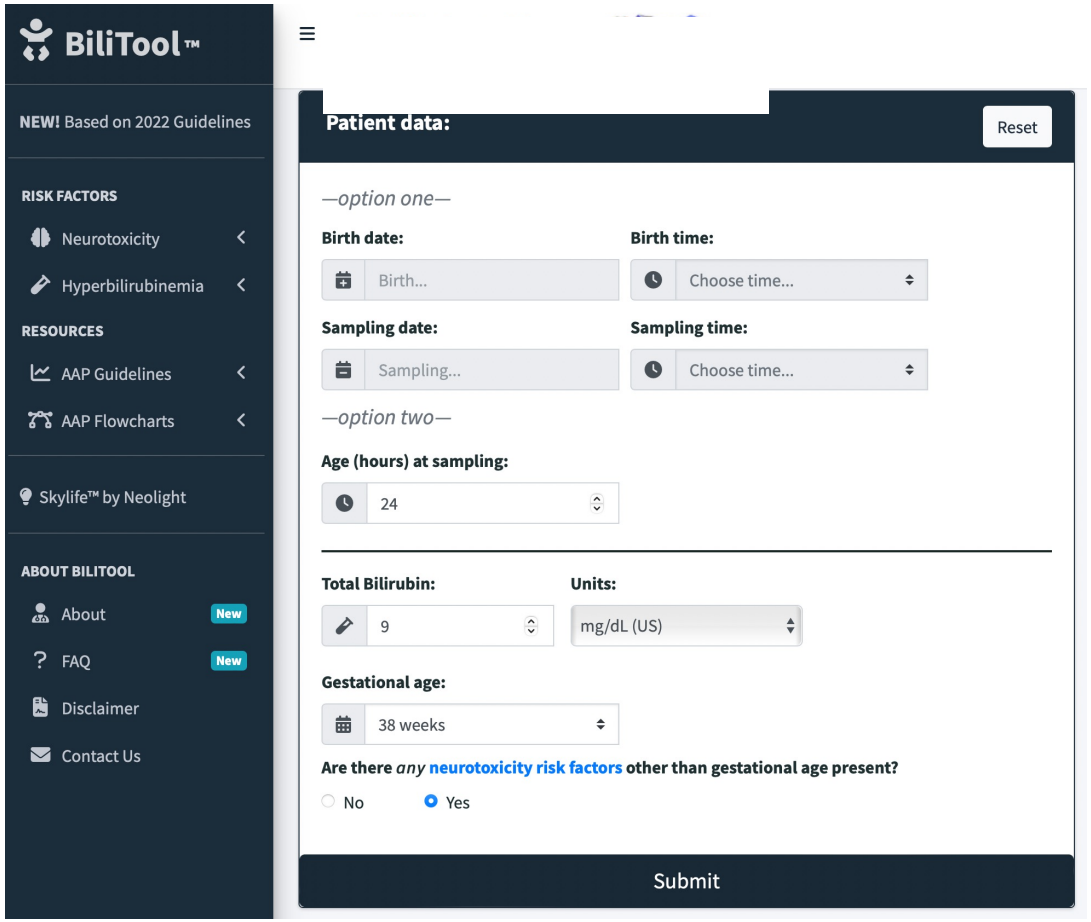
Case Presentation

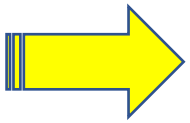
Phototherapy Thresholds:

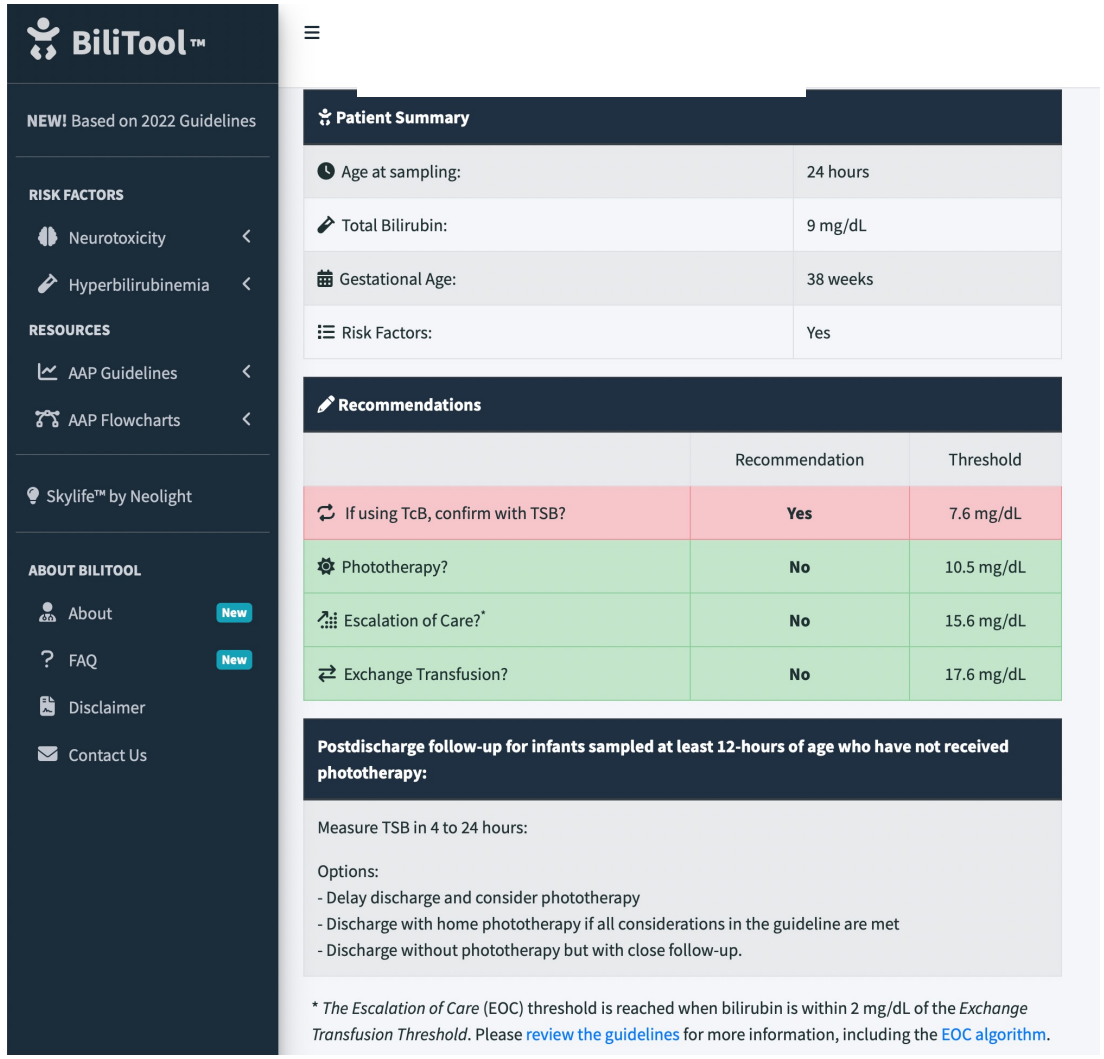
- 10.5 (with Neurotoxicity Risk Factors)
- 12.4 (without Neurotoxicity Risk Factors)



Online Tools



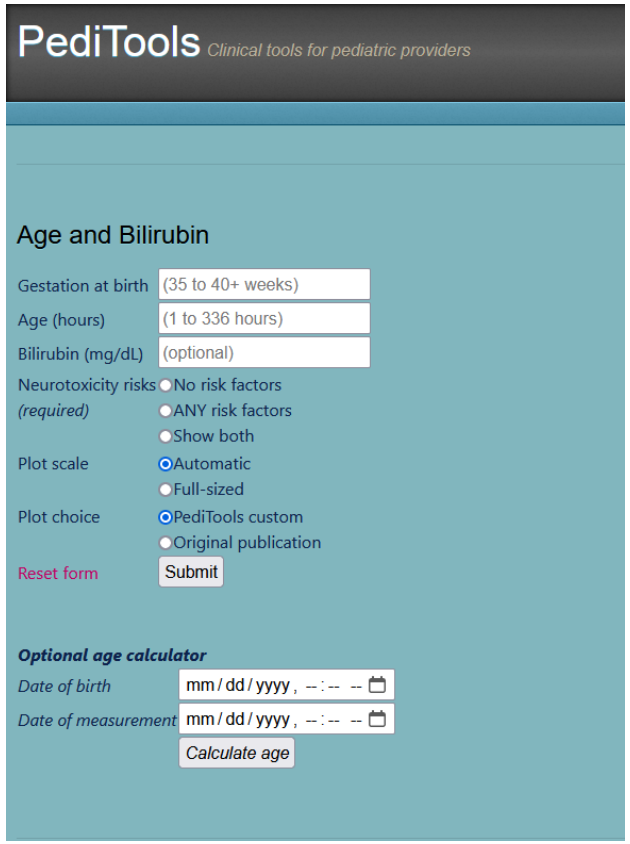


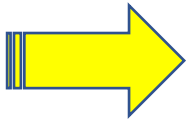


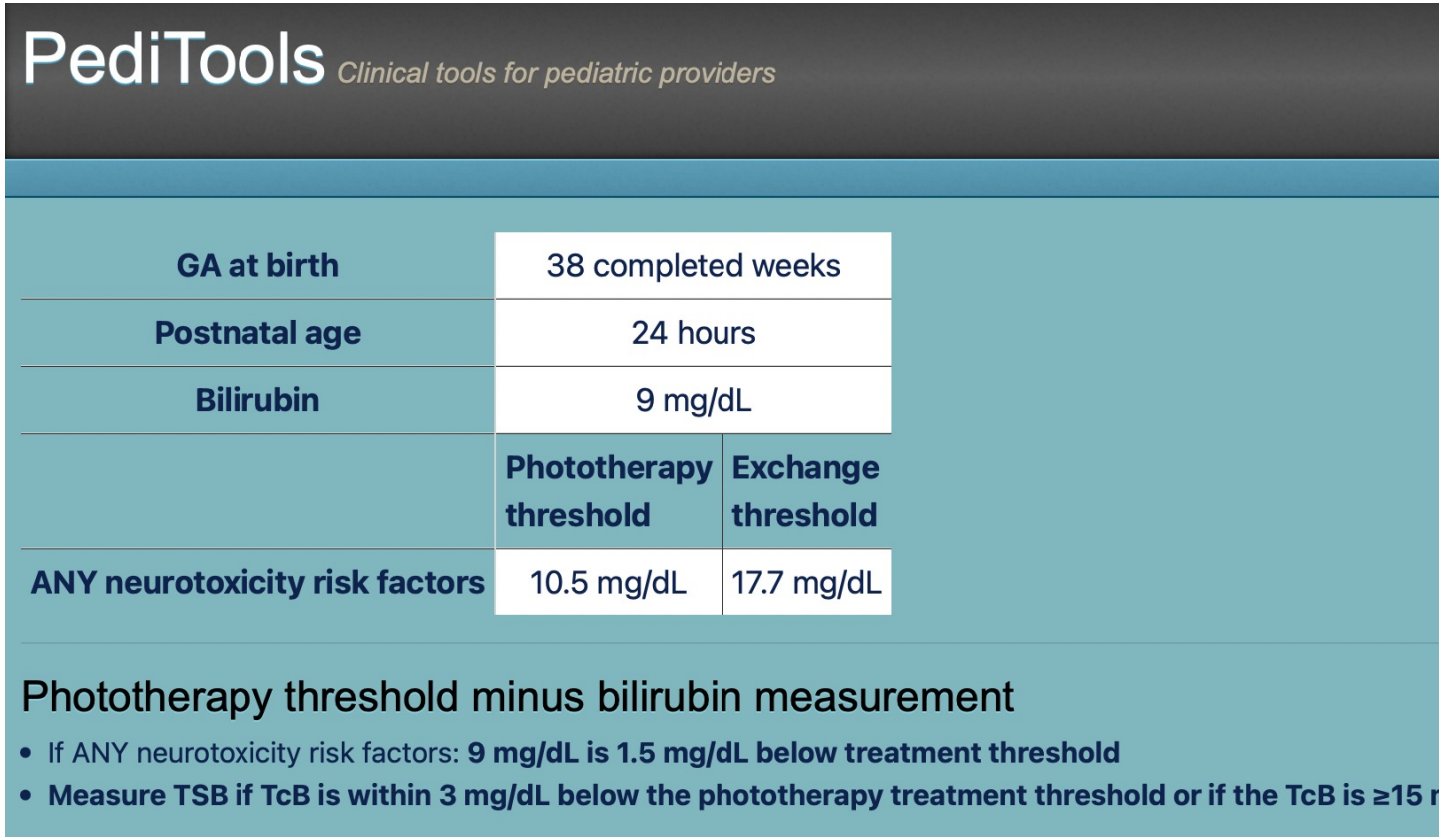
SCAN ME

https://bilitool.org/

Online Tools







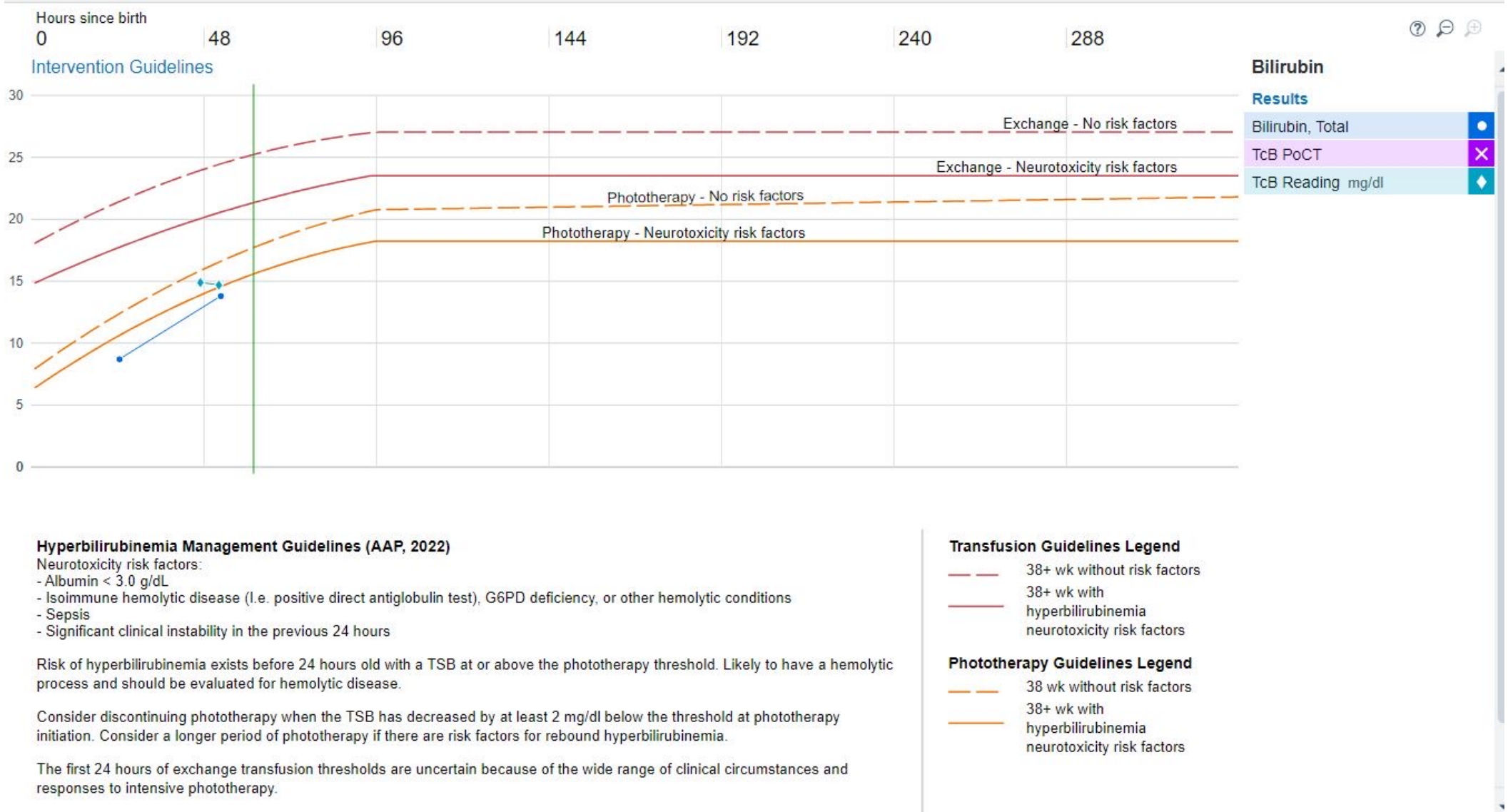
SCAN ME

https://peditools.org/bili2022/

Epic Tools


Overview
IP Summary
Index
Flowsheet
Apnea/Bradycardia
Bilirubin
Glucose
Delivery Summary
Current Meds
Meds Hx
Bilirubin
27-35 wk (Premie BiliRecs)
35 wk (AAP, 2022)
36 wk (AAP, 2022)
37 wk (AAP, 2022)
38 wk (AAP, 2022)
39 wk (AAP, 2022)
40+ wk (AAP, 2022)
Hours since birth
0
48
96
144
192
240
288
Intervention Guidelines
30
25
20
15
10
5
0
Exchange - No risk factors
Exchange - Neurotoxicity risk factors
Phototherapy - No risk factors
Phototherapy - Neurotoxicity risk factors
Bilirubin
Results
Bilirubin, Total
TcB PoCT
TcB Reading mg/dl
Hyperbilirubinemia Management Guidelines (AAP, 2022)
Neurotoxicity risk factors:
- Albumin < 3.0 g/dL
- Isoimmune hemolytic disease (I.e. positive direct antiglobulin test), G6PD deficiency, or other hemolytic conditions
- Sepsis
- Significant clinical instability in the previous 24 hours
Risk of hyperbilirubinemia exists before 24 hours old with a TSB at or above the phototherapy threshold. Likely to have a hemolytic process and should be evaluated for hemolytic disease.
Consider discontinuing phototherapy when the TSB has decreased by at least 2 mg/dl below the threshold at phototherapy initiation. Consider a longer period of phototherapy if there are risk factors for rebound hyperbilirubinemia.
The first 24 hours of exchange transfusion thresholds are uncertain because of the wide range of clinical circumstances and responses to intensive phototherapy.
Reproduced with permission from Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. Pediatrics 2022; e2022058859.10.1542/peds.2022-058859
Transfusion Guidelines Legend
38+ wk without risk factors
38+ wk with hyperbilirubinemia neurotoxicity risk factors
Phototherapy Guidelines Legend
38 wk without risk factors
38+ wk with hyperbilirubinemia neurotoxicity risk factors

Epic Tools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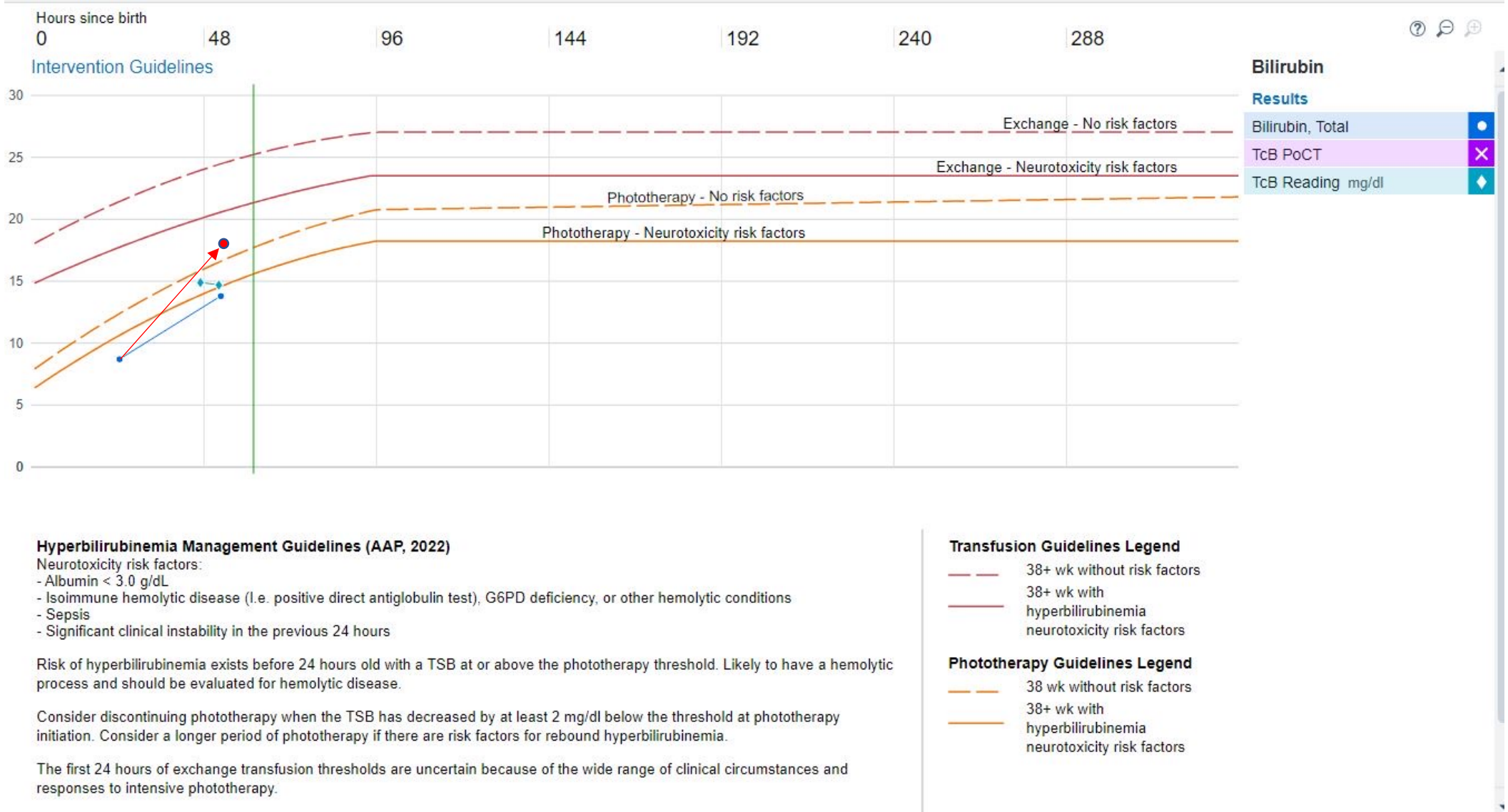
38+ wk without risk factors
38+ wk with hyperbilirubinemia neurotoxicity risk factors
Phototherapy Guidelines Legend
38 wk without risk factors
38+ wk with hyperbilirubinemia neurotoxicity risk factors

Subthreshold Treatment?

- Thresholds based on expert opinion
- Clinicians and families may choose to treat at lower levels based on individual circumstance or preference
  - Risk factors
  - Absolute level
  - Rate of rise
  - Timing of testing and follow-up

- Considerations:
  - Risk of overtreatment on infant and family
  - Higher cost and LOS
  - Insurance denials

Epic Tools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Escalation of Care

- Escalation of Care threshold is 2 mg/dL below the exchange transfusion threshold
- These infants have rapidly increasing levels and may need intensive care to prevent need for exchange transfusion
  - Should optimally be managed in a NICU
  - Consider urgent transfer to NICU if institution lacks facilities for an emergent exchange transfusion
  - Initiate intensive phototherapy and IV hydration while awaiting transfer
  - TsB measured every 2 hours – until lower than “escalation of care” threshold
  - Further recommendations regarding IVIG and considerations for exchange transfusion

Escalation of Care

Patient Summary

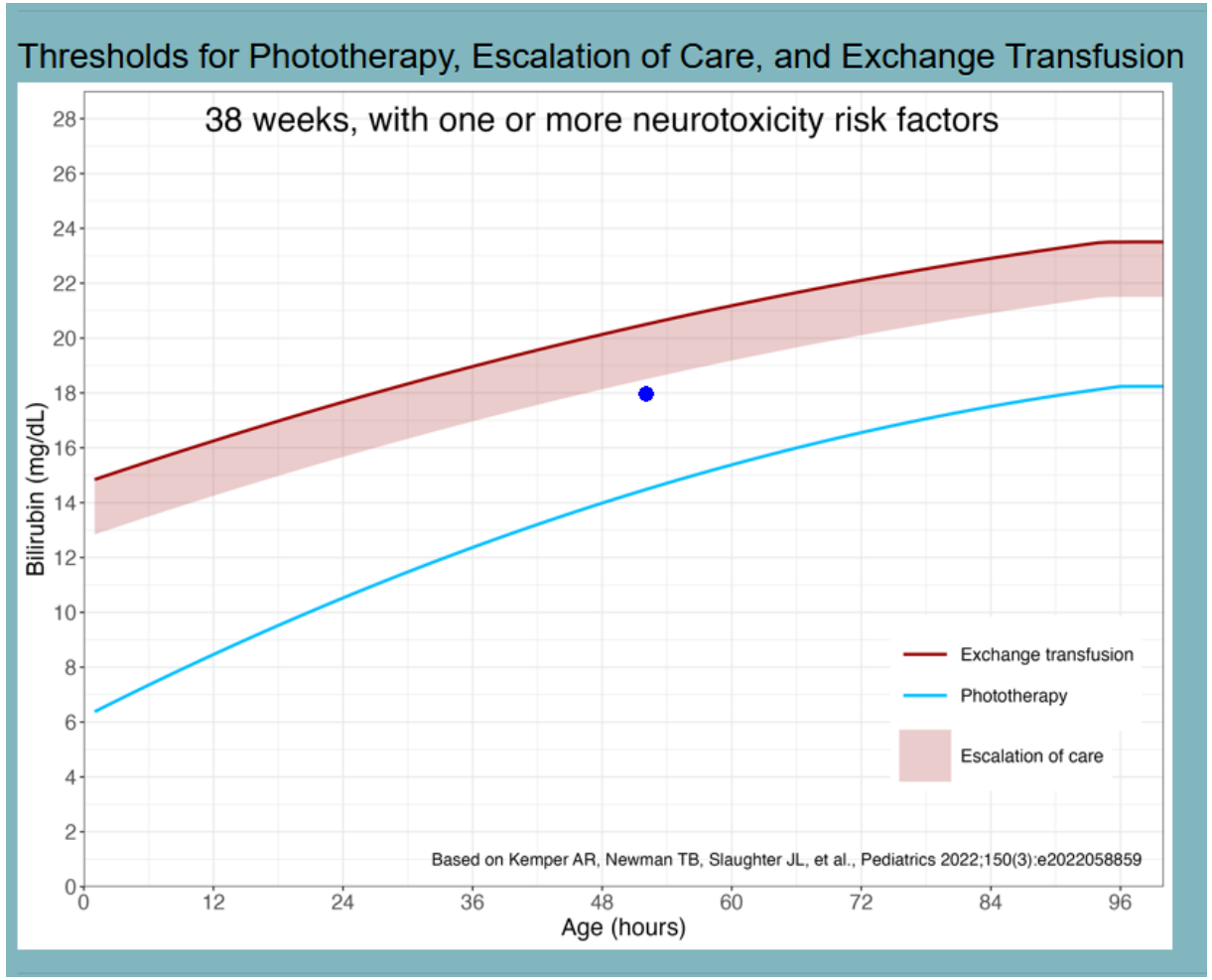
Age at sampling:	52 hours
Total Bilirubin:	18 mg/dL
Bilirubin trend:	Not available (Learn more »)
Gestational Age (GA):	39 weeks
Neurotoxicity Risk Factors:	Yes

Recommendations Copy to Clipboard

	Recommendation	Threshold
If using TcB, confirm with TSB?	**Yes**	11.6 mg/dL
Phototherapy?	**Yes**	14.5 mg/dL
Escalation of Care? (More »)	**No**	18.5 mg/dL
Exchange Transfusion?	**No**	20.5 mg/dL

Postdischarge Follow Up

Because phototherapy is recommended, there are no postdischarge recommendations at this time.



Monitoring Infants on Phototherapy

- For hospitalized infants on phototherapy:
  - Measure TsB within 12 hours
  - Frequency of TsB monitoring should be guided by:
    - TsB level
    - TsB trajectory
    - Presence of neurotoxicity risk factors
    - Age of child
  - Measure H/H (assess for anemia)
  - Obtain DAT if mother Antibody positive, O, or Rh(D) negative (if not already done)

Discontinuing Phototherapy

- Goal to minimize phototherapy exposure and separation from mother yet avoid rebound hyperbilirubinemia following phototherapy.
- Stop phototherapy when 2 mg/dL below the threshold at the initiation of phototherapy

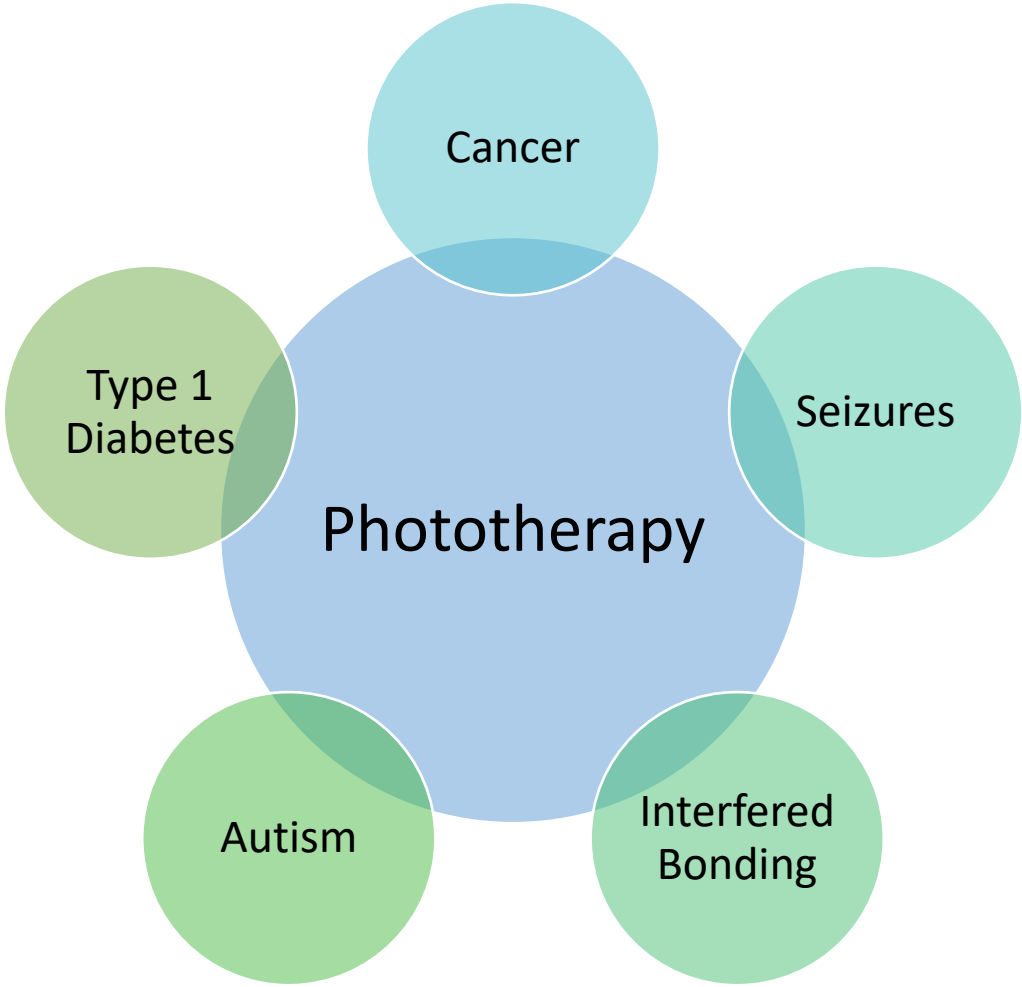
- When to repeat bilirubin level after stopping phototherapy?
  - Based on risk of rebound hyperbilirubinemia:
    - 6-12 hours if: received phototherapy < 48 hrs of life, DAT positive, or suspected hemolytic disease
    - Otherwise, check in 12-24 hrs

Post-Discharge Follow-Up

Post-birth hospitalization discharge follow-up for infants who have NOT received phototherapy

Phototherapy threshold minus bilirubin measurement		Discharge recommendations
0.1 - 1.9 mg/dL	Age <24 hours	Delay discharge, consider phototherapy, measure TSB in 4 to 8 hours
	Age ≥24 hours	Measure TSB in 4 to 24 hours. Options: • Delay discharge and consider phototherapy • Discharge with home phototherapy if all considerations in the guideline are met • Discharge without phototherapy but with close follow-up
2.0 - 3.4 mg/dL	(regardless of age)	TSB or TcB in 4 to 24 hours
3.5 - 5.4 mg/dL	(regardless of age)	TSB or TcB in 1– 2 days
5.5 - 6.9 mg/dL	Discharging <72 hours	Follow-up within 2 days; TcB or TSB according to clinical judgment
	Discharging ≥72 hours	Clinical judgment
≥7.0 mg/dL	Discharging <72 hours	Follow-up within 3 days; TcB or TSB according to clinical judgment
	Discharging ≥72 hours	Clinical judgment

Is Phototherapy Dangerous?



Case Presentation

- Infant born at 38 weeks gestation to a mother who has blood type O+.
- Infant found to be A+, DAT positive after birth
- His bilirubin level is 9.0 at 24 hours of life
- How would you manage this infant?
  - Which bilirubin nomogram would you use?
  - When would you start phototherapy? When would you stop phototherapy?
  - When would you recheck a bilirubin level?

Take Home Points: Hyperbilirubinemia

- Use the new 2022 AAP Hyperbilirubinemia Guidelines in managing infants at risk for hyperbilirubinemia
- Highlights of the new 2022 guidelines include:
  - Higher thresholds, separated by gestational age and neurotoxicity risk factors
  - Escalation of care guidelines
  - Follow-up recommendations based on distance from threshold
- Consider judicious use of phototherapy
  - Avoid subthreshold treatment and balance need for appropriate treatment and follow up with potential risks of overtreatment.

Discussion/Worksheet

- How does your hospital currently provide discharge education and follow up for jaundice/hyperbilirubinemia?
- Any opportunities for improving this care at your hospital? Barriers to making changes? How to overcome?

BREAK

Please return in 10 minutes!

Routine newborn care: criteria for discharge

- AAP Care of the Well Newborn
- **Physiologic Stability** for at least 12 consecutive hours:
    - Axillary temperature of 36.5 to 37.4 degrees C or 97.7-99.3 degrees Fahrenheit in an open crib with appropriate clothing
    - Respiratory rate less than 60 per minute
    - No signs of respiratory distress
    - Awake heart rate 100-190 beats per minute - and no lower than 70 beats per minute while sleeping - without signs of circulatory compromise.
    - Completed at least two successful feedings and have voided and stooled

Routine Screening/Testing

Maternal

- Blood type and antibody screen
- Rubella immunity
- Syphilis
- Hepatitis B surface antigen
- Hepatitis C status
- HIV status
- Gonorrhea and chlamydia
- Glucose testing

Infant

- Blood type and Coombs (if clinically indicated)
- **Glucose (if clinically indicated)**
- Hearing screen
- Congenital heart disease screen
- State screen collection

Assessments completed and documented

- Assessments for **early onset sepsis clinically** and **significant jaundice** should have been completed based on current practice guidelines.
- All maternal and infant laboratory tests should be available and have been reviewed.
- Adequate social support

Routine newborn care: interventions prior to discharge

- Vitamin K
- Erythromycin eye ointment
- Immunizations (HBV; Nirsevimab was new last year) – *Healthy Mom Healthy Baby Tennessee* Podcasts
- Other appropriate primary care interventions

Updating discharge planning/teaching

- Assemble a team to review and compare current discharge checklists and education and update protocols to reflect current guidelines and needs.
- Implement/update a process for providing parent/caregiver education **from admission.**
- Utilize a checklist, rooming in, and a teach-back process for verifying understanding
- Offer education via phone or, preferably, video call when primary caregivers are not present at the hospital.

Updating discharge teaching

- Incorporate checklists and education into EHR.
- Consider the use of community based non-traditional workforce (i.e. doulas, community health workers, patient navigators, etc.)
- Educate all providers, nurses, and staff on updated discharge protocols.
- Facilitate access to community resources, including signing up for Dolly Parton's Imagination Library Programs - Governor's Early Literacy Foundation (governorsfoundation.org)

Discharge education

- Caregivers (preferably two) prepared to care for the infant at home: feeding, wet diapers, stools, jaundice, cord, skin, and circumcision (if applicable) care, temperature assessment, signs of illness, reasons to seek care, safe sleep, child passenger safety, non-accidental trauma, maintaining a smoke-free environment, and ways to prevent infection.

Social risk factors

- Untreated non-prescribed parental substance use/misuse, history of child abuse or neglect any caregiver, household mental illness, lack of social support, history of domestic violence, adolescent mothers, barriers to adequate follow up (lack of transportation, language, or communication barriers).
- Maternal Edinburgh screening
- Discharge may need to be delayed when risk factors are present to prepare a plan to safeguard the infant with social work and/or child protective services.
- Other potential challenges:
  - Low health literacy
  - Language barriers
  - Other sources of misinformation

Drug/opioid-exposed newborns

- Caregivers should be taught how to soothe, feed, and care for an infant with neonatal abstinence syndrome (NAS) / neonatal opioid withdrawal syndrome (NOWS). A plan of safe care should be developed per the Child Abuse Prevention and Treatment Act (CAPTA) and state policy to protect infants and support caregiver recovery.
- AAP guidelines: Neonatal Opioid Withdrawal Syndrome | Pediatrics | American Academy of Pediatrics (aap.org)
- AAP discharge guidance: discharge checklist for opioid-exposed newborns
- ILPQC discharge checklist: discharge checklist for opioid-exposed newborns

- TN outpatient resources: Baby Steps, Firefly, Grow with Me, others

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Case Presentation

- 2 day old, term baby in the nursery
- Baby's mother had been taking opiate pain medications during her pregnancy that were prescribed to her to help with chronic injuries
- Baby is eating well, taking 1 oz per feed. He is sleeping 1-2 hours at a time. However, he is having some mild tremors and seems to be really fussy and crying while awake.
- The healthcare team thinks he is withdrawing and asks about scoring him on the Finnegan Scoring Scale.
- What would you do?
  - Would you score him on the Finnegan scale?
  - Would you use another scoring system?
  - Should this baby be admitted to the NICU to start medications?

NAS (or NOWS) - Background

- NOWS = Neonatal Opioid Withdrawal Syndrome
- Rising number of mothers using opioids in pregnancy
- Rising number of infants with NOWS
  - Increased length of stays
  - Increased hospital costs
  - Increased burden on families and the health care system

Finnegan Scoring

- Most widely used scoring tool in the U.S.
- Based on a study published by Dr. Finnegan in 1975
- Has been modified and even simplified over the years
- While well studied and widely used, no good studies to formally validate this tool to guide infant management

Modified Finnegan Neonatal Abstinence Score Sheet[1]

System	Signs and Symptoms	Score	AM	PM	Comments
Central Nervous System Disturbances	Excessive high-pitched (or other) cry < 5 mins	2			
	Continuous high-pitched (or other) cry > 5 mins	3			
	Sleeps < 1 hour after feeding	3			
	Sleeps < 2 hours after feeding	2			
	Sleeps < 3 hours after feeding	1			
	Hyperactive Moro reflex	2			
	Markedly hyperactive Moro reflex	3			
	Mild tremors when disturbed	1			
	Moderate-severe tremors when disturbed	2			
	Mild tremors when undisturbed	3			
	Moderate-severe tremors when undisturbed	4			
	Increased muscle tone	1			
	Excoriation (chin, knees, elbow, toes, nose)	1			
	Myoclonic jerks (twitching/jerking of limbs)	3			
	Generalised convulsions	5			
Metabolic/ Vasomotor/ Respiratory Disturbances	Sweating	1			
	Hyperthermia 37.2-38.3C	1			
	Hyperthermia > 38.4C	2			
	Frequent yawning (> 3-4 times/ scoring interval)	1			
	Mottling	1			
	Nasal stuffiness	1			
	Sneezing (> 3-4 times/scoring interval)	1			
	Nasal flaring	2			
	Respiratory rate > 60/min	1			
	Respiratory rate > 60/min with retractions	2			
Gastrointestinal Disturbances	Excessive sucking	1			
	Poor feeding (infrequent/uncoordinated suck)	2			
	Regurgitation (≥ 2 times during/post feeding)	2			
	Projectile vomiting	3			
	Loose stools (curds/seedy appearance)	2			
	Watery stools (water ring on nappy around stool)	3			
	Total Score				
	Date/Time				
	Initials of Scorer				

Finnegan Scoring

- Based on 21 signs and symptoms seen in opiate-exposed infants
- Most centers will use a score ≥ 8 to determine if infant is withdrawing and whether to start meds
- Scoring system can be complex and subjective
- Requires frequently disturbing the infant in order to score the infant

Modified Finnegan Neonatal Abstinence Score Sheet[1]

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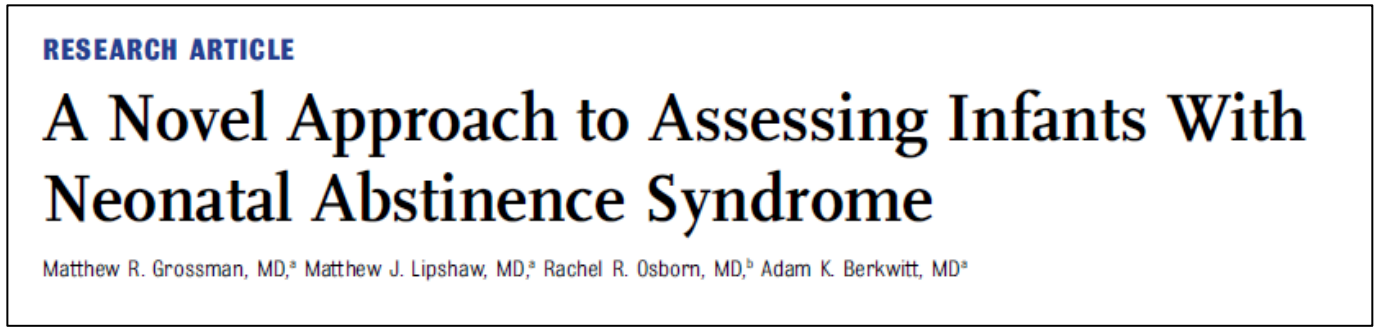
	Watery stools (water ring on nappy around stool)	3			
	Total Score				
	Date/Time				
	Initials of Scorer				

Eat-Sleep-Console



RESEARCH ARTICLE

A Novel Approach to Assessing Infants With Neonatal Abstinence Syndrome

Matthew R. Grossman, MD,[a] Matthew J. Lipshaw, MD,[a] Rachel R. Osborn, MD,[b] Adam K. Berkwitt, MD[a]

An Initiative to Improve the Quality of Care of Infants With Neonatal Abstinence Syndrome

Matthew R. Grossman, MD,[a] Adam K. Berkwitt, MD,[a] Rachel R. Osborn, MD,[a] Yaqing Xu, MS,[b] Denise A. Esserman, PhD,[b] Eugene D. Shapiro, MD,[a,c] Matthew J. Bizzarro, MD[a]

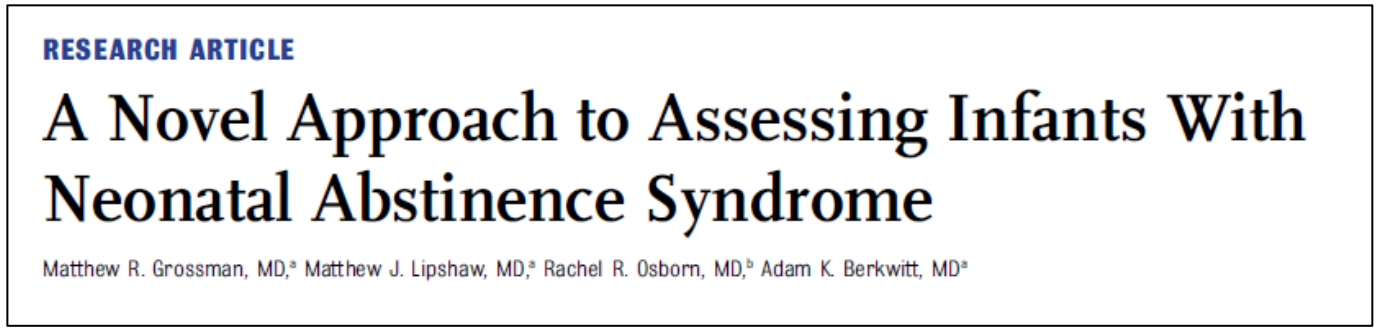
- Based on studies published by Dr. Grossman (2017-2018)
- Focus on non-pharmacological measures and minimizing disruption to infant
- Evaluates infant's ability to eat, sleep, and be consoled

Eat-Sleep-Console

- Eat: eat at least 1 oz/feed or breastfeed well
- Sleep: sleep undisturbed for at least 1 hour
- Console: if crying, be consoled within 10 minutes

- Simple “Yes/No” answers to these criteria
- If not meeting these criteria, non-pharmacologic interventions maximized
- If unsuccessful, can give morphine dosing PRN

Eat-Sleep-Console



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- Decreased their length of stay
- Decreased percentage of infants treated with morphine
- Decreased hospital care costs
- Increase in infants receiving majority breast milk
- Decrease in NICU admissions
- No readmissions or adverse events reported

Adoption of ESC management

RESEARCH ARTICLE

A Quality Improvement Initiative to Improve the Care of Infants Born Exposed to Opioids by Implementing the Eat, Sleep, Console Assessment Tool

Jennifer S. Achilles, MD, Jennifer Castaneda-Lovato, RN

RESEARCH ARTICLE

Improving Care for Infants With Neonatal Abstinence Syndrome: A Multicenter, Community Hospital–Based Study

Joshua Parlaman, MD,[a,b] Parimal Deodhar, MD,[a,b] Virginia Sanders, MD,[a,b] Jennifer Jerome, MD,[a,b] Corrie McDaniel, DO[a,b]

RESEARCH ARTICLE

Successful Implementation of the Eat Sleep Console Model of Care for Infants With NAS in a Community Hospital

Douglas Dodds, MD, Kayla Koch, MD, Talia Buitrago-Mogollon, MHA, CPHQ, Sara Horstmann, MD

Quality improvement initiative to improve inpatient outcomes for Neonatal Abstinence Syndrome

Elisha M. Wachman[1] · Matthew Grossman[2] · Davida M. Schiff[1,3] · Barbara L. Philipp[1] · Susan Minear[1] · Elizabeth Hutton[1] · Kelley Saia[4] · FNU Nikita[5] · Ahmad Khattab[6] · Angela Nolin[6] · Crystal Alvarez[5] · Karan Barry[1] · Ginny Combs[1] · Donna Stickney[1] · Jennifer Driscoll[1] · Robin Humphreys[1] · Judith Burke[1] · Camilla Farrell[7] · Hira Shrestha[1] · Bonny L. Whalen[8]

RESEARCH ARTICLE

The Colorado Hospitals Substance Exposed Newborn Quality Improvement Collaborative: Standardization of Care for Opioid-Exposed Newborns Shortens Length of Stay and Reduces Number of Infants Requiring Opiate Therapy

Sunah S. Hwang, MD, MPH, PhD,[a,b] Blair Weikel, MPH,[a] Jillian Adams, MSW,[d] Stephanie L. Bourque, MD, MSCS,[a,b] Jaime Cabrera, MPH,[c] Nancy Griffith, MSN,[c] Anne M. Hall, MD,[a,b] Jessica Scott,[a,b] Danielle Smith, MD,[a,b] Colleen Wheeler, PA,[a] Jade Woodard, MPA,[d] Erica Wymore, MD, MPH[a,b]

Adoption of ESC management

Eat, Sleep, Console Approach

A Family-Centered Model for the Treatment of Neonatal Abstinence Syndrome

Lisa M. Grisham, NNP-BC; Meryl M. Stephen, CCRN; Mary R. Coykendall, RNC-NIC; Maureen F. Kane, NNP-BC; Jocelyn A. Maurer, RNC-NIC; Mohammed Y. Bader, MD

Eat, sleep, console method and the management of neonatal opioid withdrawal syndrome: A literature review

Sarah C. Rhoads [a, b, *], Aksana Waskosky [b]

[a] *IU Health Riley Hospital for Children, Indianapolis, IN, USA*
[b] *The School of Nursing at the University of Indianapolis, USA*

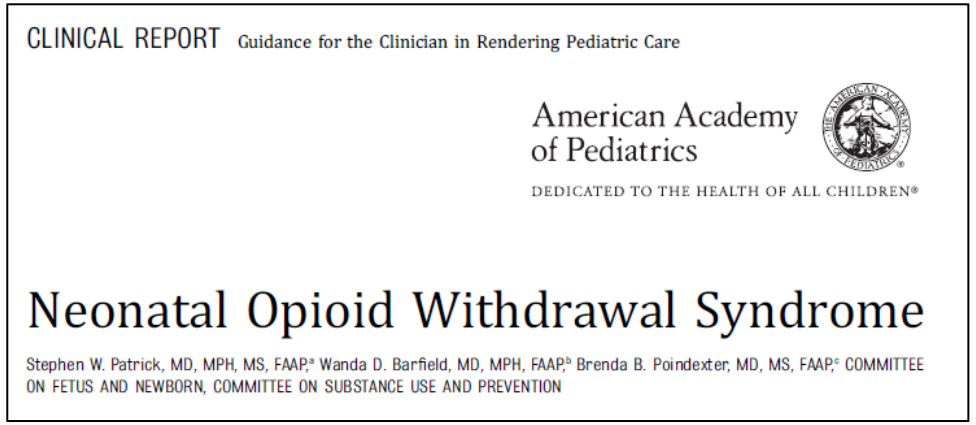
- Similar themes in studies looking at ESC method:
- ↓ in initiation of pharmacological intervention
- ↓ in average length of stay
- ↓ in cost of treatment
- ↑ in parent/caregiver presence and involvement

Challenges/Limitations of ESC

- Mostly studied only in single center QI initiatives
- Concern that the simplified scoring system may under-detect NAS
- Concern that impact is mostly due to emphasis on non-pharmacologic interventions
- No long-term data on behavioral or neurodevelopmental outcomes
- Challenges to implementation
  - Resources vary across institutions; ESC approach may not be feasible in every situation
  - Ability for rooming-in may vary in each hospital
  - Nursing staffing/resources and availability of providers may pose a challenge
  - Requires time investment and education in making a large change in practice

2020 AAP Clinical Report

- Antenatal Counseling and Screening
  - Universal toxicology screening of mothers?
- Periods of Observation/Monitoring of Infant
- Diagnosis
  - Does not recommend one specific approach or scoring system (FNASS, MOTHER, ESC)
  - No evidence to support one tool over another
  - Recognizes potential benefits of ESC – but needs to be more widely studied, and unclear if impact due to more adherence to non-pharmacologic interventions
  - Important to establish consistent standardized approach


CLINICAL REPORT Guidance for the Clinician in Rendering Pediatric Care

American Academy of Pediatrics

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Neonatal Opioid Withdrawal Syndrome

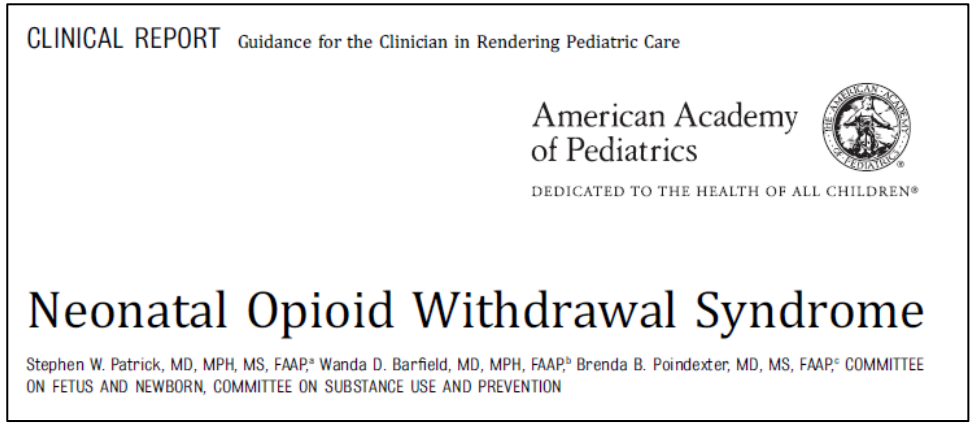
Stephen W. Patrick, MD, MPH, MS, FAAP,[a] Wanda D. Barfield, MD, MPH, FAAP,[b] Brenda B. Poindexter, MD, MS, FAAP,[c] COMMITTEE ON FETUS AND NEWBORN, COMMITTEE ON SUBSTANCE USE AND PREVENTION

SCAN ME

2020 AAP Clinical Report

- Treatment
  - Prioritizing keeping mother-infant dyad together
  - Rooming-In preferred
  - Emphasis on non-pharmacological measures
    - Low stimulation environment
    - Skin-to-Skin care
    - Encourage Lactation Support and Breastfeeding (if not contraindicated)
  - If pharmacologic treatment needed, infant should be monitored closely

- Discharge Preparation and Education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SCAN ME

Finnegan vs ESC

RESEARCH ARTICLE

Correlating Scores but Contrasting Outcomes for Eat Sleep Console Versus Modified Finnegan

Kelsey Ryan, MD, Andrea Moyer, BS, Megan Glait, BS, Ke Yan, PhD, Mahua Dasgupta, MS, Kristine Saudek, MD, Erwin Cabacungan, MD

Hospital Pediatrics, April 2021

- Retrospective cohort study (published April 2021)
- Scored simultaneously with M-FNASS and ESC scoring
  - Compared management using FNASS (Epoch 1) vs ESC (Epoch 2)
- ESC scores correlated with FNASS scores
  - No inherent difference in detection of clinical disease
- ESC based management led to:
  - Reduced Length of Stay
  - Reduced Initiation & Duration of Pharmacologic Treatment

Finnegan vs ESC

NEJM, June 2023

- Multi-Center cluster randomized controlled trial at 26 US Hospitals
- Hospitals transitioned from usual care using Finnegan tool to Eat, Sleep, Console approach
- 1305 infants enrolled
  - Incidence of adverse outcomes similar across both groups
  - Primary Outcome: Time from birth to medical readiness for discharge
    - 14.9 days in usual care group vs 8.2 days in ESC group
  - Secondary Outcomes:
    - Mean Length of Hospital Stay: 14.0 days for usual care vs 7.8 days for ESC
    - Proportion receiving pharmacologic treatment: 52% for usual care vs 19.5% for ESC

Case Presentation

- 2 day old, term baby in the nursery
- Baby's mother had been taking opiate pain medications during her pregnancy that were prescribed to her to help with chronic injuries
- Baby is eating well, taking 1 oz per feed. He is sleeping 1-2 hours at a time. However, he is having some mild tremors and seems to be really fussy and crying while awake.
- The healthcare team thinks he is withdrawing and asks about scoring him on the Finnegan Scoring Scale.
- What would you do?
  - Would you score him on the Finnegan scale?
  - Would you use another scoring system?
  - Should this baby be admitted to the NICU to start medications?

Take Home Points: NAS/NOWS management

- Alternative approaches for evaluation and management of NAS/NOWS – such as the Eat-Sleep-Console (ESC) method – are increasingly being adopted at many centers
- Studies using ESC often show improved length of stays, decreases in medication use, decreases in health care costs, and improvement in caregiver presence and involvement
- Regardless of which scoring system you use, there should be a consistent, standardized approach; as well as an emphasis on non-pharmacologic measures and improving parent/caregiver involvement
- More studies are needed in this area evaluating the various approaches and scoring tools; future studies should also evaluate long term outcomes

Discussion/Worksheet

- How does your hospital coordinate discharge and discharge education for families with prenatally drug-exposed infants/social risk factors?
- Any opportunities for improving this care at your hospital? Barriers to making changes? How overcome?

Routine newborn care: newborn screening

- Newborn screening started in 1963 when Dr. Robert Guthrie pioneered the first screening for phenylketonuria
- TN program started in 1968 and now includes:
  - Testing for more than 60 conditions (amino acid, endocrine, fatty acid, hemoglobin, lysosomal storage, organic acid, and other disorders) through collection of drops of blood from heelstick on filter paper
  - Hearing screening using otoacoustic emissions test (OAE) or auditory brainstem response test (ABR)- Claire's law, 2008: 1-3-6 Plan
  - Critical congenital heart disease screening (2013)
    - 97% in one foot passes
    - Or 95% in right hand and <=3% difference between right hand and foot
    - Rescreen in one hour unless <90%=>immediate assessment

Newborn discharge follow-up

- Newborn visit within 24-48 hours of discharge for infants discharged prior to 48 hours of life.
- For longer hospital stays (i.e., 5 days), the first outpatient visit may be scheduled further out from discharge, depending on risk factors.
- Document newborn visit (date, time provider) and other appointments at the time of discharge

Car seat safety checks before discharge

- An **infant car safety seat** that meets Federal Motor Vehicle Safety Standard 213 should be available at hospital discharge with demonstration of appropriate infant positioning and use. **Car seat testing for high risk infants.**

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Case Presentation

- You are in the Newborn Nursery and are taking care of a 3 day old, ex-36+2 wk GA infant (BW 2350 grams) born via c-section who is ready to go home

- You check the discharge checklist – and see that everything has been completed…

…. except for the car seat test!

Car Seat Screening – Background

Committee on Injury and Poison Prevention and Committee on Fetus and Newborn

Safe Transportation of Premature Infants

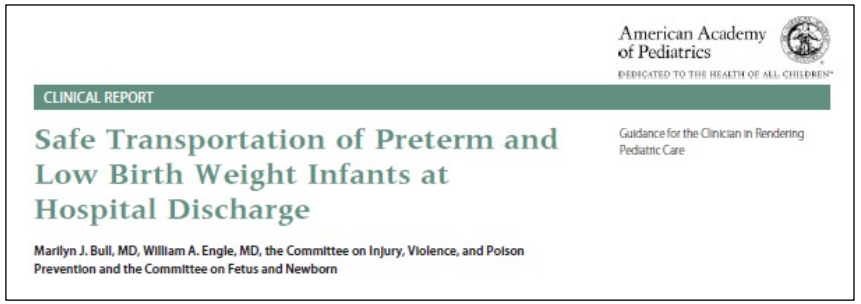
Pediatrics 1991

- First recommended by the AAP in 1991
- Joint recommendation of Committee on Injury and Poison Prevention and COFN

"Current information suggests that all preterm infants of less than 37 weeks gestation should have a period of observation in a car seat before discharge to monitor for possible apnea, bradycardia, or oxygen desaturation"

Car Seat Screening – AAP Guidelines

- Clinical Report issued in 2009
- Authored by COFN and Committee on
  Injury, Violence, and Poison Prevention


American Academy of Pediatrics
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CLINICAL REPORT

Safe Transportation of Preterm and Low Birth Weight Infants at Hospital Discharge

Guidance for the Clinician in Rendering Pediatric Care

Marilyn J. Bull, MD, William A. Engle, MD, the Committee on Injury, Violence, and Poison Prevention and the Committee on Fetus and Newborn

Pediatrics 2009

- Preterm infants have an increased risk of apnea, bradycardia, desaturations (especially if in semi-reclined position)
- These frequent events may lead to risk of adverse neurodevelopmental outcomes

"It is suggested that preterm infants should have a period of 90 to 120 minutes (or longer) in a car safety seat before hospital discharge"

"Information is limited"… "more research is needed"

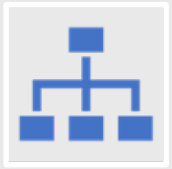
Car Seat Screening

- Preterm births account for 10-12% of births in the US each year
  - Many of these are late preterm infants (LPIs); some of which are in the Well Newborn Nursery or Mother Baby Unit (without continuous monitoring)

- Car seat testing done in ~400,000 to 500,000 infants per year
  - Potential burdens and costs of nursing hours/time; prolonged hospital stays

Variability, Questions, and Controversies

Variation in Protocols and Criteria



Does the test pick up clinically significant events?

Does it change long term outcomes?

Should we continue to routinely perform this test for all preterm infants?

Car Seat Screening – Variation in Care

Car Seat Safety for Preterm Neonates: Implementation and Testing Parameters of the Infant Car Seat Challenge

Natalie Louise Davis, MD, **Yevgeniy Zenchenko, BS**, **Anthony Lever, MS**, and **Lawrence Rhein, MD**
Boston Children's Hospital Division of Newborn Medicine, Boston, Mass (Drs Davis and Rhein); and Boston Children's Hospital Division of Respiratory Diseases, Boston, Mass (Mr Zenchenko, Mr Lever, and Dr Rhein)

Acad Pediatr 2013

- Surveyed 103 Level II and III NICUs in NY/New England
- 89% performed car seat challenge
  - 17% did not test all babies <37 wks GA
  - 45% did not follow guidelines for test duration
  - Thresholds for failure criteria varied

Is it time to study routine car seat tolerance screening in a randomized controlled trial? An international survey of current practice and clinician equipoise

Erik A. Jensen[1], Jay S. Greenspan[2], Zubair H. Aghai[2], David L. Carola[2], Eric C. Eichenwald[1], Sara B. DeMauro[1] and Kevin Dysart[1]

J Perinatology 2022

- Surveyed 488 attendees at 2018 Hot Topics in Neonatology conference
- 75% performed car seat screening at their institution
  - US based: 96%
  - Non-US based: 23%
- Variation in proposed management after failure
- Variation in how soon test should be repeated
- **66% believed it was medically necessary**

Car Seat Screening – Variation in Care

- BORN Network study
- Surveyed 84 Newborn Nurseries across 35 states

Variation in Car Seat Tolerance Screen Performance in Newborn Nurseries

Natalie L. Davis, MD, MMSc,[a] Benjamin D. Hoffman, MD,[b] Eric C. Eichenwald, MD[c]

Pediatrics August 2020

- 90% performed car seat tolerance tests
  - Most that didn't noted poor data on utility and outcomes
- Variability in:
  - Timing of testing
  - Failure criteria cutoff
    - O2 sat failure criteria: ranged from <85% to <93%
    - Bradycardia failure criteria: ranged from <60 to <100
    - Duration of episode: ranged from any duration to >60 seconds
  - Follow up of failed test
    - 93% repeat at future point (with variability noted in timing of repeat test)
    - 5% admitted to higher level of care
    - 1% discharged in car bed

Car Seat Screening – Variation in Care


Variation in Car Seat Tolerance Screen Performance in Newborn Nurseries

Natalie L. Davis, MD, MMSc,[a] Benjamin D. Hoffman, MD,[b] Eric C. Eichenwald, MD[c]

Pediatrics August 2020

- Clinicians were asked:

"Is Car Seat Tolerance Testing (CSTS) a good way to assess cardiorespiratory readiness for discharge in at risk infants"

  - 39% Yes
  - 26% No
  - 35% Unsure

Infants Who Fail the Car Seat Challenge


ORIGINAL ARTICLES

www.jpeds.com • THE JOURNAL OF PEDIATRICS

Clinical Outcomes Associated with a Failed Infant Car Seat Challenge

Malika D. Shah, MD[1], Keith A. Dookeran, MD, PhD[2], and Janine Y. Khan, MD, MRCP[1]

J Peds 2017

- Single center retrospective study (2009-2015) of infants on the Mother Baby Unit who failed the ICSC and were subsequently admitted to the NICU for a period of observation/monitoring
- ICSC done for infants <37 wks GA or BW <2.5 kg
- 148 infants failed the ICSC and were admitted to the NICU
  - Of these ->
    - 39% had further apnea episodes
      - (48% of preterm; 17% of term infants)
    - 19% needed phototherapy
    - 2% needed NG feeding support
    - 7% needed thermoregulatory support
  - Only 25% had NO co-morbid conditions during observation period and were discharged home after repeat testing

Car Seat Screening – Late Preterm Infants

Epidemiology and Predictors of Failure of the Infant Car Seat Challenge

Davis et al, Pediatrics, 2013

- Retrospective review (2009-2010) of 1173 infants tested
- Higher failure rate in late preterm infants
- 4.3% overall failure rate
  - 2.4% in infants <34 wks GA;
  - 5.6% in late preterm infants

Car Seat Tolerance Screening for Late-Preterm Infants

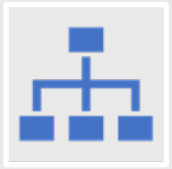
Aimee Magnarelli, DO,[a] Nina Shah Solanki, MD,[b] Natalie L. Davis, MD, MMSc[b]

Pediatrics Jan 2020

- Single center retrospective study (2013-2017) focusing on late preterm infants
- 918 infants underwent CSTS -> 4.6% (42) failed
- Of those 42 -> 24% (10) failed a repeat CSTS
- Of those 10 -> 40% (4) required supplemental O2

Variability, Questions, and Controversies

Variation in Protocols and Criteria



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Does it change long term outcomes?

Should we continue to routinely perform this test for all preterm infants?

Cochrane Review


Cochrane Library
Trusted evidence.
Informed decisions.
Better health.
Cochrane Database of Systematic Reviews
[Intervention Review]
Pre-discharge "car seat challenge" for preventing morbidity and mortality in preterm infants
Elizabeth Pilley[1], William McGuire[2]

Cochrane Review, 2006

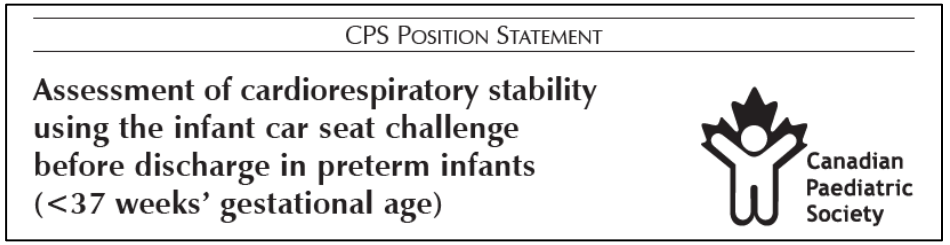
“There is no evidence that undertaking a pre-discharge "car seat challenge" benefits preterm infants.”

“It is not clear whether the level of oxygen desaturation, apnea, or bradycardia detected in the car seat challenge is actually harmful for preterm infants. “

“We have not identified any randomized controlled trials that assessed whether undertaking a car seat challenge is beneficial or harmful to preterm infants.”

“Further studies are needed to determine whether the car seat challenge accurately predicts the risk of clinically significant adverse events in preterm infants travelling in car seats. “

Canadian Paediatric Society

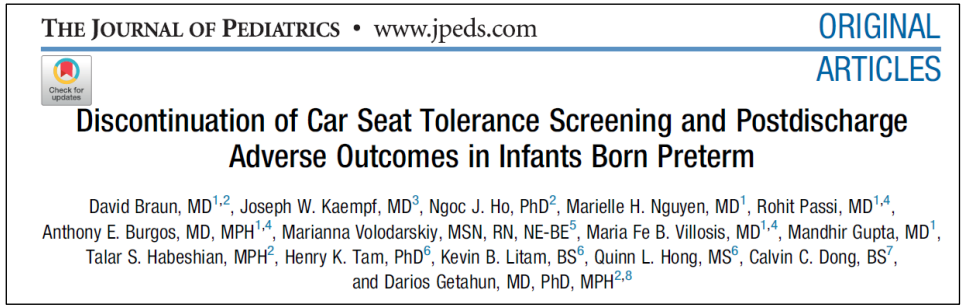


Canadian Paediatric Society, Fetus and Newborn Committee, 2016.

"While it is clear that infants placed in a car seat are more likely to experience oxygen desaturation and/or bradycardia than when they are supine, neither positioning predicts an adverse neurodevelopmental outcome or mortality post-discharge."

"Due to inconsistency among ICSC test results and the lack of evidence that failing an ICSC is associated with either mortality risk or an adverse neurodevelopmental outcome, the CPS cannot recommend administering this test routinely as part of the discharge protocol for preterm infants"

Car Seat Screening – Recent Literature



THE JOURNAL OF PEDIATRICS • www.jpeds.com ORIGINAL ARTICLES

Discontinuation of Car Seat Tolerance Screening and Postdischarge Adverse Outcomes in Infants Born Preterm

David Braun, MD[1,2], Joseph W. Kaempf, MD[3], Ngoc J. Ho, PhD[2], Marielle H. Nguyen, MD[1], Rohit Passi, MD[1,4], Anthony E. Burgos, MD, MPH[1,4], Marianna Volodarskiy, MSN, RN, NE-BE[5], Maria Fe B. Villosis, MD[1,4], Mandhir Gupta, MD[1], Talar S. Habeshian, MPH[2], Henry K. Tam, PhD[6], Kevin B. Litam, BS[6], Quinn L. Hong, MS[6], Calvin C. Dong, BS[7], and Darios Getahun, MD, PhD, MPH[2,8]

Journal of Pediatrics 2023

- Retrospective cohort study (2010-2021)
- Kaiser Southern California 14 hospital health care system
- Compared before/after discontinuation of CSTS for preterm infants in Dec 2016
- Total cohort of 41,264 infants
  - Failure rate of 3.4% (in those that received CSTS)

- Primary outcome: composite rate of death, 911 call-triggered transports, readmissions associated with respiratory disorders, apnea, ALTE/BRUEs within 30 days of discharge

- Findings: Discontinuation of CSTS not associated with a change in 30 day post-discharge adverse outcomes

Take Home Points: Car Seat Challenges

- Car Seat Tolerance Screening (CSTS) currently still recommended for all preterm infants <37 weeks gestation
- Wide variation seen in screening protocols, criteria for screening, “failure” criteria, and proposed management after a “failure”
- CSTS may pick up previously unidentified apnea, bradycardia, or desaturation events. However, there is limited data and evidence on the reliability and reproducibility of the CSTS.
- More research is needed to see if performing the CSTS prevents morbidity and mortality and/or if it changes long term outcomes.
- Some institutions no longer routinely perform CSTS on all preterm infants prior to discharge.

Discussion/Worksheet

- Does your hospital do car seat testing on infants?
- How does your hospital provide discharge teaching on car seat safety?
- Any opportunities for improving this care at your hospital? Barriers to making changes? How to overcome?
- Share any additional ideas for improvements, barriers, and approaches to overcoming them with the group!

Newborn Topics

Early Onset Sepsis

Neonatal Hypoglycemia

Hyperbilirubinemia

NAS/NOWS

Car Seat Challenges

Overall Take Home Points for today:

1. Use an approach centered around the clinical exam of the infant when assessing an infant at risk for Early Onset Sepsis
2. Consider incorporating non-invasive options such as dextrose gel into your approach for managing neonatal hypoglycemia
3. Consider judicious use of phototherapy for hyperbilirubinemia
4. Use a standardized system (such as ESC) in evaluating babies for NOWS – making sure to emphasize non-pharmacologic measures and improving parent/caregiver involvement
5. Use standardized screening protocols and failure criteria when performing car seat challenges. Consider the utility of routinely performing car seat challenges.

Nursery/Infant Workshop:

Common Problems
and
Best Practices in the Newborn Nursery

TIPQC
Tennessee Initiative for Perinatal Quality Care