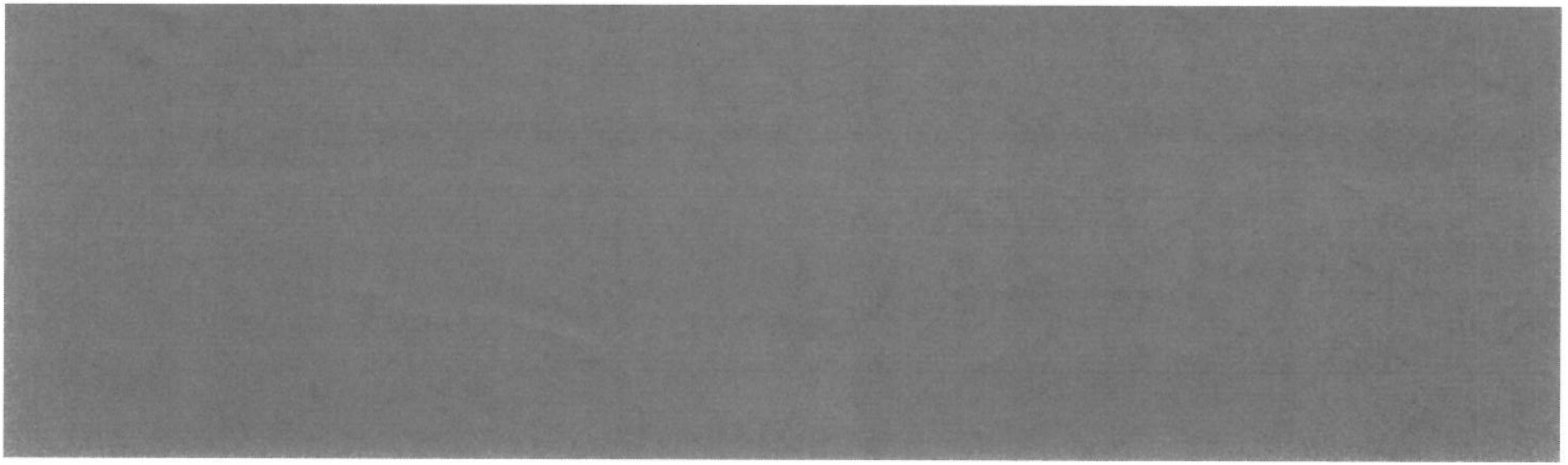
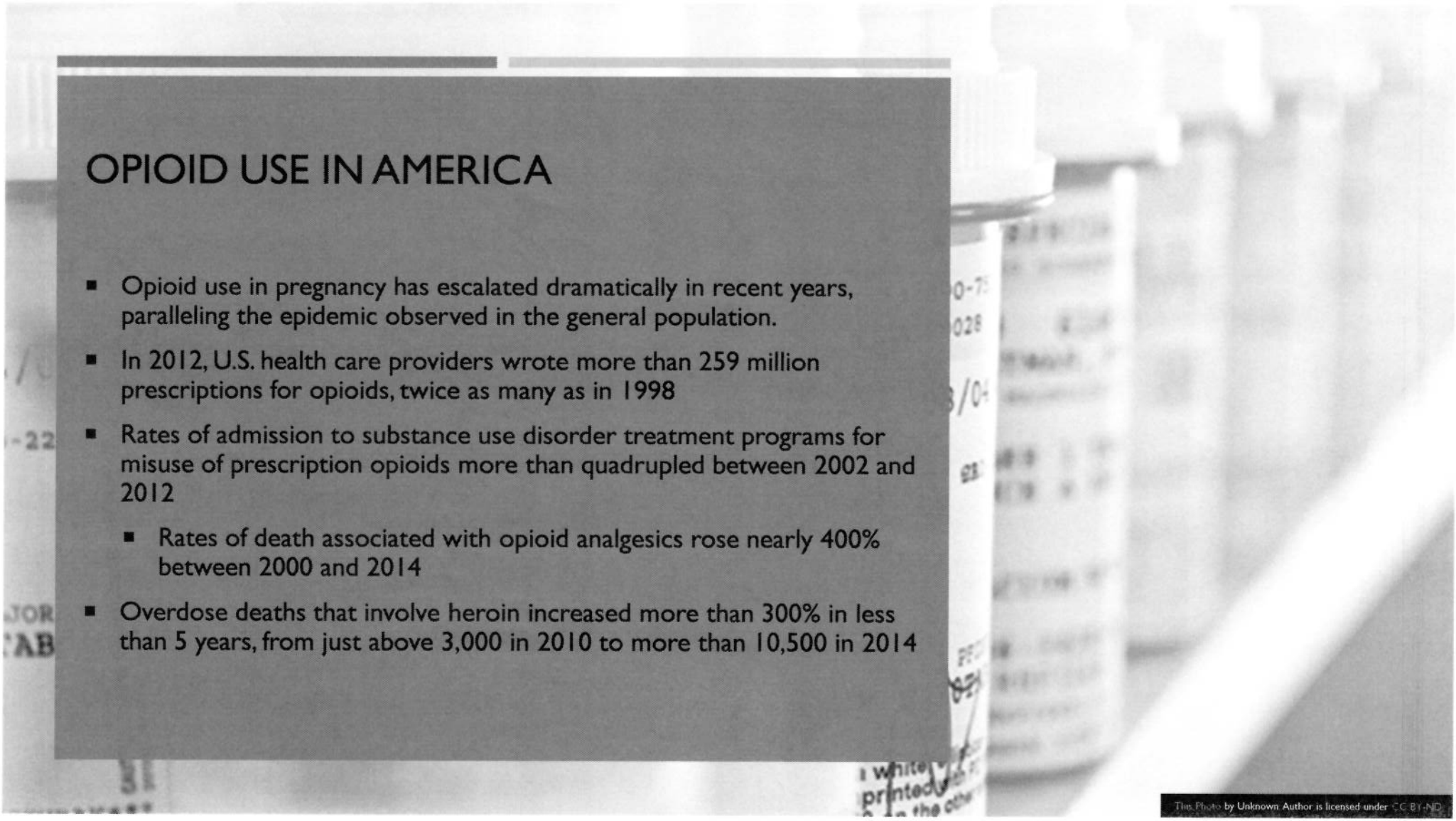
PERINATAL SUBSTANCE USE DISORDER

CHANGING CLINICAL APPROACHES IN NEONATAL SCREENING AND TREATMENT



OPIOID USE IN AMERICA

- Opioid use in pregnancy has escalated dramatically in recent years, paralleling the epidemic observed in the general population.
- In 2012, U.S. health care providers wrote more than 259 million prescriptions for opioids, twice as many as in 1998
- Rates of admission to substance use disorder treatment programs for misuse of prescription opioids more than quadrupled between 2002 and 2012
  - Rates of death associated with opioid analgesics rose nearly 400% between 2000 and 2014
- Overdose deaths that involve heroin increased more than 300% in less than 5 years, from just above 3,000 in 2010 to more than 10,500 in 2014

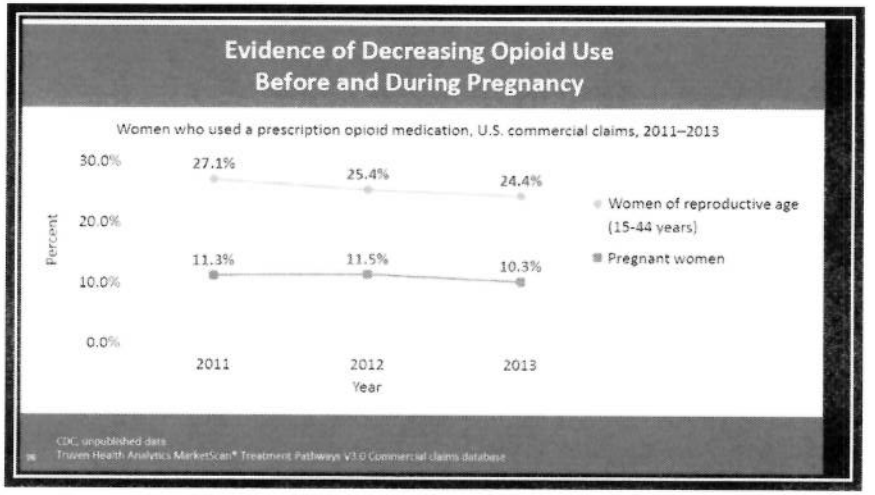


OPIOID USE IN PREGNANCY

- In 2007, 22.8% of women who were enrolled in Medicaid programs in 46 states filled an opioid prescription during pregnancy
- Antepartum maternal opioid use increased nearly fivefold from 2000 to 2009, based on diagnostic codes
- The rising prevalence of opioid use in pregnancy has led to a QUADRUPLED increase in neonatal abstinence syndrome
  - 1.5 cases per 1,000 hospital births in 1999 to 6.0 per 1,000 hospital births in 2013
- Associated with $1.5 billion in related annual hospital charges.
- States with the highest rates of opioid prescribing also have the highest rates of neonatal abstinence syndrome.

OPIOID PRESCRIBING DURING PREGNANCY

- According to US estimates:
  - One third of reproductive-age women filled a prescription for an opioid medication
  - 14-22% of pregnant women filled an opioid medication prescription during pregnancy



COMPLICATIONS ASSOCIATED WITH OPIOID USE IN PREGNANCY

- Women who use drugs during their pregnancy have higher rates of complications:
  - Premature rupture of the membranes
  - Placental abruption
  - Fetal growth restriction
  - Stillbirth
- National incidence of Neonatal Abstinence Syndrome increases now contributing to 3% of all NICU admissions
  - Some hospitals, up to 50% of all NICU days are related to NAS
  - Newborns exposed to drugs in utero have a higher incidence of NICU admission when compared with nonexposed infants, even when corrected for gestational age
- Common newborn complications include the following:
  - Lower birth weights
  - Prematurity
  - Seizures
  - Respiratory complications

NEONATAL ABSTINENCE SYNDROME

- The signs of neonatal abstinence syndrome are many and varied
- Mimic other metabolic disorders in the newborn, as well as infection.
- Dysfunction in autonomic regulation, state control, and sensory and motor functioning.
- Signs can be broadly classified by system

Feeding and Gastrointestinal	Autonomic and Metabolic	Respiratory and Vasomotor	State, Tone, and CNS	Other
Uncoordinated suck	Fever	Tachypnea	Lethargy	Skin excoriation
Weak/poor suck	Temperature Instability	Retractions	Hypotonia	Poor weight gain
Excessive sucking	Mottling	Nasal stuffiness	Hypertonia	Excessive weight gain
Watery/loose stools	Piloerection	Sneezing	Tone regulation difficulty	High pain scores
Vomiting/reflux	Diaphoresis	Yawning	Hyperreflexia	
Projectile vomiting	Hypoglycemia	Nasal flaring	Seizure	
Hyperphagia		Bradycardia	Tremor Jitteriness	
Abdominal tenderness		Tachycardia	Hyperactivity	
			High pitched cry	

REGIONAL DIFFERENCES IN OPIOID PRESCRIBING AND NAS

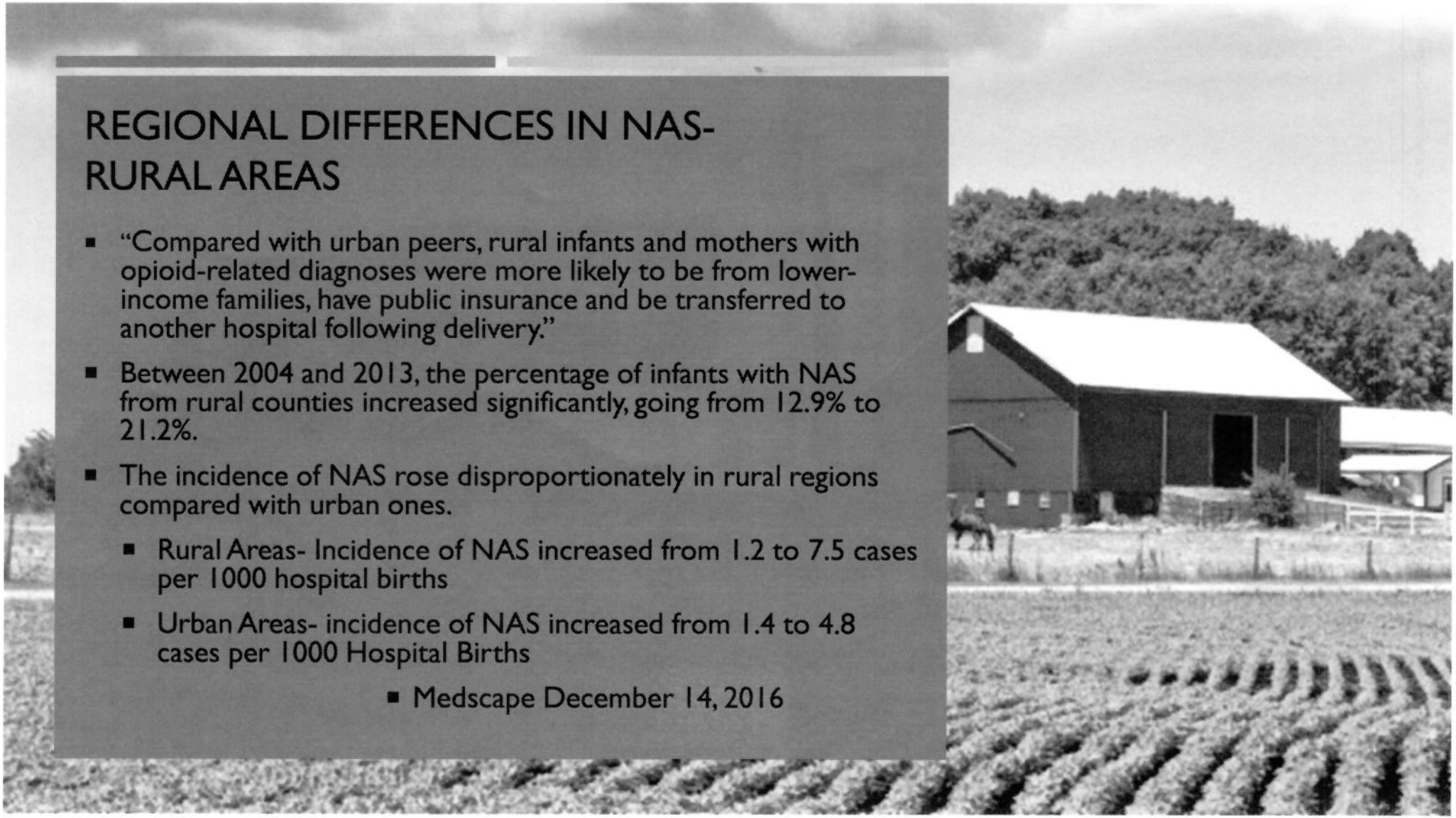
Some States Have Higher Opioid Prescribing Rates, 2012

cdc.gov/vitalsigns/opioid-prescribing/infographic.html
cdc.gov/drugoverdose

24

NAS Incidence by Geographic Region, 2012

Patrick SW, Davis MM, Lehmann CU, et al. *J Perinatol*. 2015 Aug;35(8):650-5.



REGIONAL DIFFERENCES IN NAS- RURAL AREAS

- "Compared with urban peers, rural infants and mothers with opioid-related diagnoses were more likely to be from lower-income families, have public insurance and be transferred to another hospital following delivery."
- Between 2004 and 2013, the percentage of infants with NAS from rural counties increased significantly, going from 12.9% to 21.2%.
- The incidence of NAS rose disproportionately in rural regions compared with urban ones.
  - Rural Areas- Incidence of NAS increased from 1.2 to 7.5 cases per 1000 hospital births
  - Urban Areas- incidence of NAS increased from 1.4 to 4.8 cases per 1000 Hospital Births
    - Medscape December 14, 2016

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- **STANDARDIZATION IMPROVES OUTCOMES**
  - Studies show care guided by protocol or policy development shortened length of treatment, shortened length of stay, faster weaning from pharmacologic treatment
  - Hospitals with protocols focused on infant symptoms had shortest length of stay
- Separate Obstetrical and Neonatal Teams/Aims
- Obstetrical Team Focuses
  - Universal Screening/SBIRT Implementation
  - Establishing Protocol/Clinical Checklists
  - Connecting/Mapping Local Treatment Resources
  - Educational Resources (Patients, Providers, Staff)
  - Prevention

PERINATAL SUBSTANCE USE- SCREENING

Perfect World

- Detecting prenatal drug use would be simple. Every pregnant woman would get tested with an accurate tool and both the mother and baby would receive appropriate therapy.
- Drug use would be recognized as a medical issue, and legal entanglements would not flow from positive toxicology results.
- Societal resources would be committed to strengthening family bonds and to the well-being of each family member

Real World

- Approaches to screening vary
  - Urine toxicology on those "at greatest risk"
    - Ethically perilous, bias
  - Universal urine toxicology
    - Unlawful search and seizure
    - ACOG specifies explicit consent
- Consequences of drug use during pregnancy can go beyond the clinical
  - May result in child removal, as well as maternal arrest, prosecution and punishment.

PERINATAL SUBSTANCE USE- UNIVERSAL SCREENING AND SBIRT

Best solution for now…

- All women would complete a questionnaire
- This would allow their provider to identify and provide services to any women with evidence of substance abuse
- Recommended by ACOG, AAP, AMA, CDC

SBIRT

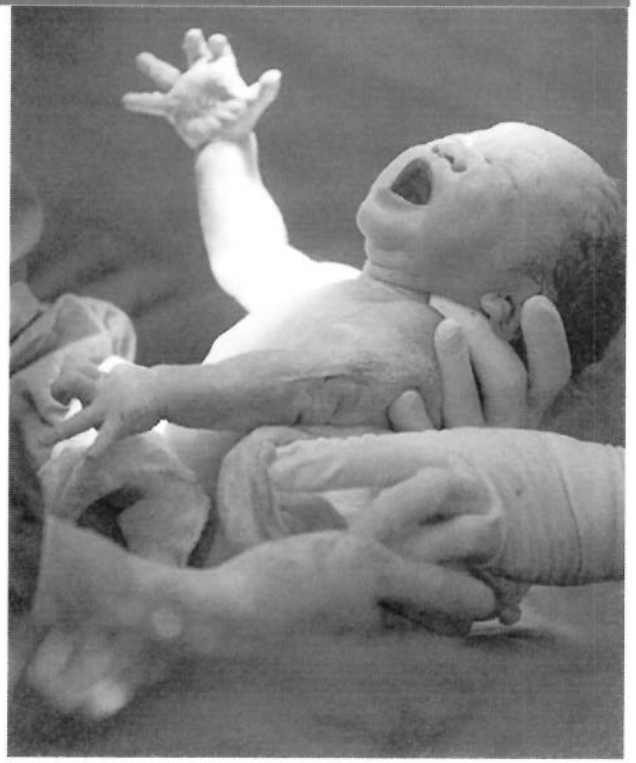
- **Screening** — a healthcare professional assesses a patient for risky substance use behaviors using standardized screening tools. Screening can occur in any healthcare setting
- **Brief Intervention** — a healthcare professional engages a patient showing risky substance use behaviors in a short conversation, providing feedback and advice
- **Referral to Treatment** — a healthcare professional provides a referral to brief therapy or additional treatment to patients who screen in need of additional services

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Neonatal Focuses
  - Strengthening Family and Care Team Relationships
  - Improving Pre-Delivery Planning
  - Standardizing Identification and Assessment of Substance Exposed Newborns
  - Family Education
  - Improving Infant Nutrition and Breastfeeding
  - Optimizing Non-Pharmacologic Care
  - Standardized Pharmacologic Care
  - Coordinating Safe Discharge

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Strengthen Family and Care Team Relationships
  - Dispelling myths about addiction
  - Standardizing language
  - Reducing bias
- Improving Pre-Delivery Planning
  - Prenatal Consultation for mothers
    - Maternal treatment recommendations during pregnancy/delivery
    - Physiology of NAS
    - Post-birth care expectations
      - Testing of newborn
      - Screening protocols
      - Care and treatment of newborn



ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Standardize Identification and Assessment of Substance Exposed Newborns
  - Identifying at risk newborns
  - Evidence based assessment
  - Finnegan versus Eat, Sleep, Console
    - Recent research from Yale New Haven Children's Hospital shows superiority in ESC
    - Grossman, M. R., MD, Lipshaw, M. J., MD, Osborn, R. R., MD, & Berkwitt, A. K., MD. (2018). A novel approach to assessing infants with neonatal abstinence syndrome. *Hospital Pediatrics, 8*(1).

COMPARING METHODS OF ASSESSMENT

Modified Finnegan Scoring

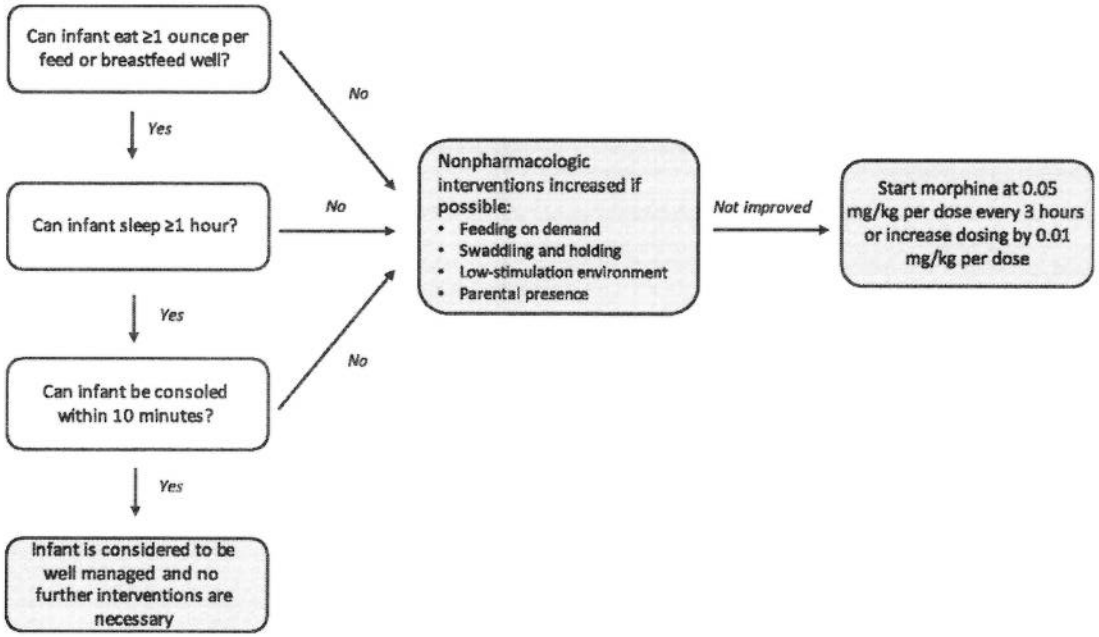
- **Likely in place at local institutions**
  - Tool most often used (~95%) in the United States for assessing NAS since its development in mid 1970s
  - Historical "gold standard," in research
    - However, never validated or score cutoffs tested- based on original author's experience with point at which infants calmed
  - Basic premise- Infants are scored for a series of 21 clinical signs of withdrawal, every 3-4 hours following a feeding. If the score is consistently 8 or higher, pharmacological intervention may be warranted.

Eat, Sleep Console Protocol

- **Protocol is spreading nationwide as collaboratives increase**
- Increasing body of literature is supporting positive outcomes backed by evidence
- Basic premise- Infants are physiologically stable if they can eat skillfully, sleep peacefully, and be calmed from crying within 10 minutes.

EAT, SLEEP, CONSOLE PROTOCOL

- Simple assessment with concrete terms
  - Less confusing symptoms, greater interrater reliability
- Easy for parents to participate in scoring infant
  - Family involvement is vital
  - Use of diary for documentation by parents



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NNEPQIN
NORTHERN NEW ENGLAND
PERINATAL QUALITY IMPROVEMENT NETWORK

Healthy Moms/Healthy Babies

NAS QI/Learning Collaborative formed in 2015

16/17 NH, 11/12 VT & 4 ME hospitals participating

Monthly webinars, regional trainings, provider & family education, clinical care guidelines, QI initiatives, sharing of materials, peer strategizing, brainstorming & support

NNEPQIN NAS "BUNDLE"

- **Prenatal / parental education**
- **Maternal presence and rooming-in**
- **Breastfeeding** if no concerning maternal substance use
- **Baby-centered care / scoring**
  - Care / score based on infant's waking & feeding schedule
  - Skin-to-skin & (breast)feed pre-scoring
  - Skin-to-skin / hold during scoring
- **Involve family in care / scoring**

TIME				
EATING				
Poor eating due to NAS? Yes / No				
SLEEPING				
Sleep ≤ 1 hr due to NAS? Yes / No				
CONSOLING				
Unable to console within 10 min due to NAS? Yes / No				
Consoling Support Needed 1: Able to console on own 2: Able to console with caregiver support within 10 min 3: Unable to console with caregiver support within 10 min				
PLAN OF CARE				
Recommend Formal Parent/Caregiver Huddle? Yes / No				
Recommend Full Care Team Huddle? Yes / No				
Management Decision 1: Continue Optimize Non-pharm Care 2: Initiate Medication Treatment 3: Continue Medication Treatment 4: Other (please describe)				
PARENTAL / CAREGIVER PRESENCE				
0: No parent present 1: < 1 hour 2: 1-2 hours 3: 2-3 hours 4: ≥ 3 hours				
NON-PHARM CARE INTERVENTIONS				
Rooming-in: Increase / Reinforce				
Parent/caregiver presence: Increase / Reinforce				
Skin-to-skin contact: Increase / Reinforce				
Holding by caregiver / cuddler: Increase / Reinforce				
Safe swaddling: Increase / Reinforce				
Optimal feeding at early hunger cues: Increase / Reinforce				
Quiet, low light environment: Increase / Reinforce				
Non-nutritive sucking / pacifier: Increase / Reinforce / Not Needed				
Additional help / support in room: Increase / Reinforce				
Limiting # of visitors: Increase / Reinforce				
Clustering care: Increase / Reinforce				
Safe sleep / fall prevention: Increase / Reinforce				
Parent caregiver self-care & rest: Increase / Reinforce				
Optional Comments:				

TIME				
EATING				

Indicate **Yes** if **Poor eating** is **due to <u>NAS/opioid-withdrawal symptoms</u>:**

- **Unable to coordinate feeding *<u>within 10 minutes</u>* of showing hunger** *OR*
- **Unable to sustain breastfeeding for *<u>at least 10 minutes</u>*** *OR*
- **Unable to feed with *<u>at least 10 mL</u>* by bottle or other feeding method** (*or other age-appropriate duration / volume*

2: Able to console with caregiver support within 10 min				

Indicate **Yes** if **Sleep < 1 hour** is **due to <u>NAS/opioid-withdrawal symptoms</u>** (e.g., tremors, increased startle)

Management Decision				

Indicate **Yes** if **Unable to Console within 10 minutes <u>due to NAS/opioid-withdrawal symptoms</u>** (e.g., tremors, increased startle)

PARENTAL / CAREGIVER PRESENCE				
0: No parent present 1: < 1 hour 2: 1-2 hours 3: 2-3 hours 4: ≥ 3 hours				
NON-PHARM CARE INTERVENTIONS				
Rooming-in: Increase / Reinforce				
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Safe sleep / fall prevention: Increase / Reinforce				
Parent/caregiver self-care & rest: Increase / Reinforce				
Optional Comments:				

NON-PHARM CARE INTERVENTIONS	
Rooming-in: Increase / Reinforce	
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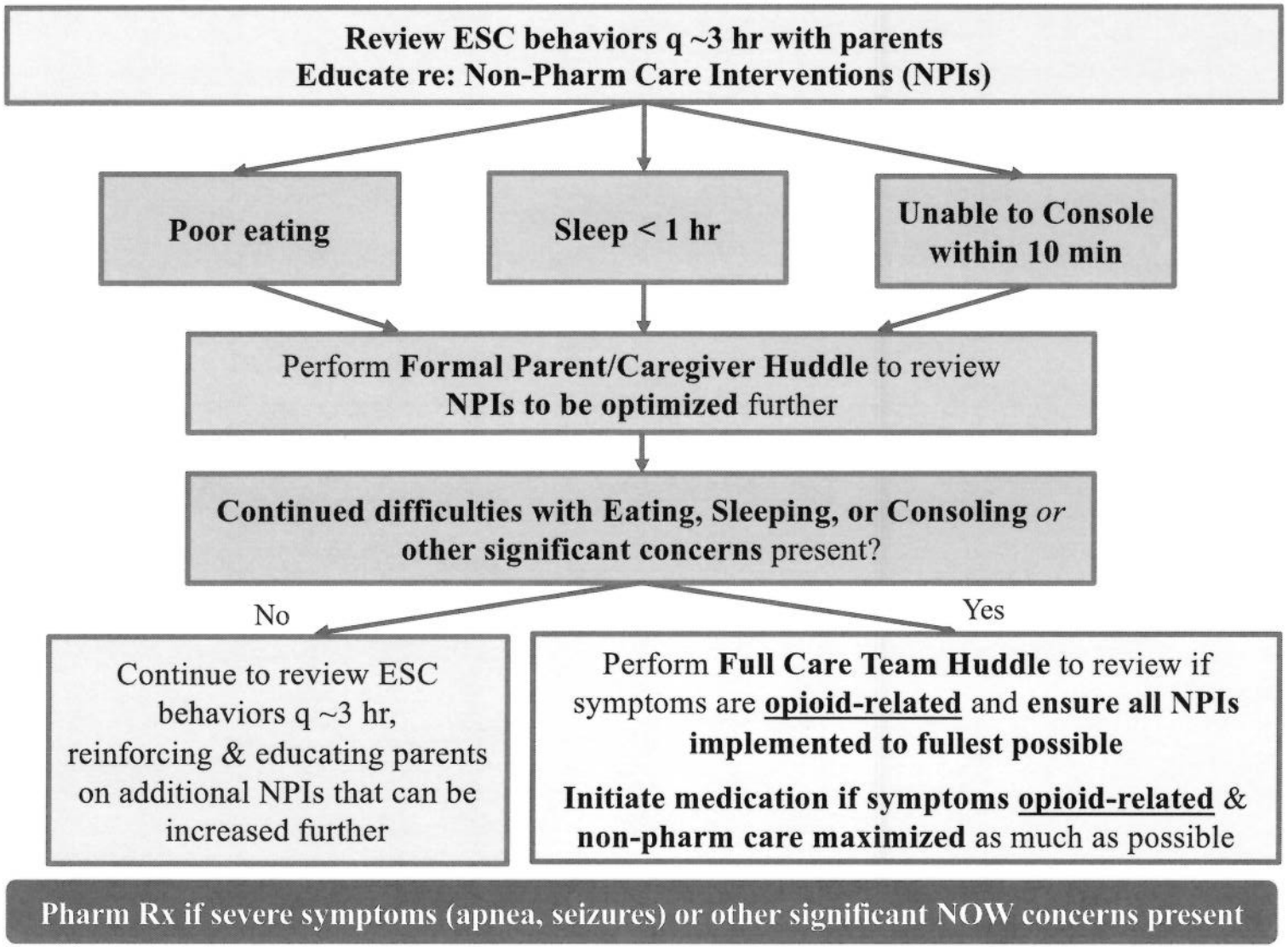
Optional Comments:	


Review ESC behaviors q ~3 hr with parents
Educate re: Non-Pharm Care Interventions (NPIs)
Poor eating
Sleep < 1 hr
Unable to Console within 10 min
Perform Formal Parent/Caregiver Huddle to review NPIs to be optimized further
Continued difficulties with Eating, Sleeping, or Consoling or other significant concerns present?
No
Yes
Continue to review ESC behaviors q ~3 hr, reinforcing & educating parents on additional NPIs that can be increased further
Perform Full Care Team Huddle to review if symptoms are opioid-related and ensure all NPIs implemented to fullest possible
Initiate medication if symptoms opioid-related & non-pharm care maximized as much as possible
Pharm Rx if severe symptoms (apnea, seizures) or other significant NOW concerns present

ILPQC INFANT BEDSIDE TRACKING SHEET

ILPQC

ILPQC Infant Bedside Sheet

Baby's Name _____ Baby's Med Record # _____ Date _____

Shift Time (i.e. 7am-7pm)											
ESC Assessment											
Poor feeding due to NAS? Yes/No											
Sleep < 2 hr due to NAS? Yes/No											
Unable to consol < within 10 minutes due to NAS? Yes/No											
Care Plan											
Recommend Full Care Team Huddle? Yes/No											
Management Decision 1 Optimize Non-Pharmacologic Care 2 Initiate Medication 3 Continue Medication 4 Other (please describe)											
Parental Caregiver Presence 0 No parent present 1 < 1 hour 2 1-2 hours 3 2-3 hours 4 ≥ 3 hours											
Non-Pharmacologic Care (check all that were reviewed)											
Parent-Infant Skin-to-Skin Contact											
Parent caregiver presence											
Skin-to-skin contact											
Holding by caregiver/cuddler											
Safe swaddling											
Optimal feeding at early hunger cues											
Quiet, dim-light environment											
Non-nicotine sucking pacifier											
Limiting visitors											
Clustering Care											
Safe sleep-fall prevention											
*Was the above Infant Bedside Sheet fully completed for this shift? Yes/No											

*Record total number of fully completed shifts (columns) for this infant in BSEDCap- Question 22 on Neonatal Form. Use multiple forms if needed.

Version 2.0 (5.17.2018)
Adapted from NNEPQIN ESC Care Tool

SAMPLE CARE DIARY TO TRACK ESC

Newborn Care Diary

IL PQC

Baby's name: _____ Medical Record Number: _____ Date: _____

Time of feed (start to finish)	Breast feeding (total # minutes)	Bottle feeding (total # mL)	Time baby fell asleep	Time baby woke up	Did baby feed well? (if no, describe)	Did baby sleep for an hour or more? (If no, describe)	Did baby console in 10 min? (if no, describe)	Check box for diaper wet	Check box for diaper dirty (please describe)	Care provided and extra comments	Update given to care team
8:10-8:25	L-10 R-15		8:35	11:60	Yes, but I had a hard time getting him to latch since he was crying. Took 10 min to get him on	Yes	Yes, but he was very fussy and I had to offer the breast	√	√√ Loose	Skin to skin provided right when he woke up.	√ 1:1:19 @ 1205

Gratefully adapted from Northern New England Perinatal Quality Improvement Network. Reviewed 12.17.18

EAT SLEEP CONSOLE OUTCOMES VERSUS FINNEGAN SCORING

- Study authors noted:
  - Vast decrease in number of infants requiring pharmacological treatment (12% vs 62%)
  - Fewer infants requiring increases in pharmacological treatment (8 times versus 76 times)
  - Significantly shorted adjusted length of stay
  - No significant adverse events
  - No readmissions
- Other studies/QI projects have demonstrated "loosening" of Finnegan scoring parameters, with prioritization of feeding success, weight gain, sleep patterns and inconsolability resulted in less pharmacologic need and shorter length of stay

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Provide Family Education
  - Developing booklets and pocket cards for easy distribution
- Improving Infant Nutrition and Breastfeeding
  - Emphasis on breastfeeding when safe for infant, as both optimum nutrition and comfort
  - Encourages hospitals to develop specific protocol with clear, concise guidelines on risk vs benefits of specific situations
    - Ex. Active abuse at time of delivery versus participant in supervised treatment

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Optimizing Non-Pharmacological Care
  - Establishing rooming-in guidelines/physical environment of care
  - Skin to skin contact
  - Rocking/swaying/holding
  - Uninterrupted rest periods
  - Swaddling/containment
  - Pacifiers/nursing for comfort
  - Decreased light and sound
  - Mother as primary caregiver throughout hospitalization

ILLINOIS PERINATAL QUALITY COLLABORATIVE INITIATIVE FOR MOTHERS AND NEWBORNS AFFECTED BY OPIOIDS (MNO)

- Standardized Approach to Pharmacological Treatment
  - Protocols decrease length of stay!
    - Regardless of approach to assessment
- Coordinate Safe Discharge
  - Appropriate observation periods (4-7 days if never medicated, at least 48 hours off medications)
  - Feeding well, gaining weight
  - Clearance from Social Services/DCFS
  - COMMUNICATION with PCP
  - Developmental follow-up or Early Intervention
  - For some families, home health visits may be appropriate

QUESTIONS??

"Red Flags" in Newborns

SIGNS AND SYMPTOMS THAT ALWAYS REQUIRE FURTHER EVALUATION

Nursing Assessment is Key!!

- RNs are the most constant caregivers throughout a newborn's hospitalization.
- Partner with parents and take their concerns regarding their infant seriously
  - Reassurance for normal newborn findings
  - "Mother's intuition"- usually right!
- Report concerns to PCP/on-call provider, and escalate up the chain of command if needed.
  - Throw me under the bus: "That Nurse Practitioner from the NICU said…"

Bilious (Green) Emesis

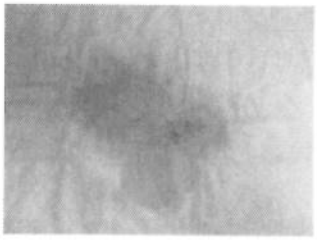
THINK: INTESTINAL OBSTRUCTION!

Bilious (Green) Emesis

- Newborns are prone to reflux ("spitting up") due to small stomach size, esophageal sphincter tone, overfeeding
  - Clear, mucousy, breastmilk/formula
  - Shortly after feedings or with position changes/fussing
  - Usually accompanied by normal abdominal examination
- Bloody emesis- can follow abruption or hemorrhage during delivery
  - Bright red or "old" brown
  - Swallowed maternal blood
  - Can cause bloody stools
  - Apt Test- looks for adult hemoglobin in specimen to prove it isn't infant's blood

Bilious (Green) Emesis

- Bilious emesis- color can range from lime to dark forest green
  - Can have benign cause- swallowed meconium stained fluid, or ileus (especially in infants whose mothers received magnesium sulfate)
  - BUT MUST ALWAYS RULE OUT INTESTINAL OBSTRUCTION!!
    - Can be congenital atresia (passage through "tube" of intestine did not form properly), malrotation (intestine is twisted tightly on itself), stenosis (significant narrowing of intestines that does not allow stool to pass)
  - Accompanied by abnormal abdominal examination- hypo or hyperactive bowel sounds, tenderness, distension, lack of regular stooling- BUT NOT ALWAYS!!
  - Other symptoms
    - Refusing to feed
    - Unexplained fussiness
    - Vital sign abnormalities
    - Delayed capillary refill

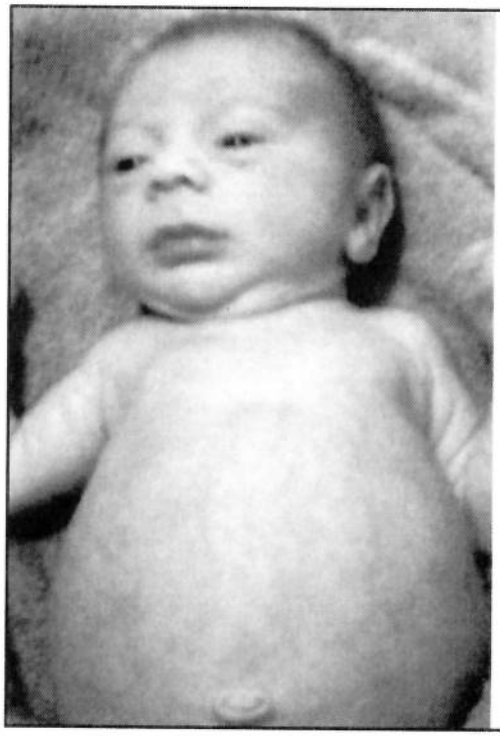


Bilious (Green) Emesis

Infant needs immediate imaging with abdominal film (KUB) to look at bowel gas pattern

AND

Upper GI contrast series to rule out obstruction- Not always visible on plain film



Bilious (Green) Emesis

- Newborns with intestinal obstruction can deteriorate quickly
  - Bowel becomes inflamed/edematous → third spacing of fluid → poor perfusion → shock and metabolic acidosis
  - Pain!
  - Can cause sepsis as bowel bacteria infects blood stream/peritoneum
  - Respiratory distress

Bilious (Green) Emesis

- Treatment of Suspected Intestinal Obstruction
  - MAKE NPO!
  - Decompress abdomen with OG tube, preferably to low intermittent suction
  - Establish IV access
    - Maintain hydration and glucose with D10W IV fluids
    - Give fluid bolus of NS (20ml/kg) to combat metabolic acidosis and shock
  - Sepsis evaluation
    - Start Ampicillin and Gentamicin
  - TRANSPORT to a higher level of care

Apnea in a Term Newborn

THINK: SEIZURES!

Apnea in a Term Newborn

- Apnea, by definition, is a pause in breathing lasting 20 seconds or more.
  - Central- Depression of respiratory center in brain
  - Obstructive- airway collapse that blocks breathing efforts
  - Mixed- combination of above
- In preterm infants, it is related to an immature respiratory center in the brain. This causes a disturbance of respiratory control during REM sleep.
  - Loss of upper airway tone, pharyngeal collapse, airway obstruction→ this is mixed apnea.
- This causes periodic breathing (breathe, pause, breathe, pause). If the pauses last 20 seconds, it is apnea of prematurity.

Apnea in a Term Newborn

- Apnea in an infant <36-37 weeks can be accepted/expected at times due to their prematurity.
  - Still requires evaluation and treatment, such as:
    - High flow nasal cannula/CPAP to overcome airway tone issues
    - Caffeine citrate to stimulate respiratory center in brain
    - Septic evaluation if new-onset or worsening

Apnea in a Term Newborn

- Apnea in a preterm infant can be "normal"→ APNEA IN A TERM INFANT IS NEVER NORMAL!
- Signs of apnea
  - Cyanotic spells
  - Bradycardia
  - Desaturations
  - Respiratory distress, observed cessation of breathing for 20 seconds or more

Apnea in a Term Newborn

- Causes of apnea:
  - Obstructive
    - Choanal atresia or Pierre-Robin sequence
  - Central
    - Meningitis
    - Stroke
    - Structural brain abnormality
    - Hypoxic-ischemic encephalopathy
    - Electrolyte or glucose derangement
    - Inborn error of metabolism
    - Seizures- all of above can also CAUSE seizures

Apnea in a Term Newborn

- Treatment
  - Cardiorespiratory monitoring with pulse oximeter
  - Septic evaluation- needs to include LP
    - Antibiotics: Ampicillin and Claforan, possibly Acyclovir
  - Respiratory support as needed
  - Careful observation for associated symptoms of seizures
    - Posturing, staring, rhythmic movement, sucking
    - Phenobarbital is first line medication
  - TRANSPORT to a higher level of care

Persistent Hypoglycemia

THINK: ENDOCRINE DISORDER

Persistent Hypoglycemia

- Hypoglycemia- differing opinions on threshold for newborns (40-60mg/dL)
  - Studies disagree on a number, but agree on one thing- SYMPTOMS most important
  - Some evidence babies are protected by several mechanisms
    - Spontaneous rise in glucose levels over 1st 24 hours
    - Gluconeogenesis-generating glucose from non-carbs (brown fat metabolism)
    - Glycogenolysis- rapid source of glucose for about 10 hours
    - Ketogenesis- newborn brains can utilize as alternative fuel source
  - Transient- most neonates only are hypoglycemic in first few hours/first day of life
    - Resolves with feeding/time

Persistent Hypoglycemia

- Symptoms- Predominantly neurological
  - Must have enough SUGAR to run your BRAIN
  - Mild
    - Jitteriness
    - Lethargy
    - Hypothermia
    - Tachypnea
    - Poor feeding/disinterest
    - Cyanosis
  - Severe
    - Seizures
    - High pitched cry
    - Decreased responsiveness

Persistent Hypoglycemia

- Screening:
  - ANYONE WITH SYMPTOMS
  - Infants of Diabetic Mothers
  - Late preterm (34-36 6/7) or post term (42 weeks +)
  - Required resuscitation/PPV or 5 min Apgar <7
  - SGA (<10th%ile or <2500gm)
  - LGA (>90th%ile or >4000gm)

  - NO symptoms- FEED first
  - Symptomatic- CHECK first

Persistent Hypoglycemia

- If glucose is 45mg/dL or >
  - Feed frequently, no more than 3 hours between feedings
  - Can discontinue checks after 3 consecutive >45-50mg/dL
- If glucose is 30-44mg/dL
  - Confirm with serum as per hospital policy
  - Glucose gel administration (see handout)
  - Administer to cheek
  - Follow with feeding- does not have to be formula!!!
  - Recheck 1 hour post intervention

Persistent Hypoglycemia

- If glucose <30mg/dL
  - Give glucose gel
  - START IV and D10W fluids
    - Bolus 2ml/kg over 10 minutes
    - Start continuous D10W fluids at 70ml/kg/day
    - THEN feed infant if able
    - Recheck glucose level 1 hour after intervention
    - Readminister D10W bolus for accuchecks <30 or not improving steadily with IV fluids

Persistent Hypoglycemia

- If blood glucose levels are not normalizing with feedings or an appropriate amount of IV glucose (4-6mg/kg/min), consider pathology outside of normal transient hypoglycemia of newborn.
- Glucose Infusion Rate- determines amount of glucose given per minute based on IV fluid rate, concentration and infant weight
  - http://www-users.med.cornell.edu/~spon/picu/calc/glucinfr.htm

Persistent Hypoglycemia

- Pathologies causing hypoglycemia
  - Hyperinsulinemia- common in IDMs, can also be congenital
    - Fetus is "grown" in a high glucose environment and its pancreas becomes used to producing excessive amounts of insulin to achieve normoglycemia in utero
    - Once delivered, insulin continues to be produced at high levels without continued high glucose input
    - Often required increased concentration of dextrose IV fluids (D15W, D20W) to prevent overhydration while delivering high amounts of glucose to infant
  - Inborn Errors of Metabolism
    - Glycogen storage diseases
    - Disorders of gluconeogenesis
    - Fatty acid oxidation disorders

Persistent Hypoglycemia

- Genetic Abnormalities
  - Beckwith-Wideman
    - Large tongues, oomphalocele
  - Congenital hypopituitarism
    - Can occur with midline disorders/brain structural abnormalities
    - Abnormal growth hormone and ACTH levels
  - Congenital Adrenal Hyperplasia
    - Ambiguous genitalia
    - Other electrolyte imbalances

Persistent Hypoglycemia

- If improving with intervention as per protocol
  - Continue to monitor frequent AC glucoses until maintained X3 without additional intervention
  - If on D10W, can wean rate by 2ml/hr q3hrs for each glucose >50.
  - Continue to be vigilant for SYMPTOMS of hypoglycemia once no longer checking levels
- If not improving with interventions as per protocol
  - May need increased dextrose concentration to maintain adequate GIR
  - Needs evaluation by endocrinologist/neonatologist
  - TRANSPORT to higher level of care

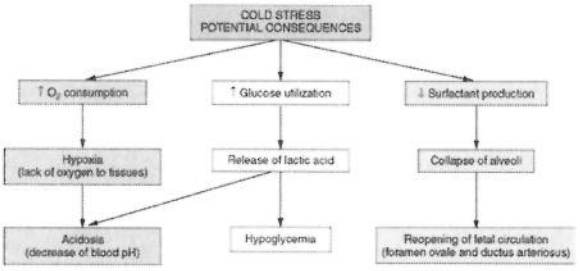
Temperature Instability

THINK: SEPSIS

Temperature Instability

- Normal axillary temperature in newborn 97.7F- 99.5F
- Preventing hypothermia is usually stressed
  - Mild hypothemia 96.8F-97.6F
  - Moderate hypothermia 89.6F-96.6F
  - Severe hypothermia <89.6F
- Causes of hypothermia
  - Preterm infants
  - Low birthweight or small for gestational age (SGA)
  - Prolonged resuscitation
  - ACUTE ILLNESS

Temperature Instability



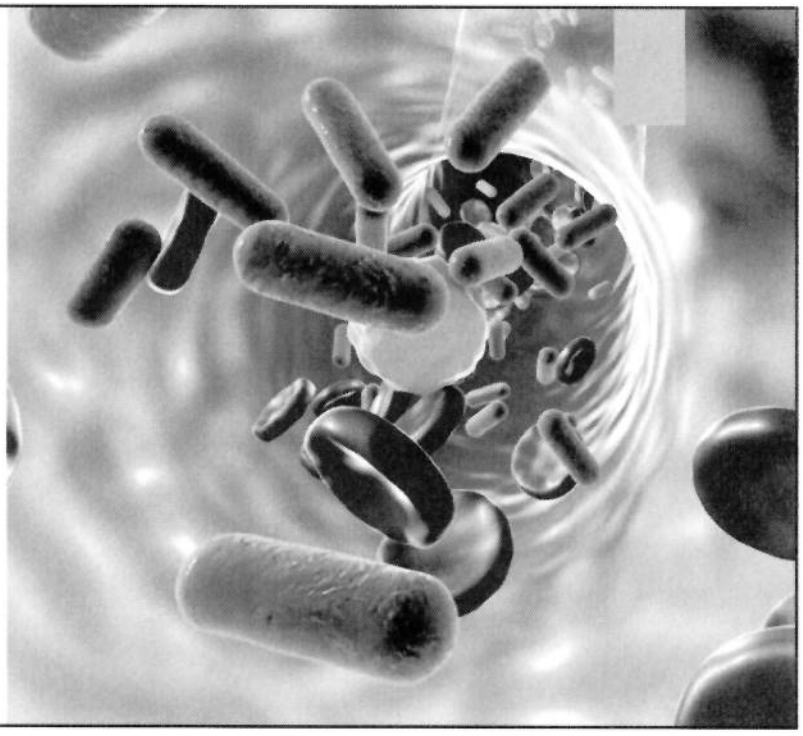
- As body temperature falls outside of normal range, metabolic rate and oxygen consumption increase
  - Hypoxemia
  - Hypoglycemia
  - Anaerobic metabolism→ lactic acidosis
- Cold stress specifically:
  - Sends signals to hypothalamus which releases norepinephrine
    - Peripheral vasoconstriction → poor perfusion and oxygenation → acidosis
    - Pulmonary vasoconstriction → PPHN

Temperature Instability

- Hyperthermia
  - Temperature >99.5F to 100.4F (guidelines vary)
  - OFTEN ENVIRONMENTAL
    - Overdressed/wrapped
    - Temperature probe inadherence
    - Skin to skin with warm parent
  - If removing environmental condition does not decrease temperature within relatively brief time (30-60 minutes)
    - SEPSIS, SPECIFICALLY VIRAL
    - Herpes Simplex Virus- usually presents 7-10 days, as early as 3 or late as 14 days of age

Temperature Instability

- Infants with persistent hypo- or hyperthermia need sepsis evaluation
  - As detailed in Sepsis Presentation
  - Antibiotic coverage +/- acyclovir
  - Careful regulation of thermal environment
- Consider transport to higher level of care depending on the capabilities of your institution



Failed Critical Congenital Heart Defect Screening

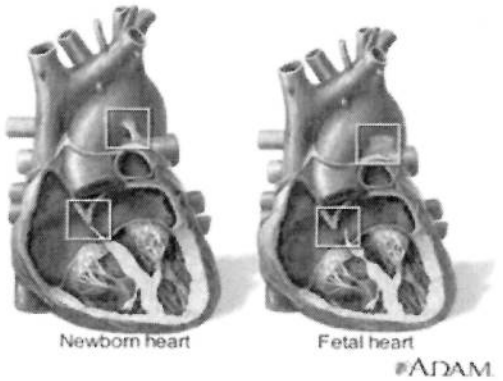
THINK: HEART DEFECT

Failed CCHD Screening

- American Academy of Pediatrics and US Department of Health and Human Services recommends universal screening at ~24 hours of age for critical congenital heart defect screening
  - Incidence of CCHD 18/10,000 liveborn infants
    - Will require surgical or cardiac catheterization intervention in neonatal period
    - Estimated 50% of defects are missed on routine prenatal ultrasounds
    - Often not symptomatic at birth or until fetal circulation pathways have completely closed

Failed CCHD Screening

- Basic premise of screening: assess difference in pre and post ductal oxygen saturations
  - Right hand and either foot
  - Should both be >95% and 3 or less points apart
- If either reading is <90%, automatically NEEDS EVALUATION WITH ECHO
- If either reading is 90-95%, or there is more than a 3 point difference, REPEAT the test in ONE HOUR
  - May repeat ONE additional time, after a second hour
  - If failed X3, NEEDS EVALUATION WITH ECHO



Failed CCHD Screening

- Causes of CCHD Screening Failure
  - Respiratory Distress/Hypoxemia
    - Pneumonia/Sepsis
    - Surfactant Deficiency/RDS
  - Persistent Pulmonary Hypertension
    - Creates right to left shunt → unoxygenated blood sent out to body → PULSE OX DIFFERENCE
    - Can be seen on ECHO
    - Still needs treatment
  - CRITICAL CARDIAC LESION

Failed CCHD Screening

Cyanotic Heart Defects- The "Big 6"

- Truncus Arteriosus
- Transposition of the Great Arteries
- Tricuspid Atresia
- Tetrology of Fallot
- Total Anomalous Pulmonary Venous Return
- Pulmonary Atresia

Other Critical Defects Found on Screening

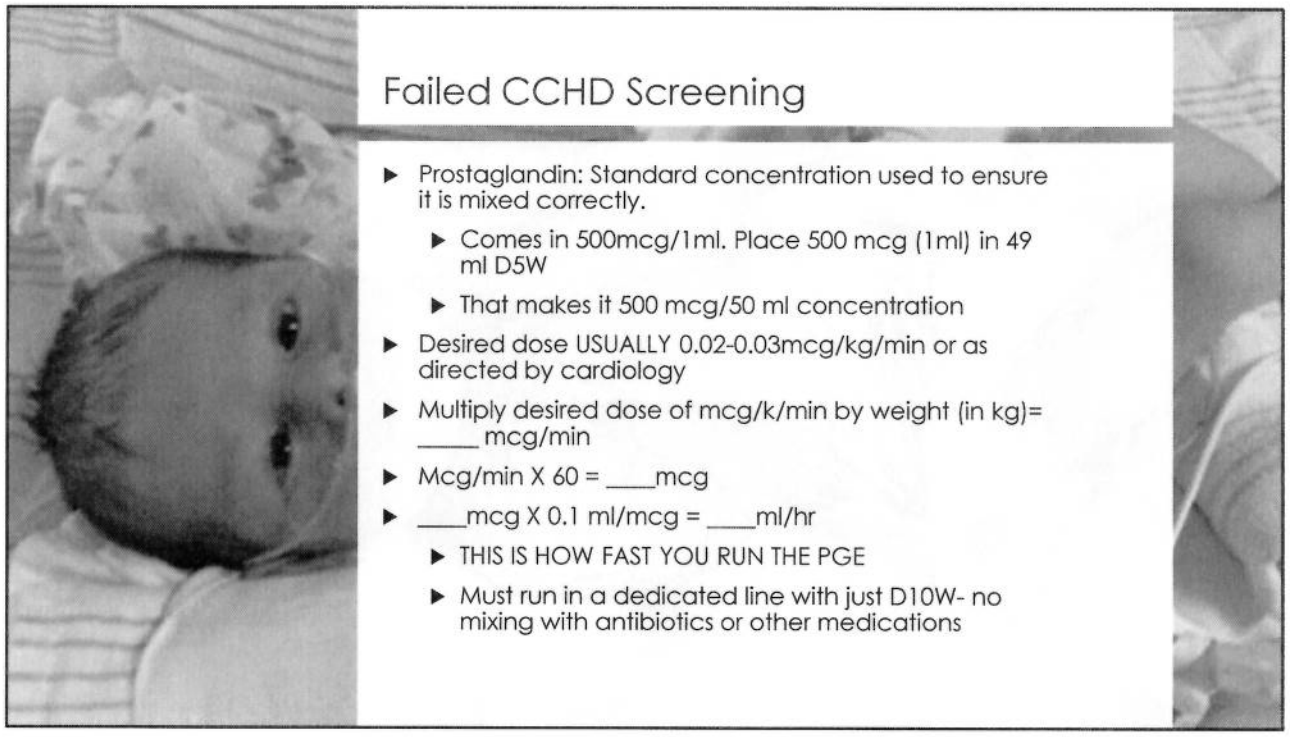
- Coarctation of the aorta
- Ebstein's Anomaly
- Single ventricle pathologies
  - Hypoplastic Left/Right
  - Double Outlet Right Ventricle

Failed CCHD Screening

- Evaluation and Treatment
  - Assess for concurrent symptoms
    - Murmur
    - Brachial and femoral pulses
    - Capillary refill, extremity warmth
    - Respiratory symptoms
  - Chest X-ray- assess for pulmonary causes of low saturations
  - ECHO- if infant is hemodynamically stable with rapid access to diagnostic cardiology at hospital, can obtain ECHO there.
  - Treat with oxygen if necessary to maintain SpO2 within normal range until pathology is known/other instructions received
  - Consider septic evaluation/obtaining blood gas and lactic acid
  - Consult Neonatology and/or Pediatric Cardiology

Failed CCHD Screening

- Prostaglandin E1/Alprostadil
  - Recommended availability in all hospitals with labor and delivery departments
  - CHOI Transport Team ALWAYS carries
- There are NO cardiac or pulmonary pathologies that are a contraindication to starting PGE1…
  - BUT there are MANY CCHDs that can be stabilized by its use.
- Side Effects
  - Apnea- much, much less common at lower starting dosages
  - Hyperthermia
  - Irritability

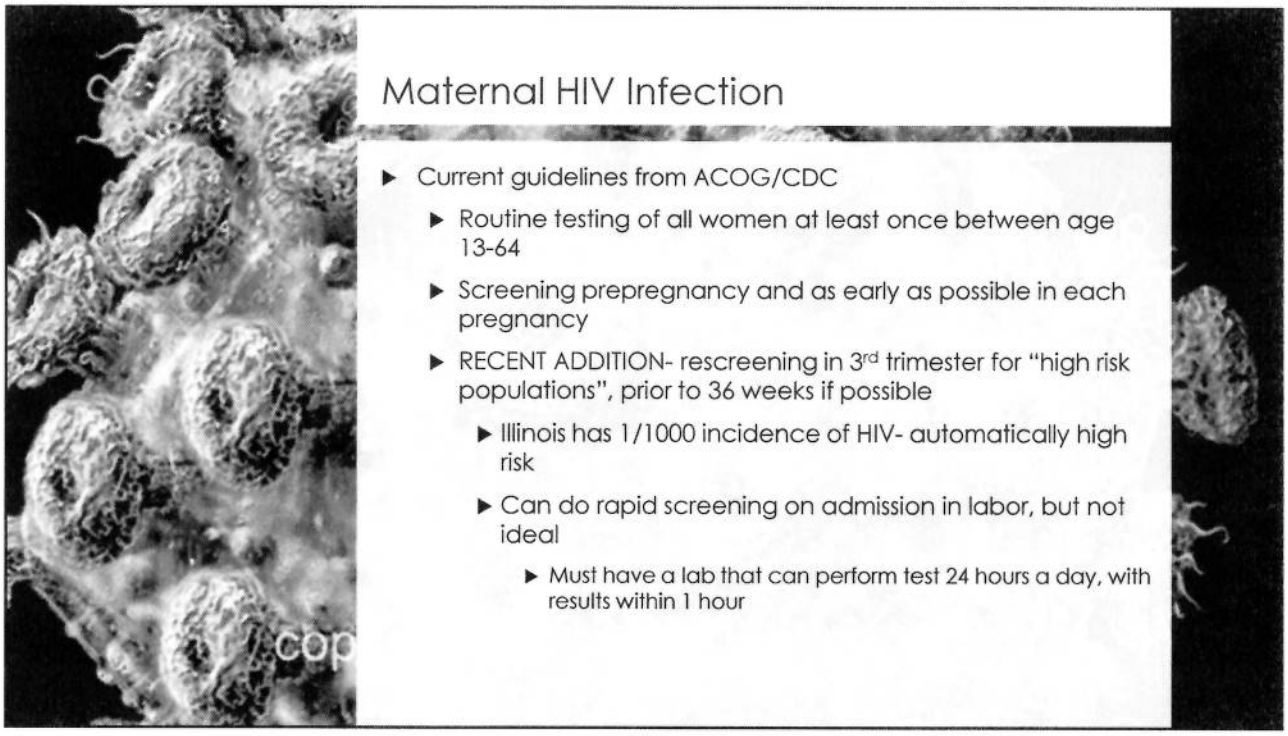


Failed CCHD Screening

- Prostaglandin: Standard concentration used to ensure it is mixed correctly.
  - Comes in 500mcg/1ml. Place 500 mcg (1ml) in 49 ml D5W
  - That makes it 500 mcg/50 ml concentration
- Desired dose USUALLY 0.02-0.03mcg/kg/min or as directed by cardiology
- Multiply desired dose of mcg/k/min by weight (in kg)= _____ mcg/min
- Mcg/min X 60 = ____mcg
- ____mcg X 0.1 ml/mcg = ____ml/hr
  - THIS IS HOW FAST YOU RUN THE PGE
  - Must run in a dedicated line with just D10W- no mixing with antibiotics or other medications

Maternal HIV Infection

THINK: TRIPLE MEDICATIONS



Maternal HIV Infection

- Current guidelines from ACOG/CDC
  - Routine testing of all women at least once between age 13-64
  - Screening prepregnancy and as early as possible in each pregnancy
  - RECENT ADDITION- rescreening in 3rd trimester for "high risk populations", prior to 36 weeks if possible
    - Illinois has 1/1000 incidence of HIV- automatically high risk
    - Can do rapid screening on admission in labor, but not ideal
      - Must have a lab that can perform test 24 hours a day, with results within 1 hour

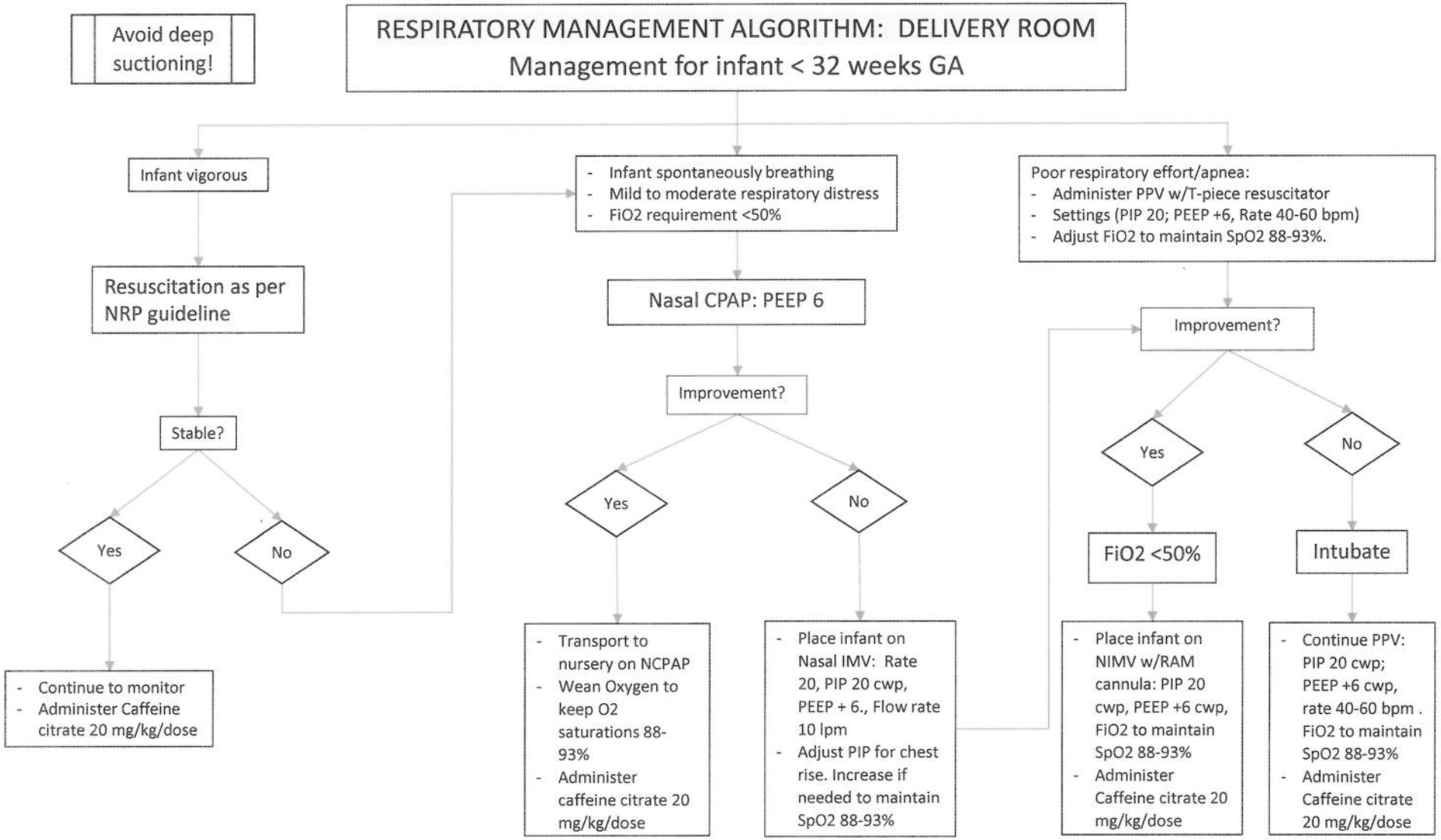
Maternal HIV Infection

- Low Risk Infants- MUST BE ALL
  - At least 33 weeks gestation
  - Mother received ART for at least 28 days prior to delivery
  - Mother had undetectable viral load at least 28 days prior to delivery and believed to remain that way
  - Mother did not become HIV positive during pregnancy
- High Risk Infants- IF ANY
  - Less than 33 weeks gestation
  - Mother's last viral load >1000
  - Did not receive intrapartum ART
  - ART was started <28 days prior to delivery
  - Mother became HIV positive during pregnancy OR diagnosed with HIV in labor/postpartum

Maternal HIV Infection

- Low Risk Infants
  - Draw CBC at birth
  - DO NOT need HIV DNA PCR at birth
  - HIV DNA PCR at 2 and 6 weeks, 4 months
  - Begin prophylaxis with AZT (zidovudine) 4mg/kg PO q12 hours or 3mg/kg IV q12 hours
    - Prophylaxis continues through 4 weeks of age
- High Risk Infants
  - Draw CBC at birth
  - HIV DNA or RNA PCR at birth, 2 and 6-8 weeks, 4 months
  - Urine for CMV prior to 3 weeks of age
  - Begin prophylaxis AZT (Dosing specific to gestational age)
    - Also Nevirapine (Viramune) 4mg/kg PO BID
    - Also 3TC (lamivudine) 2mg/kg PO BID
    - TRANSPORT to higher level of care for Infectious Disease consultation

Questions??


Avoid deep suctioning!
RESPIRATORY MANAGEMENT ALGORITHM: DELIVERY ROOM
Management for infant < 32 weeks GA
Infant vigorous
Resuscitation as per NRP guideline
Stable?
Yes
No
- Continue to monitor
- Administer Caffeine citrate 20 mg/kg/dose
- Infant spontaneously breathing
- Mild to moderate respiratory distress
- FiO2 requirement <50%
Nasal CPAP: PEEP 6
Improvement?
Yes
No
- Transport to nursery on NCPAP
- Wean Oxygen to keep O2 saturations 88-93%
- Administer caffeine citrate 20 mg/kg/dose
- Place infant on Nasal IMV: Rate 20, PIP 20 cwp, PEEP + 6., Flow rate 10 lpm
- Adjust PIP for chest rise. Increase if needed to maintain SpO2 88-93%
Poor respiratory effort/apnea:
- Administer PPV w/T-piece resuscitator
- Settings (PIP 20; PEEP +6, Rate 40-60 bpm)
- Adjust FiO2 to maintain SpO2 88-93%.
Improvement?
Yes
No
FiO2 <50%
Intubate
- Place infant on NIMV w/RAM cannula: PIP 20 cwp, PEEP +6 cwp, FiO2 to maintain SpO2 88-93%
- Administer Caffeine citrate 20 mg/kg/dose
- Continue PPV: PIP 20 cwp; PEEP +6 cwp, rate 40-60 bpm . FiO2 to maintain SpO2 88-93%
- Administer Caffeine citrate 20 mg/kg/dose

OXYGEN MANAGEMENT ALGORITHM: < 32 WEEKS GA

Goal : 88% - 93%

HYPEROXIA: Oxygen is a drug with potentially significant side effects:

- Oxidative stress
- lung injury
- ROP

Alarm limits set at 85% and 95%

If Saturation > 93%
Wean Oxygen by 5%

Assess and wean FiO_2 every 5 minutes

DESATURATION: Prolonged hypoxia can lead to brain injury.

Evaluate infant and monitor before making Oxygen changes

- Assure patent airway
- Heart rate > 100
- Pulse wave appropriate on saturation monitor
- Heart rate on monitor and pulse oximeter heart rate correlate

Sp02 5-10% below target value for > 4 minutes

SpO2 10-15% below target value for >2 minutes

Sp02 >15% below target value

- Increase O2 by 5%
- Stimulate, suction, and reposition as indicated
- Assess breath sounds
- Monitor airway, HR, RR until Sp02 stabilized

Sp02 Improving?

Yes

No

Monitor until Sp02 stable

Pre Delivery
Pre Transfer Checklist

Interventions	Yes	No	Comments
Antenatal Interventions			
Magnesium Sulfate for Neuroprotection • Loading dose of 4-6 grams by infusion pump over 20-30 minutes followed by continuous IV infusion at 1-2 grams per hours			
Betamethasone • 12 mg. every 24 hours X 2 Dexamethasone • 6 mg. every 12 hours X 4 doses			
Antibiotics • Rupture of membranes before labor and before 37 weeks gestation o IV Ampicillin 2 grams every 6 hours o Erythromycin 250 mg. every 6 hours o Azithromycin may be substituted for Erythromycin • GBS Prophylaxis o Penicillin G – 5 million units IV, then 2.5 to 3.0 million units IV every 4 hours o Penicillin Allergic- See Guidelines			
Golden Minute			
➢ Timed Cord Clamping for 30-60 seconds			
Delivery Room - Thermoregulation			
▪ Increase temperature in delivery room to 79 degrees			
▪ Newborn placed on activated chemical mattress			
▪ Place hat on newborn			
▪ Newborn wrapped in plastic wrap – no drying			
Record baby's first temperature			Temperature_____

Delivery Room- Resuscitation			
❖ Pulse Oximeter placed on right wrist			
❖ Follow Oxygen Administration guideline o Targeted oxygen saturations o Targeted oxygen sat. for **< 32 weeks gestation is 88-93%** o Initiate CPAP support on Room Air			
❖ Follow Resuscitation Guideline ❖ When administering mask CPAP- vent the stomach after 4-5 minutes of initiating CPAP			
❖ Administer Caffeine – 20 mg/Kg IV over 30 min.			
Infection Prevention			
✓ Followed checklist for insertion of peripheral IV **Allow cleansing agents to dry**			
✓ Followed checklist for drawing blood culture			
✓ Followed checklist for administering medication			
✓ Followed checklist for micropuncture			
✓ Followed checklist for any sterile procedure			
✓ Initiated antibiotics within 60 minutes of birth o Ampicillin 200 mg. q 8 hours o Gentamicin – Follow guideline			
Developmental Procedures			
⊥ Head midline			
⊥ Flexed position			
⊥ Eye protection			
Containment			
⊥ Containment during resuscitation			
⊥ Containment during painful procedure			
⊥ Containment during examination			
Family Integration			
Parents informed of the following. ⊥ Timed cord clamping			
⊥ Advantages of colostrum, pumping and Breast milk			
⊥ Mother provided colostrum			
⊥ Skin to skin provided			

Debriefing Guide

Analysis Phase:

Preparation and Initial Steps:
Does the group think they prepared adequately?
What might have improved this phase?
Warmer pre-heated?
< 32 week delivery- increased resources/ No drying
Chemical mattress, hat and plastic bag
Timed Cord Clamping performed.....

Who was the leader? How did you know?

Free Flow oxygen
Provided free-flow oxygen and/or CPAP correctly
Administered CPAP by mask/ Inserted OG tube after 3-4 minutes of mask CPAP or PPV's Reason for administering CPAP?
Used pulse oximetry and interpreted appropriately (Used correct extremity and technique for application)

Positive Pressure Ventilation
Was PPV administered correctly? How do you assess if the PPV is effective?
What are the indications for PPV? When do you discontinue PPV?
MR SOPA used appropriately? Ventilated at correct rate and pressure

Leadership:
- *Maintained situational awareness(Stated overall plan for the resuscitation)*
- *Identified self as the leader*
- *Listened to other team members and appreciated their input (Problem solved together)*
- *Delegated tasks appropriately*
- *Identified team members by name*
- *Met time criteria for arrival at delivery*

Resource Management:
- *Were adequate numbers of personnel available?*
- *Were all personnel skilled in their role?*
- *Documentation was accomplished?*
- *Was their adequate operational (administrative and managerial) support?*
- *Was their adequate staff on the unit to handle other patients?*
- *Were appropriate measures taken to assure safe patient care of other laboring patients?*
- *Was their adequate staff to assure containment procedures could be followed?*
- *Was their adequate staff to assure mid-line head positioning was constantly maintained?*

- *Was their adequate staff to implement the family integration plan?*

Communication:

- *Closed loop communication utilized*
- *Identify each other by name*
- *All team members actively shared information*
- *Changes in information shared with all team members*
- *Team members protect each other from work overload*
- *Team members maintain situational awareness*
- *Team huddles with assignment of roles prior to delivery*
- *Calls for help appropriately*

Identify opportunities for improvement "human factors"

- ☐ Communication needed improvement
- ☐ Teamwork needed improvement
- ☐ Leadership needed improvement
- ☐ Decision-making needed improvement
- ☐ Assessment needed improvement
- ☐ Other

Briefly describe, but be specific:

Identify opportunities for improvement: "non-human factors"

- ☐ ***Delay in initiating resuscitation measures***
- ☐ ***Equipment issues***
- ☐ ***Medication issues***
- ☐ ***Inadequate support (in-unit or other areas of the hospital)***
- ☐ ***Other***

Briefly describe, but be specific: