

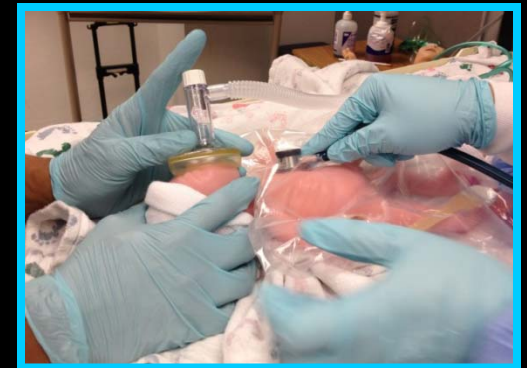
# 2015 Neonatal Resuscitation Guidelines Overview and Update

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Myra H. Wyckoff, MD

Professor of Pediatrics

UT Southwestern Medical Center at Dallas

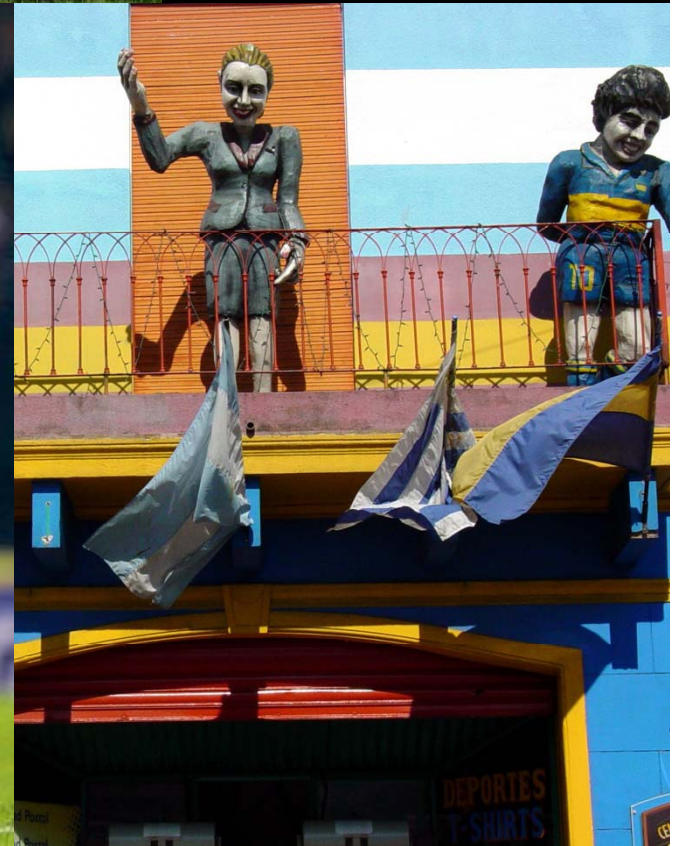


- I have nothing to disclose
- No financial relationships with industry



# Howdy Y'all! (Saludes desde Tejas)





# Reanimación Neonatal





# Achieving Consensus on Resuscitation Science

- Since 2000, a Neonatal Task Force has participated with the International Liaison Committee on Resuscitation (ILCOR) for complete review of newborn resuscitation science every 5 years.
- 23 questions reviewed for the 2015 Neonatal Resuscitation Guidelines





# ILCOR Evaluation Process Brings New Resuscitation Science Forward for Review

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- Identify and prioritize the questions that need scientific review and assign reviewers (2-3 per question)
- Minimum requirements for every search strategy are specified and done by professional librarians
  - Medline, Embase, and Cochrane Systematic Reviews
  - Hand searches
- Every reviewer rates the level and quality of evidence using a standardized evidence evaluation (GRADE system)
- Consensus for each question reached by entire Neonatal Task Force in Feb 2015

# ILCOR Guidelines for Neonatal Resuscitation

- New ILCOR Consensus on Science with Treatment Recommendations (CoSTR) document available online since October 15, 2015
- CoSTR co-published in *Circulation, Resuscitation and Pediatrics*
- Download at: [www.heart.org/cpr](http://www.heart.org/cpr)



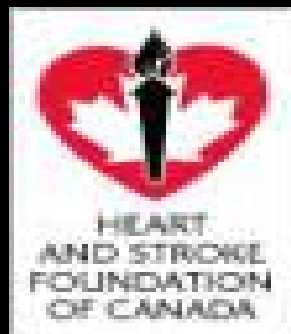




# Achieving Consensus on Resuscitation Science

- The various resuscitation councils then take the ILCOR CoSTR document and adapt/develop their own guidelines appropriate for their own region or country using the science in CoSTR.

- ERC
- AHA/AAP for US
- Brazil
- Etc.



# USA Guidelines for Neonatal Resuscitation

- New USA/Canadian guidelines available since October 15, 2015
- USA/Canadian Guidelines supplement also co-published in *Circulation*, *Resuscitation* and *Pediatrics*



**Circulation**

## Part 13: Neonatal Resuscitation

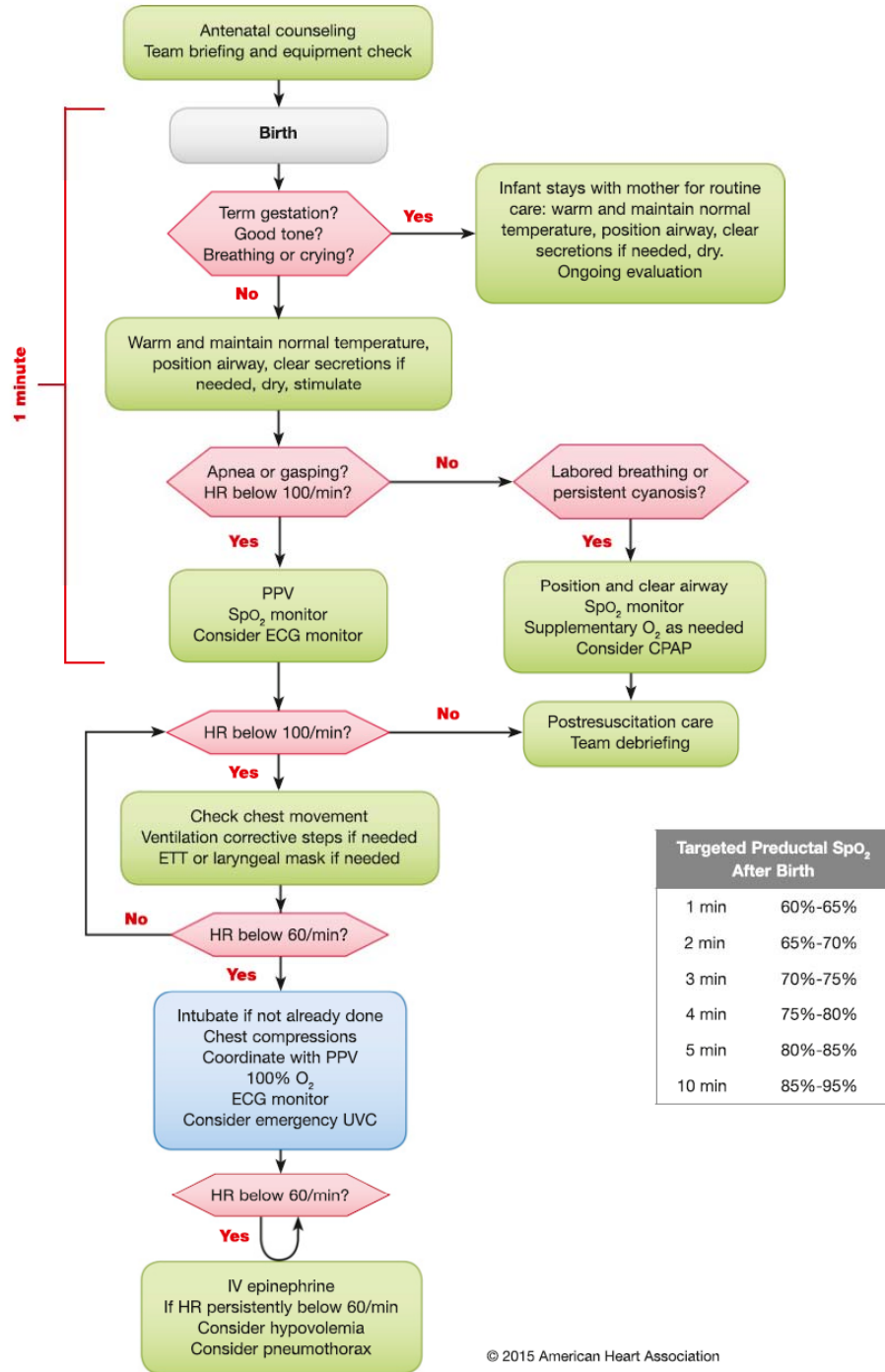
2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Myra H. Wyckoff, Chair; Khalid Aziz; Marilyn B. Escobedo; Vishal S. Kapadia;  
John Kattwinkel; Jeffrey M. Perlman; Wendy M. Simon; Gary M. Weiner; Jeanette G. Zaichkin

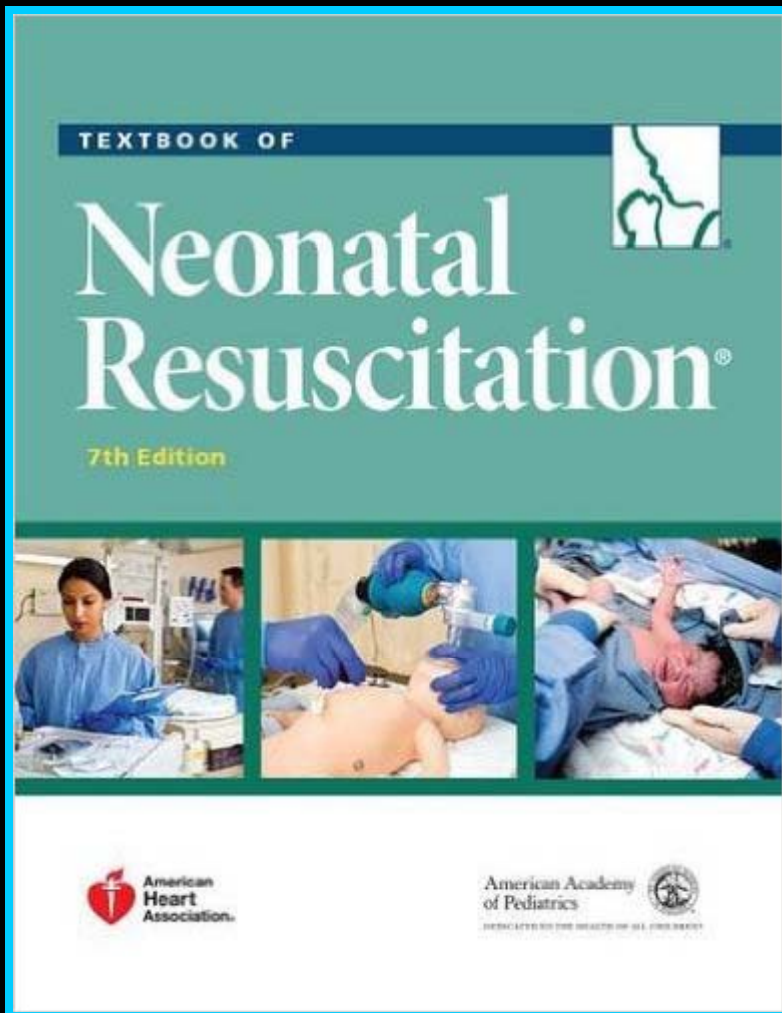


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# 2015 New Algorithm



# Neonatal Resuscitation Program Guidelines

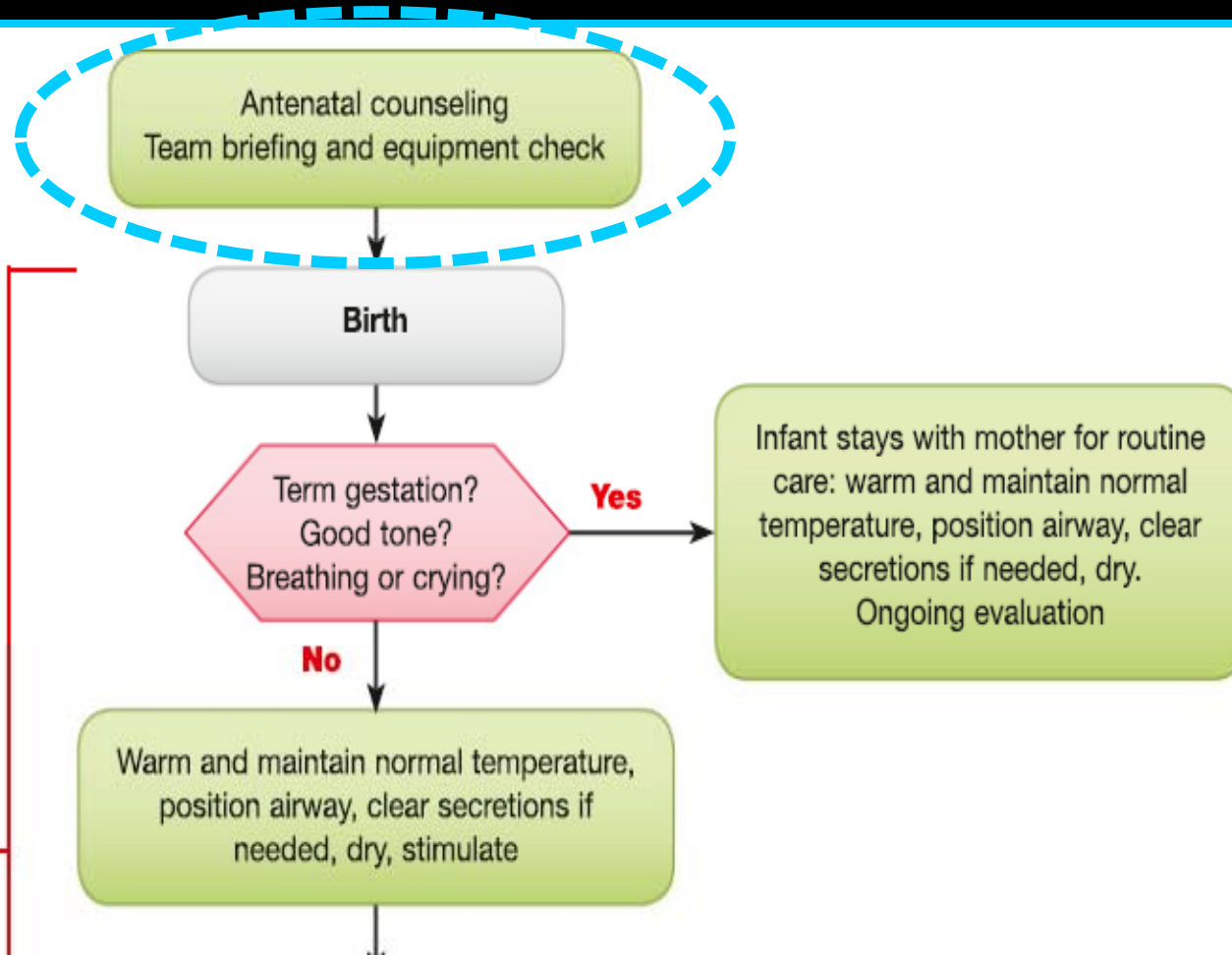


- AAP NRP Steering Committee uses the US guidelines to develop the educational program for neonatal resuscitation (NRP)
- 7<sup>th</sup> edition NRP available May 1, 2016
- New guidelines should be adopted in the USA by Jan. 1, 2017



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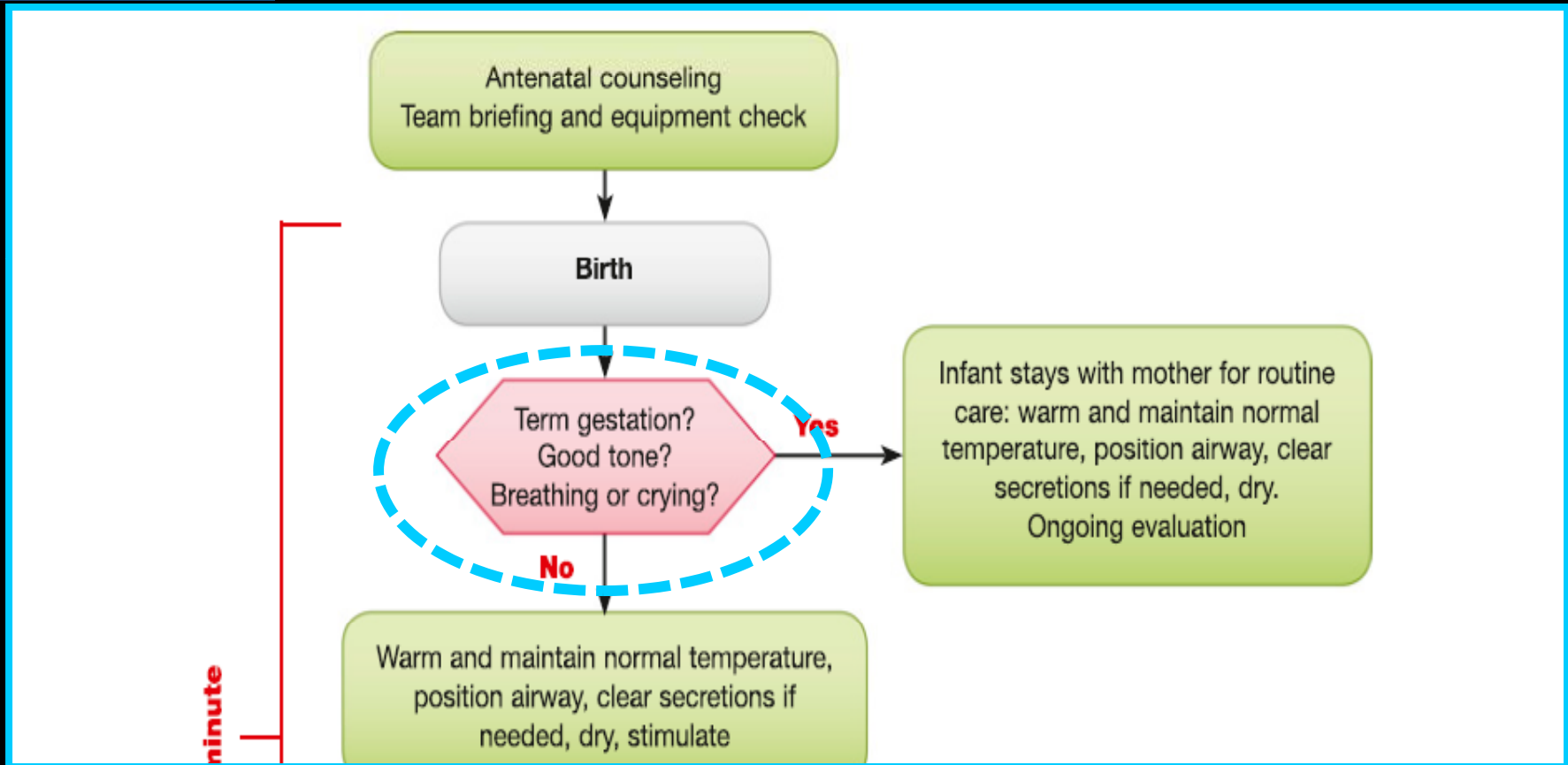
# 2015 Neonatal Resuscitation Guidelines





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# Initial 3 questions to ask following birth have NOT Changed



## Delayed Cord Clamping: 2010 ILCOR Review

- OK for Term Infants who were not in need of resuscitation
- Not enough data to make a recommendation for preterm infants



## 2015: Delayed Cord Clamping (DCC) for Preterm Infants?

- Outcomes examined: mortality, severe IVH, any IVH, hemodynamic stability, hyperbilirubinemia, neurodevelopment
- Sixteen articles included
  - RCTs 12 articles (691 cases)
  - Non-RCTs 4 articles (811 cases)
- No difference in mortality or severe IVH
- No data for neurodevelopment
- DCC improved any IVH, hemodynamic stability
- We suggest DCC for preterm infants not requiring immediate resuscitation after birth



# Outcome: PVH/IVH (gr I-IV)

<RCT>

Study or Subgroup	DCC		ICC		Weight	Odds Ratio M-H, Fixed, 95% CI
	Events	Total	Events	Total		
Hofmeyr 1988	8	23	10	13	19.6%	0.16 [0.03, 0.75]
Hofmeyr 1993	8	40	11	46	19.3%	0.80 [0.28, 2.23]
Kugelman 2007	2	30	4	35	8.1%	0.55 [0.09, 3.26]
McDonnell 1997	0	15	1	16	3.3%	0.33 [0.01, 8.83]
Mercer 2003	3	16	5	16	9.6%	0.51 [0.10, 2.62]
Mercer 2006	5	36	13	36	26.4%	0.29 [0.09, 0.91]
Oh 2011	4	16	3	17	5.1%	1.56 [0.29, 8.38]
Rabe 2000	1	19	3	20	6.5%	0.31 [0.03, 3.33]
Strauss 2008	1	45	1	60	2.0%	1.34 [0.08, 22.03]
<b>Total (95% CI)</b>		<b>240</b>		<b>259</b>	<b>100.0%</b>	<b>0.49 [0.29, 0.82]</b>

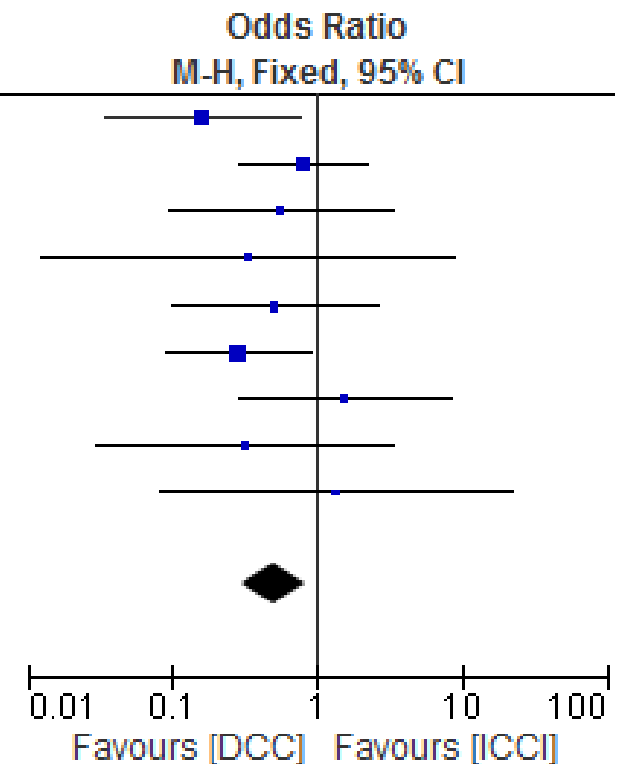
Total events

32

51

Heterogeneity:  $\text{Chi}^2 = 6.20$ ,  $\text{df} = 8$  ( $P = 0.63$ );  $I^2 = 0\%$

Test for overall effect:  $Z = 2.70$  ( $P = 0.007$ )







# 2015 Guidelines for Delayed Cord Clamping

- Delayed cord clamping is suggested for 30-60 seconds for most vigorous term and preterm newborns
  - Place skin to skin with mom or OB securely hold in a warm, dry towel or blanket
  - Very preterm newborns may be wrapped in a warm blanket or polyethylene plastic
- No delay if placental circulation disrupted (abruption, cord avulsion, bleeding placenta previa, bleeding vasa previa)



# 2015 Guidelines for Delayed Cord Clamping

- Insufficient evidence regarding timing of cord clamping if baby is not vigorous, multiples
  - Suggest bring to warmer for initial steps
- Other scenarios where safety data are limited will benefit from a discussion between neonatal and obstetric providers to plan whether cord clamping will be delayed
  - Fetal IUGR, abnormal umbilical artery Doppler measurements, abnormal placentation
  - Other situations where utero-placental perfusion or umbilical cord blood flow are affected
- Need good communication and teamwork with OBs



## What about Cord Milking?

- Appealing as can be done quickly so that resuscitation could commence quickly for babies who are not breathing
- ~200 babies randomized to either cord milking or immediate cord clamping in 4 small RTCs, 1 cohort study
- At the time of review no studies comparing cord milking to delayed cord clamping

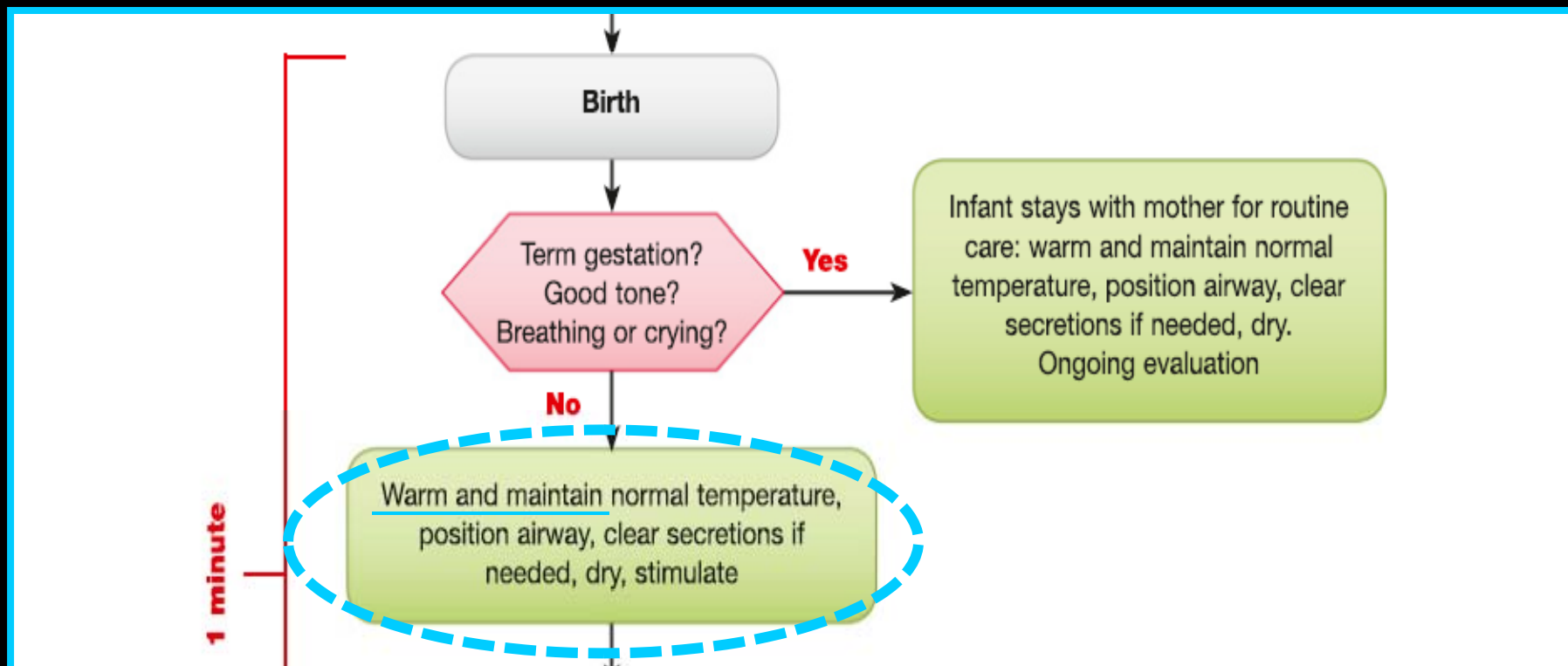


# Cord Milking Science Still Too Limited to Adapt for Routine Use

- ILCOR **suggests against the routine use** of cord milking for infants born at less than 29 weeks of gestation but cord milking may be considered a reasonable alternative to immediate cord clamping to improve initial mean blood pressure, hematological indices and ICH. However, there is no evidence for improvement or safety in long term outcomes.
- If new compelling science is available in the coming years, an interim recommendation can be made using the new ILCOR process of continuing review



# Increased Emphasis on Maintaining Normal Temperature in the DR



- 5 different ILCOR systematic reviews regarding importance and methods of temperature stabilization in the DR



# ILCOR Systematic Reviews

## Regarding Temperature Stabilization

- 36 observational studies of increased risk of mortality associated with hypothermia at admission (low-quality evidence but upgraded to moderate-quality evidence due to effect size, dose-effect relationship, and single direction of evidence).
- Hypothermic infants have increased morbidity
  - Hypoglycemia, Respiratory Distress, IVH, Late onset sepsis
- Temperature should be monitored and maintained between 36.5-37.5°C after delivery

# Will Likely Need Combination of Strategies to Provide Warmth

- For all newborns

- Environmental Temperature at least 25°C (77°F)
- Warm Blankets for Drying
- Hats (wool or plastic)



- For newborns requiring resuscitation

- Radiant Warmer
- Warm, humidified gases

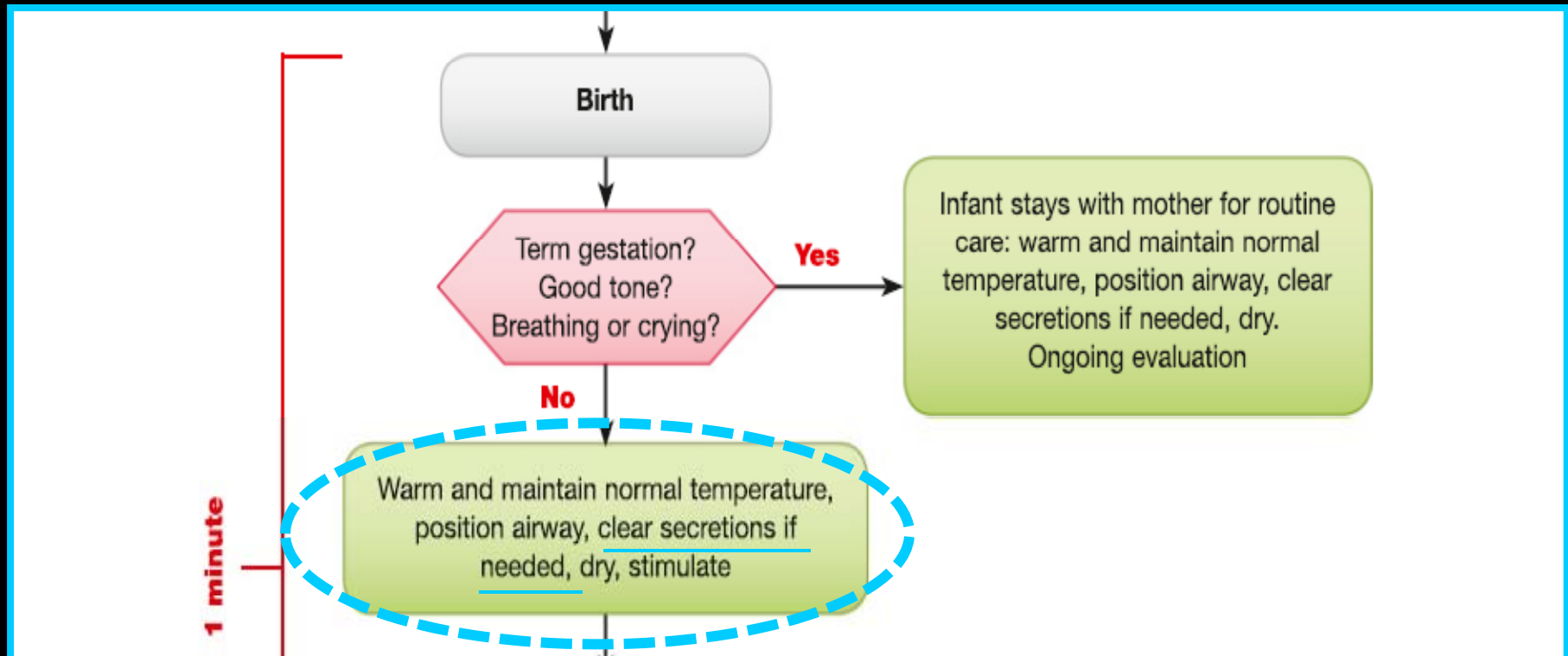


- For Preemies

- Polyethylene Occlusive wrapping
- Heated (NaAcetate) Mattresses



# Initial Steps now the Same Regardless of Amniotic Fluid Status

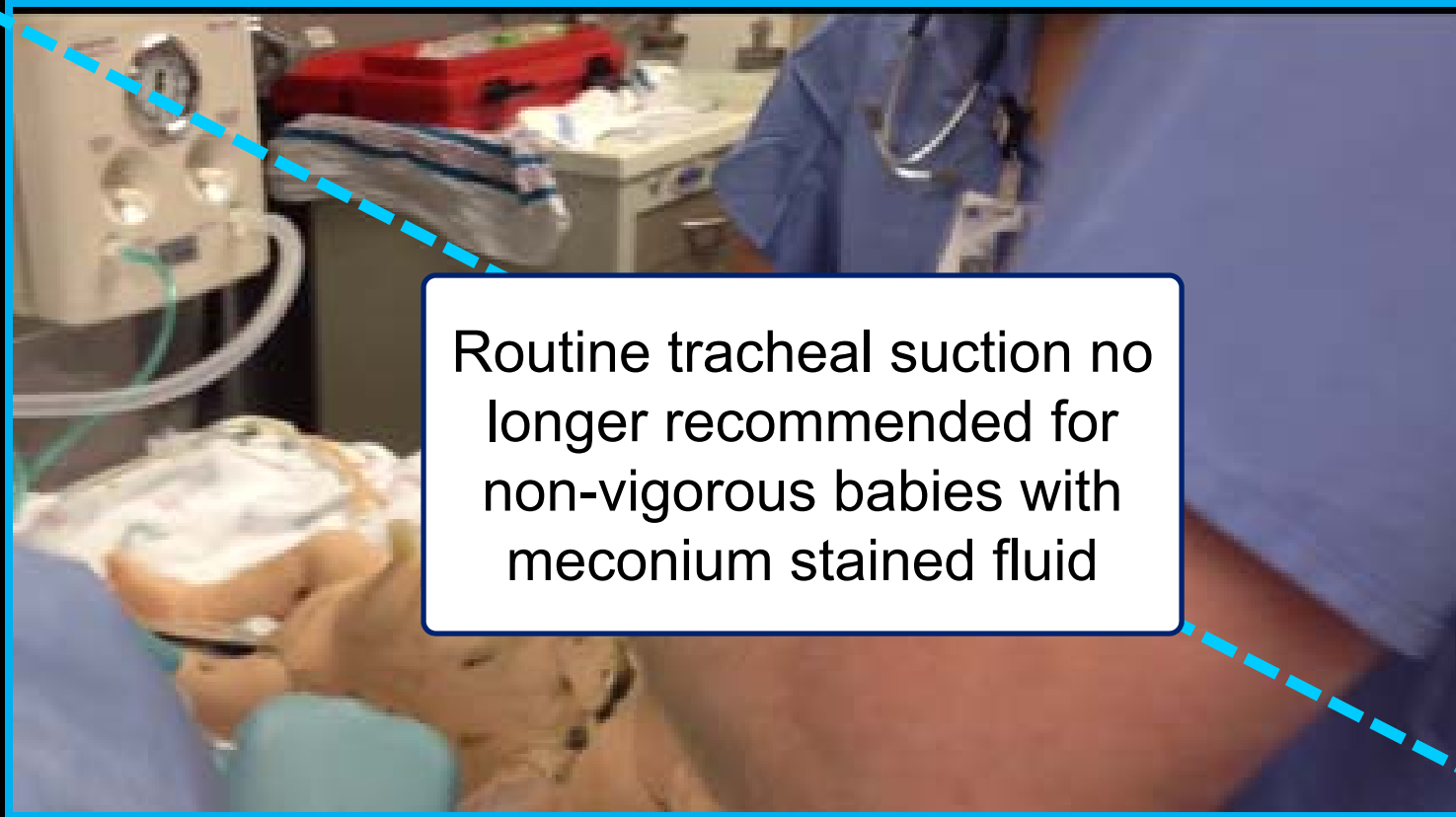


- Clear airway only if needed
  - Apneic
  - Drowning in secretions
  - Airway obstructed despite ventilation corrective steps (MRSOPA)



# 2015: Do We Still Intubate and Suction Every Non-vigorous Meconium Exposed Infant?

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Routine tracheal suction no longer recommended for non-vigorous babies with meconium stained fluid



## Endotracheal Suction for Nonvigorous Neonates Born through Meconium Stained Amniotic Fluid: A Randomized Controlled Trial

Subhash Chettri, MBBS, Bethou Adhisivam, DNB (Ped), and B. Vishnu Bhat, MD, MD

- 122 non-vigorous, meconium stained newborns randomized
  - 61 No Suction, 61 intubated and suctioned
  - 33% MAS in the No Suction Group
  - 31% MAS in the Suction Group
  - No difference in rates of pneumothorax, PPHN, need for mechanical ventilation, survival or 9 month neurodevelopmental exams

# 2015 PAS Abstract: Additional RCT Pending Publication

[4680.1] Role of Endotracheal Suction on the Occurrence of Meconium Aspiration Syndrome (MAS) in Non-Vigorous Meconium Stained Neonates-A Randomized Controlled Trial

*Sushma Nangia et al. New Delhi, India.*

- 175 non-vigorous, meconium stained newborns randomized
- 88 No Suction, 87 intubated and suctioned
- 26% MAS in the No Suction Group
- 32% MAS in the Suction Group
- $p=0.378$

# 2016 PAS Meeting: Additional RCT Pending Publication

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[3130.8] Endotracheal Suctioning for Prevention of Meconium Aspiration Syndrome: A Randomized Controlled Trial (CTRI Registration No. 2015/04/008819)

*Ashok Kumar, Preetam Kumar, Sriparna Basu. Department of Pediatrics, Banaras Hindu University, Varanasi, Uttar Pradesh, India.*

- 132 non-vigorous, meconium stained newborns randomized
- 66 No Suction, 66 intubated and suctioned
- 23 % MAS in the No Suction Group
- 32% MAS in the Suction Group
- p=NS (RR 1.400; 95% CI, 0.793 – 2.470)

# 2015: Meconium Management

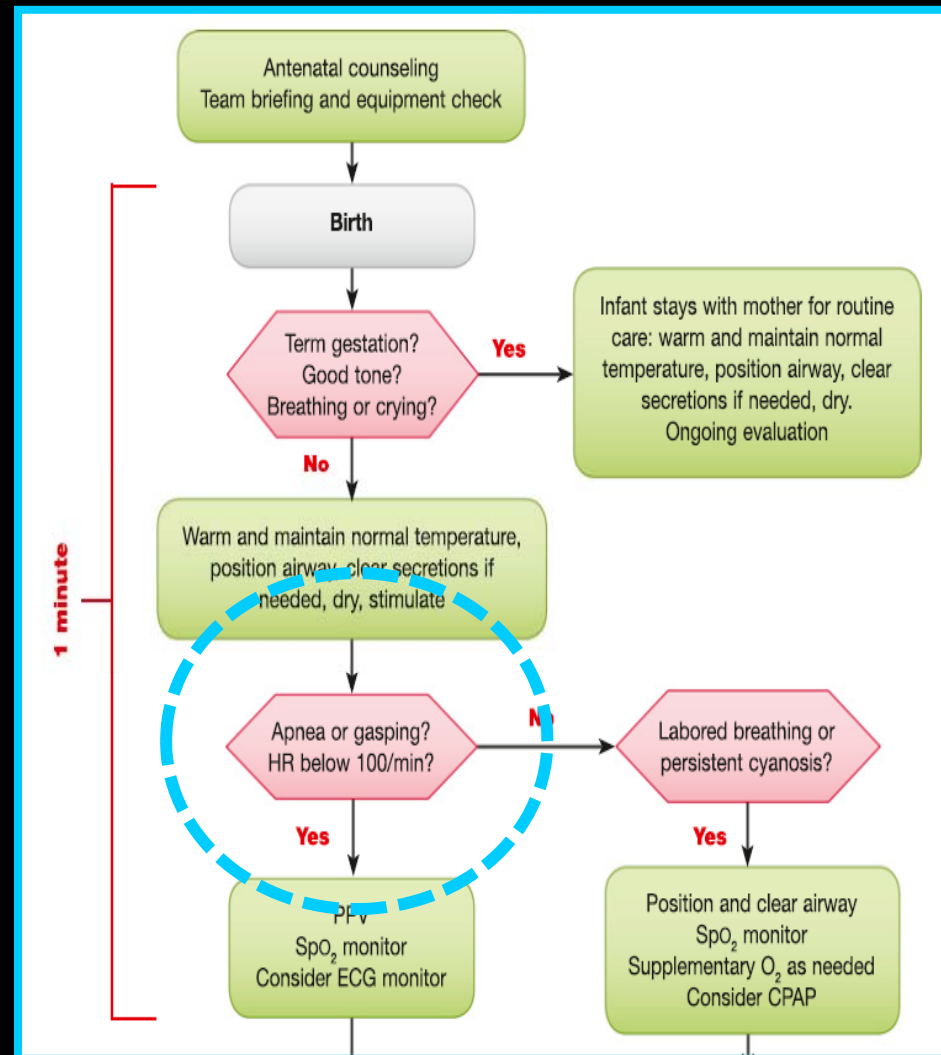
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- Still need a provider with PPV and intubation skills present at birth of infants born through meconium stained fluid
- Much higher need for effective PPV
- Will still need to practice the skill of intubation and suction for the rare case of airway obstruction



# 2015 Neonatal Resuscitation Guidelines: Assessment Questions Remain the Same



# 2015: Heart Rate Remains the Most Important Indicator of Successful Resuscitation

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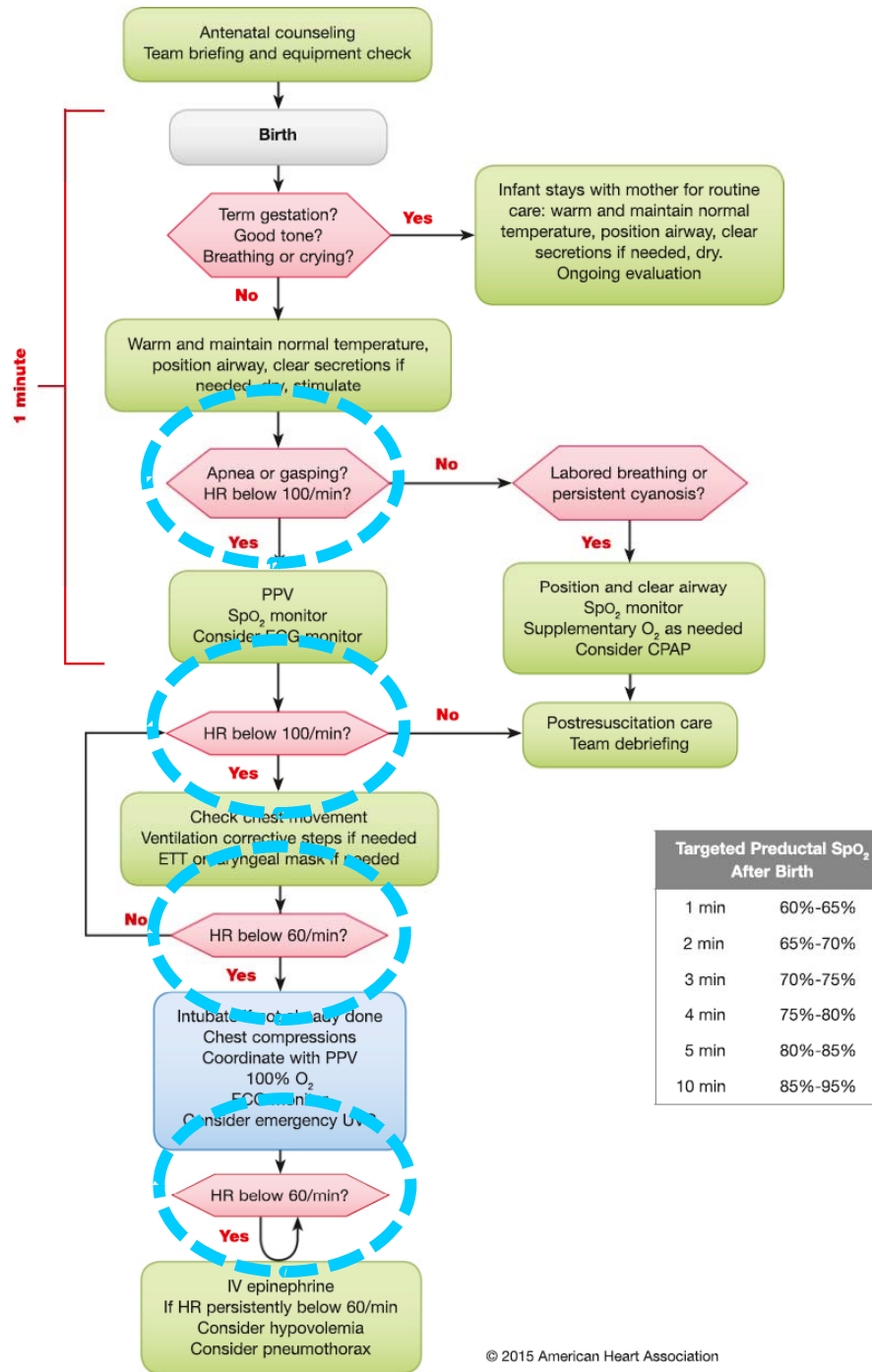
- Cardiac Output = Stroke Volume X Heart Rate
- Stroke Volume Does not Change Significantly in the Newborn
- Therefore, Heart rate determines the output to the lungs
  
- Initial Heart Rate assessed by auscultation
  - Palpation of the umbilical cord is less reliable and less accurate





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# 2015 Neonatal Resuscitation Algorithm



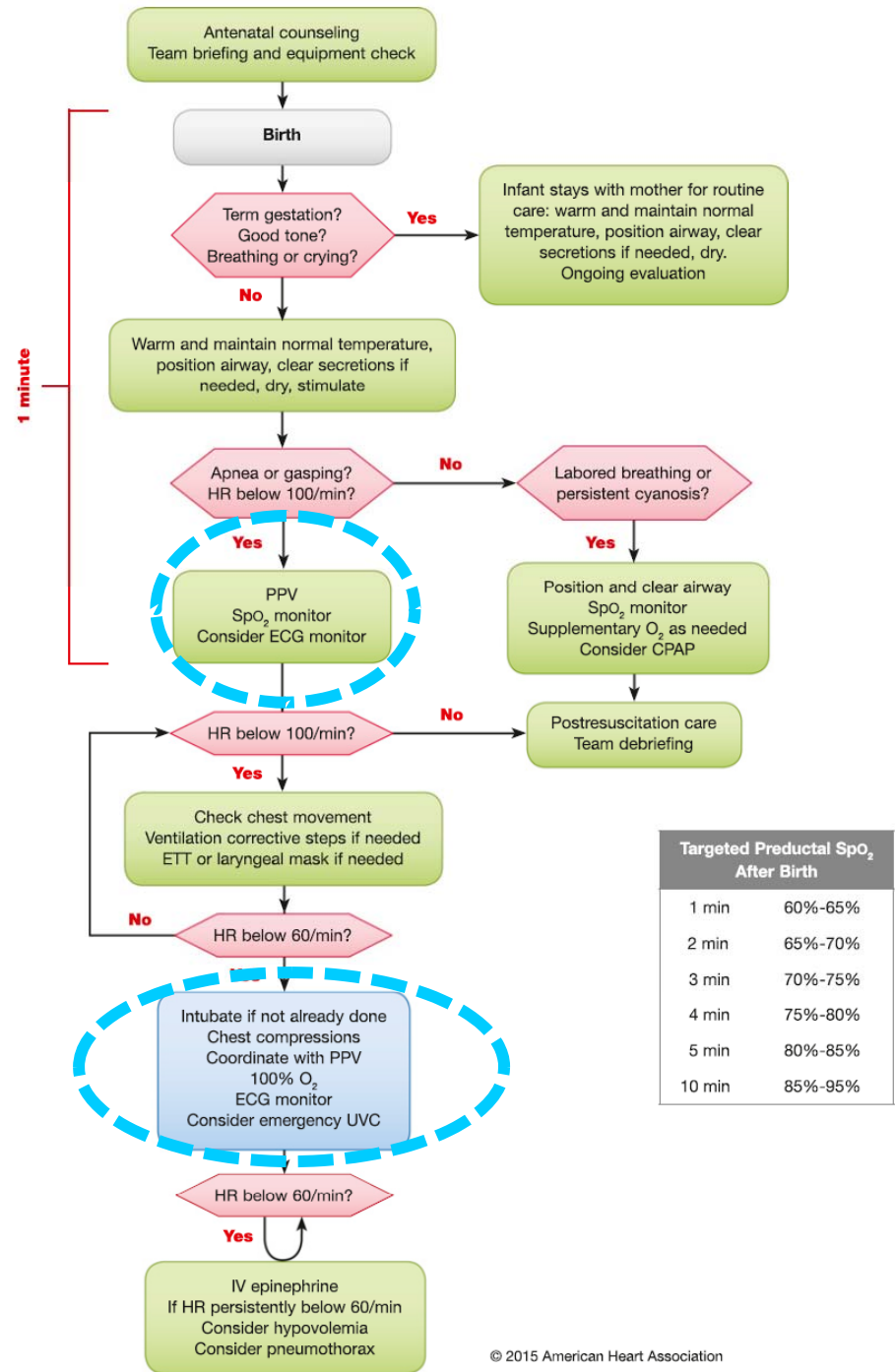
Targeted Productal SpO <sub>2</sub> After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%



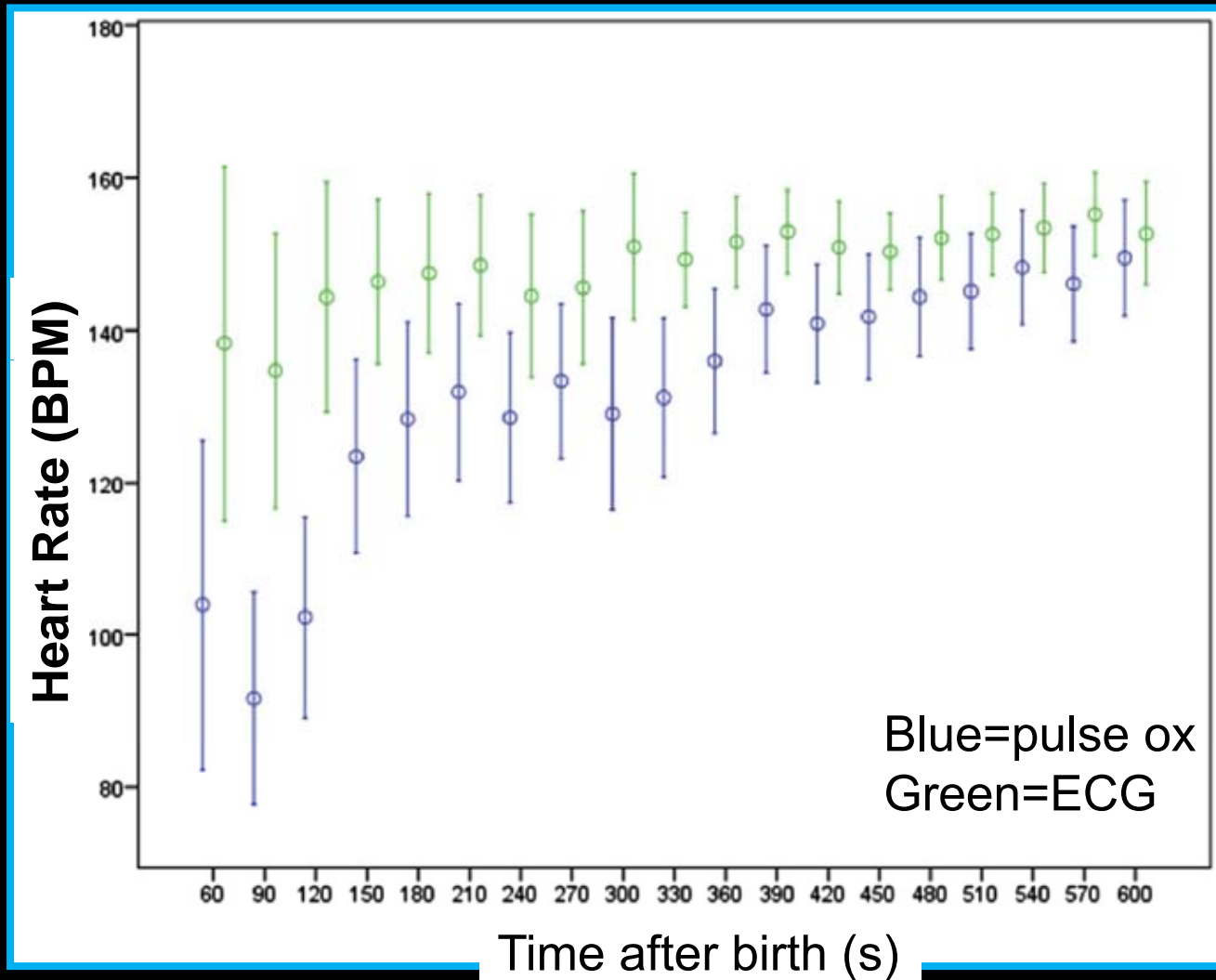


## 2015 Neonatal Resuscitation Algorithm

- Initial HR assessed by auscultation
  - PPV begins, consider **ECG monitor**
  - When/if chest compressions begin, **ECG is preferred** method of determining HR



## Pulse Oximetry Measures a Lower Heart Rate at Birth Compared with Electrocardiography J Pediatr 166(1): 49-53.



- **Unnecessary** Interventions may be initiated if relying solely on Pulse Oximetry for Heart Rate in the delivery room

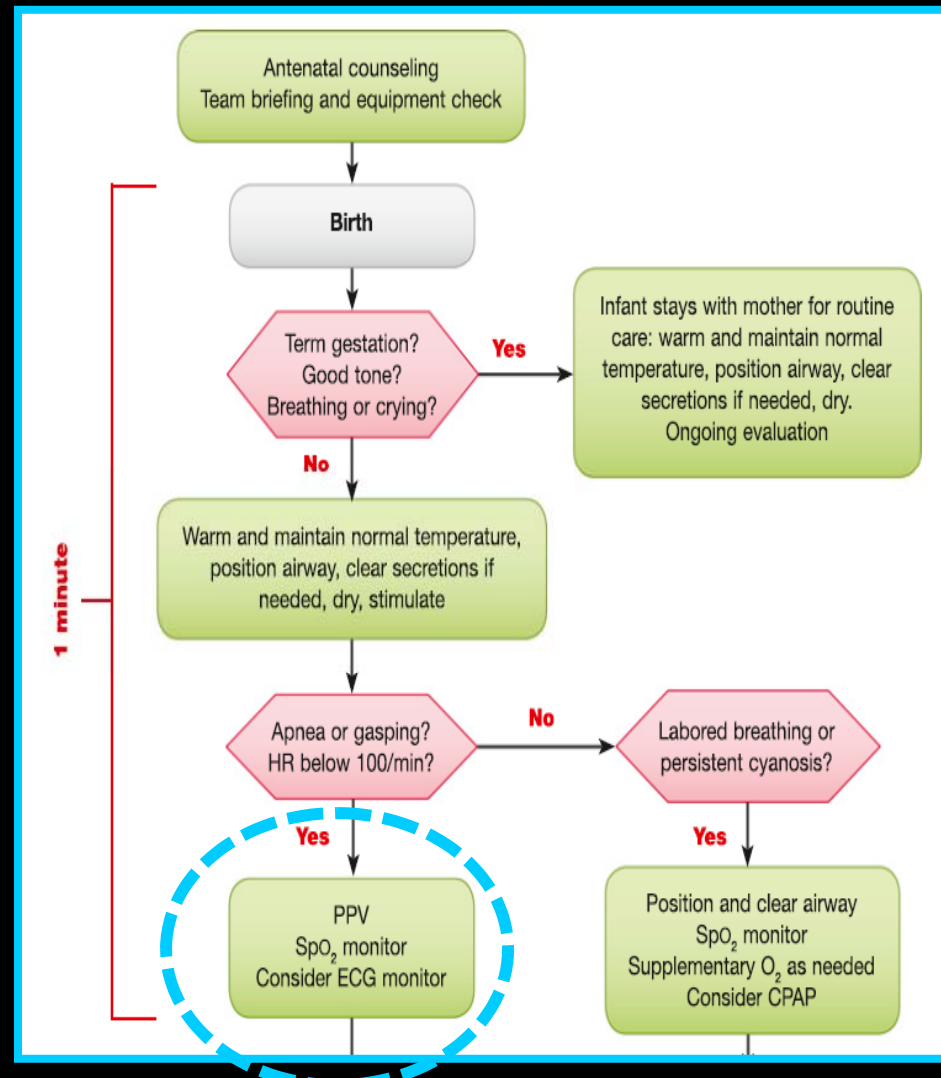


## Strategies for Accessing ECG in the Delivery Room

- Have a portable ECG on a cart or pole that can be pulled into the room
- Utilize the ECG on the maternal crash cart that is already present on L&D
- Obtain/place monitor next to Radiant Warmer for each LDR and OR (\$\$) but can be done with new construction
- New technologies for rapid acquisition of ECG are under development



# 2015 Neonatal Resuscitation Guidelines: Assessment Questions Remain the Same





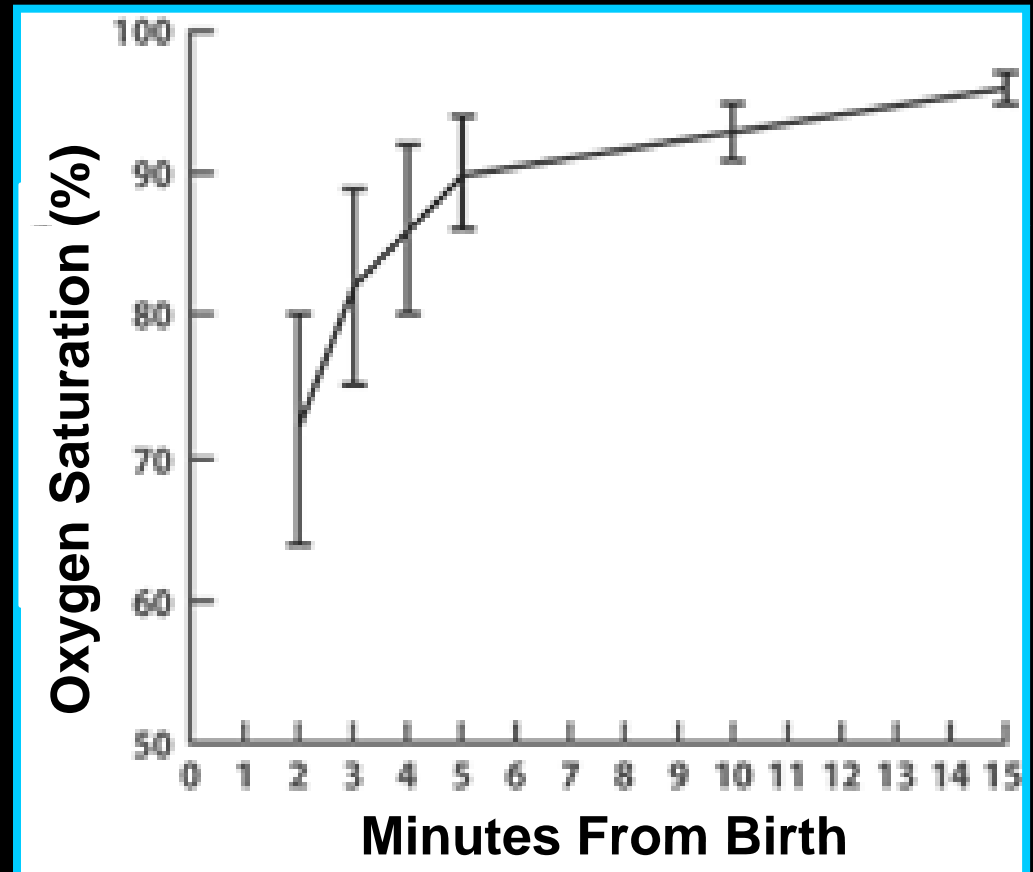
## 2015: No Changes for Pulse Oximetry in the Delivery Room

- Every delivery area must have an oximeter readily available
- Use an oximeter
  - Whenever resuscitation is anticipated
  - When positive pressure ventilation is administered for more than a few breaths
  - When cyanosis is persistent
  - When supplemental oxygen is administered
  - All infants  $\leq 32$  wks OB EGA

# 2015: Initial Oxygen Concentration for Positive Pressure Ventilation

- Initial FiO<sub>2</sub> for PPV
  - ≥ 35 weeks' GA = **21%**
  - < 35 weeks' GA = **21-30%**

Targeted Preductal SpO <sub>2</sub> After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%



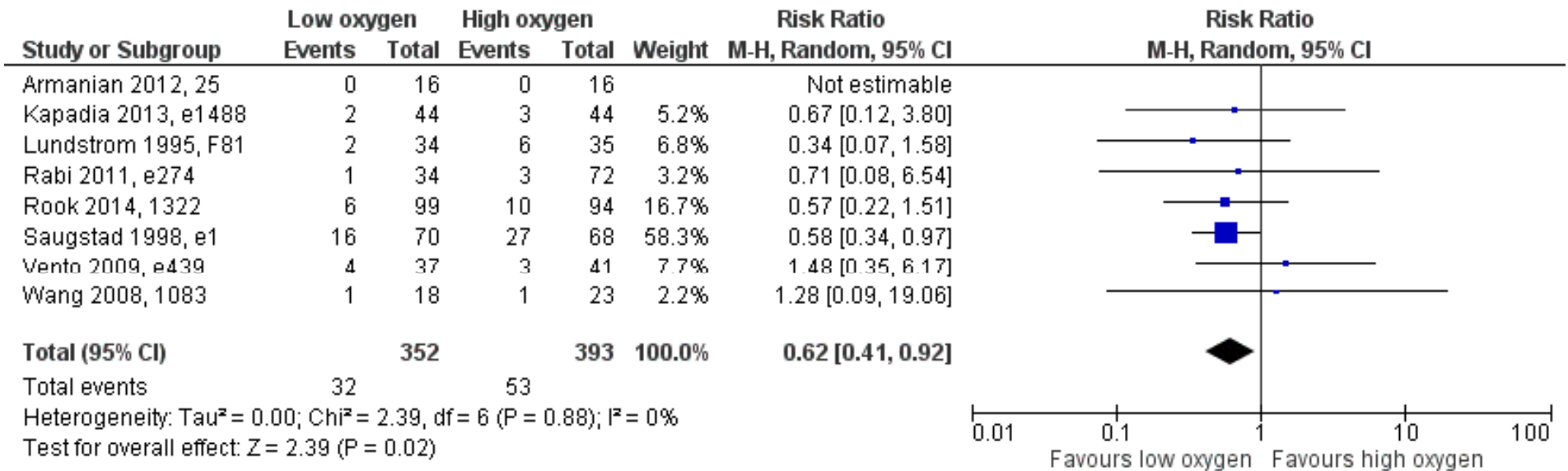


# What Oxygen Concentration Should We Start PPV with for ELGAN Infant?

- **P**: Among preterm newborns (< 37 wk GA) who receive **PPV** in the delivery room, does
- **I**: low initial oxygen (21-30%)
- **C**: high initial high oxygen (50-100%)
- **O**: decrease mortality, BPD, ROP, intraventricular hemorrhage, neurologic deficit, time to HR > 100 bpm
  
- Final AHA search strategy → 1752 citations, 46 potentially relevant studies → **9 Studies included** → **8 RCTs, 1 Cohort**



# Mortality before discharge: *All RCT and quasi-RCT*



**2015 Treatment Recommendation:** Among preterm newborns, we recommend that resuscitation be initiated with low oxygen (21-30%) and titrated to reach the saturation target.

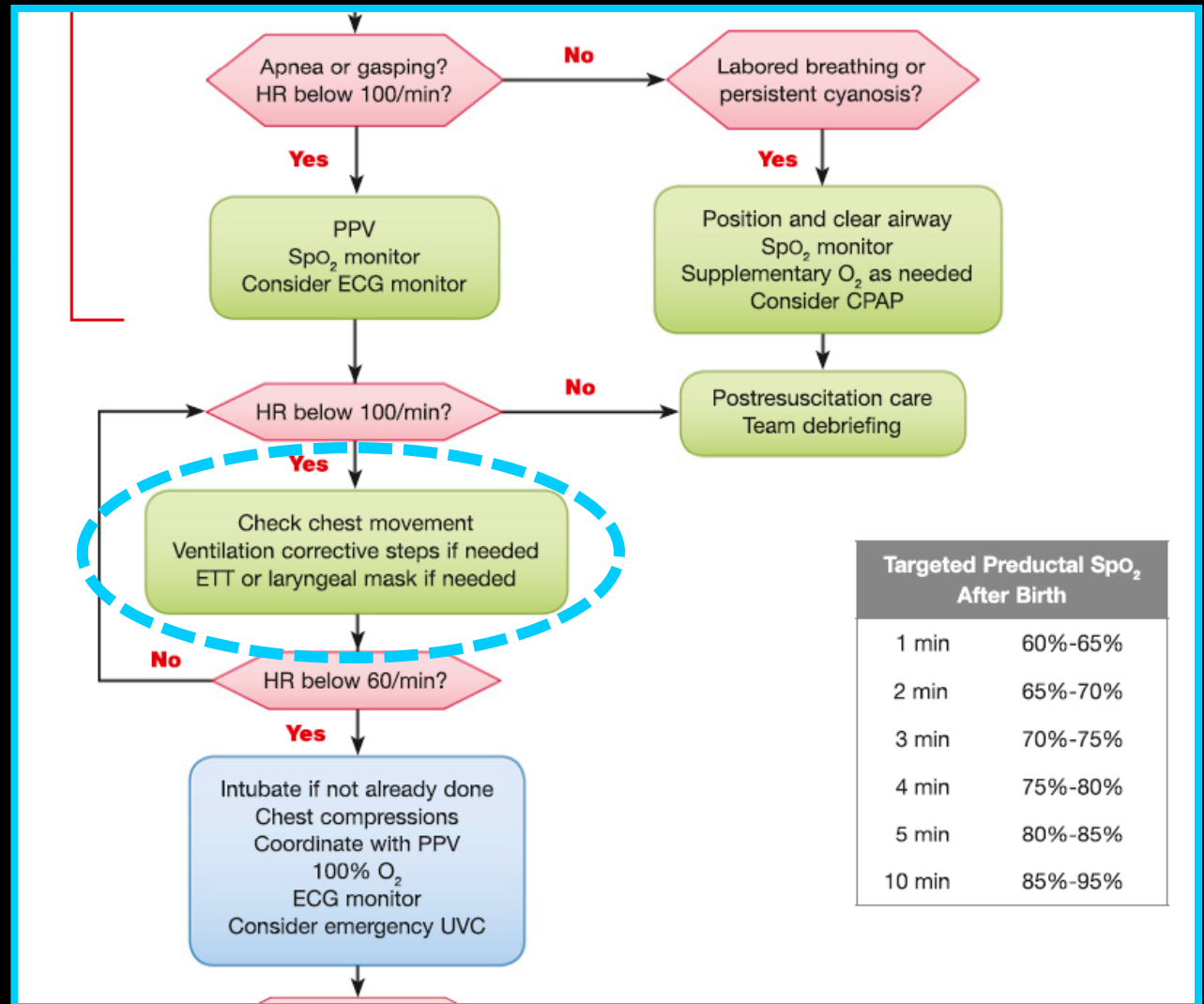




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# Focus Intently on Achieving Effective Ventilation

- Mask
- Reposition
- Suction
- Open the Mouth
- Increase Pressure
- Advanced Airway



Targeted Productal SpO <sub>2</sub> After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

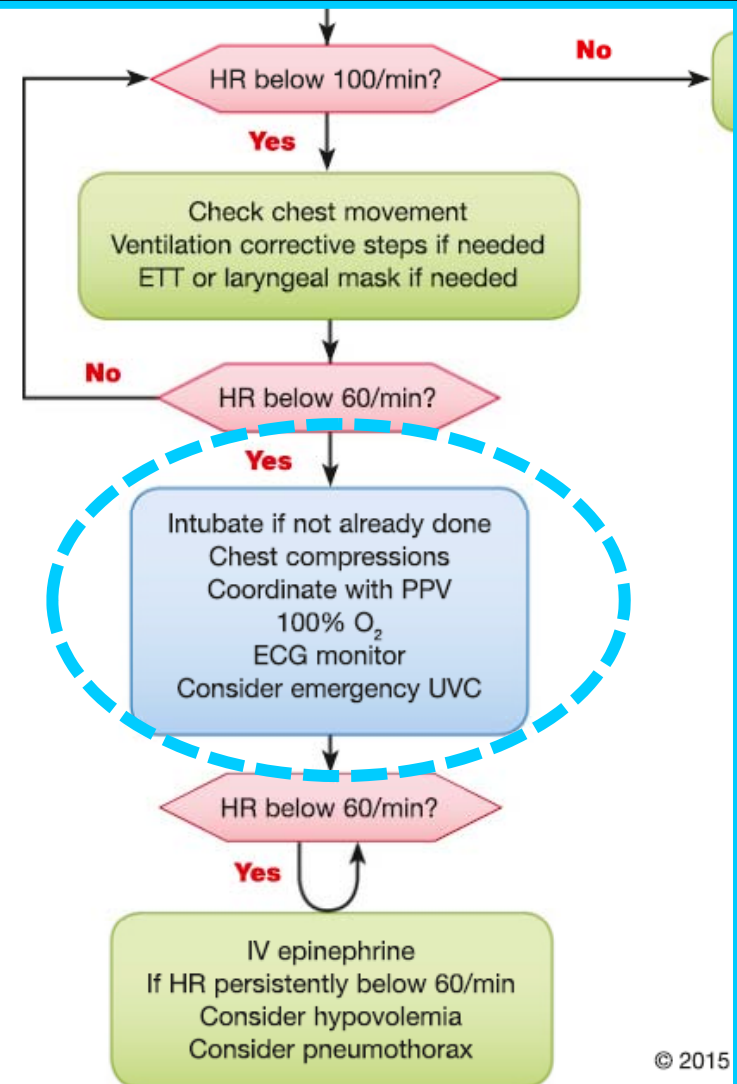
# Intubation STRONGLY Recommended Prior to Compressions



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# What else stays the same?

- No change in cardiac compression recommendations
  - Two Thumb technique



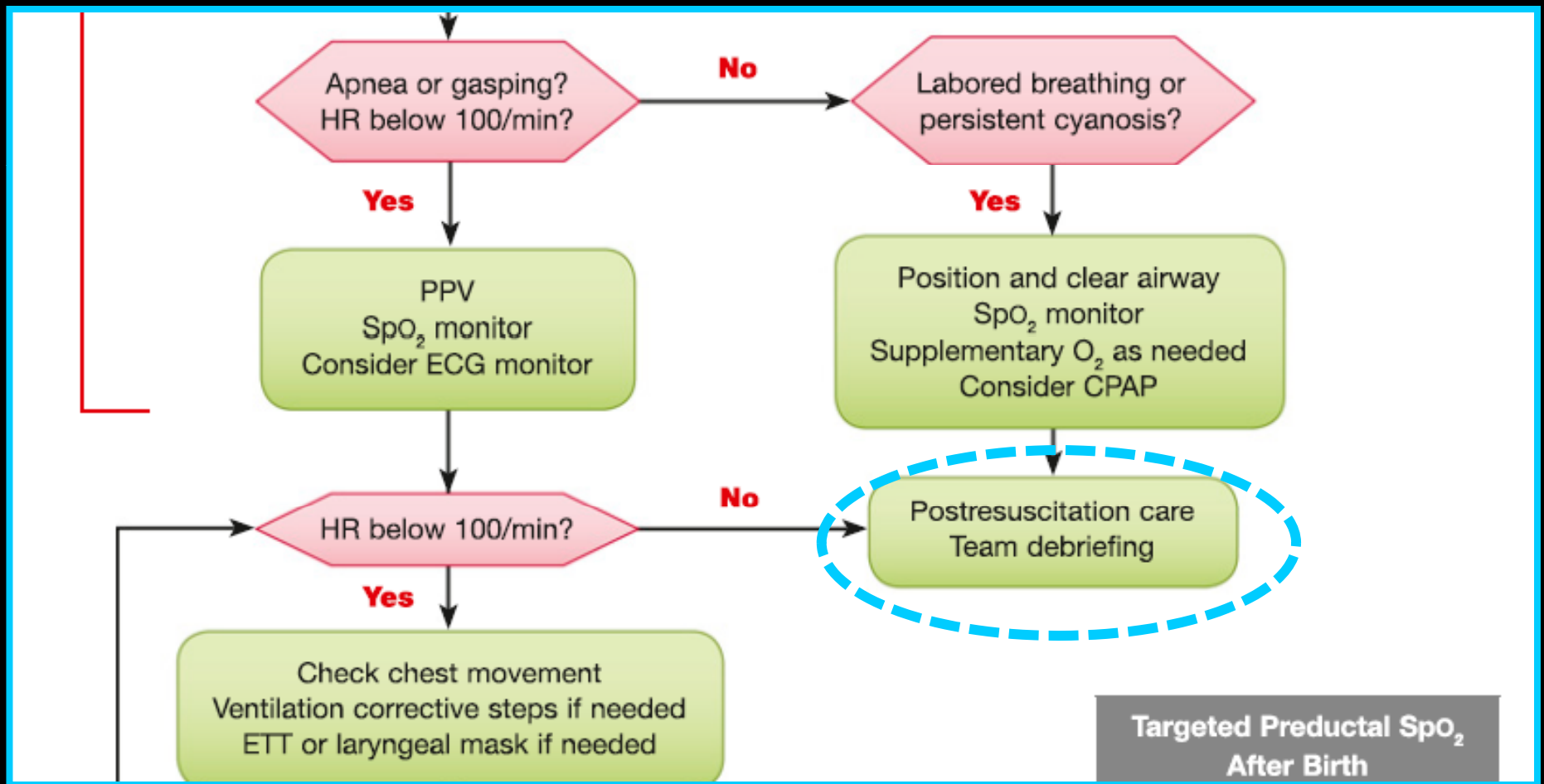
- No change in drug (Epinephrine or Volume) recommendations
  - IV preferred Epi route





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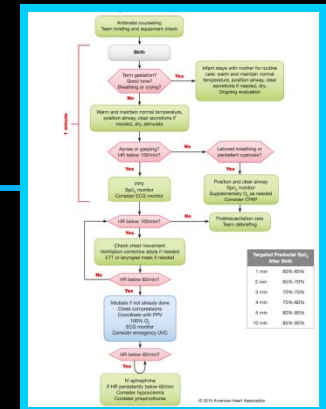
# Team Debriefing and Reflection are Key to Improving Performance





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# Veni, Venti, Vici



- For 2015 Neonatal Resuscitation Guidelines, another thing that has **NOT** changed is...

- “Ventilation of the lungs is the single most important and most effective step in resuscitation of the compromised newborn.”



# Acknowledgments

- Thanks to the AAP for several of the drawings and photos used for illustration

(ILCOR CoSTR)

[http://circ.ahajournals.org/content/132/16\\_suppl\\_1/S204.full.pdf+html](http://circ.ahajournals.org/content/132/16_suppl_1/S204.full.pdf+html)

(USA Guidelines)

[http://pediatrics.aappublications.org/content/136/Supplement\\_2/S196](http://pediatrics.aappublications.org/content/136/Supplement_2/S196)