THE GOLDEN MINUTE AFTER BIRTH

~THE ROLE OF OBSTETRICIANS

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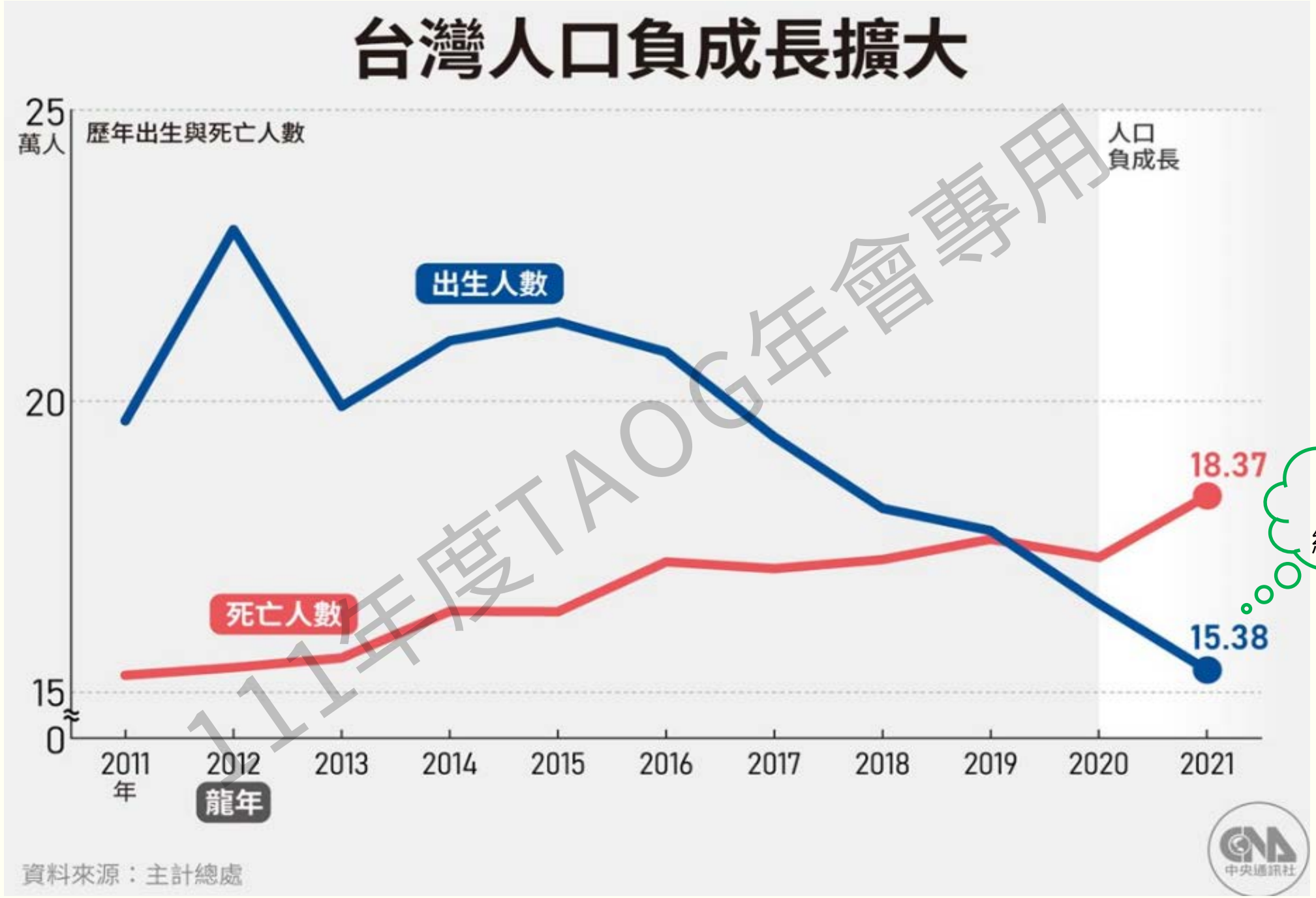
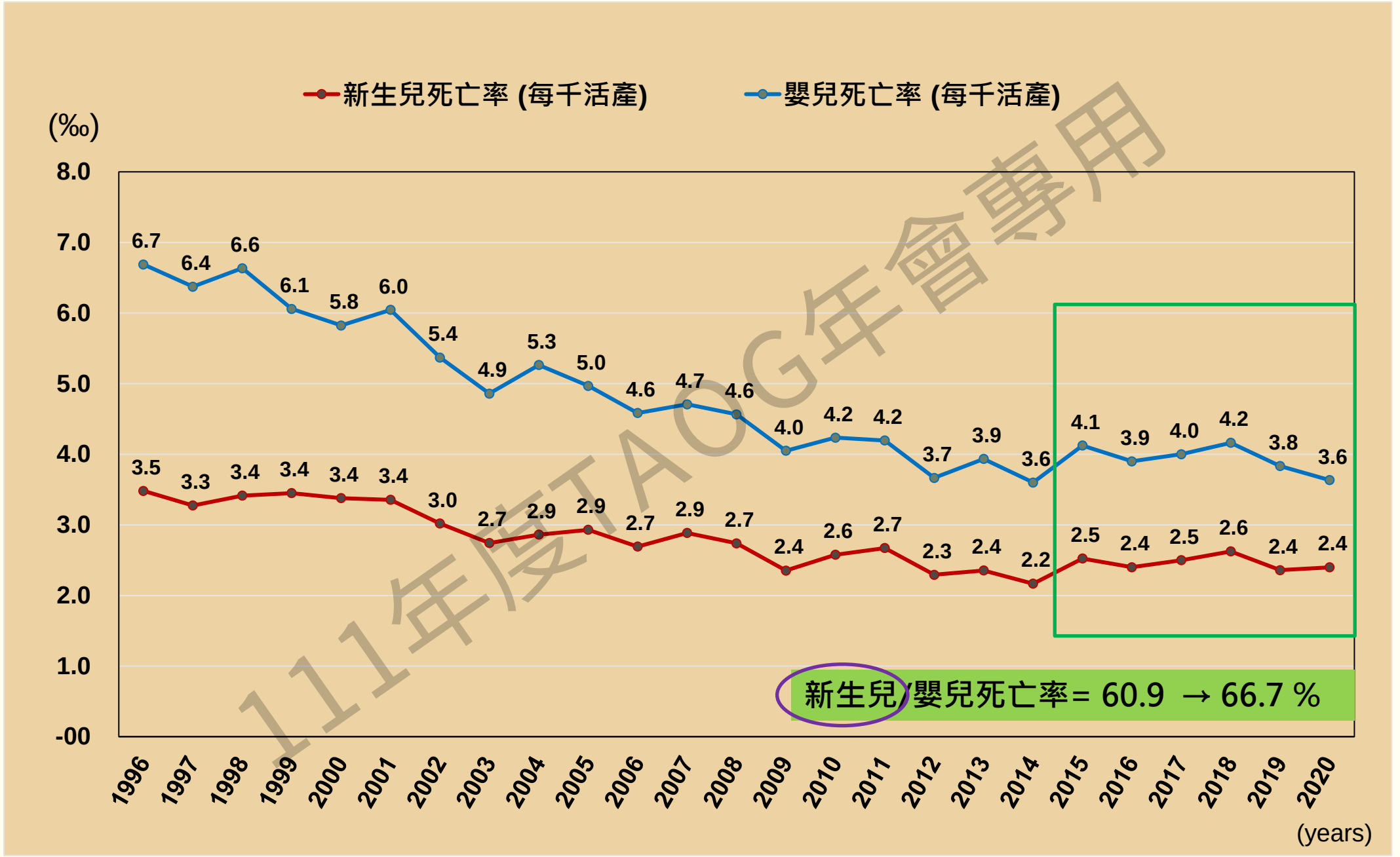




國民健康署

Introduction

- Worldwide each year, an estimated 814,000 neonatal deaths are related to intrapartum hypoxic events (“birth asphyxia”) in full-term infants. Of those that survive, many are left with neurological impairments.

(BMC Public Health2011)

- **Perinatal asphyxia** and **extreme prematurity** are two pregnancy complications that can necessitate complex resuscitation; however, only **60%** of asphyxiated newborns can be predicted antepartum. The remaining newborns are critical to prepared.

(Neonatal resuscitation,2015)

Introduction

- "Golden Hour" of neonatal life is defined as the first hour of post-natal life in both preterm and term neonates and mentioned by Reynolds et al in 2009. This concept in neonatology has been adopted from adult trauma where the initial first hour of trauma management is considered as golden hour. It was decrease in patient mortality with better trans-port and patient outcome and has an important effect on both immediate and long-term outcomes of all neonates.

(NN 2009)

- This critical time period was then called "the golden minutes" by Vento et al. in 2009. The following year, the International Liaison Committee on Resuscitation (ILCOR) emphasized the importance of the first minute of life using the term the Golden Minute. *(J Perinat Med 2019)*

- Generally, **a baby is born when the whole body is out, and that is when the clock is started, and the Golden Minute begins**.

Introduction

- Delivery room is the beginning place of handling of the newborn and covers all procedures carried out on the newborn immediately following birth, including heart rate assessment, suctioning, ventilation/sustained inflation, provision of positive end-expiratory pressure (PEEP), cord clamping, oxygen supplementation and heat loss prevention.

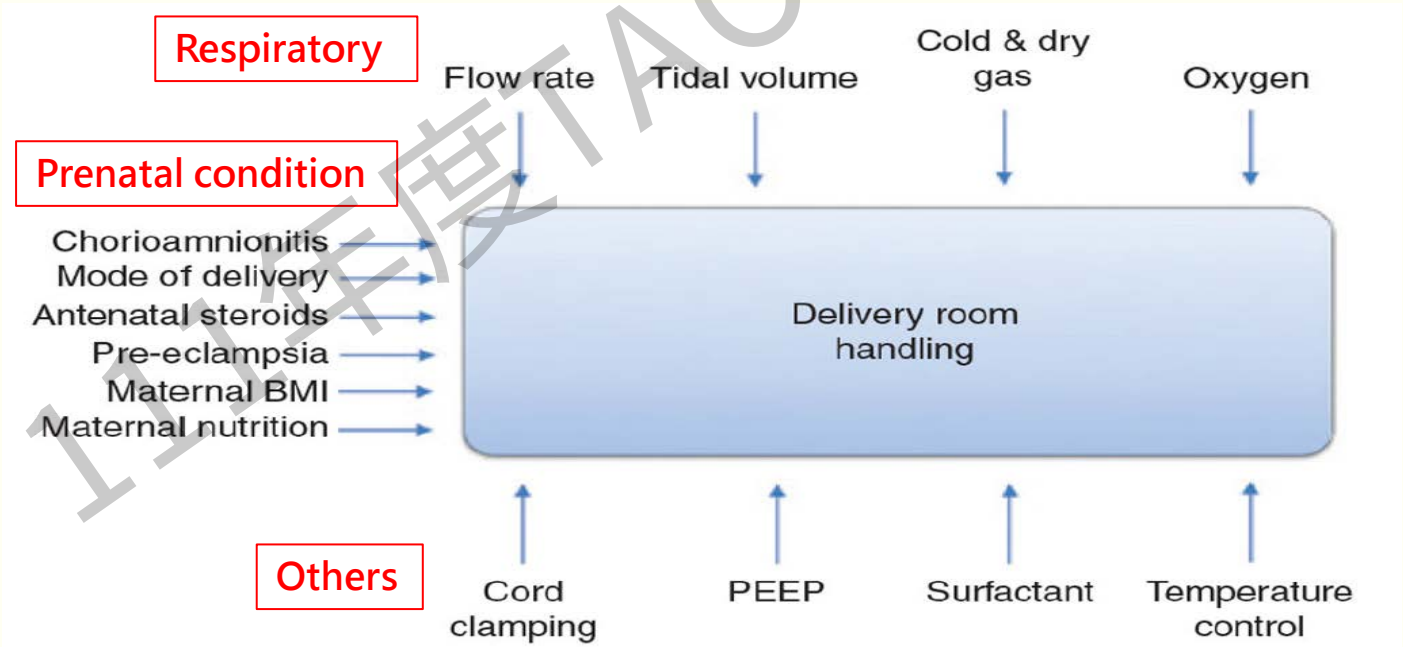


Figure 1:
Factors influencing the Golden Minute(s) and outcome of delivery room handling.

(J Perinat Med 2019)

Introduction

- An important goal is to optimize the health of the mother by ensuring a **good nutritional status**, **preventing teenage pregnancy** (1.33%, Taiwan 2021) and giving **adequate antenatal care**. (including education, maternal BMI, and antenatal steroid ...)

  (J Health Popul Nutr 2012)

- Further, it is known that a general cesarean section rate between 10–15%, therefore, may be the optimal for neonatal outcome and avoids elective cesarean delivery before **39 weeks of gestation**.

  (Am J Obstet Gynecol 2010)

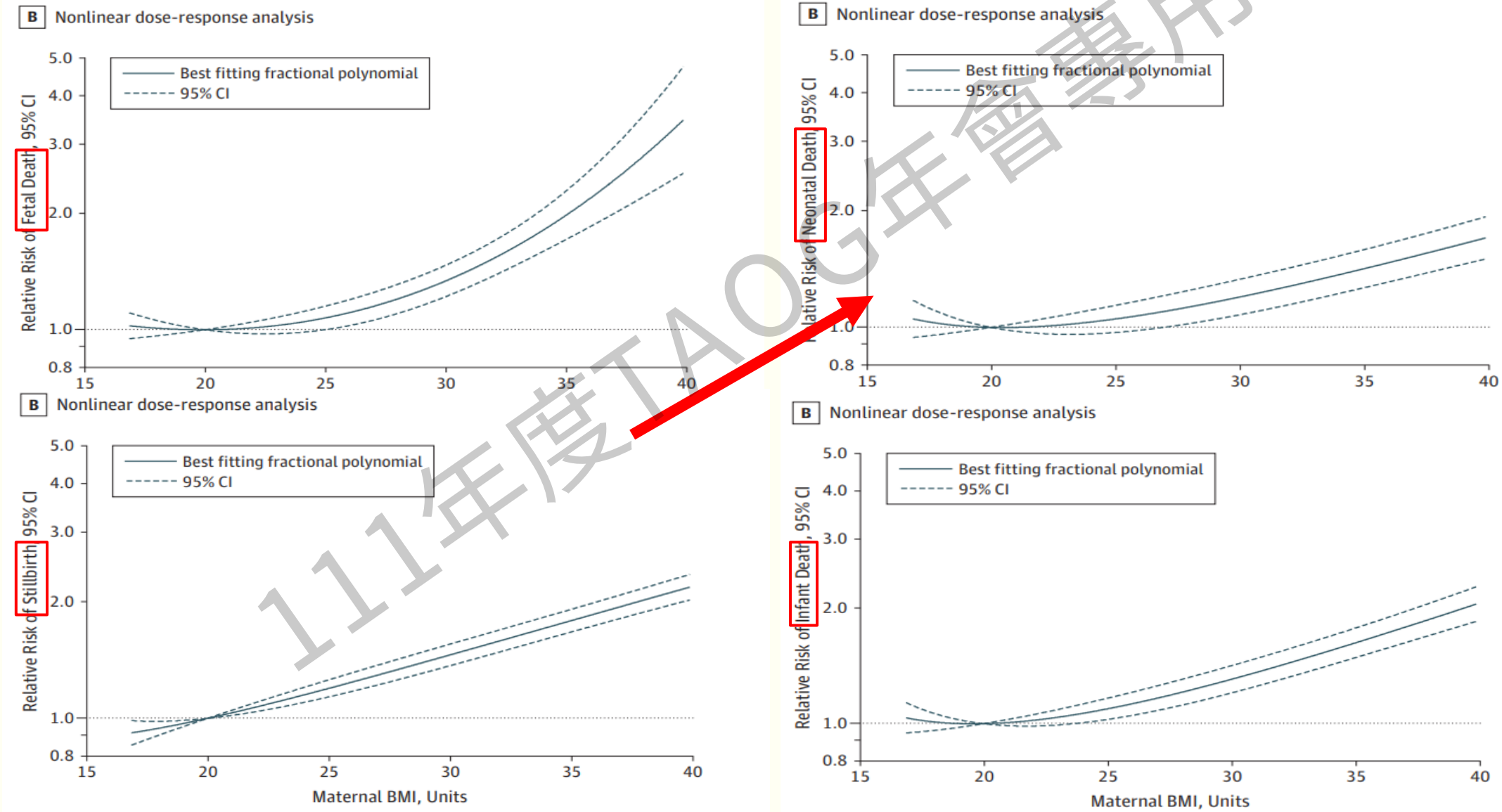
- Of the approximately 130 million annual births world-wide, **5–10%** need some intervention immediately after birth to initiate breathing and **30%** of intrapartum stillbirths could be saved by adequate resuscitation.

  (N Engl J Med 2010)

- The importance of the "golden minute" is emphasized , implying that the newborn should have highest priority during the first minute after birth and it also should be **evidence based**.

  (Neonatology 2009)

Maternal Body Mass Index and the Risk of Fetal Death, Stillbirth, and Infant Death



(JAMA 2014)

Delivery Room Tasks during the First Minute of Life

- The most recent International Liaison Committee on Resuscitation (ILCOR) guidelines for newborn resuscitation specify the first 60 s as an important period, **especially less than 28 weeks of gestation**.
- According to ILCOR, **85%** of babies born at term initiate spontaneous respirations within 10–30 s, **10%** respond to drying and stimulation, **3%** initiate respirations after positive pressure ventilation, **2%** will be intubated to support respiratory function, and only **0.1%** will require chest compressions and/or epinephrine .

(Circulation 2015)

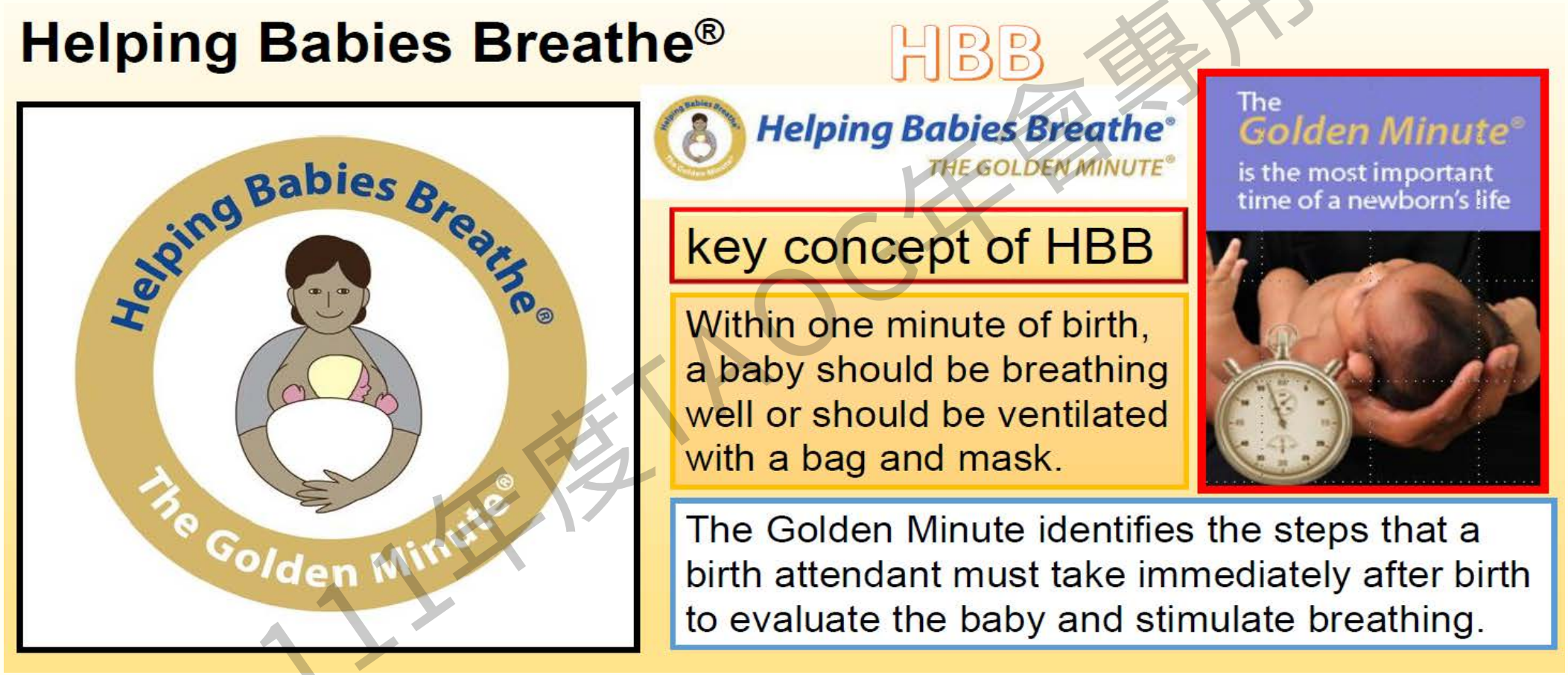
Table 1. Procedures to be performed during the first minute of life in newborns (gestation of 27–36 weeks) in need of stabilization at birth

Procedure	Time after birth, s
Placement in polyethylene bags (<28 weeks)	61 (40–79)
Heart rate auscultation or cord palpation	62 (49–91)
Respiratory support	70 (46–125)
Use of pulse oximeter	78 (64–95)
Heart rate monitoring	
CPAP	
IPPV	
Intubation	
Use of surfactant	
Chest compressions	
Adrenaline administration	

Data are presented as medians (with interquartile ranges), showing the time after birth (in seconds) when some of these pro-cedures were successfully achieved (data from McCarthy et al. Intravenous access is occasionally needed and a pneumotho-rax should be evacuated. Suctioning should not be carried out rou-tinely; however it may be needed in special cases. CPAP = Conti-nuous positive airway pressure; IPPV = intermittent positive pres-sure ventilation.

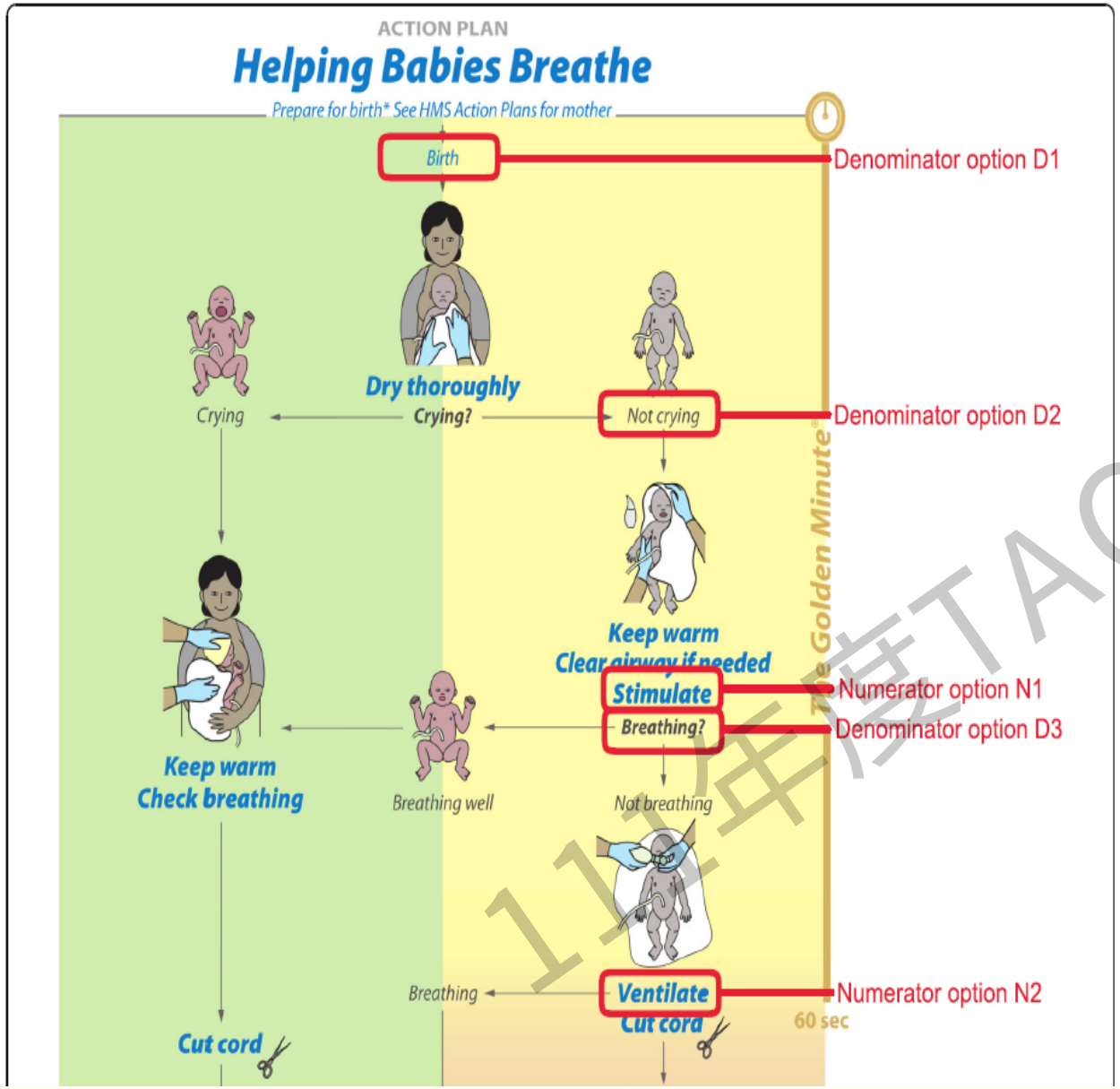
(Neonatology 2015)

Helping babies Breath (HBB)



Since the launch of HBB in 2010 by the American Academy of Pediatrics (AAP). It is a simulation-based neonatal resuscitation program for low resource settings.

→ ↓ Neonatal mortality ~50%
↓ Stillbirth ~25%



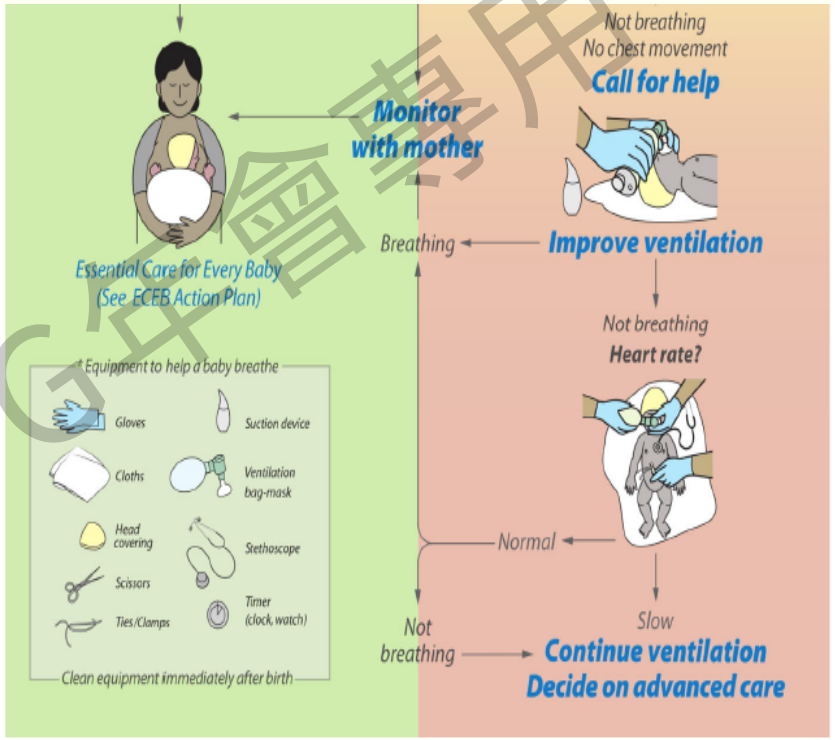
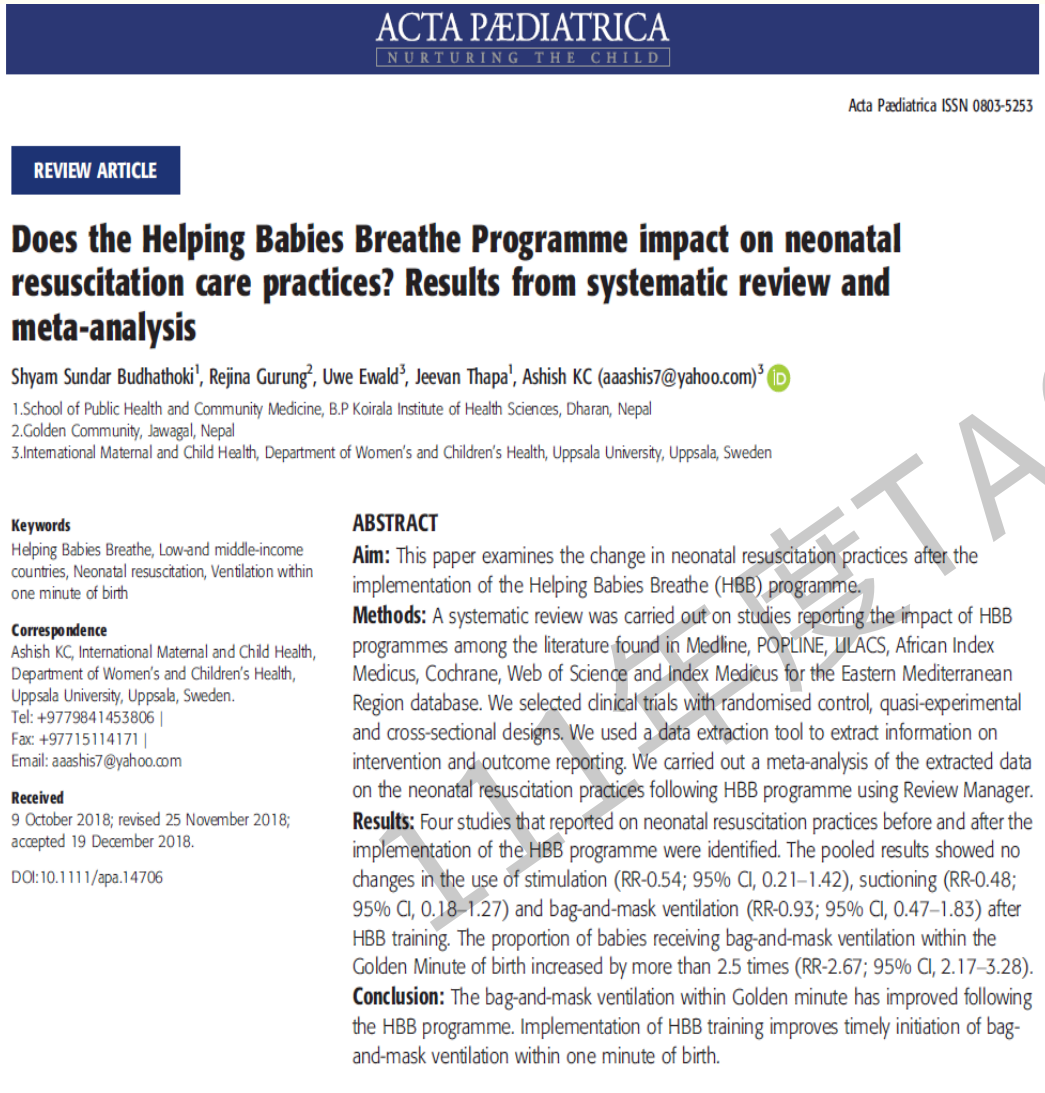


Fig. 1 Helping Babies Breathe algorithm decision points to measure neonatal resuscitation coverage

(BMC Pregnancy and Childbirth 2020)

Helping Babies Breath Program impact on neonatal resuscitation care practices



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REVIEW ARTICLE

Does the Helping Babies Breathe Programme impact on neonatal resuscitation care practices? Results from systematic review and meta-analysis

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Keywords
Helping Babies Breathe, Low-and middle-income countries, Neonatal resuscitation, Ventilation within one minute of birth

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ABSTRACT

Aim: This paper examines the change in neonatal resuscitation practices after the implementation of the Helping Babies Breathe (HBB) programme.

Methods: A systematic review was carried out on studies reporting the impact of HBB programmes among the literature found in Medline, POPLINE, LILACS, African Index Medicus, Cochrane, Web of Science and Index Medicus for the Eastern Mediterranean Region database. We selected clinical trials with randomised control, quasi-experimental and cross-sectional designs. We used a data extraction tool to extract information on intervention and outcome reporting. We carried out a meta-analysis of the extracted data on the neonatal resuscitation practices following HBB programme using Review Manager.

Results: Four studies that reported on neonatal resuscitation practices before and after the implementation of the HBB programme were identified. The pooled results showed no changes in the use of stimulation (RR-0.54; 95% CI, 0.21–1.42), suctioning (RR-0.48; 95% CI, 0.18–1.27) and bag-and-mask ventilation (RR-0.93; 95% CI, 0.47–1.83) after HBB training. The proportion of babies receiving bag-and-mask ventilation within the Golden Minute of birth increased by more than 2.5 times (RR-2.67; 95% CI, 2.17–3.28).

Conclusion: The bag-and-mask ventilation within Golden minute has improved following the HBB programme. Implementation of HBB training improves timely initiation of bag-and-mask ventilation within one minute of birth.

- Results: The pooled results showed **no statistical difference** in the use of *stimulation* (RR-0.54; 95% CI, 0.21–1.42), *suctioning* (RR-0.48; 95% CI, 0.18–1.27) and *bag-and-mask ventilation* (RR-0.93; 95% CI, 0.47–1.83) after HBB training. The proportion of babies **receiving bag-and-mask ventilation within the Golden Minute of birth** increased by more than 2.5 times (RR-2.67; 95% CI, 2.17–3.28).

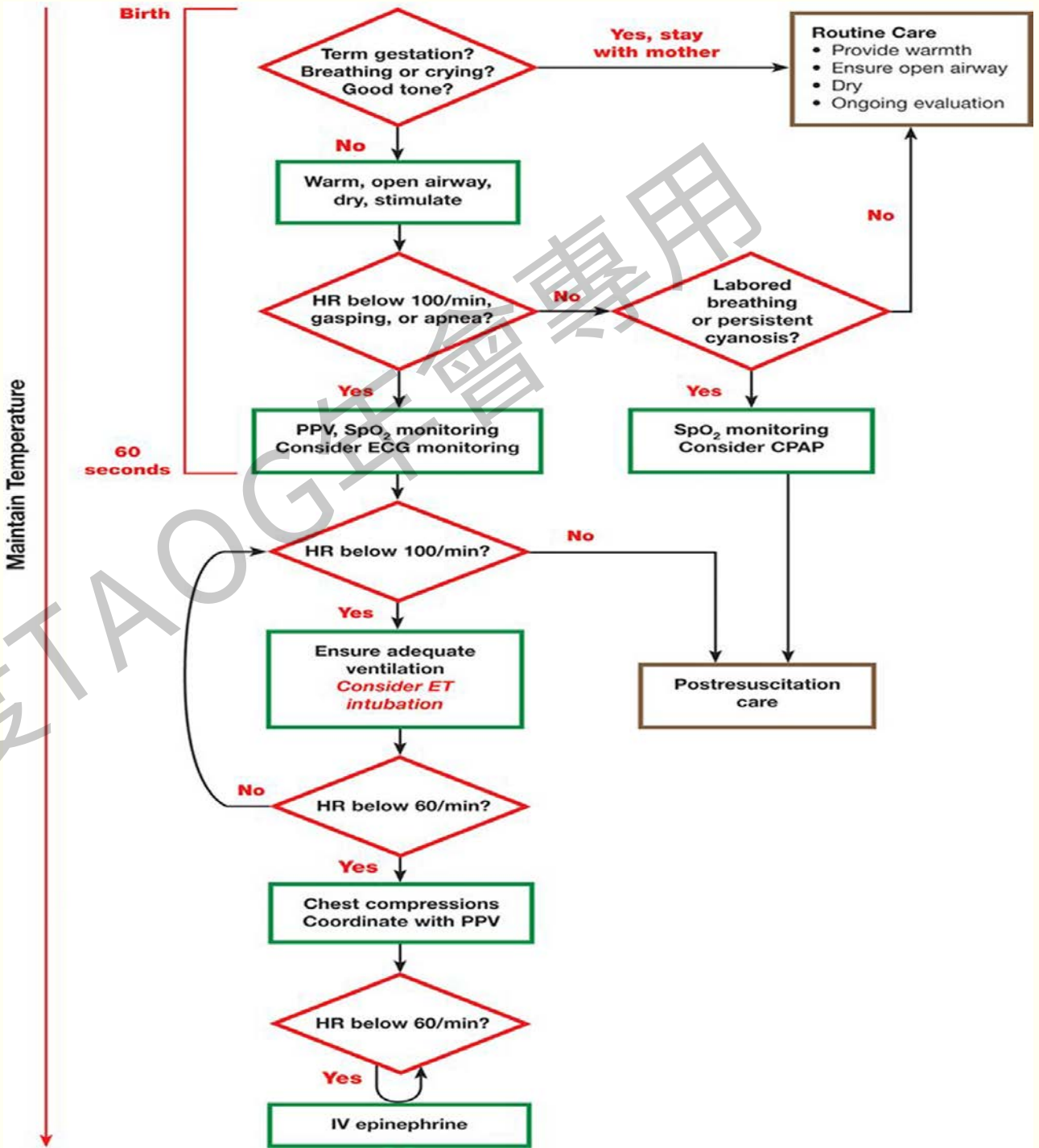
- Conclusion: The bag-and-mask ventilation within Golden minute has improved following the HBB program. Implementation of HBB training improves timely initiation of bag-and-mask ventilation within one minute of birth.

(Acta Pædiatrica, 2019)

Neonatal Life Support:

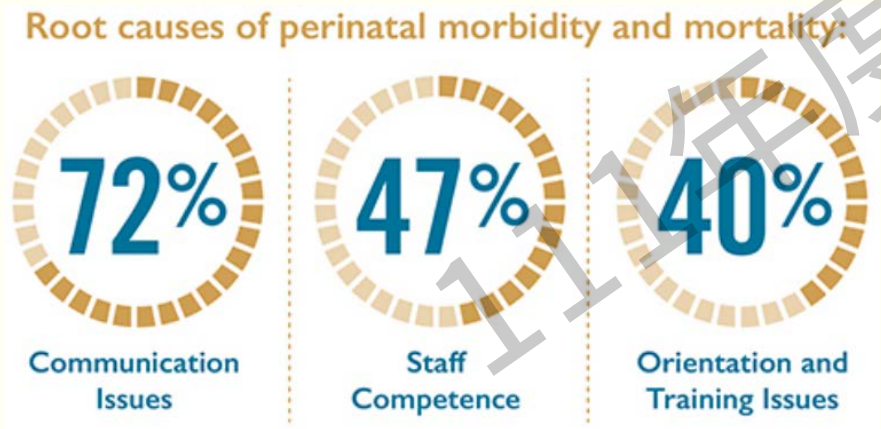
2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations

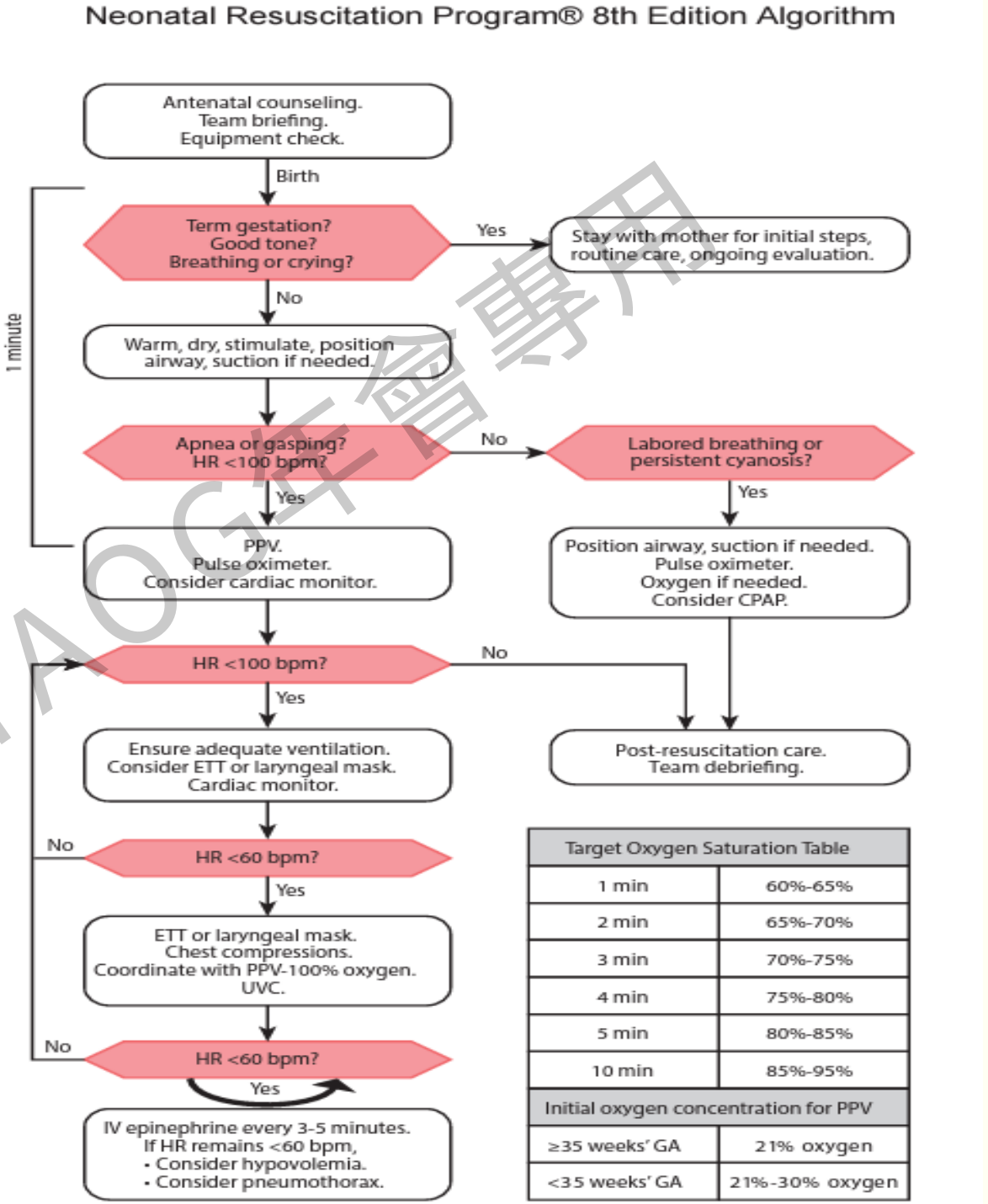
*The following should be achieved within 30 s: drying, warming, wrapping in plastic (<28 weeks of gestation), positioning the airways correctly, stimulating to breathe if needed, and auscultating the heart rate and breathing rate.



2020 ILCOR

NRP (Neonatal Resuscitation Program) 8th Edition*





Target Oxygen Saturation Table	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%
Initial oxygen concentration for PPV	
≥35 weeks' GA	21% oxygen
<35 weeks' GA	21%-30% oxygen

Cord Clamping and Cord Milking

- At birth two thirds of the blood volume was in the infant – after 1 min without clamping this had changed to 80%.
- **Early (immediate)** cord clamping- This means cutting the umbilical cord 10 to 15 seconds after birth or sooner.
- **Delayed** cord clamping:
  - The American College of Obstetricians and Gynecologists recommends waiting **30–60 s** when feasible before clamping the cord in **preterm** infants.
  - New data discussed above indicate that it may also be beneficial even in Western Europe and North America to delay clamping of the cord in **term** babies.
  - The ILCOR also recommends delayed cord clamping of **at least 1 min**.

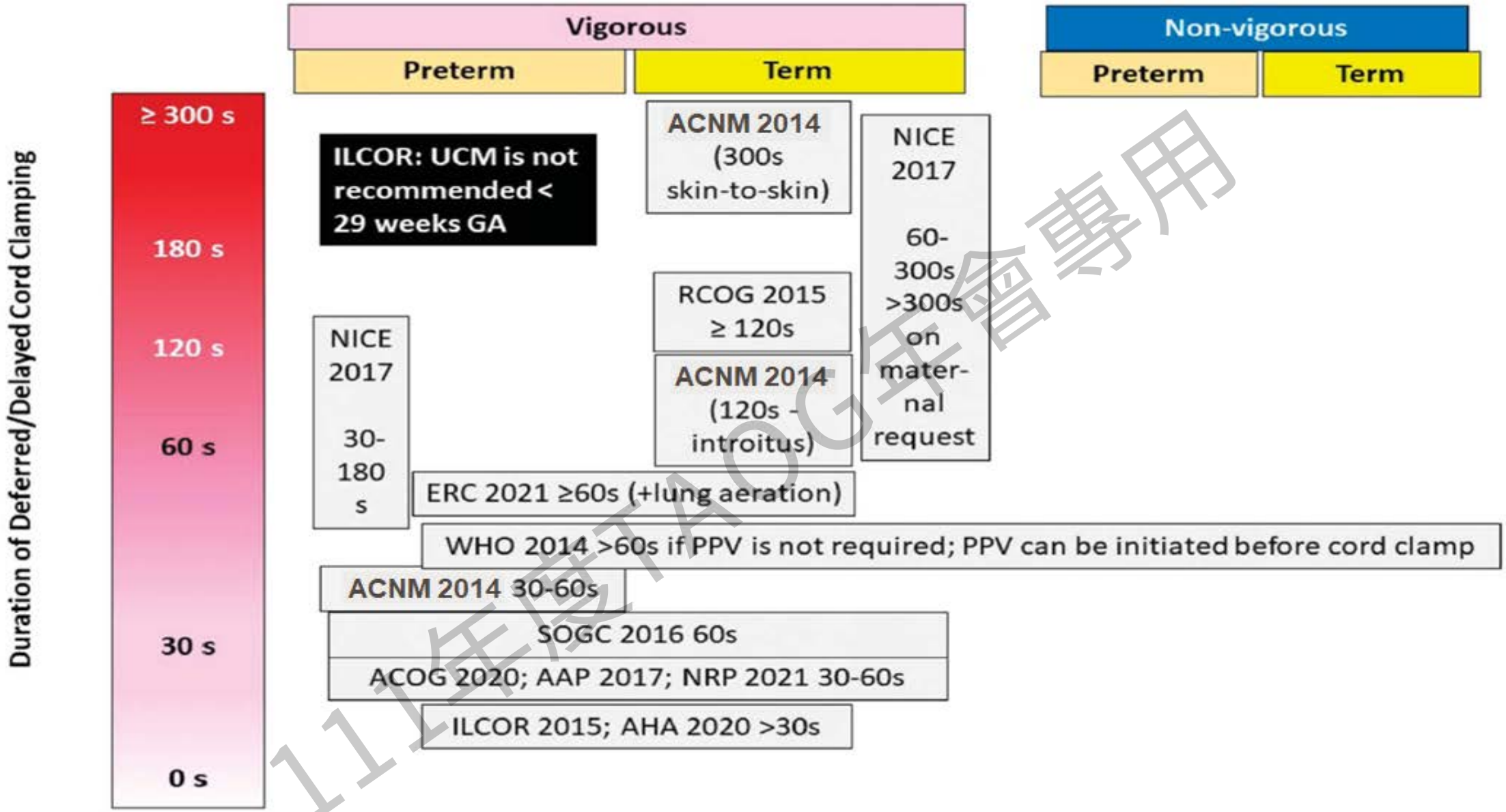


Fig. 1. Delayed umbilical cord clamping recommendations by various organizations. The vertical axis shows duration of delay between birth and umbilical cord clamping. The recommendations for vigorous and nonvigorous neonates (preterm and term) are aligned under the respective legends. There is significant variability in these recommendations. ILCOR, International Liaison Committee on Resuscitation; UCM, umbilical cord milking; GA, gestational age; ACNM, American College of Nurse Midwives; NICE, National Institute for Health and Care Excellence; RCOG, Royal College of Obstetricians and Gynaecologists; ERC, European Resuscitation Council Guidelines; WHO, World Health Organization; PPV, positive pressure ventilation; SOGC, Society of Obstetricians and Gynaecologists of Canada; ACOG, American College of Obste-tricians and Gynecologists; AAP, American Academy of Pediatrics; NRP, neonatal resuscitation program; AHA, American Heart Association. *(Obstet Gynecol 2021)*

Cord Clamping and Cord Milking (Term)

- A Cochrane review of 15 trials including 3,911 women and **term** infant pairs showed no negative maternal effects of delayed cord clamping.

  ↑ *the newborn’ s hemoglobin at 12–24 h of age* (MD 1.49 g/dL, 95% CI 1.21 to 1.78)

  ↑ *the risk of jaundice needing phototherapy* (RR 1.61, 95% CI 1.04 to 2.44)

  ↓ *iron deficiency at 3–6 months of age* (RR 0.37 95% CI 0.15 to 0.96)

  May improved development of some neuromotor functions.

(Cochrane Database Syst Rev 2013)

Cord Clamping and Cord Milking (Preterm)

- In **preterm infants** a meta-analysis shows that delayed cord clamping of at least 30s reduces *the need for transfusion due to anemia* (34 -> 24%) and *necrotizing enterocolitis* (31.5 -> 20.5%) . Perhaps more importantly, a 40% reduction in all grades of *intraventricular hemorrhage* was found (20.1 -> 13.5%) .

(Cochrane Database Syst Rev 2012)

Cord Clamping and **Cord Milking (Preterm)**

- Cord milking seems to be an alternative to delayed cord clamping in preterm babies. In a study of infants of 24–28 weeks of gestational age cord milking versus immediate cord clamping seems reduced *the need for transfusions in the first 28 days* (97->83%) and *reduced intraventricular hemorrhage* (51->25%) .

(J Perinatol 2013)

- But Katheria et al compared umbilical cord milking (UCM) with delayed cord clamping (DCC) in a randomized trial of preterm neonates delivered (<32 weeks of gestation). However, **UCM was associated with *severe intraventricular hemorrhage in extremely preterm neonates (23–27 weeks of gestation) and death*.** Some organizations have recommended against UCM less than 28–29 weeks of gestation.

(JAMA 2019)

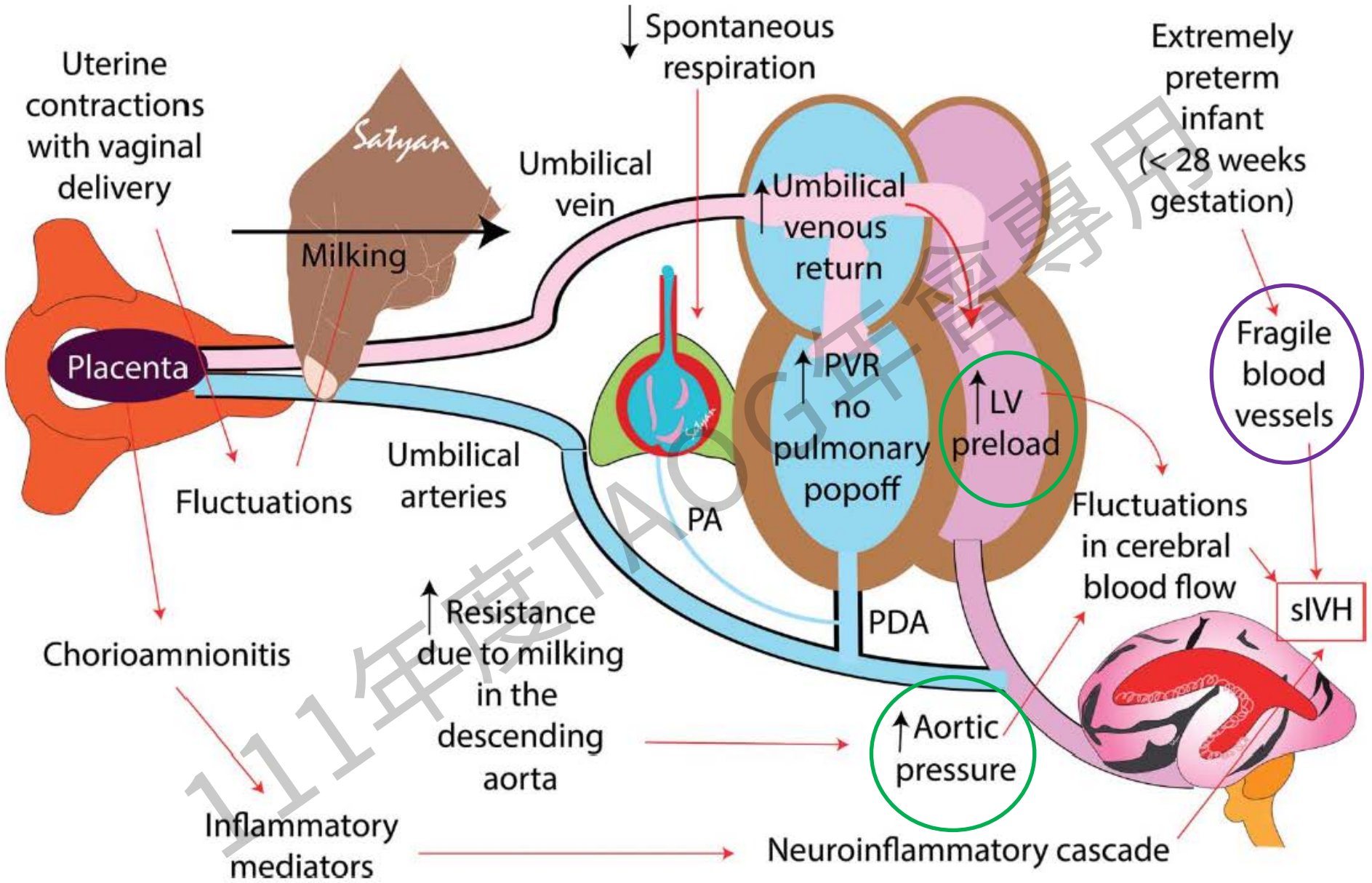


Fig. 2. Speculative pathogenesis of umbilical cord milking associated severe intraventricular hemorrhage (sIVH) in extremely preterm neonates.

(Obstet Gynecol 2021)

DCC vs. ECC for health problem or population in preterm babies

Primary outcomes:

*Death of baby
*Death or neurodevelopment
*Severe IVH
*IVH (all grades)
*Periventricular leukomalacia
*Chronic lung disease
*Maternal blood loss>500ml

DCC with immediate neonatal care after cord clamping compared to ECC (subgroup analysis by gestation) for health problem or population

Patient or population: babies born preterm, and their mothers
Setting: hospital births mostly in high-income countries
Intervention: delayed cord clamping (DCC) with immediate neonatal care after cord clamping
Comparison: early cord clamping (ECC)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with ECC (subgroup analysis by gestation)	Risk with DCC with immediate neonatal care after cord clamping			
Death of baby (up to discharge)	Study population		RR 0.73 (0.54 to 0.98)	2680 (20 RCTs)	⊕⊕⊕⊖ MODERATE [1,2]
	74 per 1000	54 per 1000 (40 to 72)			
Death or neurodevelopmental impairment in early years	Study population		-	(0 studies)	-
	see comment	see comment			
Severe intraventricular haemorrhage (IVH grades 3, 4)	Study population		RR 0.94 (0.63 to 1.39)	2058 (10 RCTs)	⊕⊕⊖⊖ LOW [3,4]
	48 per 1000	45 per 1000 (30 to 66)			
Intraventricular haemorrhage (IVH, all grades)	Study population		RR 0.83 (0.70 to 0.99)	2333 (15 RCTs)	⊕⊕⊕⊕ HIGH [5,6]
	187 per 1000	155 per 1000 (131 to 185)			
Periventricular leukomalacia (PVL)	Study population		RR 0.58 (0.26 to 1.30)	1544 (4 RCTs)	⊕⊕⊖⊖ LOW [7]
	22 per 1000	13 per 1000 (6 to 28)			
Chronic lung disease (CLD) - oxygen supplement at 36 weeks (corrected for gestation)	494 per 1000	514 per 1000 (464 to 563)			
Maternal blood loss of 500 mL or greater	Study population		RR 1.14 (0.07 to 17.63)	180 (2 RCTs)	⊕⊖⊖⊖ VERY LOW [9,10]
	11 per 1000	12 per 1000 (1 to 188)			

Unable for conclusion

(Cochrane Database of Systematic Reviews 2019)

DCC vs. ECC for health problem or population in preterm babies

- Hematological:

A possible benefit for DCC over ECC -

* *Blood transfusion in infant* : (average RR 0.66, 95% CI 0.50 to 0.86).

Little or no difference-

* Hyperbilirubinemia (treated by phototherapy) : (average RR 1.05, 95% CI 0.95 to 1.16) , high-certainty evidence.
* Volume of blood transfused (in mL) : (MD -6.00, 95% CI -26.11 to 14.11) , low-certainty evidence.
* Hemoglobin (Hb) within first 24 hours of birth (in g/dL) : (MD 0.80, 95% CI -0.02 to 1.62), very low-certainty evidence.

(Cochrane Database of Systematic Reviews 2019)

DCC vs. ECC in preterm babies

insufficient data to be confident in our findings

DCC with immediate neonatal care with cord intact compared to ECC in babies born preterm

Patient or population: babies born preterm, and their mothers
Setting: hospital births in UK
Intervention: delayed cord clamping (DCC) with immediate neonatal care with cord intact
Comparison: early cord clamping (ECC)

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with ECC (subgroup analysis by gestation)	Risk with DCC with immediate neonatal care with cord intact			
Death of baby (up to discharge)	Study population		RR 0.47 (0.20 to 1.11)	270 (1 RCT)	⊕⊕◯◯ LOW [1]
	111 per 1000	52 per 1000 (22 to 123)			
Death or neurodevelopmental impairment at age 2 to 3 years	Study population		RR 0.61 (0.39 to 0.96)	218 (1 RCT)	⊕⊕◯◯ LOW [2]
	340 per 1000	207 per 1000 (133 to 326)			
Severe intraventricular haemorrhage (IVH grades 3, 4)	Study population		RR 0.84 (0.29 to 2.45)	266 (1 RCT)	⊕⊕◯◯ LOW [3]
	53 per 1000	45 per 1000 (15 to 130)			
Intraventricular haemorrhage (IVH, all grades)	Study population		RR 0.90 (0.64 to 1.26)	266 (1 RCT)	⊕⊕◯◯ LOW [4]
	356 per 1000	320 per 1000 (228 to 449)			
Periventricular leukomalacia (PVL)	Study population		RR 0.86 (0.32 to 2.31)	266 (1 RCT)	⊕⊕◯◯ LOW [5]
	61 per 1000	52 per 1000 (19 to 140)			
Chronic lung disease (CLD) – oxygen supplement at 36 weeks (corrected for gestation)	Study population		RR 0.95 (0.66 to 1.37)	249 (1 RCT)	⊕⊕◯◯ LOW [6]
	325 per 1000	309 per 1000 (215 to 445)			
Maternal blood loss of 500 mL or greater	Study population		RR 0.94 (0.72 to 1.22)	254 (1 RCT)	⊕⊕◯◯ LOW [7 8]
	476 per 1000	447 per 1000 (343 to 580)			

(Cochrane Database of Systematic Reviews 2019)

DCC vs. UCM in preterm babies

insufficient data for reliable conclusions

DCC with immediate neonatal care after cord clamping compared to UCM in babies born preterm

Patient or population: babies born preterm, and their mothers
Setting: hospital births mostly in high-income countries
Intervention: delayed cord clamping (DCC) with immediate neonatal care after cord clamping
Comparison: umbilical cord milking (UCM).

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with UCM (subgroup analysis by gestation)	Risk with DCC with immediate neonatal care after cord clamping			
Death of baby (up to discharge)	Study population 44 per 1000	94 per 1000 (41 to 216)	RR 2.14 (0.93 to 4.93)	322 (3 RCTs)	⊕⊕◯◯ LOW [1 2]
Death or neurodevelopmental impairment at age 2 to 3 years	Study population 162 per 1000	270 per 1000 (126 to 577)	RR 1.67 (0.78 to 3.57)	195 (2 RCTs)	⊕◯◯◯ VERY LOW [3 4]
Severe intraventricular haemorrhage (IVH grades 3, 4)	Study population 0 per 1000	0 per 1000 (0 to 0)	RR 2.63 (0.11 to 61.88)	58 (1 RCT)	⊕⊕◯◯ LOW [5 6]
Intraventricular haemorrhage (IVH, all grades)	Study population 129 per 1000	170 per 1000 (71 to 409)	RR 1.32 (0.55 to 3.17)	125 (2 RCTs)	⊕◯◯◯ VERY LOW [7 8]
Periventricular leukomalacia (PVL)	Study population 0 per 1000	0 per 1000 (0 to 0)	not estimable	58 (1 RCT)	⊕⊕◯◯ LOW [9 10]
Chronic lung disease (CLD) - oxygen supplement at 36 weeks (corrected for gestation)	Study population 48 per 1000	74 per 1000 (21 to 265)	RR 1.53 (0.43 to 5.48)	125 (2 RCTs)	⊕⊕◯◯ LOW [11 12]
Maternal blood loss of 500 mL or greater	Study population see comment	see comment	-	(0 studies)	-

(Cochrane Database of Systematic Reviews 2019)

UCM vs. ECC in preterm babies

insufficient data for reliable conclusion

UCM compared to ECC in babies born preterm

Patient or population: babies born preterm, and their mothers.
Setting: hospital births mostly in high-income countries.
Intervention: umbilical cord milking(UCM)
Comparison: early cord clamping (ECC).

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of participants (studies)	Certainty of the evidence (GRADE)
	Risk with ECC (subgroup analysis by gestation)	Risk with UCM			
Death of baby (up to discharge)	Study population		RR 0.81 (0.47 to 1.41)	931 (9 RCTs)	⊕⊕◯◯ LOW [1] [2]
	60 per 1000	48 per 1000 (28 to 84)			
Death or neurodevelopmental impairment at age 2 to 3 years	Study population		-	(0 studies)	-
	see comment	see comment			
Severe intraventricular haemorrhage (IVH grades 3, 4)	Study population		RR 0.75 (0.39 to 1.45)	618 (6 RCTs)	⊕⊕◯◯ LOW [3] [4]
	64 per 1000	48 per 1000 (25 to 93)			
Intraventricular haemorrhage (IVH, all grades)	Study population		RR 0.85 (0.62 to 1.18)	716 (8 RCTs)	⊕⊕⊕◯ MODERATE [5] [6]
	270 per 1000	230 per 1000 (168 to 319)			
Periventricular leukomalacia (PVL)	Study population		RR 0.63 (0.15 to 2.63)	315 (3 RCTs)	⊕⊕◯◯ LOW [7] [8]
	31 per 1000	20 per 1000 (5 to 82)			
Chronic lung disease (CLD) - oxygen supplement at 36 weeks (corrected for gestation)	Study population		RR 1.03 (0.64 to 1.66)	682 (7 RCTs)	⊕⊕⊕◯ LOW [9] [10] [11]
	198 per 1000	204 per 1000 (127 to 329)			
Maternal blood loss of 500 mL or greater	Study population		not estimable	200 (1 RCT)	⊕⊕◯◯ LOW [12] [13]
	0 per 1000	0 per 1000 (0 to 0)			

(Cochrane Database of Systematic Reviews 2019)

UCM vs. ECC in preterm babies

- Hematological:

A possible benefit for UCM over ECC -

* *blood transfusion in infant* : (average RR 0.71, 95% CI 0.57 to 0.89) , very low-certainty evidence.

No evidence for a difference -

* Hyperbilirubinemia (treated by phototherapy) : (average RR 1.39, 95% CI 0.73 to 2.63), very low-certainty evidence.
* Volume of blood transfused (in mL) : (MD -19.00, 95% CI -39.61 to 1.61), very low-certainty evidence.
* Hb within first 24 hours of birth (in g/dL) : (average MD 0.84, 95%CI 0.54 to 1.14), moderate-certainty evidence.

(Cochrane Database of Systematic Reviews 2019)

New Standards for Birth Weight

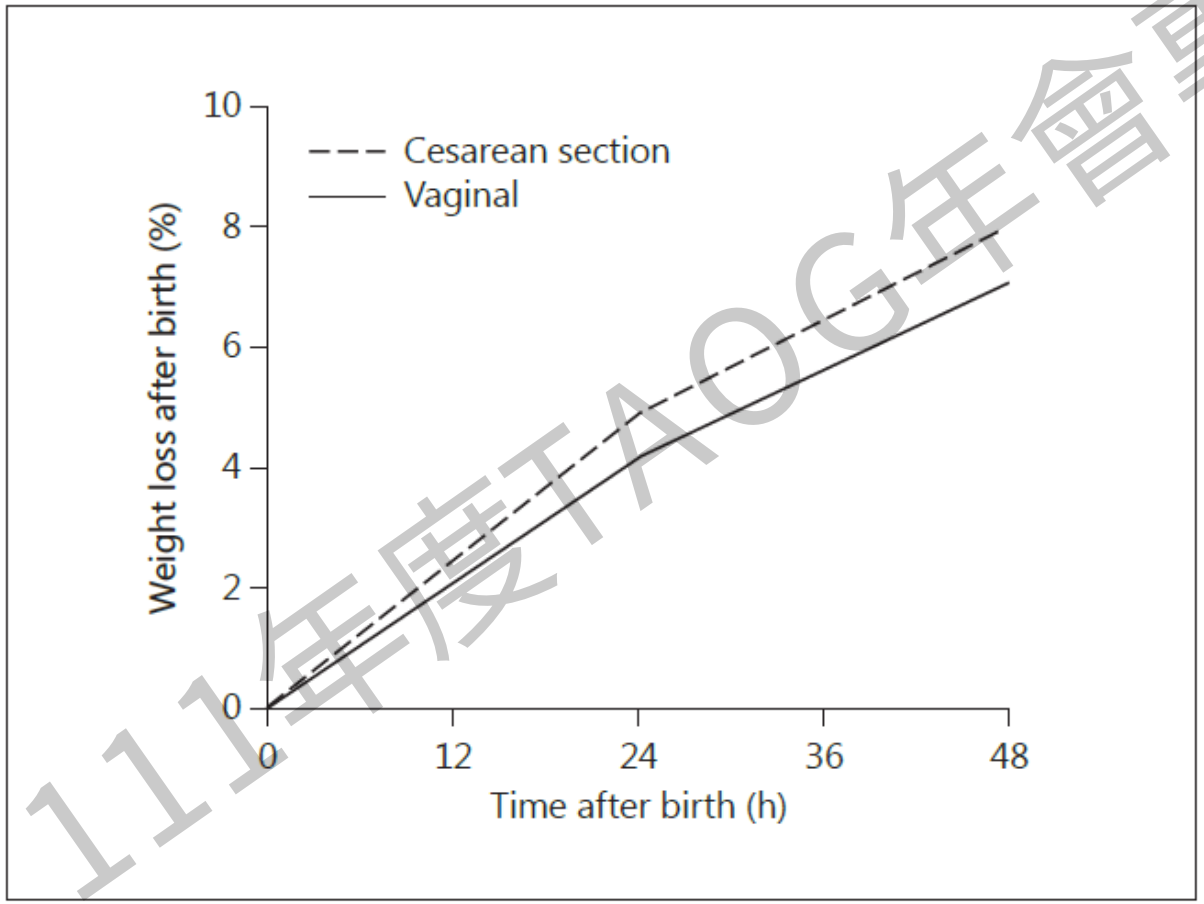


Fig. 1. Median weight loss in the first 48 h after birth

- It is a challenge that birth weight after delayed cord clamping is 20–30 g/kg higher than with early cord clamping.

(Pediatrics 2015)

Heart rate assessment

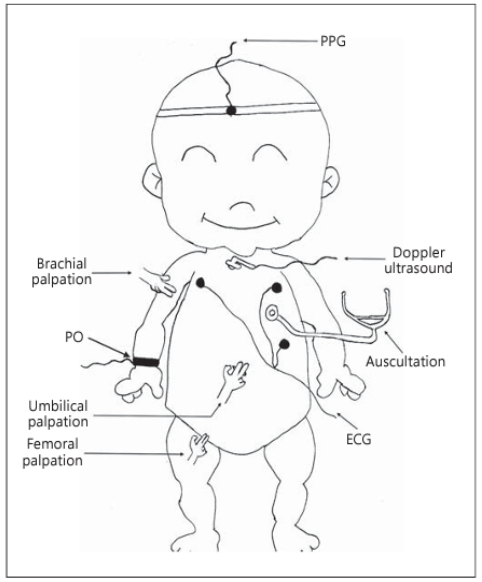


Fig. 1. Potential sensor application.

Table 2. Advantages and limitations of various methods of HR assessment in neonates

	Advantages	Limitations
Auscultation	– Inexpensive – Easy to perform – Fast HR assessment – Not technology dependent	– Inaccurate – External noise interference – Intermittent
Palpation	– Inexpensive – Simple – Fast HR assessment – 'Out of the way' from the infant's chest – Not technology dependent	– Inaccurate – Infant's movements may interrupt assessment – Intermittent
PO	– Significantly more accurate – Continuous	– Affected by poor tissue perfusion – Cost (compared to auscultation and palpation)
Doppler ultrasound	– Accurate HR assessment by blood flow – Able to use through a polyethylene bag – Able to detect flow in situations of pulseless electric activity	– Further research required before continual clinical use – Requires clinician experience to operate optimally – Cost (compared to auscultation and palpation)
ECG	– Accurate, the 'gold standard' – Relatively fast compared to PO – Continuous	– May damage the skin of extremely premature infants – Requires clinician experience to operate optimally – Detects pulseless electrical activity – Cost (compared to auscultation and palpation)

Until more evidence is available, auscultation is still the gold standard for heart rate assessment at birth.

(Neonatology 2016)

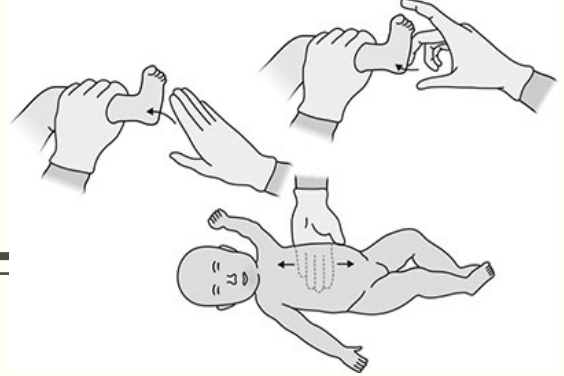
Suctioning or Wiping

- According to ILCOR 2010, routine intrapartum oropharyngeal and nasopharyngeal suctioning for infants born with clear or meconium-stained amniotic fluid is **no longer recommended**. Because it may activate the vagus nerve and induce bradycardia and apnea.

  (Circulation 2010)

- However, suctioning may be needed occasionally if the meconium is thick and apparently blocks the airway. To suction or not in such cases is a clinical decision.

Stimulation



- Neonatal resuscitation guidelines universally state that tactile stimulation should be the initial step to help establish a regular breathing pattern in term and preterm babies after birth. However, the concept of stimulation is poorly defined, and there is very little data to guide clinicians with respect to how this intervention is best performed. Preterm babies are also reported to receive tactile stimulation less frequently than term babies.

(Arch Dis Child Fetal Neonatal Ed 2018)

- Further studies are needed to elucidate the potential benefit of tactile stimulation on preterm ventilation after birth.

(Resuscitation 2018)

Thermal Control

- Hypothermia can be prevented by keeping **delivery room temperature** from **26 to 28 °C**, using pre-warmed linen sheets to receive the newborn just after birth, re-warming surfaces and eliminating drafts. In the delivery room and during transportation various interventions that can be practiced to prevent hypothermia.

(Pediatrics 2013)

- The aim of thermal control in the delivery room should be to maintain a **rectal temperature between 36.5 and 37.5°C**.

(Semin Fetal Neonatal Med 2018)

- All newborns, but particularly preterm babies, are vulnerable to **hypothermia** after birth . Low admission temperature is a predictor of poor outcome across all GAs, yet it is not known whether hypothermia is causally related to patient outcomes or simply a marker of disease severity.

(Circulation 2015)

Thermal Control

- Extremely low birth weight infants have higher body temperature on admission to the NICU if they are immediately **put into polyethylene bags before drying**.

(Adv Neonatal Care 2010)

- A Cochrane review concluded that plastic wraps or bags were effective in reducing heat loss in infants **<28 weeks of gestation** (MD 0.58°C, 95% CI 0.50 to 0.6) but not in infants between 28 and 31 weeks. It also may *decrease the brain injury* (RR 0.78 95% CI 0.47 to 1.27) , *lung injury* (RR 0.60 95% CI 0.38 to 0.95) and *mortality rate* (RR 0.91 95% CI 0.73 to 1.15).

(Cochrane Database Syst Rev 2018)

Thermal Control

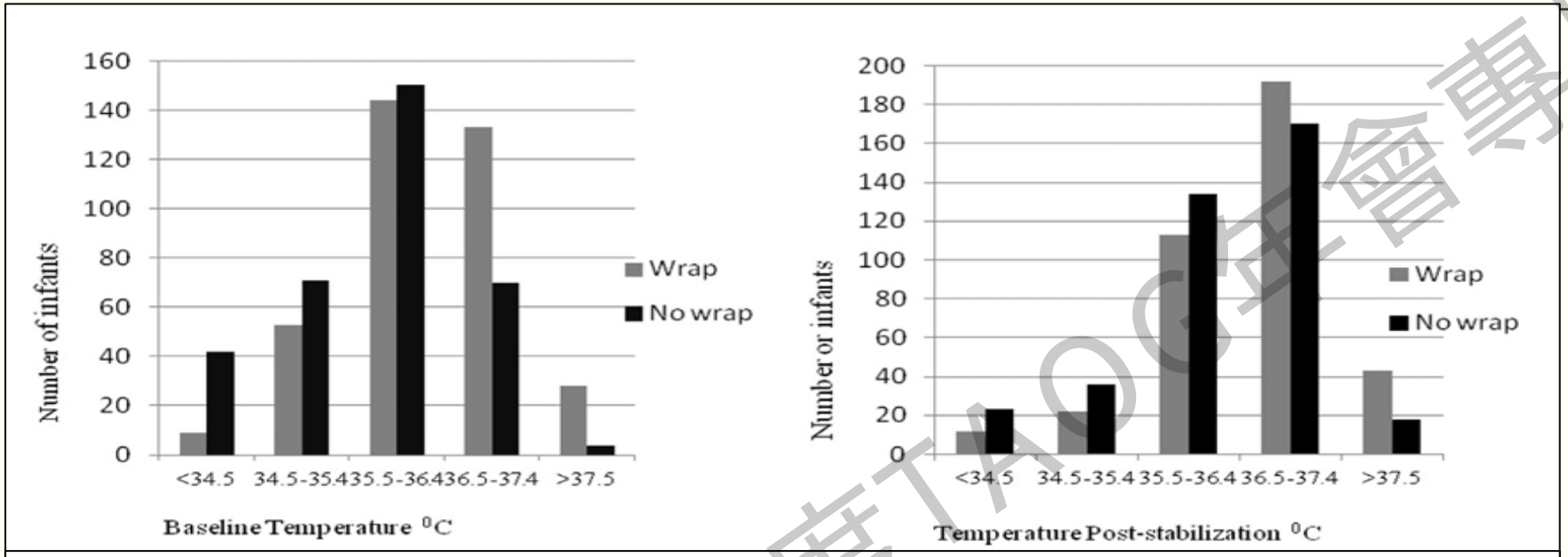
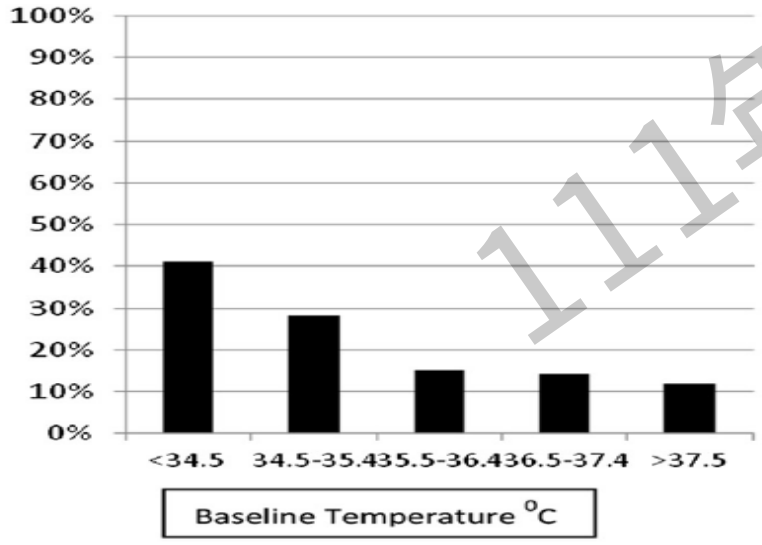


Fig 2. Distribution of baseline and poststabilization temperature in infants assigned to wrap and no-wrap groups.



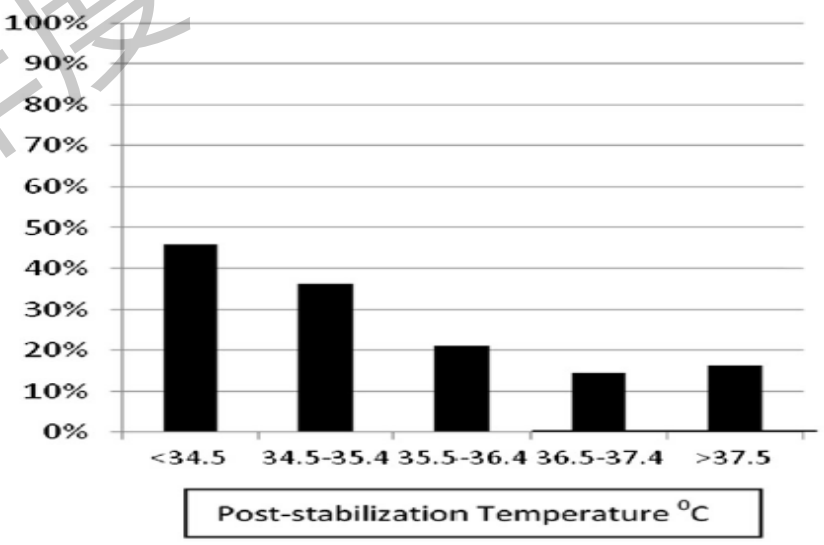


Fig 3. Mortality rates of all infants according to baseline and poststabilization temperature.

(J Pediatr 2015)

Oxygenation

- In 2010, ILCOR recommended that term or near-term infants in need of artificial ventilation in the delivery room should be given **room air** instead of 100% and there were confirmed in 2015.
- For premature infants, the question is more challenging. Recent meta-analyses have shown that for infants with GA between 28 and 31 weeks, an initial FiO2 of 21–30% is appropriate. **For infants <28 weeks, supplementing oxygen (for instance 30%) is recommended**.

(Curr Opin Pediatr 2018)

Oxygenation

- Very recent data have shown that babies <32 weeks of GA who do not reach an SpO2 of 80% within 5 min of life have an increased risk of death and severe IVH, with significantly reduced cognitive and motor scores at 2 years of age . Although it is presently not known the relationship is, it is recommended that an **SpO2 of 80% be reached within 5 min of birth**.

(Curr Opin Pediatr 2018)

Target Oxygen Saturation Table	
1 min	60%–65%
2 min	65%–70%
3 min	70%–75%
4 min	75%–80%
5 min	80%–85%
10 min	85%–95%
Initial oxygen concentration for PPV	
≥35 weeks' GA	21% oxygen
<35 weeks' GA	21%–30% oxygen

Ventilation

- Approximately **3–5%** of newborns require assisted ventilation at the time of birth and can become severely depressed unless effective ventilation is provided rapidly.

(Cochrane Database Syst Rev 2018)

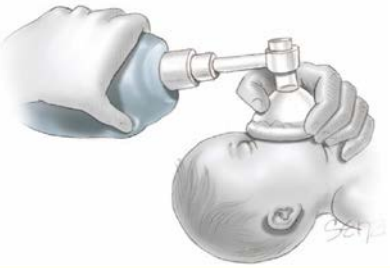
- Various studies in preterm neonates have identified early continuous positive airway pressure (CPAP) use in the immediate postnatal period as beneficial in *decreasing the need for and/or the duration of mechanical ventilation* (RR 0.50, 95% CI 0.42 to 0.59) and *the need for surfactant* (RR 0.54, 95% CI 0.40 to 0.73) *without evidence of worsening bronchopulmonary dysplasia (BPD)* (RR 0.89, 95% CI 0.81 to 0.97).

(N Engl J Med 2008)
(Cochrane Database Syst Rev 2021)

- More recent studies have also shown that early CPAP in the delivery room with sustained inflation decreases the need for intubation and is associated with *fewer days on mechanical ventilation, fewer surfactant doses, fewer resuscitations and lower oxygen needs* (5–6 cm H2O initially) , but no difference in the mortality rate.

(J Matern Fetal Neonatal Med 2017)

Ventilation: Bag-Mask ventilation (BMV)



RESEARCH Open Access

Neonatal resuscitation: EN-BIRTH multi-country validation study

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Abstract

Background: Annually, 14 million newborns require stimulation to initiate breathing at birth and 6 million require bag-mask-ventilation (BMV). Many countries have invested in facility-based neonatal resuscitation equipment and training. However, there is no consistent tracking for neonatal resuscitation coverage.

Methods: The EN-BIRTH study, in five hospitals in Bangladesh, Nepal, and Tanzania (2017–2018), collected time-stamped data for care around birth, including neonatal resuscitation. Researchers surveyed women and extracted data from routine labour ward registers. To assess accuracy, we compared gold standard observed coverage to survey-reported and register-recorded coverage, using absolute difference, validity ratios, and individual-level validation metrics (sensitivity, specificity, percent agreement). We analysed two resuscitation numerators (stimulation, BMV) and three denominators (live births and fresh stillbirths, non-crying, non-breathing). We also examined timeliness of BMV. Qualitative data were collected from health workers and data collectors regarding barriers and enablers to routine recording of resuscitation.

Results: Among 22,752 observed births, 5330 (23.4%) babies did not cry and 3860 (17.0%) did not breathe in the first minute after birth. 16.2% (n = 3688) of babies were stimulated and 4.4% (n = 998) received BMV. Survey-report underestimated coverage of stimulation and BMV. Four of five labour ward registers captured resuscitation numerators. Stimulation had variable accuracy (sensitivity 7.5–40.8%, specificity 66.8–99.5%), BMV accuracy was higher (sensitivity 12.4–48.4%, specificity > 93%), with small absolute differences between observed and recorded BMV. Accuracy did not vary by denominator option. < 1% of BMV was initiated within 1 min of birth. Enablers to register recording included training and data use while barriers included register design, documentation burden, and time pressure.

Conclusions: Population-based surveys are unlikely to be useful for measuring resuscitation coverage given low validity of exit-survey report. Routine labour ward registers have potential to accurately capture BMV as the numerator. Measuring the true denominator for clinical need is complex; newborns may require BMV if breathing ineffectively or experiencing apnoea after initial drying/stimulation or subsequently at any time. Further denominator research is required to evaluate non-crying as a potential alternative in the context of respectful care. Measuring quality gaps, notably timely provision of resuscitation, is crucial for programme improvement and impact, but unlikely to be feasible in routine systems, requiring audits and special studies.

Keywords: Birth, Neonatal resuscitation, Coverage, Quality, Measurement, Validity, Survey, Hospital records, Health management information systems

Five hospitals in Bangladesh, Nepal, and Tanzania (2017–2018)

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(BMC Pregnancy and Childbirth 2020)

Ventilation: BMV vs. LMA

LMA Sizing

LMA Size	Patient Size
1	Neonate / Infants < 5 kg
1 ½	Infants 5-10 kg
2	Infants / Children 10-20 kg
2 ½	Children 20-30 kg
3	Children/Small adults 30-50 kg
4	Adults 50-70 kg
5	Large adult >70 kg

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	№ of partici-pants (studies)	Certainty of the evidence (GRADE)	Com-ments
	Risk with BMV	Risk with LMA				
Failure with primary modality of resuscitation	Study population		RR 0.16 (0.09 to 0.30)	660 (5 RCTs)	⊕⊕⊕⊖ MODERATE [1]	
	194 per 1000	31 per 1000 (17 to 58)				
Need for intubation	Study population		RR 0.24 (0.12 to 0.47)	660 (5 RCTs)	⊕⊕⊕⊖ MODERATE [1]	
	158 per 1000	38 per 1000 (19 to 74)				
Apgar score ≤ 7 at 5 minutes	Study population		RR 0.34 (0.16 to 0.74)	511 (2 RCTs)	⊕⊕⊕⊖ MODERATE[2]	
	94 per 1000	32 per 1000 (15 to 69)				
Admission to NICU	Study population		RR 0.6 (0.4 to 0.9)	191 (2 RCTs)	⊕⊕⊕⊖ MODERATE[3]	
	438 per 1000	263 per 1000 (175 to 394)				
Death or HIE	Study population		RR 0.65 (0.17 to 2.43)	191 (2 RCTs)	⊕⊕⊖⊖ LOW[3 4]	
	52 per 1000	34 per 1000 (9 to 127)				

***The risk in the intervention group** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

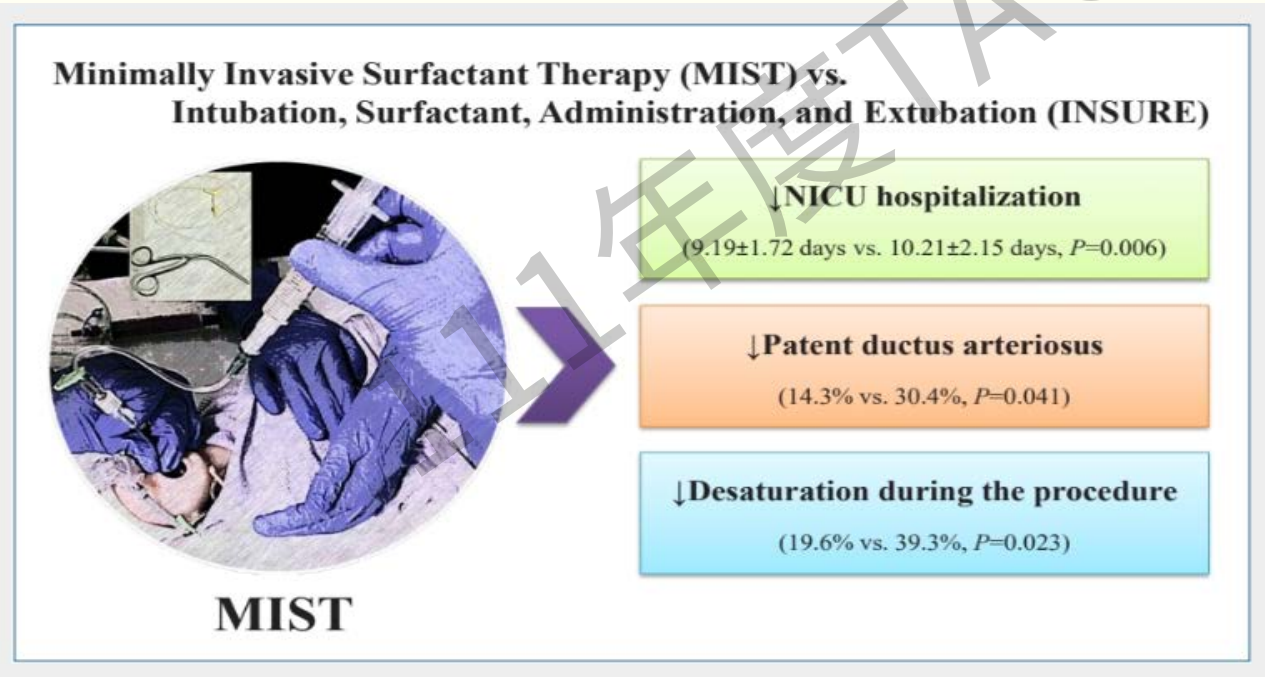
- LMA is more effective in terms of *shorter resuscitation and ventilation times, and less need for endotracheal intubation and were less likely to require admission to the NICU.*
- But most studies enrolled infants with birth weight over 1500 g or 34 or more weeks' gestation and it is lack of evidence to support LMA use in more premature infants.

(Cochrane Database of Systematic Reviews 2018)

Surfactant in delivery room

- Less invasive surfactant administration techniques, such as the less-invasive surfactant application (LISA) or the minimal invasive surfactant therapy (MIST) , which avoid standard intubation by giving surfactant through a suction catheter into the trachea, has shown reducing the need for ventilation and decreasing rates of BPD. Death and/or BPD at 36 weeks was also reduced by 25%.

(Arch Dis Child Fetal Neonatal Ed 2017/ Neonatology 2019)



↓ *NICU hospitalization*
↓ *Patent ductus arteriosus*
↓ *Desaturation during the procedures*

(Clinical and Experimental Pediatrics 2021)

Taking home message

- Delivery room management, especially in the first 'golden' minute, is of the utmost importance and interventions in pregnancy and delivery should as far as possible be evidence based.

Management	Suggestion
Prenatal care	Avoid teenage pregnancy, maternal BMI control, care of related complication
Antepartum management	Antenatal steroid therapy, prophylactic ABx for GBS, MgSO4 for neuroprotection, consultation and standby of pediatrist……
Selection of birth mode	Avoid elective and early term cesarean delivery
Delayed cord clamping/Cord milking	Consider delaying around 60 sec; avoid cord milking in extremely preterm pregnancy
Suctioning of the mouth and airways/Stimulation	not routine required
Thermal control	DR: 26-28℃, newborn: 36.5-37.5℃; infants <28 weeks of gestation wrap in plastic bag
Ventilatory support and surfactant instillation	CPAP is preferred; LISA or MIST for surfactant
NRP training	Be trained completely and accepted