IRC 2021
CONGRESSO NAZIONALE
16•17•18 DICEMBRE

NUOVE LINEE GUIDA 2021:
RIANIMAZIONE CARDIOPOLMONARE
POST-LOCKDOWN

IRC | Italian Resuscitation Council

# RCP Neonatale

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# Conflicts of interest

- Member of the ILCOR Neonatal Resuscitation Task Force
- Member of the  ERC NLS Science and Education Committee

EUROPEAN RESUSCITATION COUNCIL

# Guidelines for Neonatal Resuscitation (history)

[<1960] Empirical observations

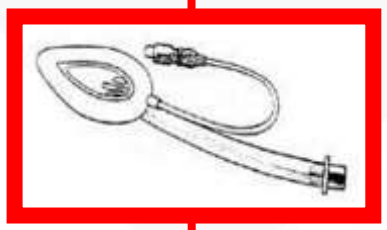
[1966] AHA committee on cardiopulmonary resuscitation (adults)

[1987] Bloom RS, Cropley C, editors. Textbook of neonatal resuscitation

[1992] International Liaison Committee on Resuscitation (ILCOR)

Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part VII. Neonatal resuscitation. (JAMA, Oct 1992)

[2000]



[2005]


[2010]


[2015]


[2020]

# Summary of changes since the 2015 guidelines

**Summary of changes since the 2015 guidelines**

***Management of the umbilical cord***

Clamping after at least 60 s is recommended, ideally after the lungs are aerated. Where delayed cord clamping is not possible cord milking should be considered in infants >28 weeks gestation.

***Infants born through meconium-stained liquor***

In non-vigorous infants, recommendations are against immediate laryngoscopy with or without suction after delivery, because this may delay aeration and ventilation of the lungs.

***Use of the laryngeal mask***

If facemask ventilation is unsuccessful or if tracheal intubation is unsuccessful or not feasible a laryngeal mask may be considered as an alternative means of establishing an airway in infants of >34 weeks gestation (about 2000 g, although some devices have been used successfully in infants down to 1500 g).

***Inflation pressure***

If there is no response to initial inflations despite an open airway then a gradual increase in the inflation pressure is suggested.

A starting pressure of 25 cm $H_2O$ is suggested for preterm infants <32 weeks gestation.

***Air/oxygen for preterm resuscitation***

Recommendations are for starting in air at 32 weeks gestation or more, 21-30% inspired oxygen at 28-31 weeks gestation and 30% inspired oxygen at <28 weeks gestation.

The concentration should be titrated to achieve saturations of ≥80% at 5 min of age because there is evidence of poorer outcomes where this is not achieved.

***Chest compressions***

If chest compressions are required, the inspired oxygen concentration should be increased to 100% and consideration given towards securing the airway ideally with a tracheal tube.

***Vascular access***

The umbilical vein is still favoured as the optimal route of access but, intraosseous access is an alternative method of emergency access for drugs/fluids.

***Adrenaline***

Where the heart rate has not increased after optimising ventilation and chest compressions an intravenous dose of adrenaline of 10–30 micrograms $kg^{-1}$ is recommended, repeated every 3–5 min in the absence of a response.

***Glucose during resuscitation***

An intravenous dose of 250 mg $kg^{-1}$ (2.5 mL $kg^{-1}$ of 10% glucose) is suggested in a prolonged resuscitation to reduce the likelihood of hypoglycaemia.

***Prognosis***

Failure to respond despite 10–20 mins of intensive resuscitation is associated with high risk of poor outcome. It is appropriate to consider discussions with the team and family about withdrawal of treatment if there has been no response despite the provision of all recommended steps of resuscitation and having excluded reversible causes

Madar J. et al. Resuscitation 2021

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# Infants born through meconium-stained liquor

**TABLE 1 ■ Summary of NRP/AHA Recommendation for Delivery Room Management of Meconium-Stained Newborn over the Years**

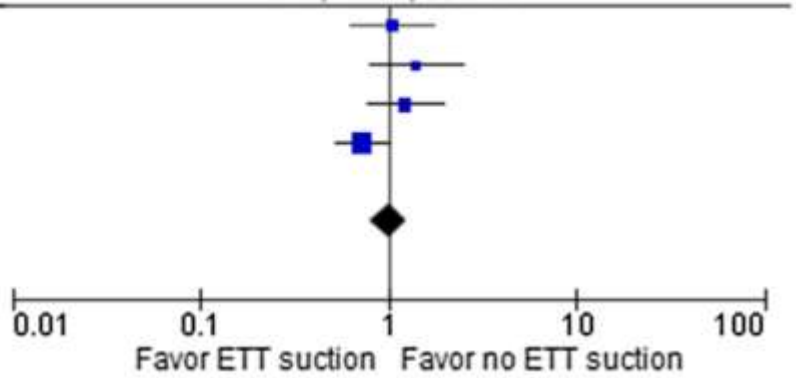
| | NRP Edition (Year), AHA Guideline | | | | | | |
|---|---|---|---|---|---|---|---|
| Guidelines | First Edition (1987) | Second Edition (1990) | Third Edition (1994) | Fourth Edition (2000), AHA 2000 | Fifth Edition (2006) AHA 2005 | Sixth Edition (2011), AHA 2010 | Seventh Edition (2016), AHA 2015 |
| Intrapartum oro-nasopharyngeal suction after delivery of head | Yes | Yes | Yes | Yes | No | No | No |
| Endotracheal intubation and suction | Yes for all | Yes for all | Yes for all, notes controversy regarding vigorous infants | Yes for nonvigorous infants, not recommended for vigorous infants (AHA class I) | Yes for nonvigorous infants (AHA class indeterminate), not recommended for vigorous infants | Yes for nonvigorous infants, because insufficient evidence to change practice | No for nonvigorous infants, because insufficient evidence to continue this practice (AHA class IIb) |

*Abbreviations:* AHA = American Heart Association; NRP = Neonatal Resuscitation Program.

# Meconium Aspiration Syndrome

| Study or Subgroup | ETT suction Events | Total | No ETT suction Events | Total | Weight | Risk Ratio M-H, Fixed, 95% CI |
|---|---|---|---|---|---|---|
| Chettri, 2015 | 20 | 61 | 19 | 61 | 18.9% | 1.05 [0.63, 1.77] |
| Kumar, 2019 | 21 | 66 | 15 | 66 | 15.0% | 1.40 [0.79, 2.47] |
| Nangia, 2016 | 28 | 87 | 23 | 88 | 22.8% | 1.23 [0.77, 1.96] |
| Singh, 2018 | 31 | 75 | 44 | 77 | 43.3% | 0.72 [0.52, 1.01] |
| **Total (95% CI)** | | **289** | | **292** | **100.0%** | **1.00 [0.80, 1.25]** |
| Total events | 100 | | 101 | | | |

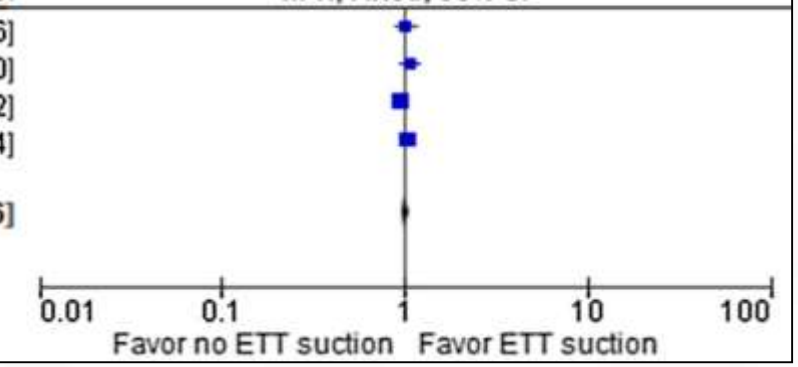
Heterogeneity: Chi² = 5.83, df = 3 (P = 0.12); I² = 49%
Test for overall effect: Z = 0.02 (P = 0.98)




# Survival at discharge

| Study or Subgroup | No ETT suction Events | Total | ETT suction Events | Total | Weight | Risk Ratio M-H, Fixed, 95% CI |
|---|---|---|---|---|---|---|
| Chettri, 2015 | 54 | 61 | 53 | 61 | 20.2% | 1.02 [0.89, 1.16] |
| Kumar, 2019 | 61 | 66 | 57 | 66 | 21.7% | 1.07 [0.95, 1.20] |
| Nangia, 2016 | 78 | 87 | 84 | 88 | 31.8% | 0.94 [0.86, 1.02] |
| Singh, 2018 | 71 | 75 | 70 | 77 | 26.3% | 1.04 [0.95, 1.14] |
| **Total (95% CI)** | | **289** | | **292** | **100.0%** | **1.01 [0.96, 1.06]** |
| Total events | 264 | | 264 | | | |

Heterogeneity: Chi² = 4.23, df = 3 (P = 0.24); I² = 29%
Test for overall effect: Z = 0.40 (P = 0.69)




Trevisanuto D et al. Resuscitation 2020

***Infants born through meconium-stained liquor***

In non-vigorous infants, recommendations are against immediate laryngoscopy with or without suction after delivery, because this may delay aeration and ventilation of the lungs.

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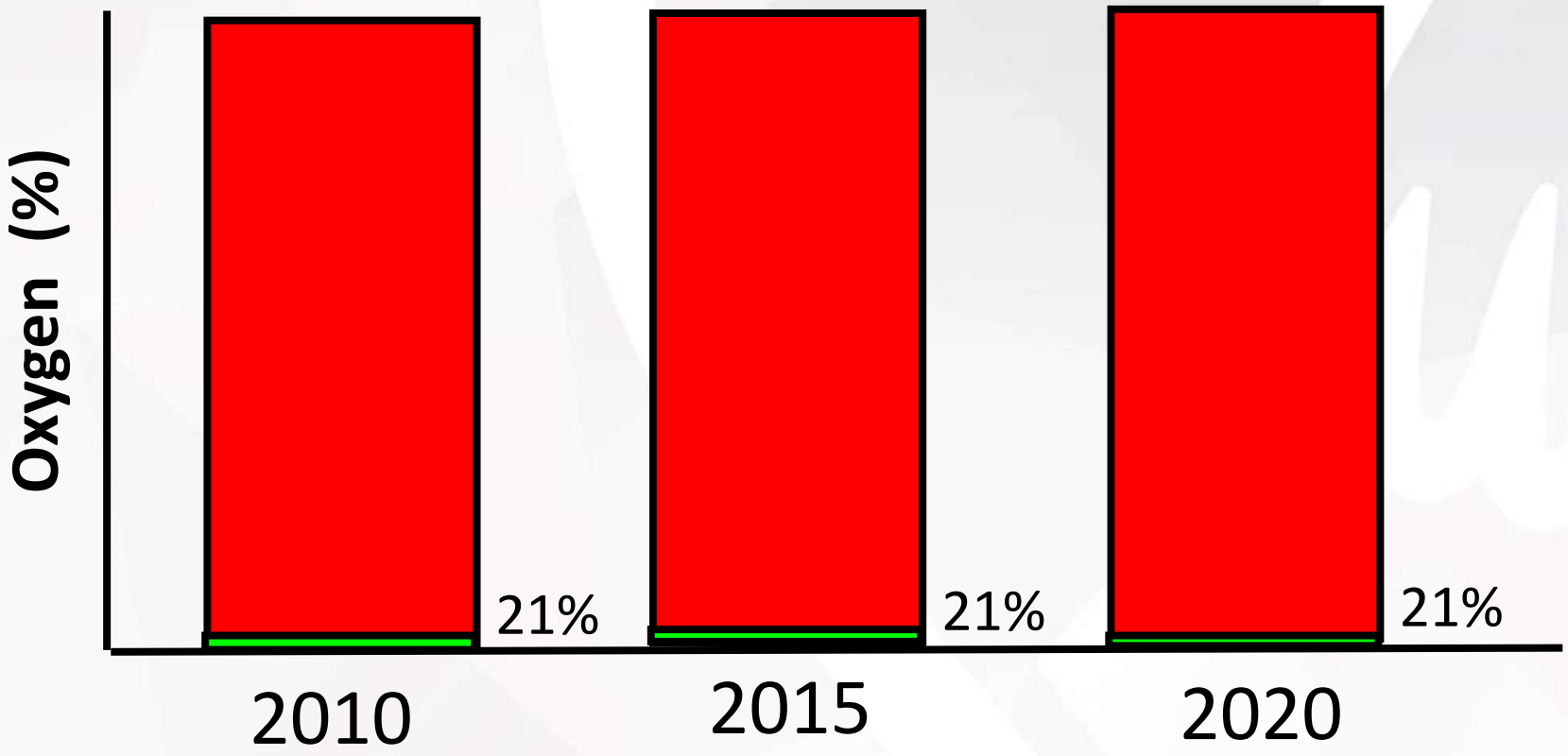
# Air/oxygen for preterm resuscitation

# Oxygen to initiate resuscitation in near-term & full-term infants




Wyckoff MH et al. 2015, 2020 AHA Guidelines

Wyllie J et al. 2015, Madar J et al. 2021 ERC Guidelines

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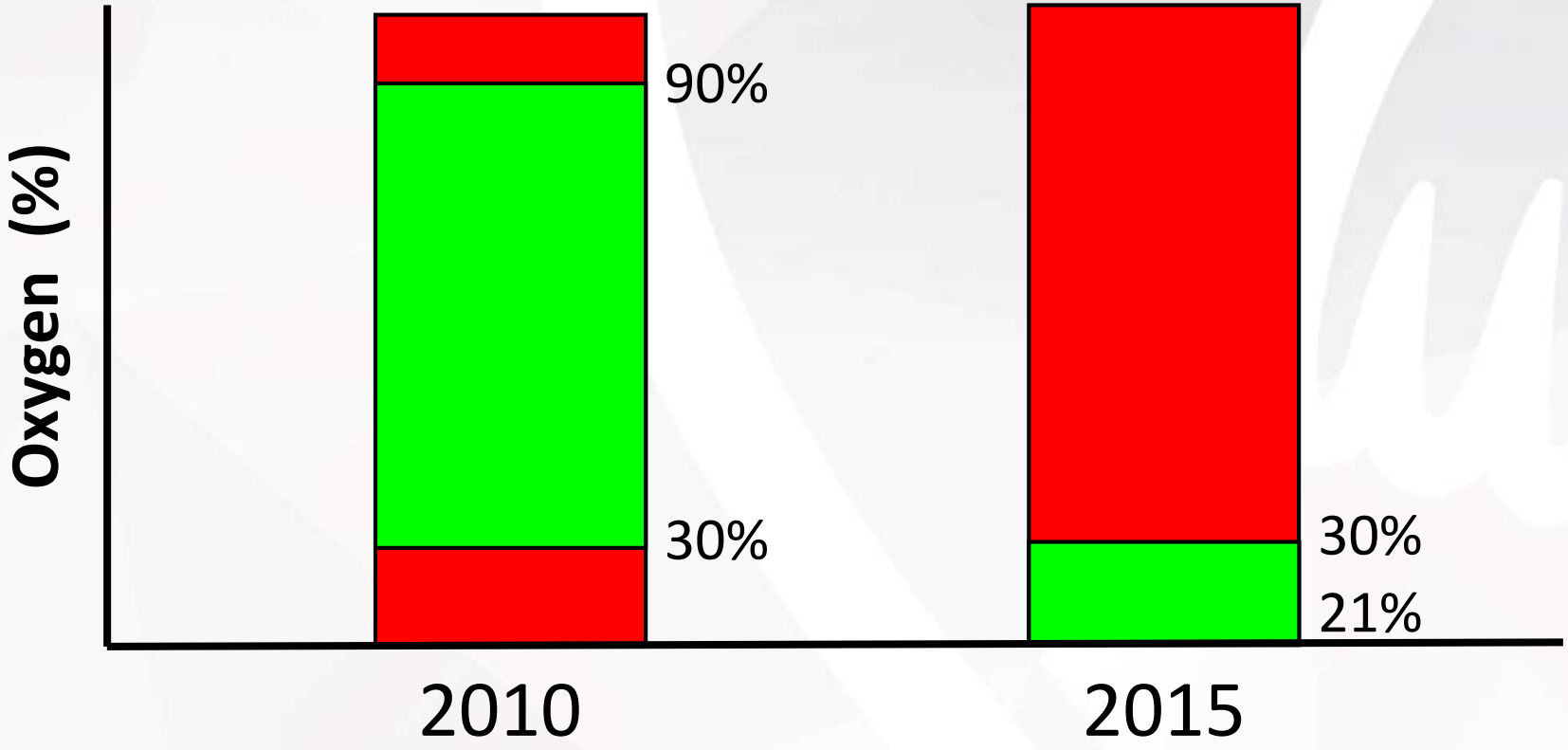
# Oxygen to initiate resuscitation in preterm infants (<35 wks)




Wyckoff MH et al. 2015 AHA Guidelines

Wyllie J et al. 2015 ERC Guidelines

# Torpido Study

- Study design: RCT
- GA: <32 weeks' gestation
- Treatment: RA versus 100% oxygen
- SpO2 targets: 65-95% up to 5 min and 85-95% until admission

Oei JL et al. Pediatrics 2017

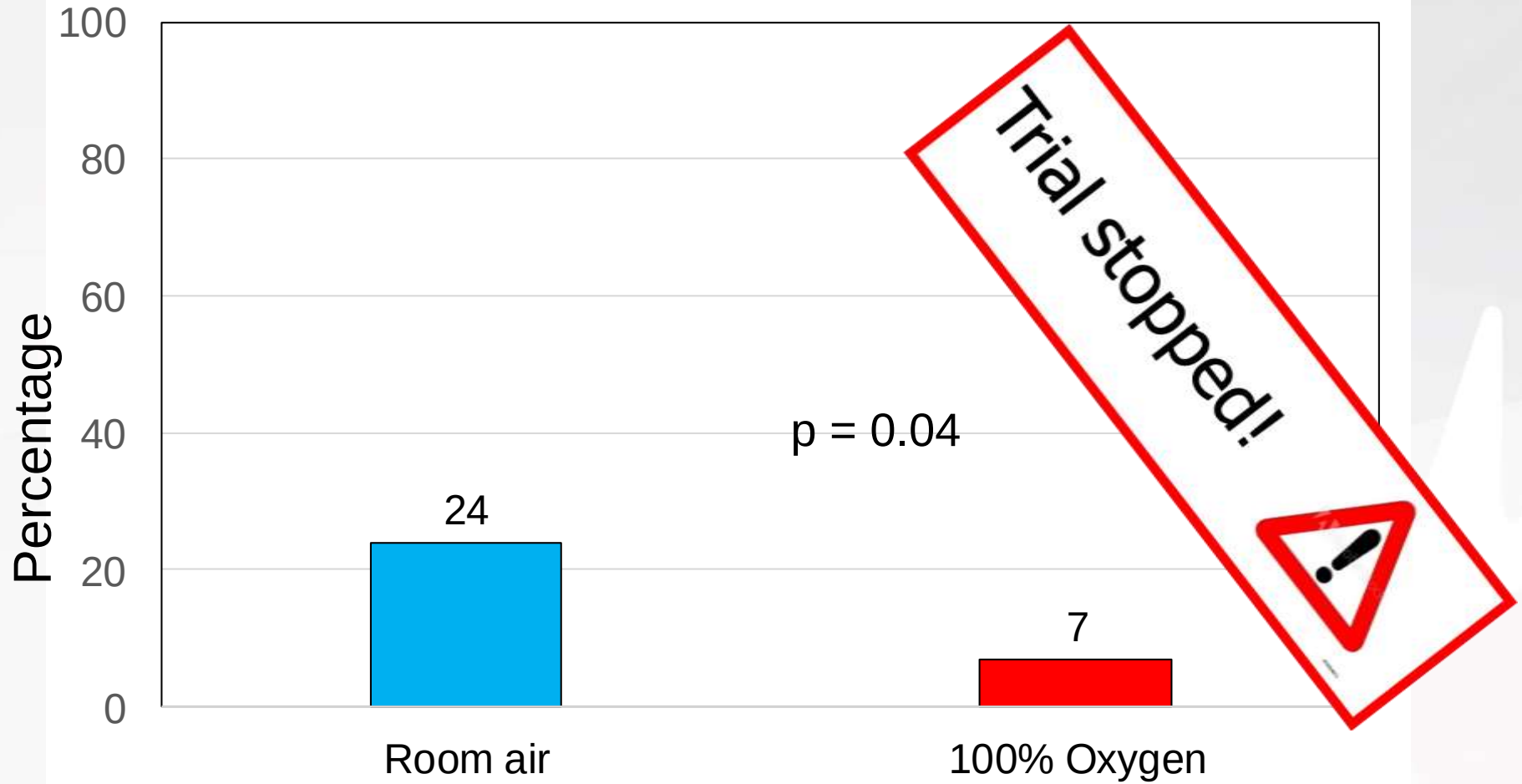
**TABLE 4** Mortality

| Variable | All Infants | | |
|---|---|---|---|
| | RA, $n = 144$ | 100% $O_2$, $n = 143$ | RR (95% CI) |
| All deaths | 14 (10) | 6 (4) | 2.3 (0.9–5.7), $P = .10$ |
| Neonatal death (death <28 d) | 12 (8) | 5 (3) | 3.1 (0.9–11.1), $P = .08$ |
| Death before hospital discharge | 14 (10) | 5 (3) | 2.6 (0.9–7.1), $P = .06$ |
| Age of death, d | 12 (2–95) | 4 (1–11) | $P = .24$ |
| Causes of death[c] | | | |

Oei JL et al. Pediatrics 2017

# Mortality rate

[subgroup of babies <28 weeks' gestation]




Oei JL et al. Pediatrics 2017

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## Adjusted OR for Outcome - Room Air as reference

| Outcome | Intermediate | 100% $O_2$ |
|---|---|---|
| *Primary* | | |
| Death or NDI | 1.01 (0 .77-1.34) | 1.03 ( 0.78-1.35) |
| Death or severe NDI | 1.14 (0.82-1.58) | 1.22 (0.90- 1.67) |
| *Secondary* | | |
| Death | 1.03 (0.68 -1.56) | 0.93 ( 0.63-1.37) |
| NDI | 1.00 (0.74- 1.35) | 1.08 (0.81-1.45) |
| Severe NDI | 1.22 (0.78-1.91) | 1.57 (1.05-2.35) |
| Language score < 70 | 1.54 (0.89-2.67 | 1.73 (1.02-2.91) |

No significant differences: CP, Cognitive score < 85, Cogntive score < 70, Visual impairmen , Hearing impariment

Soraisham AS et al. J Perinatol 2017

# Initial Oxygen Concentration for Preterm Neonatal Resuscitation

**CONCLUSIONS:** The ideal initial $F_{IO_2}$ for preterm newborns is still unknown, although the majority of newborns ≤32 weeks' gestation will require oxygen supplementation.

Welsford M et al. Pediatrics 2019

Italian Resuscitation Council

# Recommendation of FiO2 and newborn resuscitation

- Term and near term infants

OR for mortality: 0.69 (95%CI 0.54-0.88) in favour of air

➡ Start with room air – adjust according to SpO2

- Preterm infants 28-31 weeks GA

OR for mortality: 1.9 (95%CI 0.33-11.1)

➡ Start with 21-30% – adjust according to SpO2

- Preterm infants <28 weeks GA

OR for mortality: 5.3 (95% CI 1.35-20)

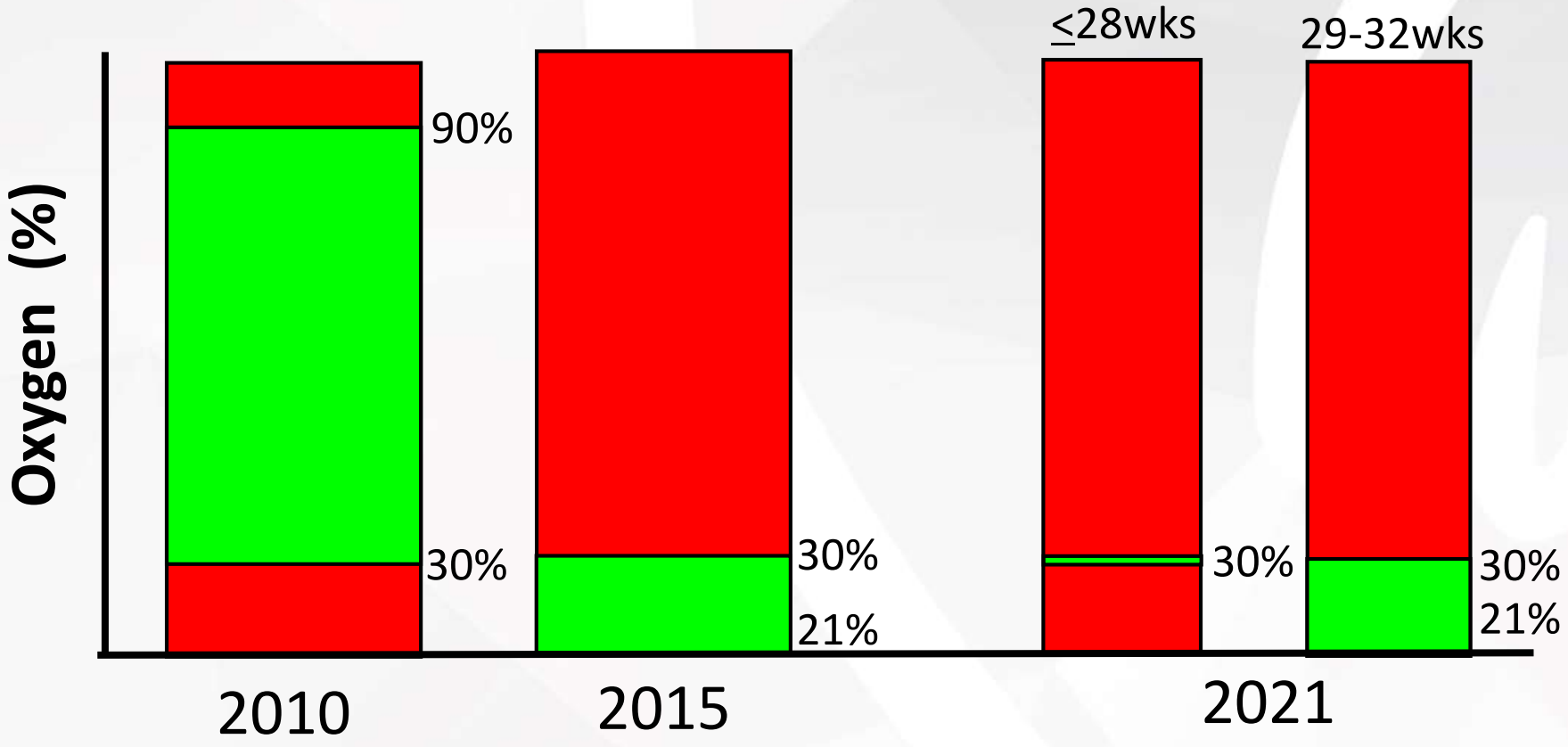
➡ Don't start with 21%

➡ Start with 30% – adjust according to SpO2

Until more data are available from randomized studies aim at a SpO2 of 80-85% within 5 minutes

Saugstad OD, 2017

# Oxygen to initiate resuscitation in preterm infants

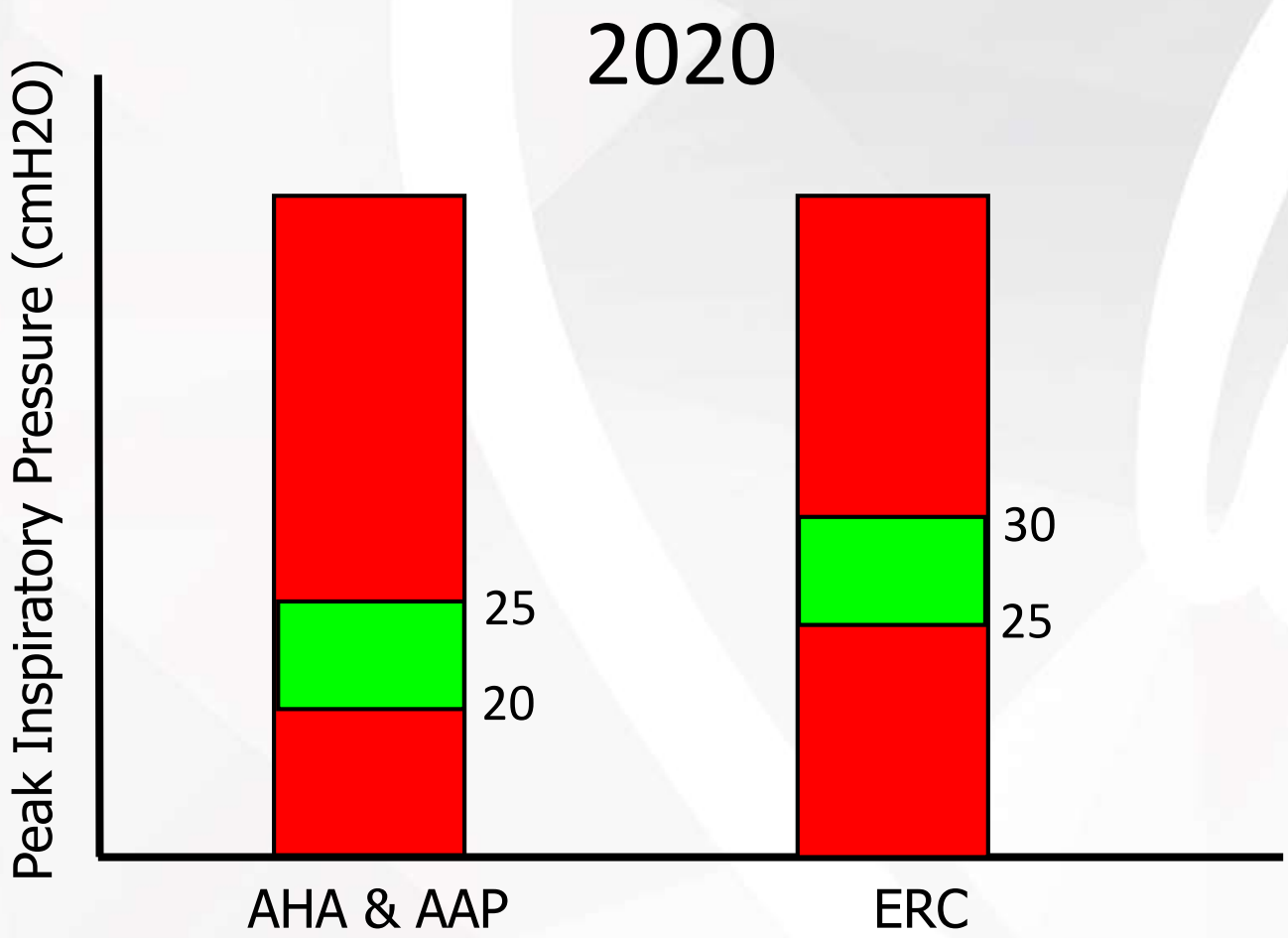



**SpO2 >80% at 5 minutes!**

Wyckoff MH et al. 2015 AHA Guidelines
Wyllie J et al. Resuscitation 2020
Madar J at al. Resuscitation 2021

# *Inflation pressure*

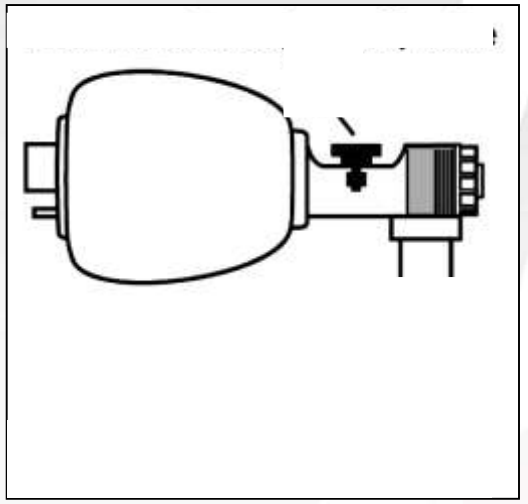
# Inspiratory Pressure for Preterm Infants (GA<32 weeks)




Kalid A et al. Circulation 2020
Madar J et al. Resuscitation 2021

**T-piece**

**or**



**Self-inflating bag**

Szyld E et al. J Pediatr 2014

Giunburg R et al. ADCF&N Ed 2018

Italian Resuscitation Council

# Guidelines 2015

## Treatment Recommendation

"There is insufficient evidence so that a recommendation of one device over another would be purely speculative…"

Wyckoff MH et al. Circulation 2015

Wyllie J et al. Resuscitation 2015

Italian Resuscitation Council

GA<29 wks

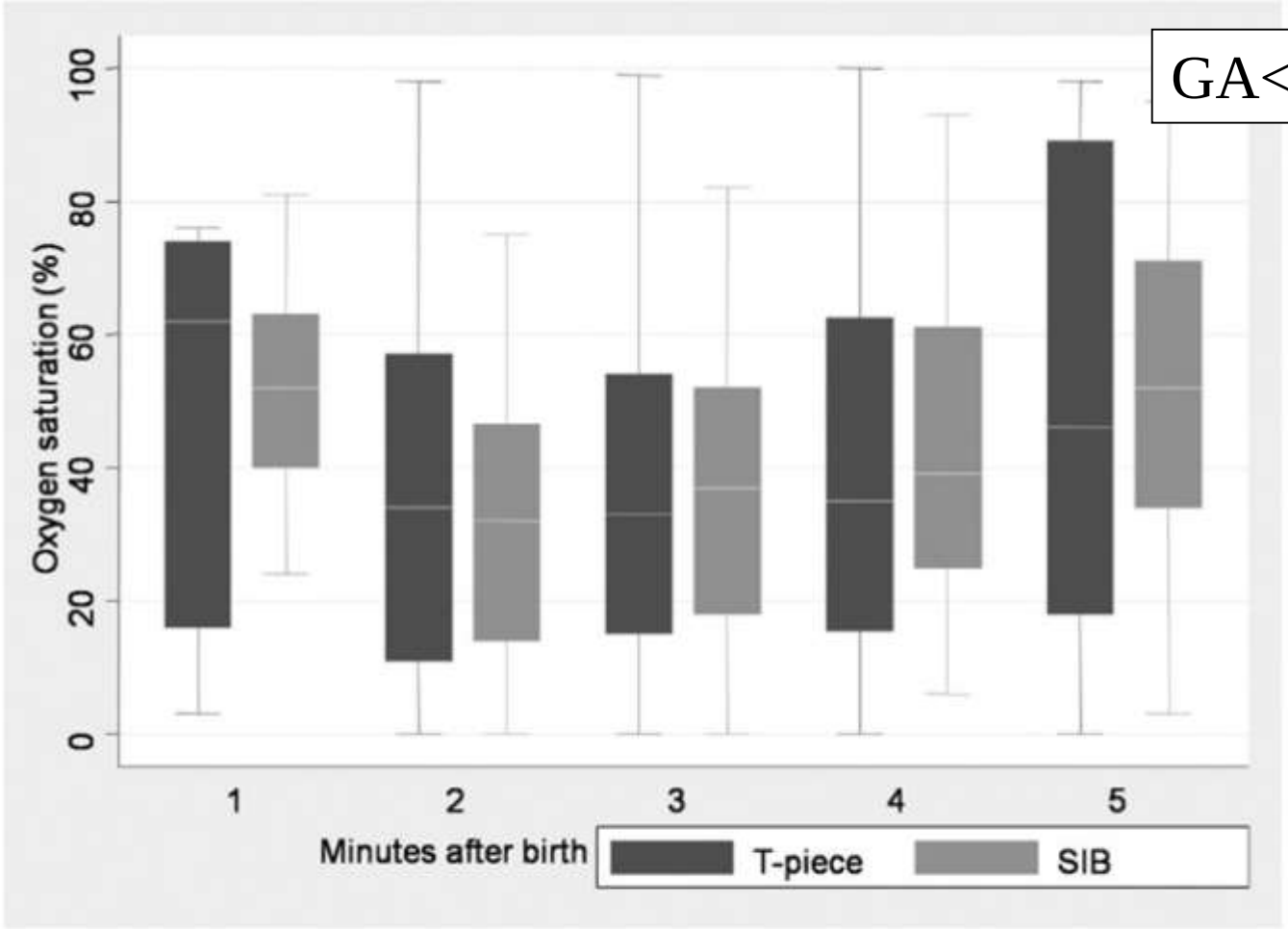



**Figure 4.** $SpO_2$ shown at each minute, for the first 6 minutes after birth, in the T-piece and SIB group. The *box plots* show the median, IQR, and range.

Dawson JA et al, J Pediatr 2011

**Table II. Secondary outcomes**

| Outcome measure | T-piece group (n = 511) | SIB group (n = 516) | OR (95% CI)* | *P* value* |
|---|---|---|---|---|
| Outcomes in the delivery room | | | | |
| Intubation for ventilatory support in the delivery room, n (%) | 86 (17) | 134 (26) | 0.58 (0.4-0.8) | .002 |
| 1-min Apgar score ≤3, n (%) | 153 (30) | 177 (34) | 1.3 (0.9-1.7) | .070 |
| 5-min Apgar score ≤5, n %) | 30 (6) | 47 (9) | 1.5 (0.9-2.5) | .080 |
| Drugs/chest compressions, n (%) | 8 (1.6) | 17 (3.3) | 0.5 (0.2-1.1) | .090 |
| Time to spontaneous breathing, min, mean ± SD† | 2.7 ± 36 | 3.05 ± 3.9 | - | .100 |
| Time elapsed until HR > 100 bpm, min, median (IQR) | 1 (0.5-1.6) | 1 (0.5-1.8) | - | .068 |
| Maximum PIP, mean ± SD‡ variability | 25.58 ± 1.9 | 28 ± 4.9 | - | <.001 |
| PIP >25 cm $H_2O$, n (%) | 52 (10) | 184 (37) | 5.0 (3.6-7.0) | <.001 |
| Mean maximum $FiO_2$ in delivery room, mean ± SD | 0.46 ± 0.19 | 0.50 ± 0.21 | - | .001 |
| Outcomes after the delivery room | | | | |
| Mortality, n (%) | 11 (2.2) | 15 (2.9) | 1.1 (0.5-2.5) | .810 |
| Air leaks (pneumothorax and/or pneumomediastinum), n (%) | 13 (2.5) | 8 (1.6) | 0.6 (0.2-1.4) | .250 |
| Mechanical ventilation, n (%) | 116 (22.7) | 147 (28.5) | 1.3 (0.9-1.8) | .160 |
| Days on mechanical ventilation, mean ± SD | 5.0 ± 7.6 | 8.3 ± 13.3 | - | .007 |
| Days on CPAP, mean ± SD | 7.83 ± 11.3 | 7.96 ± 10.1 | - | .901 |
| Hypoxic ischemic encephalopathy, n (%) | 21 (4.1) | 28 (5.4) | 1.3 (0.7-2.4) | .330 |
| Use of oxygen, n (%) | 208 (40.7) | 222 (43.0) | 1.1 (0.8-1.5) | .411 |
| Days on oxygen, mean ± SD | 13.8 ± 17 | 22.8 ± 25 | - | <.001 |

## GA>26 weeks

Szyld E et al, J Pediatr 2014

# GA>26 weeks

**Table III. Analysis in the subgroup of VLBW infants**

| Outcome measure | T-piece group (n = 85) | SIB group (n = 110) | OR (95% CI)* | *P* value* |
|---|---|---|---|---|
| HR ≥100 bpm at 2 min, n (%) | 75 (88.2) | 84 (76.4) | 0.43 (0.19-0.95) | .037 |
| Intubation for ventilatory support, n (%) | 45 (52.9) | 76 (69.1) | 2.01 (1.12-3.60) | .019 |
| Drugs/chest compressions, n (%) | 3 (3.5) | 5 (4.6) | 1.30 (0.30-5.61) | .723 |
| Mechanical ventilation, n (%) | 62 (72.9) | 85 (77.3) | 1.26 (0.66-2.43) | .487 |
| BPD, n (%) | 21 (24.7) | 44 (40.0) | 2.03 (1.09-3.79) | .036 |
| Air leaks (pneumothorax and/or neumomediastinum), n (%) | 3 (3.5) | 2 (1.8) | 0.51 (0.08-3.1) | .461 |
| Use of oxygen, n (%) | 71 (83) | 101 (92) | 2.2 (0.9-5.5) | .082 |
| Days on oxygen, mean ± SD | 21 ± 20 | 35 ± 27 | - | .0007 |

Szyld E et al, J Pediatr 2014

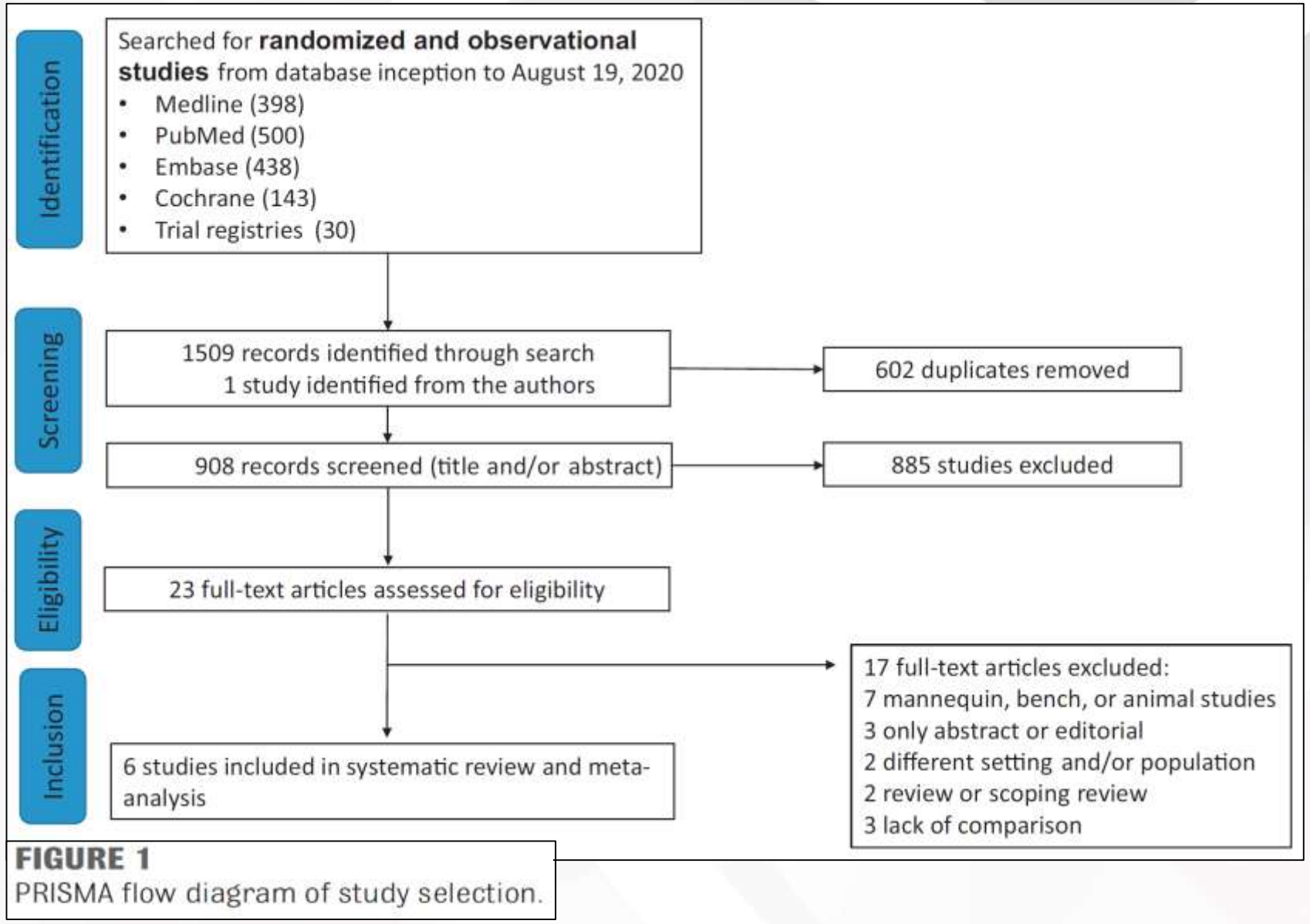



**FIGURE 1**
PRISMA flow diagram of study selection.

Trevisanuto D. et al. Pediatrics 2021

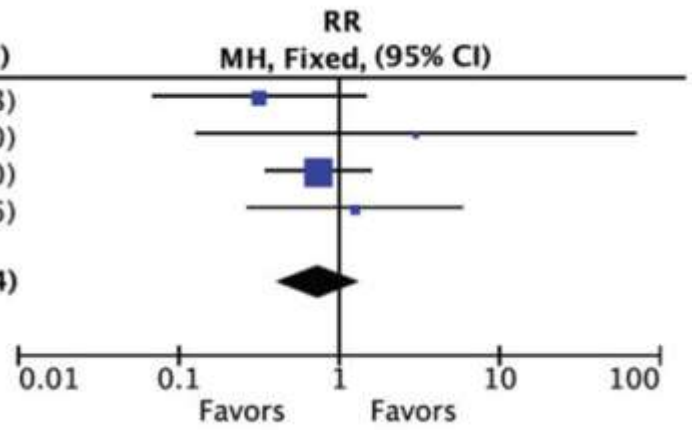
## In–hospital mortality

A

| Study or Subgroup | TPR Events | Total | SIB Events | Total | Weight | RR MH, Fixed, (95% CI) |
|---|---|---|---|---|---|---|
| Dawson et al 2012 | 2 | 41 | 6 | 39 | 25.4% | 0.32 (0.07 to 1.48) |
| Kookna et al 2019 | 1 | 25 | 0 | 25 | 2.1% | 3.00 (0.13 to 70.30) |
| Szyld et al 2014 | 11 | 511 | 15 | 516 | 61.6% | 0.74 (0.34 to 1.60) |
| Thakur et al 2015 | 3 | 40 | 3 | 50 | 11.0% | 1.25 (0.27 to 5.86) |
| **Total (95% CI)** | | **617** | | **630** | **100.0%** | **0.74 (0.40 to 1.34)** |
| Total events | 17 | | 24 | | | |

Heterogeneity: $\chi^2 = 2.36$, df = 3 ($P = .50$); $I^2 = 0\%$

Test for overall effect: $z = 1.01$ ($P = .31$)



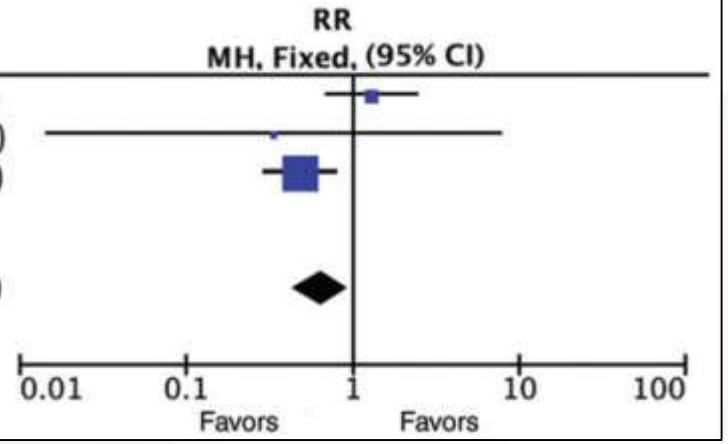

## BPD

B

| Study or Subgroup | TPR Events | Total | SIB Events | Total | Weight | RR MH, Fixed, (95% CI) |
|---|---|---|---|---|---|---|
| Dawson et al 2012 | 15 | 41 | 11 | 39 | 19.9% | 1.30 (0.68 to 2.47) |
| Kookna et al 2019 | 0 | 25 | 1 | 25 | 2.7% | 0.33 (0.01 to 7.81) |
| Szyld et al 2014 | 21 | 511 | 44 | 516 | 77.4% | 0.48 (0.29 to 2.80) |
| Thakur et al 2015 | 0 | 40 | 0 | 50 | | Not estimable |
| **Total (95% CI)** | | **617** | | **630** | **100.0%** | **0.64 (0.43 to 0.95)** |
| Total events | 36 | | 56 | | | |

Heterogeneity: $\chi^2 = 6.01$, df = 2 ($P = .05$); $I^2 = 67\%$

Test for overall effect: $z = 2.24$ ($P = .93$)

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## COMPARISON 1: T-PIECE RESUSCITATOR vs SELF-INFLATING BAG

Where resources permit, we suggest the use of a T-Piece resuscitator over the use of a self-inflating bag in infants receiving positive pressure ventilation at birth. (Weak recommendation, very low certainty of evidence). A self-inflating bag should be available as a back-up device for the T-piece resuscitator in case of gas supply failure (technical remark).

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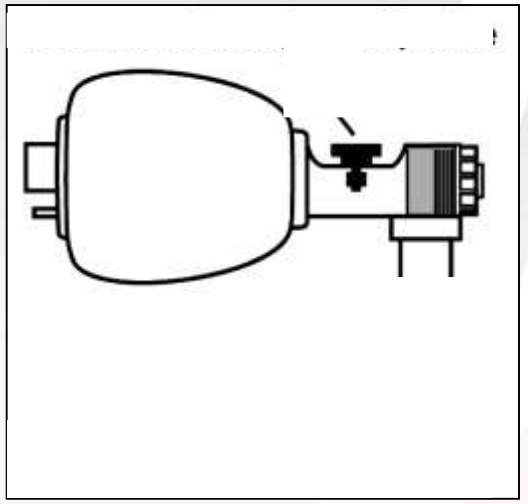
Italian Resuscitation Council

**T-piece**

>



**Self-inflating bag**

# Which T-piece?

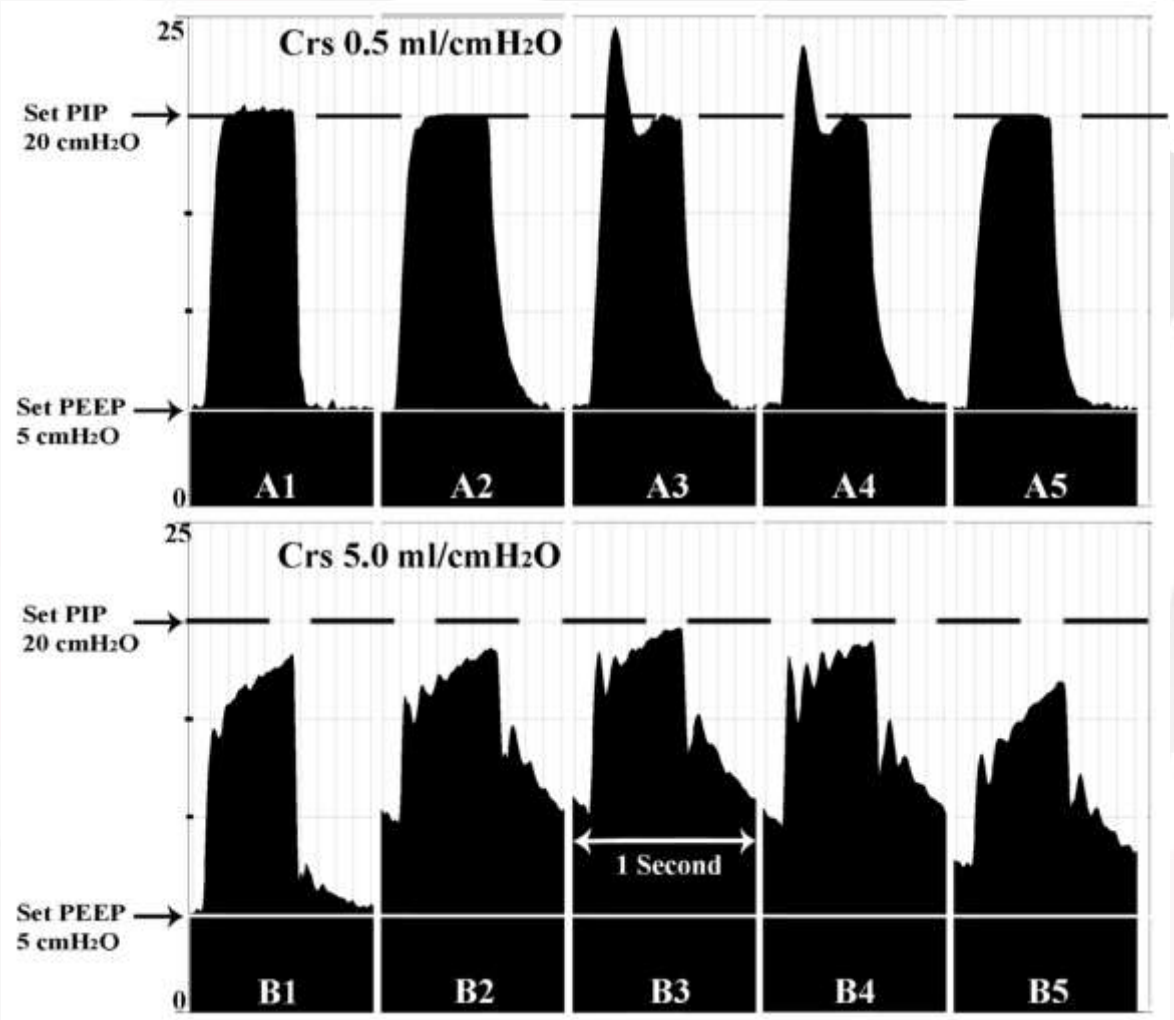



**Figure 4** Examples of recorded pressure waveforms for each TPR device tested: 1: rPAP; 2: Neopuff; 3: GE Panda; 4: Draeger Resuscitaire; and 5: Atom at test lung compliances: A: 0.5 mL/cm$H_2O$ and B: 5.0 mL/cm$H_2O$. Time scale 1 s per segment. PEEP, positive-end expiratory pressure; PIP, peak inflation pressure; TPR, T-piece resuscitator.

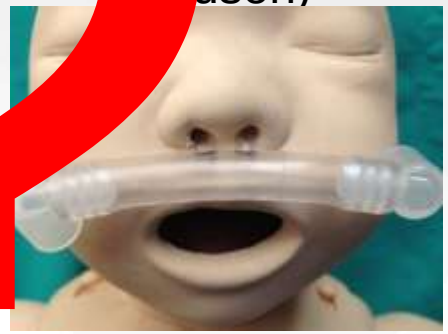
Hinder M et al. ADCF&N Ed 2019

Rimini IRC 2021 CONGRESSO NAZIONALE 16•17•18 DICEMBRE NUOVE LINEE GUIDA 2021: RIANIMAZIONE CARDIOPOLMONARE POST-LOCKDOWN

Single NF prong

Double NF prong

Short ...sal prongs ...dson)



Short binasal cannulae (Fisher&Paykel / RAM)

?

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# Use of the laryngeal mask

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# Guidelines for Neonatal Resuscitation (history)

[<1960] Empirical observations

[1966] AHA committee on cardiopulmonary resuscitation (adults)

[1987] Bloom RS, Cropley C, editors. Textbook of neonatal resuscitation

[1992] International Liaison Committee on Resuscitation (ILCOR)

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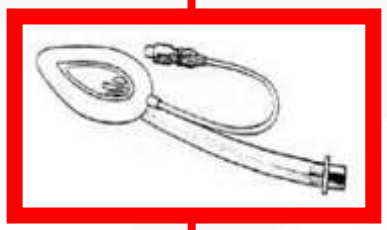

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[2010]


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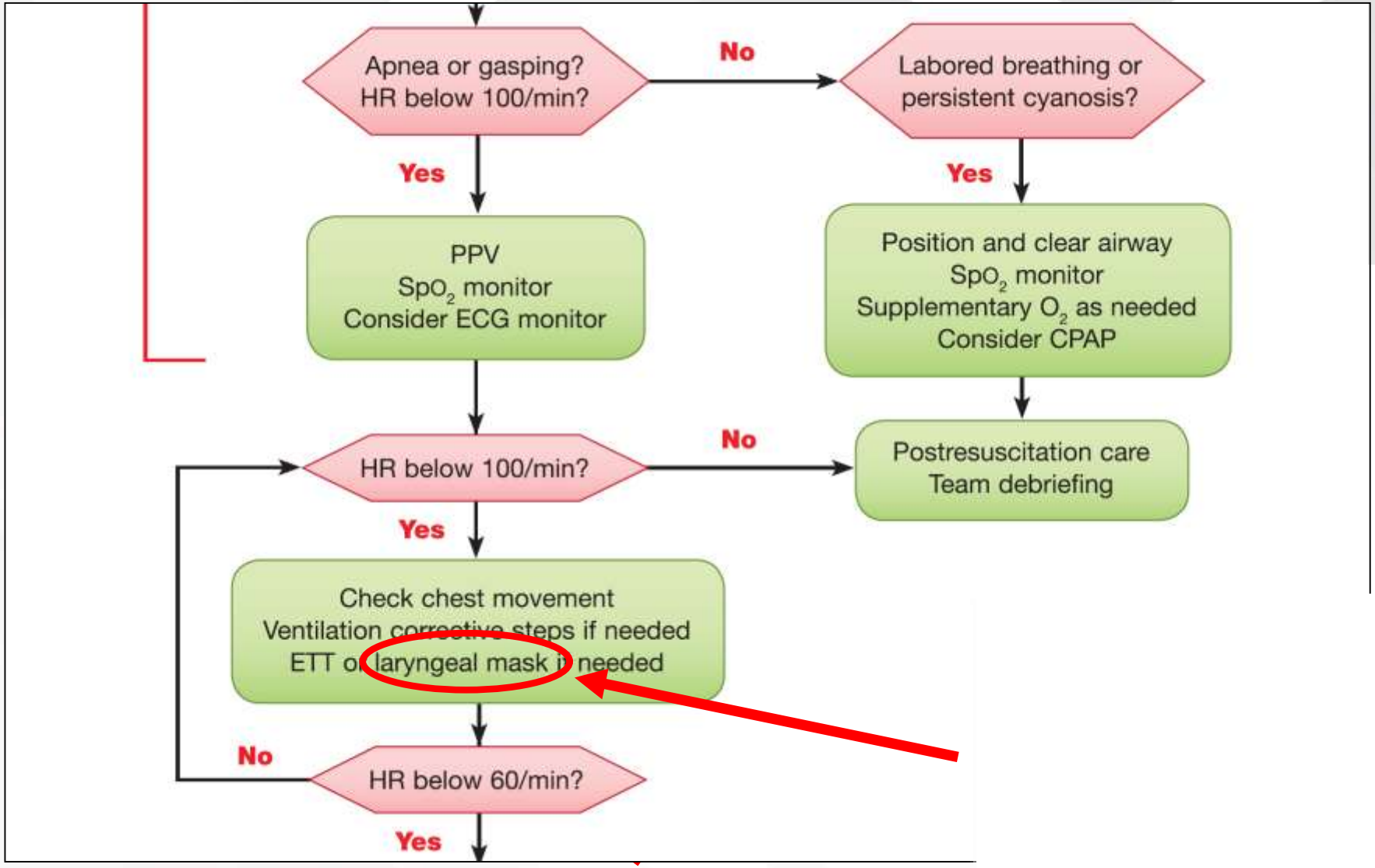
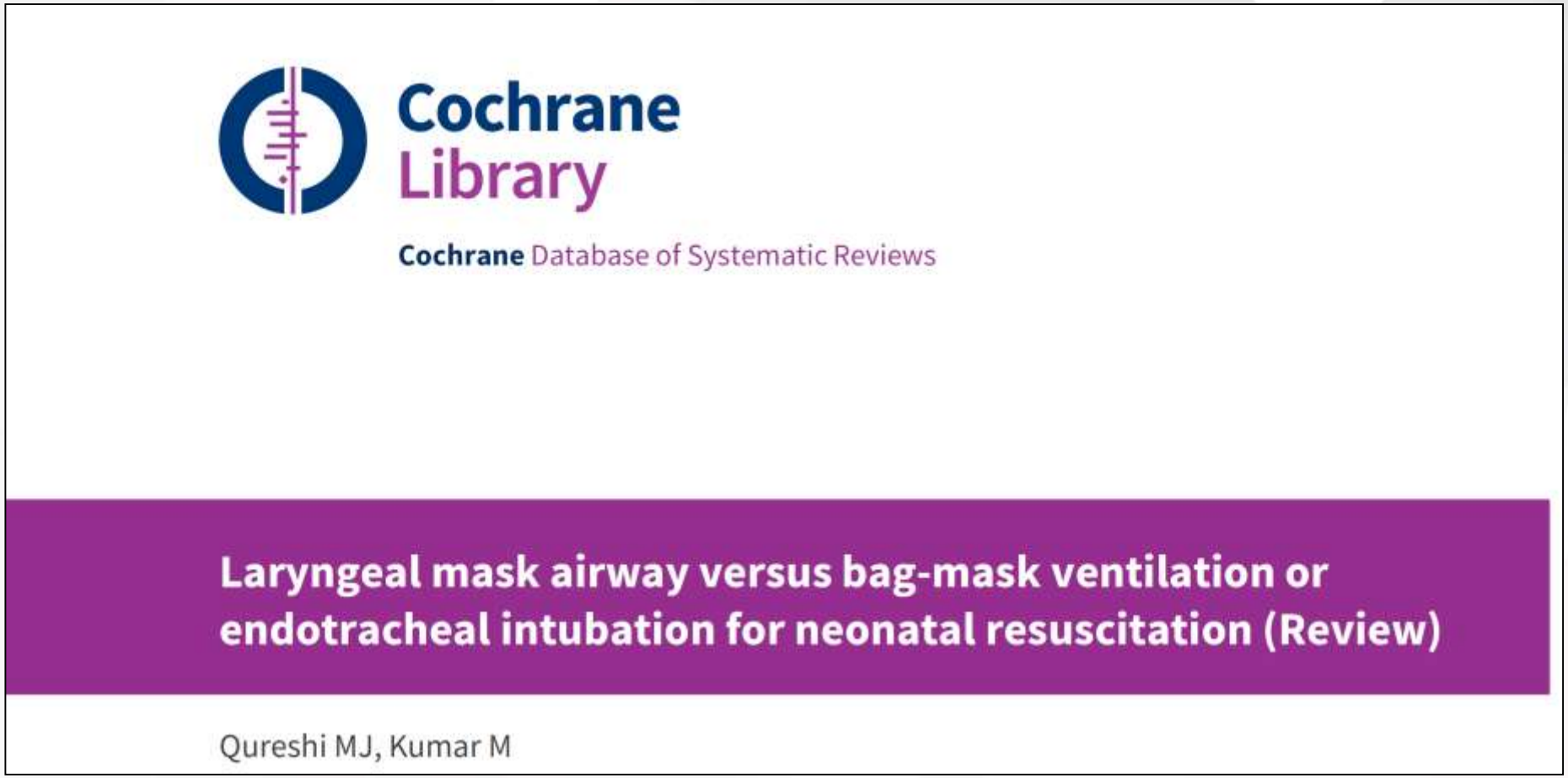
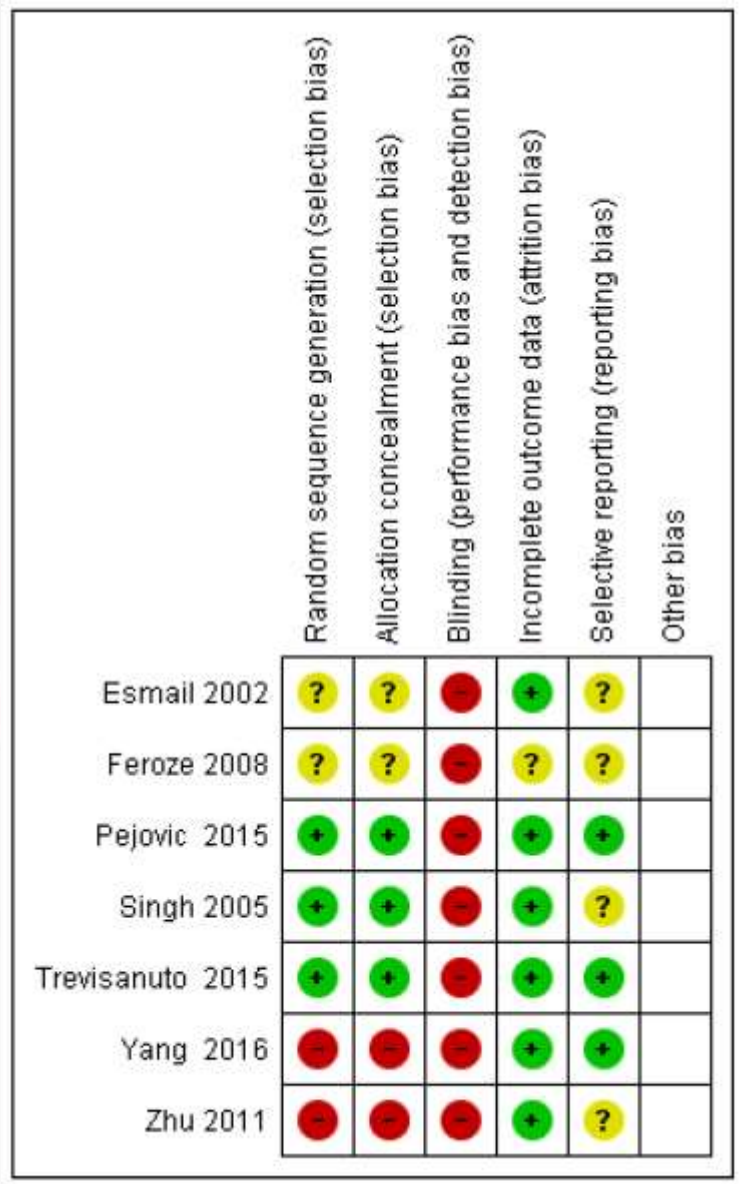



Wyckoff MH et al. Circulation 2015




Qureshi MJ, Kumar M, Cochrane Library 2018




# 7 RCT

Very low- to low-quality evidence

[794 infants]

Qureshi MJ, Kumar M, Cochrane Library 2018

## Analysis 1.2. Comparison 1 LMA versus BMV, Outcome 2 Need for intubation.

Review: Laryngeal mask airway versus bag-mask ventilation or endotracheal intubation for neonatal resuscitation

Comparison: 1 LMA versus BMV

Outcome: 2 Need for intubation

**Need for intubation**

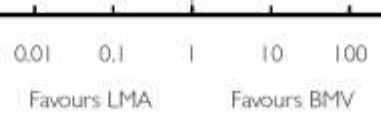
| Study or subgroup | LMA n/N | BMV n/N | Risk Ratio IV,Fixed,95% CI | Weight | Risk Ratio IV,Fixed,95% CI |
|---|---|---|---|---|---|
| Feroze 2008 | 1/25 | 5/25 | | 10.6 % | 0.20 [ 0.03, 1.59 ] |
| Pejovic 2015 | 0/24 | 0/25 | | | Not estimable |
| Singh 2005 | 1/25 | 3/25 | | 9.4 % | 0.33 [ 0.04, 2.99 ] |
| Trevisanuto 2015 | 6/71 | 15/71 | | 57.6 % | 0.40 [ 0.16, 0.97 ] |
| Zhu 2011 | 2/205 | 26/164 | | 22.4 % | 0.06 [ 0.01, 0.26 ] |
| **Total (95% CI)** | **350** | **310** | | **100.0 %** | **0.24 [ 0.12, 0.47 ]** |

Total events: 10 (LMA), 49 (BMV)

Heterogeneity: $Chi^2 = 4.90$, $df = 3$ ($P = 0.18$); $I^2 = 39\%$

Test for overall effect: $Z = 4.15$ ($P = 0.000034$)

Test for subgroup differences: Not applicable




Qureshi MJ, Kumar M, Cochrane Library 2018

## Analysis 1.4. Comparison 1 LMA versus BMV, Outcome 4 Ventilation time [seconds].

Review: Laryngeal mask airway versus bag-mask ventilation or endotracheal intubation for neonatal resuscitation

Comparison: 1 LMA versus BMV

Outcome: 4 Ventilation time [seconds]

**Ventilation time**

| Study or subgroup | LMA N | LMA Mean(SD) | BMV N | BMV Mean(SD) | Mean Difference IV,Fixed,95% CI | Weight | Mean Difference IV,Fixed,95% CI |
|---|---|---|---|---|---|---|---|
| Pejovic 2015 | 24 | 93 (52) | 25 | 140 (90) | | 1.8 % | -47.00 [ -87.96, -6.04 ] |
| Singh 2005 | 25 | 105.6 (90) | 25 | 128.4 (90) | | 1.2 % | -22.80 [ -72.69, 27.09 ] |
| Trevisanuto 2015 | 71 | 60 (44.4) | 71 | 40 (22.2) | | 22.3 % | 20.00 [ 8.45, 31.55 ] |
| Zhu 2011 | 205 | 36.4 (23.7) | 164 | 66.2 (35.4) | | 74.7 % | -29.80 [ -36.11, -23.49 ] |
| **Total (95% CI)** | **325** | | **285** | | | **100.0 %** | **-18.90 [ -24.35, -13.44 ]** |

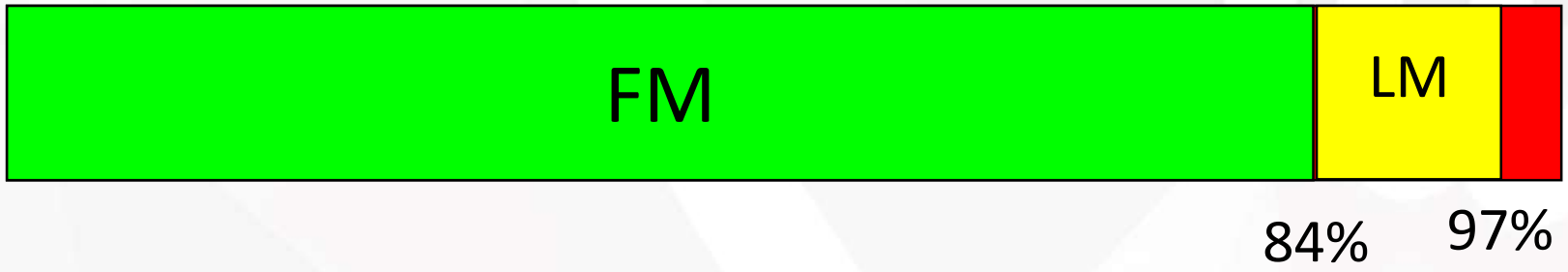
Heterogeneity: $Chi^2 = 56.88$, df = 3 ($P<0.00001$); $I^2 = 95\%$

Test for overall effect: $Z = 6.79$ ($P < 0.00001$)

Test for subgroup differences: Not applicable


Qureshi MJ, Kumar M, Cochrane Library 2018

# Effective PPV
# LM vs. FM
## [late-preterm and full-term infants]




[7 RCT]

Qureshi MJ, Kuma M, Cochrane Library 2018

Italian Resuscitation Council

Rimini IRC 2021 CONGRESSO NAZIONALE 16•17•18 DICEMBRE
NUOVE LINEE GUIDA 2021: RIANIMAZIONE CARDIOPOLMONARE POST-LOCKD

The NEW ENGLAND JOURNAL of MEDICINE

Original Article

# A Randomized Trial of Laryngeal Mask Airway in Neonatal Resuscitation

Nicolas J. Pejovic, M.D., Ph.D., Susanna Myrnerts Höök, M.D., M.Med., Josaphat Byamugisha, M.D., Ph.D., Tobias Alfvén, M.D., Ph.D., Clare Lubulwa, M.D., M.Med., Francesco Cavallin, M.Sc., Jolly Nankunda, M.D., Ph.D., Hege Ersdal, M.D., Ph.D., Mats Blennow, M.D., Ph.D., Daniele Trevisanuto, M.D., and Thorkild Tylleskär, M.D., Ph.D.

University of Bergen
Norway

Makerere University,
Kampala, Uganda

University of Padua
Italy

Karolinska Instituted
Sweden

Pejovic N et al. NEJM 2020©

IRC Italian Resuscitation Council

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The NEW ENGLAND JOURNAL of MEDICINE

November 26, 2020

# RANDOMIZATION: day-by-day cluster randomization

or

University of Bergen Norway

Makerere University, Kampala, Uganda

University of Padua Italy

Karolinska Instituted Sweden

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**PRIMARY OUTCOME:** early neonatal death (within 7 days) or admission to NICU with moderate-to-sever HIE (Thomson score>11) at day 1 to day 5 during hospitalization.

**Table 2. Outcome Measures.***

| Outcome | Laryngeal Mask Airway | Face Mask | Unadjusted Analysis | | Adjusted Analysis† | |
|---|---|---|---|---|---|---|
| | | | Relative Risk (95% CI) | P Value | Relative Risk (95% CI) | P Value |
| | *no./total no. (%)* | | | | | |
| Primary outcome | 154/563 (27.4) | 144/591 (24.4) | 1.12 (0.92–1.37) | 0.27 | 1.16 (0.90–1.51) | 0.26 |
| Secondary outcomes | | | | | | |
| Advanced resuscitation | 39/566 (6.9) | 39/597 (6.5) | 1.05 (0.69–1.62) | — | 1.08 (0.63–1.86) | — |
| Early neonatal death | 122/563 (21.7) | 109/591 (18.4) | 1.17 (0.93–1.48) | — | 1.21 (0.90–1.63) | — |
| Very early neonatal death | 89/563 (15.8) | 85/591 (14.4) | 1.10 (0.84–1.45) | — | 1.13 (0.80–1.58) | — |
| Admission to NICU with Thompson score of ≥11 at days 1–5 during hospitalization | 53/474 (11.2) | 51/504 (10.1) | 1.13 (0.89–1.70) | — | 1.27 (0.84–1.93) | — |
| Admission to NICU with Thompson score of ≥7 at days 1–5 during hospitalization | 100/474 (21.1) | 115/504 (22.8) | 0.97 (0.78–1.21) | — | 0.94 (0.70–1.27) | — |
| Any hospital admission during first 7 days of life | 496/519 (95.6) | 530/554 (95.7) | 0.99 (0.97–1.02) | — | — | — |

Pejovic N et al. NEJM 2020©

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Pejovic N et al. NEJM 2020

## Conclusions

In neonates with asphyxia, the LMA was safe in the hands of midwives but was not superior to face-mask ventilation with respect to early neonatal death and moderate-to-severe hypoxic–ischemic encephalopathy.

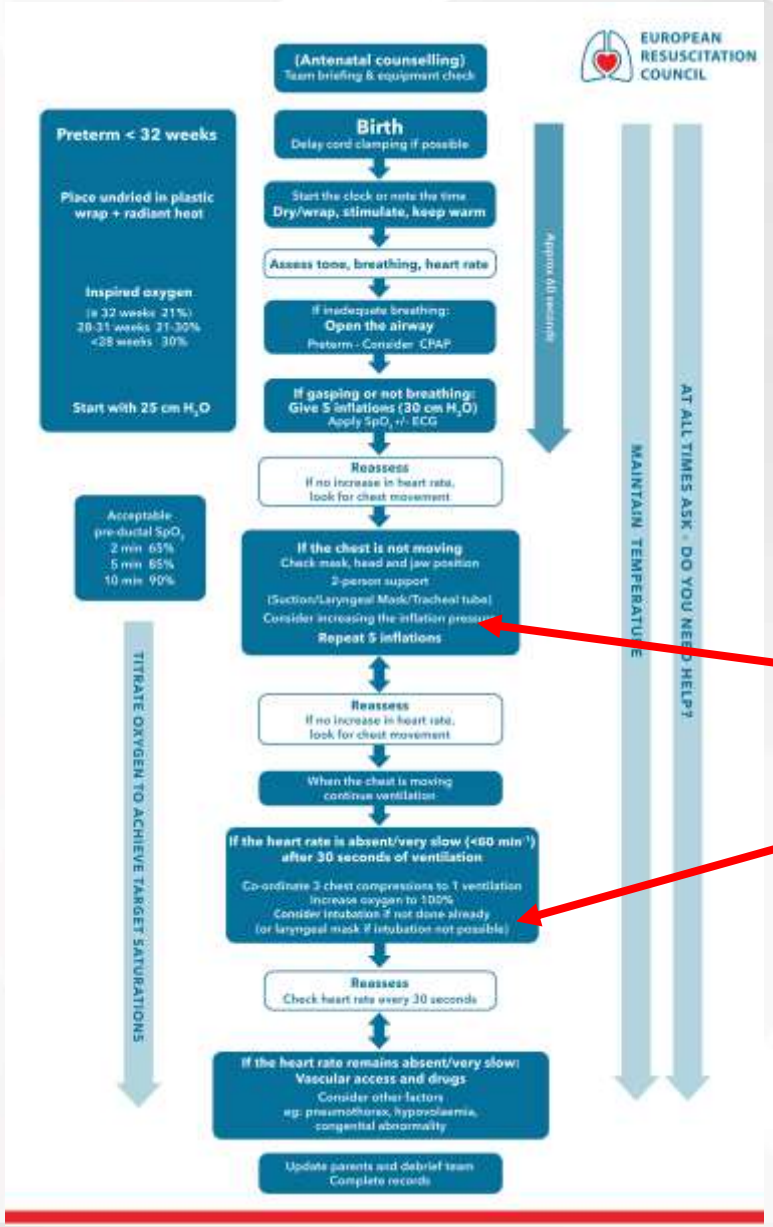
University of Bergen Norway

Makerere University, Kampala, Uganda

University of Padua Italy

Karolinska Instituted Sweden

Pejovic N et al. NEJM 2020




Laryngeal mask

Madar J et al. Resuscitation 2021

***Use of the laryngeal mask***

If facemask ventilation is unsuccessful or if tracheal intubation is unsuccessful or not feasible a laryngeal mask may be considered as an alternative means of establishing an airway in infants of >34 weeks gestation (about 2000 g, although some devices have been used successfully in infants down to 1500 g).

Madar J. et al. Resuscitation 2021

# Management of the umbilical cord


CARTOONSTOCK
.com
Search ID: dco0238
"Would you like to cut the cord?"

~~ICC~~

DCC

UCM ?

# Guidelines 2015

## Cord milking

### Treatment Recommendation

"We **suggest against** the routine use of cord milking for infants born at less than 29 weeks of gestation because there is insufficient published human evidence of benefit."

"Cord milking may be considered on an individualized basis or in a research setting as it may improve initial mean blood pressure, hematological indices and intracranial hemorrhage. There is no evidence for improvement or safety in long-term outcomes. (Weak recommendation, low level of evidence)."

Perlman J et al. Circulation 2015

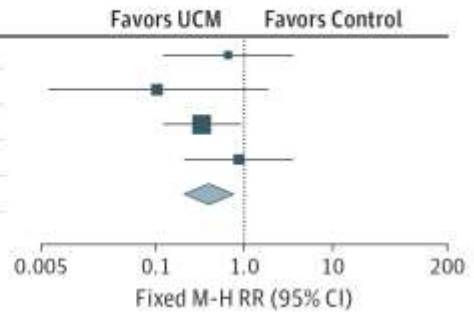
Original Investigation

# Efficacy and Safety of Umbilical Cord Milking at Birth

## A Systematic Review and Meta-analysis

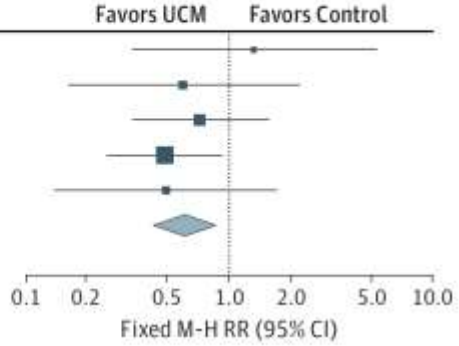
B Oxygen requirement at 36 wk, postmenstrual age in preterm infants[a]

| Source | UCM Group No. of Events | UCM Group Total | Control Group No. of Events | Control Group Total | Weight, % | Fixed M-H RR (95% CI) |
|---|---|---|---|---|---|---|
| Alan et al,[16] 2014 | 2 | 19 | 3 | 19 | 12.9 | 0.67 (0.13-3.55) |
| Hosono et al,[11] 2008 | 0 | 18 | 4 | 17 | 19.8 | 0.11 (0.01-1.82) |
| Katheria et al,[15] 2014 | 4 | 30 | 12 | 30 | 51.4 | 0.33 (0.12-0.92) |
| Rabe et al,[14] 2011 | 3 | 27 | 4 | 31 | 16.0 | 0.86 (0.21-3.51) |
| Total | 9 | 94 | 23 | 97 | 100.0 | 0.42 (0.21-0.83) |
| Heterogeneity $x_3^2 = 2.41$ ($P = .49$); $I^2 = 0\%$ | | | | | | |
| Test for overall effect: $z = 2.50$ ($P = .01$) | | | | | | |




C IVH of all grades[a]

| Source | UCM Group No. of Events | UCM Group Total | Control Group No. of Events | Control Group Total | Weight, % | Fixed M-H RR (95% CI) |
|---|---|---|---|---|---|---|
| Alan et al,[16] 2014 | 4 | 22 | 3 | 22 | 6.7 | 1.33 (0.34-5.28) |
| Hosono et al,[11] 2008 | 3 | 20 | 5 | 20 | 11.2 | 0.60 (0.17-2.18) |
| Katheria et al,[15] 2014 | 8 | 30 | 11 | 30 | 24.6 | 0.73 (0.34-1.55) |
| March et al,[12] 2013 | 9 | 36 | 20 | 39 | 42.9 | 0.49 (0.26-0.93) |
| Rabe et al,[14] 2011 | 3 | 27 | 7 | 31 | 14.6 | 0.49 (0.14-1.72) |
| Total | 27 | 135 | 46 | 142 | 100.0 | 0.62 (0.41-0.93) |
| Heterogeneity $x_4^2 = 2.03$ ($P = .73$); $I^2 = 0\%$ | | | | | | |
| Test for overall effect: $z = 2.32$ ($P = .02$) | | | | | | |




Al-Wassia H et al. JAMA Pediatr 2015

# Benefits of umbilical cord milking versus delayed cord clamping on neonatal outcomes in preterm infants: A systematic review and meta-analysis

## Conclusions

UCM wasn't reduced in-hospital mortality and need for transfusion compared to DCC. But our study suggests that UCM may lower the risk of IVH and improve certain neurodevelop-mental outcomes compared to DCC in preterm infants.

Nagano N et al. PLOS One 2018

Premature Infants Receiving Cord Milking Or Delayed Cord Clamping: A Randomized Controlled Non-inferiority Trial

**P:** In infants with GA 23-31 weeks

**I:** does Umbilical Cord Milking

**C:** Delayed Cord Clamping

**O:** resuce Intraventricular hemorrhage (IVH) or Death

Katheria AC et al. JAMA 2019

Premature Infants Receiving Cord Milking Or Delayed Cord Clamping: A Randomized Controlled Non-inferiority Trial

## Primary outcome

Intraventricular hemorrhage (IVH) or death

| DDC | UCM | p-value |
|---|---|---|
| 19/238 (8%) | 28/236 (12%) | 0.16 |

Katheria AC et al. JAMA 2019

Italian Resuscitation Council

Premature Infants Receiving Cord Milking Or Delayed Cord Clamping: A Randomized Controlled Non-inferiority Trial


**[23-27 wks]**

Severe intraventricular hemorrhage (IVH)

| | DDC | UCM | p-value |
|---|---|---|---|
| | (6%) | 20/93 (22%) | 0.0019 |

Katheria AC et al. JAMA 2019

Italian Resuscitation Council

***Management of the umbilical cord***

Clamping after at least 60 s is recommended, ideally after the lungs are aerated. Where delayed cord clamping is not possible cord milking should be considered in infants >28 weeks gestation.

Madar J. et al. Resuscitation 2021

# *Prognosis*

# Discontinuing Resuscitative Efforts

An Apgar score of 0 at 10 minutes is a strong predictor of mortality and morbidity in late preterm and term infants.

We suggest that, in infants with an Apgar score of 0 after 10 minutes of resuscitation, if the heart rate remains undetectable, it may be reasonable to stop assisted ventilation; however, the decision to continue or discontinue resuscitative efforts must be individualized.

Wyckoff MH et al. Pediatrics 2015
Willey J et al. Resuscitation 2015

# Discontinuing Resuscitative Efforts

"Newborns immediately after birth presenting with at least 10 minutes of asystole, bradycardia, or pulseless electrical activity for which CPR is indicated."

Foglia E et al. Pediatrics 2020

# Discontinuing Resuscitative Efforts

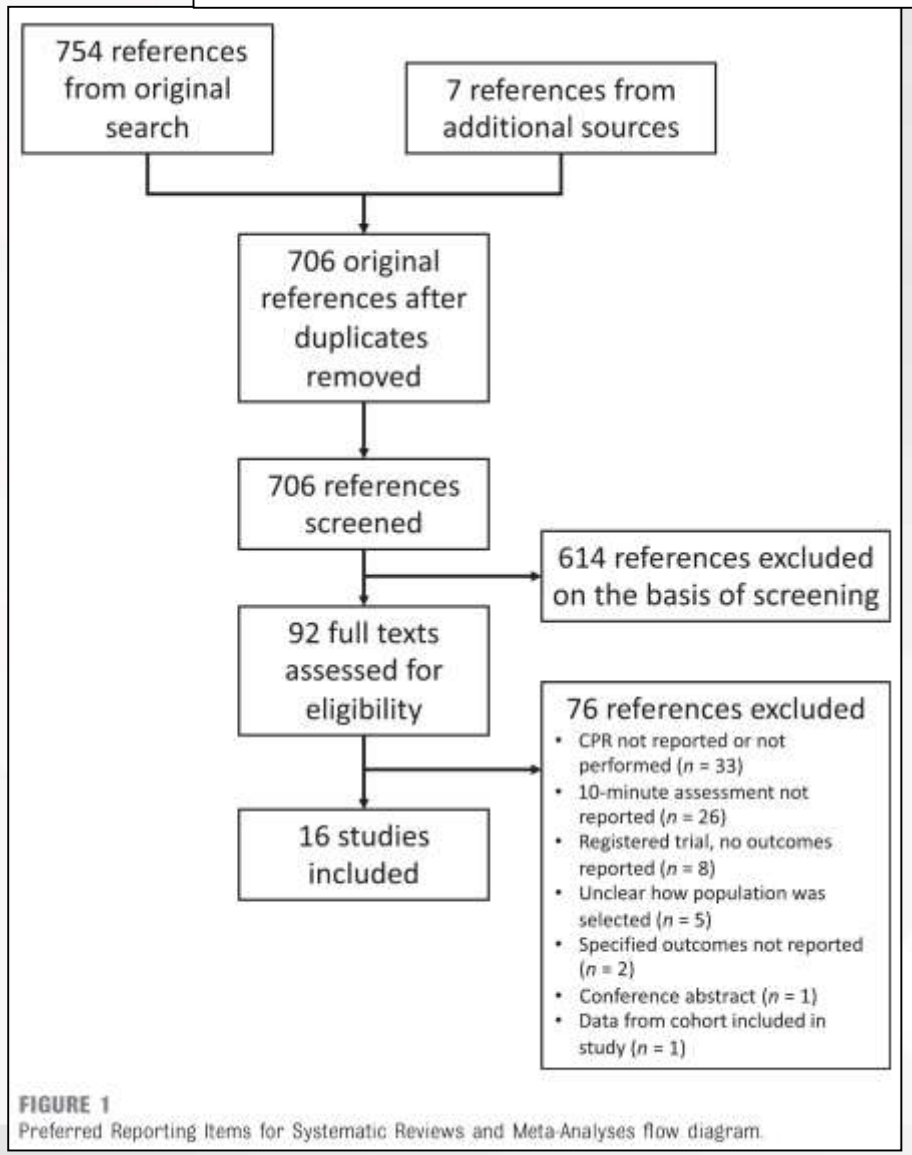



**FIGURE 1**
Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

Foglia E et al. Pediatrics 2020

# Discontinuing Resuscitative Efforts

**TABLE 5** Subgroup Analyses for Survival and Neurodevelopmental Outcomes

| Subgroup | Studies Contributing | Infants, *N* | Survival to Last Follow-up, *n* (%) | Infants Assessed for Neurodevelopment, *n* | Survival Without Moderate or Severe NDI | |
|---|---|---|---|---|---|---|
| | | | | | *n* (% of Survivors Assessed) | *n* (% of All Enrolled) |
| Population level studies | 6[12,13,15,16,23,24] | 240 | 67 of 240 (28) | 15 | 9 of 15 (60) | 9 of 131[a] (7) |
| Therapeutic hypothermia treatment | 9[10,11,17,19–21,23–25] | 206 | 122 of 206 (59) | 57 | 21 of 57 (37) | 21 of 105[b] (20) |
| Gestational age ≥ 36 wk | 13[10–13,15,17–21,23–25] | 350 | 189 of 350 (54) | 73 | 23 of 73 (32) | 23 of 166[c] (14) |
| Gestational age <36 wk | 7[12,13,15,20,23–25] | 144 | 41 of 144 (28) | 8 | 5 of 8 (63) | 5 of 42[d] (12) |
| Heart rate detection reported ≥ 20 min after birth | 5[11,20,21,23,24] | 39 | 15 of 39 (38) | 15 | 6 of 15 (40) | 6 of 39 (15) |

Foglia E et al. Pediatrics 2020

Italian Resuscitation Council

# Discontinuing Resuscitative Efforts

If the heart rate of a newly born term infant remains undetectable for more than 20 minutes after birth despite the provision of all recommended steps of resuscitation and excluding reversible causes, discuss with the clinical team and family and consider stopping resuscitation.

Madar J et al. Resuscitation 2020

# Summary of changes since the 2015 guidelines

**Summary of changes since the 2015 guidelines**

***Management of the umbilical cord***

Clamping after at least 60 s is recommended, ideally after the lungs are aerated. Where delayed cord clamping is not possible cord milking should be considered in infants >28 weeks gestation.

***Infants born through meconium-stained liquor***

In non-vigorous infants, recommendations are against immediate laryngoscopy with or without suction after delivery, because this may delay aeration and ventilation of the lungs.

***Use of the laryngeal mask***

If facemask ventilation is unsuccessful or if tracheal intubation is unsuccessful or not feasible a laryngeal mask may be co alternative means of establishing an airway in inf gestation (about 2000 g, although some d successfully in infants down to 150

***Inflation pressure***

If there is no response to initial inflatio ay then a gradual increase in the inflation pressur

A starting pressure of 25 cm $H_2O$ is sugg for preterm infants <32 weeks gestation.

***Air/oxygen for preterm resuscitation***

Recommendations are for starting in air at 32 weeks gestation or more, 21-30% inspired oxygen at 28-31 weeks gestation and 30% inspired oxygen at <28 weeks gestation.

The concentration should be titrated to achieve saturations of ≥80% at 5 min of age because there is evidence of poorer outcomes where this is not achieved.

***Chest compressions***

If chest compressions are required, the inspired oxygen concentration should be increased to 100% and consideration given towards securing the airway ideally with a tracheal tube.

***Vascular access***

The umbilical vein is still fav red as the optimal route of access but, intraosseous access ative method of emergency access for drugs/fluids.

***Adr***

creased after optimising ventilation s an intravenous dose of adrenaline of rams $kg^{-1}$ is recommended, repeated every 3–5 min in the ce of a response.

***Glucose during resuscitation***

An intravenous dose of 250 mg $kg^{-1}$ (2.5 mL $kg^{-1}$ of 10% glucose) is suggested in a prolonged resuscitation to reduce the likelihood of hypoglycaemia.

***Prognosis***

Failure to respond despite 10–20 mins of intensive resuscitation is associated with high risk of poor outcome. It is appropriate to consider discussions with the team and family about withdrawal of treatment if there has been no response despite the provision of all recommended steps of resuscitation and having excluded reversible causes

Work in progress...

Madar J. et al. Resuscitation 2021

Italian Resuscitation Council


# Italian Resuscitation Council

ircouncil.it

# Grazie!

daniele.trevisanuto@unipd.it

IRC Italian Resuscitation Council