

**neoResus**  
The Victorian Newborn Resuscitation Project

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**First Response & Advanced Resuscitation**  
Learning Modules 2 and 3  
Based on ILCOR and ANZCOR 2016

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## Learning objectives

Following completion of the theoretical & practical components of this module, the participant will be able to demonstrate their ability to:

- Assess a newborn infant's transition to extra-uterine life & determine the need for resuscitation.
- Initiate **First Response** interventions including face mask ventilation and external chest compressions.
- Initiate **Advanced Resuscitation** interventions including intubation, insertion of a laryngeal mask airway, establishing umbilical venous access and administration of adrenaline and volume expanders.

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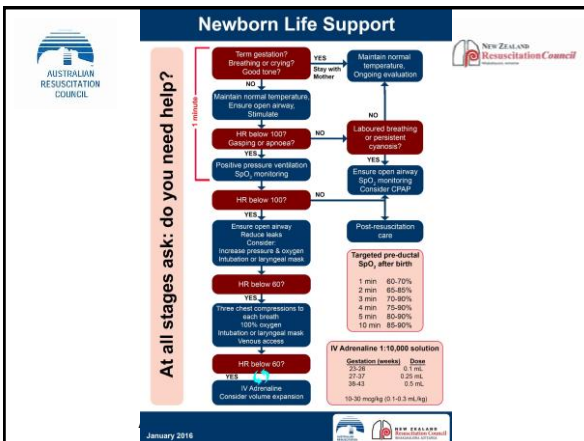
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## Transition to extra-uterine life

- Very few newborns require “resuscitation”
- Most will respond to simple interventions
- First Response interventions are therefore most important & time critical

Resuscitation at birth in Australia: 2012	
Suctioning	5%
Oxygen therapy	5%
Positive pressure ventilation	5%
Intubation & positive pressure ventilation	1%
Cardiac compressions & positive pressure ventilation	0.3%

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## Preparation for resuscitation

- Anticipation of need
  - Based on risk assessment
- Equipment
  - Checked and ready for use
- Environment
  - Warm and clean
- Skilled personnel
  - Able to form a team, nominate leadership and develop a plan of action

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## Cord clamping & cord milking

- ILCOR and the ANZCOR *suggest*:
- Delayed cord clamping for 30-60 seconds if:
  - Uncomplicated term or preterm birth, **and**
  - Not requiring immediate resuscitation
- For compromised newborns:
  - Insufficient evidence for optimal timing of cord clamping in term and preterm depressed newborns
- Insufficient evidence of benefit of cord milking, especially if <28 weeks. Not recommended.

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## Monitoring

- Pulse oximetry is recommended:
  - When the need for resuscitation is anticipated
  - When CPAP or positive pressure is used
  - When persistent cyanosis is suspected
  - When supplemental oxygen is used
  - Place the oximeter sensor on the right wrist or hand (pre-ductal oxygen saturation)
- ECG monitoring:
  - May be used as an adjunct to auscultation and pulse oximetry (if readily available)

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## Strategies to maintain normal core temperature: 36.5 - 37.5°C

- Very preterm newborns (<32 weeks):
  - Place (wet & warm) into a polyethylene bag or under a polyethylene sheet
  - Radiant warmer
- Additional measures (alone or in combination):
  - Covering the head (except the face) with a hat/bedding
  - Ambient room temperature 23 - 26°C
  - Exothermic warming mattress

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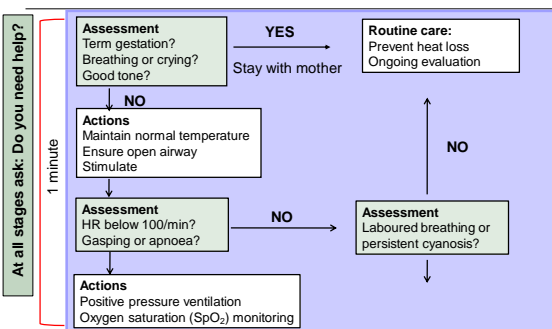
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## A: Assess and Airway




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## If meconium liquor is present

- Clear the oro-pharynx if obvious meconium
- If the newborn is vigorous:**
- Endotracheal suctioning is discouraged because it does not alter outcome and may cause harm
- If the newborn is not vigorous:**
- No evidence of the value of routine or repeated endotracheal suctioning to prevent meconium aspiration
  - Likely to cause further delays in resuscitation
  - Tracheal intubation for suctioning should only be performed for suspected tracheal obstruction.

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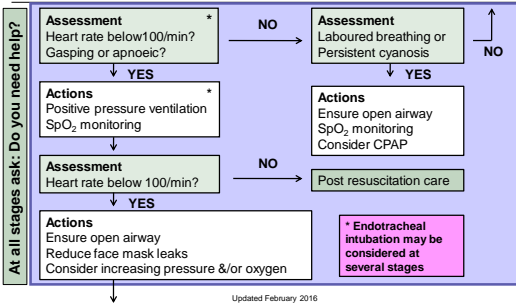
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## B: Breathing




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## Manual ventilation devices

"A T-piece device, a self inflating bag and a flow inflating bag are all acceptable devices to ventilate newborn infants either via a face mask, laryngeal mask or endotracheal tube". (ANZCOR, 2016)




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## Initial settings: T-piece device

- Gas flow
  - Set at 10 L/min (8 L/min if using cylinders)
- Maximum pressure relief valve
  - Set at 50 cm H<sub>2</sub>O
- Peak inspiratory pressure (PIP)
  - Set at 30 cm H<sub>2</sub>O (term newborn)
  - Set at 20 - 25 cm H<sub>2</sub>O (preterm <32 weeks)
- Positive end expiratory pressure (PEEP)
  - Set at 5 - 8 cm H<sub>2</sub>O

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## PEEP during resuscitation

- Without PEEP:
  - Lung aeration is not achieved as quickly
  - Functional residual capacity (FRC) is not established
- With PEEP:
  - FRC is established and maintained
  - Oxygenation is improved
- ANZCOR (2016) recommend:
  - PEEP of 5 - 8 cm H<sub>2</sub>O during resuscitation of newborn infants if appropriate equipment available

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## Oxygen use in resuscitation

- **Term and near term newborns**
  - Use room air (21%) initially.
  - Introduce supplemental oxygen if lower end of target saturations are not met, despite respiratory support
- **Preterm newborns <35 weeks' gestation**
  - Use room air (21%) **or**
  - Blended air and oxygen (up to 30%) to start
  - Avoid initiating resuscitation with high supplementary oxygen concentrations (65-100%)
  - If a blend of air and oxygen is not available, use air

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## Oxygen use in resuscitation

- **All newborns**
  - Oxygen should be used judiciously, guided by pulse oximetry
  - Avoid hyperoxaemia
  - Avoid hypoxaemia
- **If external chest compressions are required:**
  - Increase oxygen concentration to 100%
  - Oxygen concentration should be weaned as soon as the heart rate has recovered and target saturations are being met.

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## Target saturations for newborn infants during resuscitation

Time after birth in minutes	Targeted pre-ductal oxygen saturations for newborn infants during resuscitation
1 minute	60 – 70%
2 minutes	65 – 85%
3 minutes	70 – 90%
4 minutes	75 – 90%
5 minutes	80 – 90%
10 minutes	85 – 90%

ANZCOR<sup>2</sup>, 2016, Guideline 13.4

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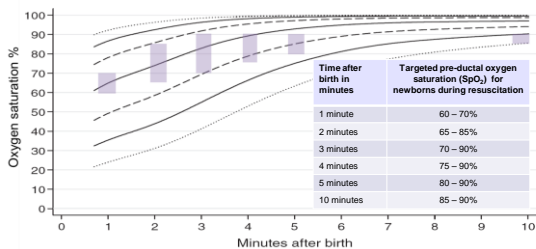
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## Centile charts with targeted pre-ductal SpO<sub>2</sub> in the first 10 mins



Adapted from Dawson *et al.*, 2010 and ANZCOR, 2016

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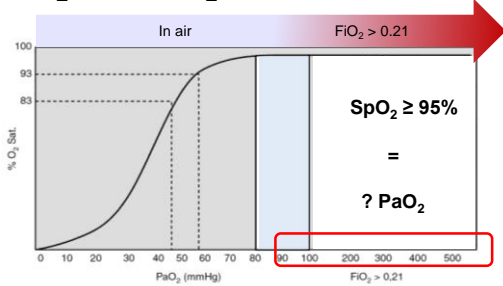
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## N.B The relationship between PaO<sub>2</sub> and SpO<sub>2</sub> is not linear

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Adapted from: Sola, Chow & Rogido, 2005, *An Pediatr* 62(3): 266-281

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## Positive pressure ventilation

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Optimal positive pressure ventilation requires:

1. An appropriate sized face mask
2. A good seal between the mask and the face (to minimise leak)

Re-assess the heart rate every 30 seconds.

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## Ventilation rate and pressure

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- Rate: 40 - 60 inflations per minute
- Peak inflating pressure (PIP):
  - Variable and should be individualised
  - Effective ventilation may be achieved with progressively lower pressures and rates
- Avoid hyperventilation (excessive PIP &/or rate)
  - Can lead to dangerously low CO<sub>2</sub> levels (<30 mmHg)
  - Can depress respiratory drive
  - Can reduce cerebral blood flow

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## Assessing the effectiveness of positive pressure ventilation

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- Re-assess the heart rate every 30 seconds
- The effectiveness of ventilation is confirmed by:
  1. An increase in the heart rate above 100/min.
  2. A slight rise and fall of the chest and upper abdomen with each inflation.
  3. An improvement in oxygenation (assessed by pulse oximetry).

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## If the heart rate is not improving with positive pressure ventilation

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- Check the ventilation technique
  - Is there a face mask leak?
  - Is the airway patent?
- Increase the peak inflating pressure
  - Increase the PIP in 5 cm increments: 30 → 35 → 40 → 45 → 50+ cm H<sub>2</sub>O if necessary
- Increase oxygen according to SpO<sub>2</sub> targets
  - Increase to 100% if the heart rate is <60/min

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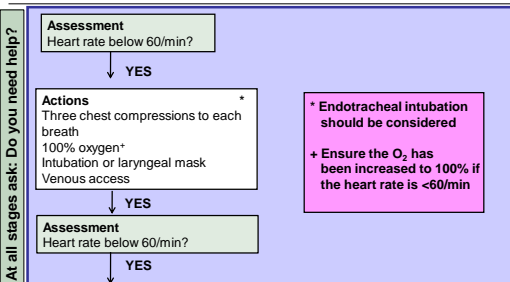
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## C: Circulation

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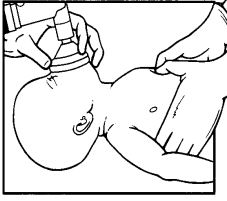
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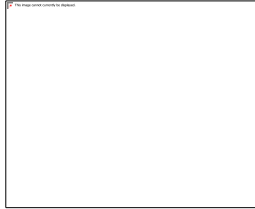
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## Techniques for ECC in newborns



Hand encircling, two thumb technique (preferred technique)



Two finger technique

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## Consider endotracheal intubation at any time, if expertise is available

Select an appropriate size endotracheal tube according to estimated birth weight

Endotracheal size internal diameter can also be calculated as gestation age in weeks divided by 10



Endotracheal size and depth of insertion

Corrected gestation (Weeks)	ETT size (Guide: GA ÷ 10)	Actual weight (kg)	ETT mark at the lip (cm)
23 – 24	2.5 mm	0.5 – 0.6	5.5
25 – 26		0.7 – 0.8	6.0
27 – 29		0.9 – 1.0	6.5
30 – 32	3.0 mm	1.1 – 1.4	7.0
33 – 34	3.5 mm	1.5 – 1.8	7.5
35 – 37		1.9 – 2.4	8.0
38 – 40		2.5 – 3.1	8.5
41 – 43		3.2 – 4.2	9.0

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## Confirming tracheal intubation

- An exhaled CO<sub>2</sub> detector is a reliable method to confirm endotracheal tube placement in neonates who have spontaneous circulation
- False positive/negative results may occur if:
  - Insufficient inflations (tidal volume) delivered
  - There is very low or absent pulmonary blood flow
  - Contaminated with adrenaline or surfactant
- Do not re-intubate unnecessarily.

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## Verify ETT position with an exhaled CO<sub>2</sub> detector (e.g. Pedi-Cap™)

Give 6 positive pressure inflations, then interpret

**"GOLD IS GOOD"**

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## Laryngeal mask airway (LMA)

Consider if:

- Face mask ventilation is unsuccessful
- Tracheal intubation is unsuccessful or not feasible
- Term or near term infant

Size 1 LMA suitable for infants  $\geq 34$  weeks,  $>2000$ g

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## D: Drugs

**At all stages ask: Do you need help?**

**Assessment**  
Heart rate below 60/min?

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YES

**Actions**  
IV Adrenaline: 1:10,000  
Dose: 0.1-0.3 mL/kg  
Consider volume expansion

▪ Endotracheal intubation should be performed

▪ Ensure the O<sub>2</sub> has been increased to 100% if the heart rate is  $<60$ /min

Remember to document all interventions & the newborn's response

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## Adrenaline

Adrenaline 1:10,000 solution	
Route	Dose
Umbilical vein Peripheral IV Intraosseous	0.1- 0.3 mL/kg (10 - 30 mcg/kg)
Endotracheal tube (ETT)	0.5 - 1.0 mL/kg (50 - 100 mcg/kg)

- Use 1:10,000
- Intravenous route recommended - will require venous access (insertion of an umbilical venous catheter, peripheral intravenous cannula or intraosseous needle)

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## Medications: Adrenaline

- Adrenaline should be given intravenously:
  - Dose can be repeated every few minutes if the heart rate remains <60/min despite effective IPPV & ECC
  - Volume expanders should also be considered
- Endotracheal adrenaline:
  - Insufficient evidence for safety and efficacy
  - Likely a higher dose will be required to achieve similar blood levels and effect
  - If endotracheal route is used, dose is 0.5-1.0 mL/kg (50-100 mcg/kg) of 1:10,000 solution

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## Medications: Volume expanders

- Intravascular fluids should be considered:
  - If fetal blood loss is suspected and/or
  - The newborn appears to be in shock (pale, poor perfusion, weak pulses)
  - The newborn has not responded to other resuscitation measures (especially if the HR is not improving)
- Normal saline should be used initially, **but:**
- O-negative red blood cell replacement is the priority in the setting of massive blood loss or suspected blood loss.
- Dose: 10 mL/kg, IV over several mins. May need to be repeated.

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## For more information on:

- Intubation
  - Use of an exhaled CO<sub>2</sub> detector
  - Use of a laryngeal mask airway (LMA)
  - Intravenous, umbilical and intraosseous access
  - Medications
  - Discontinuation &/or withdrawal of resuscitation
  - Resuscitation in special circumstances
  - Post resuscitation care and stabilisation
- See the “Learning Resources” section of the NeoResus web site at <http://www.neoeresus.org.au>

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## Australian & New Zealand Committee on Resuscitation (ANZCOR)



ANZCOR Guideline 13.1 – Introduction to Resuscitation of the Newborn Infant

**Summary**

Guideline 13.1 (1) and the Victorian NeoResus algorithm are provided as a model of the introduction of newborn resuscitation. The aim of this guideline is to provide a practical approach to the resuscitation of newborn infants. This guideline is based on the current evidence and clinical practice. The guideline is based on the current evidence and clinical practice. The guideline is based on the current evidence and clinical practice. The guideline is based on the current evidence and clinical practice.

**Who is this guideline for these guidelines?**

This guideline is intended for use by neonatal resuscitators and other healthcare professionals who are involved in the resuscitation of newborn infants. It is intended for use by neonatal resuscitators and other healthcare professionals who are involved in the resuscitation of newborn infants.

**Section 13.1 – 13.10**  
**Neonatal Guidelines**  
**Published January 2016**

Available for download at  
[www.resus.org.au](http://www.resus.org.au)

ANZCOR Guideline 13.1 – January 2016 Page 1 of 2

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## Key references

1. Pearlman JM, Kattwinkel J, Wyckoff *et al.* Part 7: Neonatal Resuscitation 2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. *Circulation*, 2015; 132 (Supp 1): S204-S241.
2. Australian & New Zealand Resuscitation Councils. (2016). Section 13: Neonatal Guidelines. Accessed 24 February 2016 from: <http://www.resus.org.au>
3. The Victorian Newborn Resuscitation Project: NeoResus. (2016). Accessed 24 February 2016 from <http://www.neoeresus.org.au>.

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