

# NEWBORN TRANSITION AND NEONATAL RESUSCITATION

2ND EDITION

LIMPOPO INITIATIVE FOR NEWBORN CARE 2021



LIMPOPO

PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF HEALTH



# TABLE OF CONTENTS

<b>Introduction to the course on newborn transition and neonatal resuscitation</b> .....	2
Course overview .....	2
How the course works .....	2
Course developers and facilitators .....	2
<b>Overview: Newborn transition and resuscitation</b> .....	3
<b>Module 1: Preparing for the birth</b> .....	6
Step 1: Prepare an emergency plan .....	6
Step 2: Handwashing .....	6
Step 3: Prepare the mother and birth companion for the delivery .....	6
Step 4: Prepare the area for delivery .....	6
Step 5: Prepare for resuscitation and check the emergency equipment .....	6
Module 1: Self assessment questions .....	12
<b>Module 2: Routine care at birth</b> .....	13
Dry thoroughly .....	13
Check if the baby is crying, check breathing, keep warm .....	13
Clamp and cut the cord .....	13
Routine care of babies born by caesarean section .....	14
Routine care of preterm babies .....	14
Monitor baby with mother and initiate breast feeding .....	14
Rapidly assess the baby immediately after birth .....	15
Module 2: Self assessment questions .....	17
<b>Module 3: Help the baby who is not breathing well</b> .....	18
3.1 Clear the airway and stimulate breathing .....	18
3.2 Ventilate with bag and mask .....	19
3.3 Improve ventilation if the baby is still not breathing well .....	21
Module 3: Self assessment questions .....	22

<b>Module 4. Advanced resuscitation</b> .....	23
4.1 Pathophysiology of birth asphyxia .....	23
4.2 Advanced care: heart rate .....	24
4.3 Endotracheal intubation .....	27
4.4 Umbilical vein catheterisation .....	30
4.5 When to withhold or discontinue life support .....	32
4.6 Post resuscitation care of the neonate .....	32
Module 4: Self assessment questions .....	33
References .....	34
Clinical practice sessions .....	35

**Note:** This document allows you to click on a page reference to jump to that page. If you are using an android or Apple device you might want to download the Adobe Reader App for better functionality. Click below to download:  
<http://www.adobe.com/africa/products/reader-mobile.html>

# INTRODUCTION TO THE COURSE ON NEWBORN TRANSITION AND NEONATAL RESUSCITATION

## COURSE OVERVIEW

The course is for doctors, midwives and clinical associates working in district and regional hospitals in South Africa. The course covers the immediate care of the newborn during transition in the delivery room as well as all neonatal resuscitation prior to the transfer of both mother and baby to the postnatal or neonatal ward. This course is complimentary to the Helping Babies Breathe (HBB) course, an initiative of the American Academy of Pediatrics and partners. All midwives in South Africa are required to undergo the HBB course. This course follows the same steps as HBB and then incorporates advanced resuscitation, resuscitation of the preterm newborn, care of the newborn delivered by caesarean section and the immediate post resuscitation care of all newborns.

## HOW THE COURSE WORKS

The course consists of 4 modules, each followed by an assessment. Each module incorporates reading, chart reviews, videos and assessment questions. A list of additional reading material will be provided.

The course can be done in a number of ways:

1. Pre-reading and attendance at a planned course in your district. Read this material and watch the videos which are available on the website [www.lincare.co.za](http://www.lincare.co.za) before attending a course in your district or facility. At the start of the course, the facilitator will give you the MCQs to do before going on to the clinical skills sessions.
2. As e-learning. You can enrol for the e-learning course. Go to the website [www.linc-learn.co.za](http://www.linc-learn.co.za) and follow the instructions on the e-learning tab. As part of the e-learning you will be assigned a facilitator; this will usually be a Paediatrician or senior clinician working in your facility, district or region. Your facilitator will host a discussion forum with a group of participants, and may set additional optional tasks. Your facilitator and group will decide on a date for the clinical skills session.

Participants who work in Limpopo and other participating provinces will be invited by their facilitator to enrol in a 2 – 3 hour skills session.

CEU points will be available on successful completion of the on-site and e-learning course.

You are welcome to read this material and watch and download the videos. We will however not be able to provide you with CEU points unless you enrol on a formal course.

## COURSE DEVELOPERS AND FACILITATORS

**The course developers are Dr Anne Robertson and Dr Rien Baarsma.**

Dr Anne Robertson is the Provincial Paediatrician in the Limpopo Province, Department of Health and jointly appointed with the University of Limpopo. She is involved in several initiatives to improve paediatric and child health in Limpopo Province and South Africa.

Dr Rien Baarsma is a Neonatologist from the Netherlands, with extensive experience in clinical neonatology, general paediatrics, teaching and research. He worked in Mankweng Hospital, Limpopo Province from 2012-2015, as a Neonatologist.

# INTRODUCTION TO THE COURSE ON NEWBORN TRANSITION AND NEONATAL RESUSCITATION

## Acknowledgements

The video's were produced by Dr Rienk Baarsma with the assistance of Ms Lolly Mashao (Limpopo Provincial Neonatal coordinator) and Dr Glenrose Rikhotso (Paediatrician, Polokwane Mankweng Hospital Complex: Limpopo Department of Health ).  
Dr Delina Manzini (Paediatric Cardiologist, Polokwane Mankweng Hospital Complex: Limpopo Department of Health) has assisted with editing and developing further assessment material.  
Mr Andrew Scholtz (Educational technologist) has advised on the education methodology and has developed and set up the on-line platform and e-learning course.

## Course facilitators

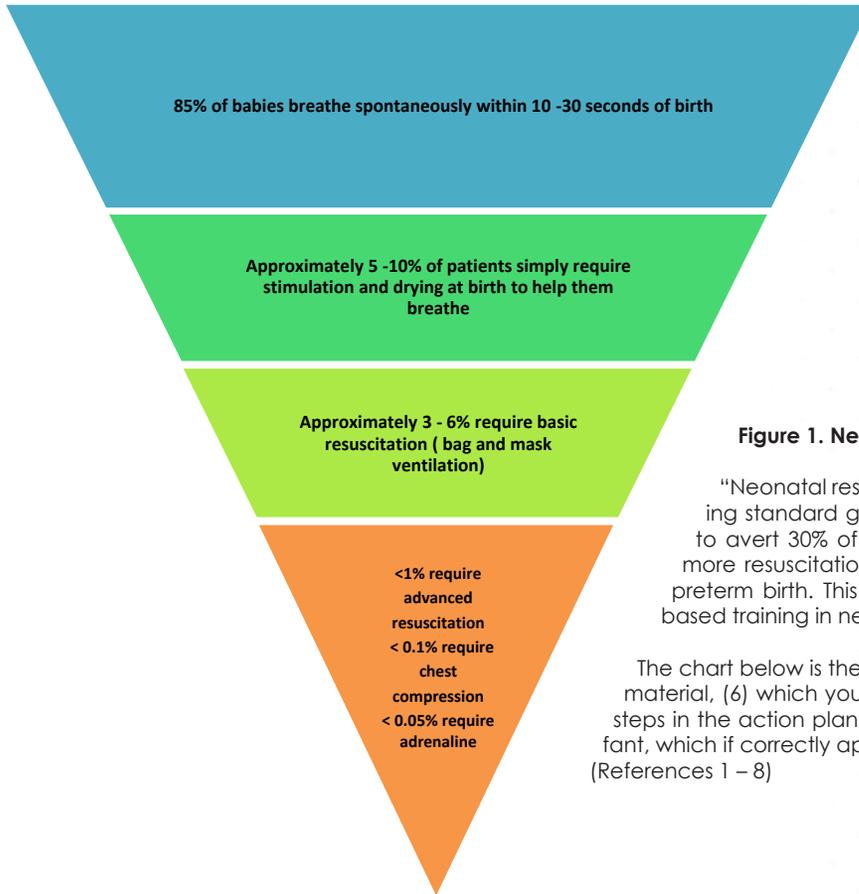
You will be assigned a course facilitator with whom you can interact and discuss. Your facilitator will usually be a Paediatrician or senior clinician in your facility, district or regional hospital.

## MODULE 1: NEWBORN TRANSITION AND RESUSCITATION

The transition from a foetus to a newborn is a physiological process that begins in the latter part of pregnancy and continues throughout labour. At around 28 weeks gestation, the alveolar cells begin to secrete surfactant on the surface of fluid-filled lungs. During labour, fluid is cleared from the lungs, and with the first breath outside the womb, air fills the previously fluid-filled lungs. The transition from foetal to newborn circulation occurs with the cessation of the placental circulation as the umbilical cord is cut or the placenta is removed. There is a decrease in pulmonary vascular resistance and an increase in pulmonary blood flow that is caused by the increase in arterial oxygen tension after the baby starts breathing, thus the gaseous exchange via the placenta ceases and the lungs take over this function. Cortisol and catecholamines prepare the foetus for the birth process and support the multi-organ transition from intrauterine to extra uterine life. Initiating breastfeeding soon after birth forms part of the transition.

The majority of newborns do not encounter any problems with the transition. Abnormalities to adaptation are more frequently found following preterm delivery; delivery by caesarean section or delivery following foetal distress.

The vast majority of babies born at term breathe spontaneously within 10 – 30 seconds of birth. An estimated 5 - 10% respond to drying and stimulation, airway clearing or positioning to breathe. Only 3 – 6% of all newborns require assisted ventilation with a bag and mask to help them breathe. Less than 1% of newborns require chest compression and drugs to assist with transition and establish breathing. We will refer to the need for drugs and chest compressions as requiring advanced resuscitation. In several large studies, only ~0.1% of newborns required chest compression and/or drugs as part of resuscitation. These numbers vary in different places in the world: in a large Swedish study, less than 1% of babies needed any resuscitation at all, including not requiring bag and mask ventilation. Two large studies done in Gauteng province, South Africa, showed that 4,7/1000 and 8,5/1000 newborns needed help with breathing at Charlotte Maxeke hospital and Chris Hani Baragwanth hospital, respectively. Very few 0,1% newborns needed cardiac compression and only 0,04% newborns required adrenaline as part of advanced resuscitation. The prognosis of those who did require cardiac compression and adrenaline was generally poor.



**Figure 1. Newborns requiring neonatal resuscitation**

“Neonatal resuscitation, when implemented systematically by personnel using standard guidelines and competency-based training, has the potential to avert 30% of intrapartum-related neonatal deaths per year.” (2) Furthermore resuscitation may avert 5 – 10% of deaths due to the complications of preterm birth. This is the premise for simplifying and increasing access to skills based training in neonatal transition and resuscitation for all health care workers.

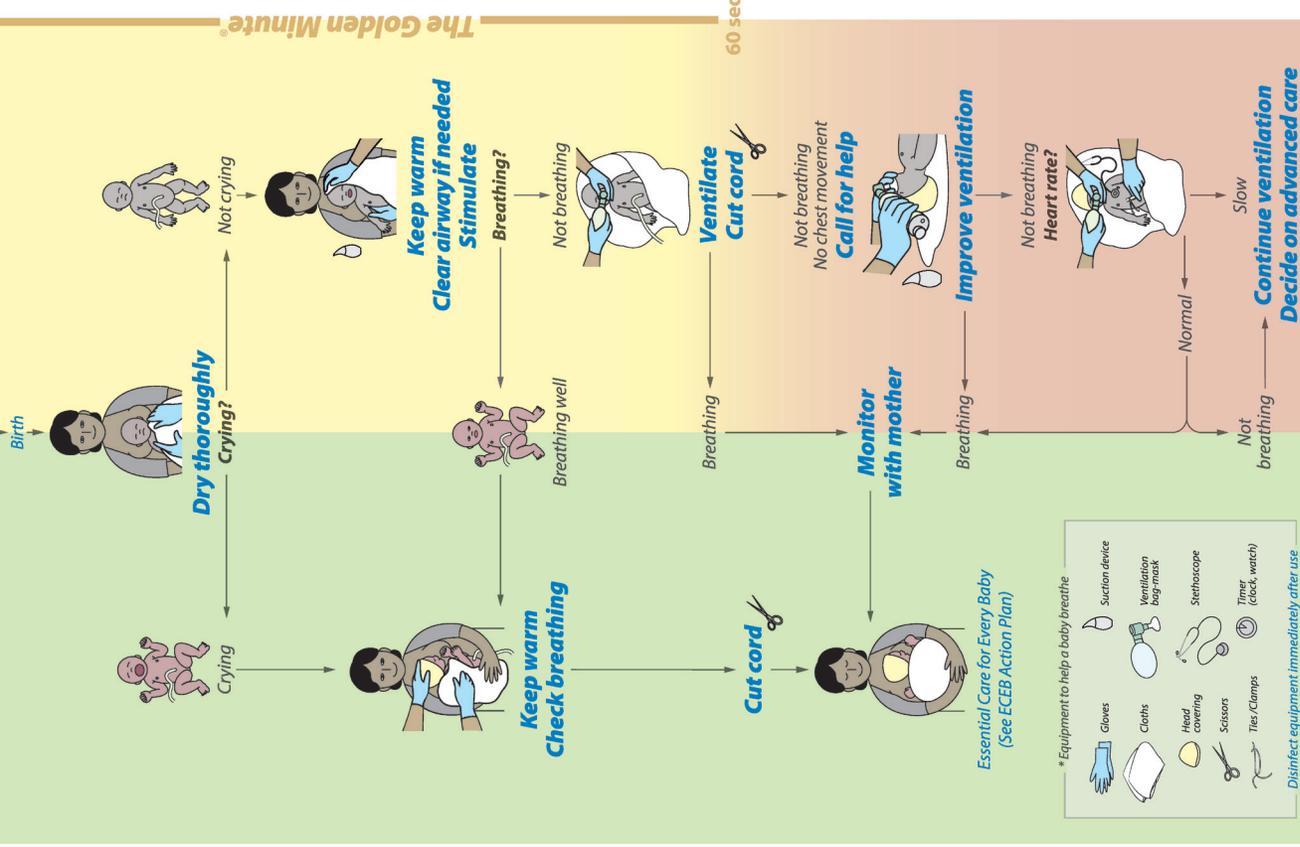
The chart below is the action plan sourced from the Helping Babies Breathe course material, (6) which you may have already done. Review the steps in the chart. The steps in the action plan offer a systematic approach to the care of the newborn infant, which if correctly applied are effective within one minute: THE GOLDEN MINUTE® (References 1 – 8)

## ACTION PLAN

# Helping Babies Breathe

Prepare for birth\*

See HMS Action Plans for mother



## MODULE 1: PREPARING FOR THE BIRTH

### PLAN AND PREPARE FOR TRANSITION BY FOLLOWING THESE 5 STEPS.

#### STEP 1: PREPARE AN EMERGENCY PLAN

Identify someone to help with transition for EVERY birth. Support during transition at birth or resuscitation may be required with any delivery but is more likely if the baby is less than 35 weeks gestation, delivered by an emergency caesarean section or has documented foetal distress. Arrange for a health worker to assist if normal transition is anticipated or for two health workers to assist if advanced resuscitation is anticipated. Four health workers should be available at a twin delivery. Review the emergency plan in your facility; including whom to call, how to communicate, and how to transport the baby should neonatal ward care or transfer be required.

#### STEP 2: HANDWASHING

Everyone who attends a delivery must wash his or her hands. This includes the mother, father, or birth companion. Good hand washing helps to prevent the spread of infection. Hands must be washed thoroughly with soap and clean tepid water. An alcohol-based cleaner may be used after washing. For the healthcare worker, this must be done before checking the emergency equipment as well as before and after caring for a mother or a baby. In addition, sterile gloves must be worn when assisting the newborn with transition. Gloves protect you from infections carried by blood and other body fluids. **Refer to Figure 3: Hand Washing and cleaning chart (pg.7)**

#### STEP 3: PREPARE THE MOTHER AND BIRTH COMPANION FOR THE DELIVERY

Explain to the mother and birth companion what will happen if the baby has a normal transition, and what will be done should the baby require support for transition. If you expect a normal transition, explain to the mother and birth companion that the baby will be placed skin-to-skin on the mother's abdomen immediately after birth, and kept skin-to-skin in order to facilitate the initiation of breastfeeding.

#### STEP 4: PREPARE THE AREA FOR DELIVERY.

The area where the baby is to be born must be clean, warm and well lit. Eliminate draughts from fans, air conditioners, open windows and doors. Warm the birthing room or theatre to 23 – 25°C and use a radiant warmer to warm the area for ventilation should this be required. If the gestational age of the baby is less than 28 weeks the temperature of the delivery room or theatre should be > 25°C. It is the responsibility of the person preparing for the delivery to ensure that the area is comfortable for the baby.

#### STEP 5: PREPARE FOR RESUSCITATION AND CHECK THE EMERGENCY EQUIPMENT.

Prepare the resuscitation surface before every delivery. This should be a flat padded surface with an overhead warmer, good lighting and a timer. Having washed hands thoroughly, check that all equipment and supplies are ready for use. Basic equipment is required at each delivery site. Additional equipment may be stored on a mobile trolley in clean plastic bags or in a box, used only for this purpose. **Refer to Table 1: Neonatal Resuscitation equipment (pg.8)** which provides a checklist of all the equipment that is required.

## How to handrub?

WITH ALCOHOL-BASED FORMULATION

1a



1b



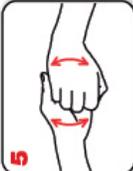
Apply a palmful of the product in a cupped hand and cover all surfaces

2



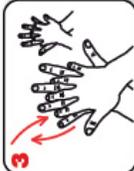
Rub hands palm to palm

5



Backs of fingers to opposing palms with fingers interlocked

3



Right palm over left dorsum with interlaced fingers and vice versa

6



Rotational rubbing of left thumb clasped in right palm and vice versa



Palm to palm with fingers interlaced



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa

8



Rinse hands with water

9



Dry thoroughly with a single use towel

10



Use towel to turn off faucet

8



...Once dry, your hands are safe.

20-30 sec



11



...And your hands are safe.

40-60 sec



## How to handwash?

WITH SOAP AND WATER



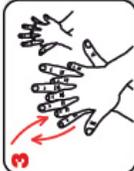
0

Wet hands with water



1

Apply enough soap to cover all hand surfaces



Right palm over left dorsum with interlaced fingers and vice versa

Palm to palm with fingers interlaced



Rotational rubbing of left thumb clasped in right palm and vice versa

Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa



8

Rinse hands with water

9



Dry thoroughly with a single use towel

10



Use towel to turn off faucet

8



...Once dry, your hands are safe.

20-30 sec



11



...And your hands are safe.

40-60 sec



**Table 1: Neonatal Resuscitation equipment**

	BASIC NEONATAL RESUSCITATION EQUIPMENT (AT EACH BEDSIDE)	NEONATAL RESUSCITATION STATION, TROLLEY OR BOX, AT LEAST 1 PER 4 DELIVERY BEDS AND 1 IN THEATRE	
<b>General</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Firm padded resuscitation surface</li> <li><input type="checkbox"/> Overhead warmer</li> <li><input type="checkbox"/> Light for the area</li> <li><input type="checkbox"/> Clock with timer in seconds</li> <li><input type="checkbox"/> Warm receiving towels</li> <li><input type="checkbox"/> Stethoscope</li> <li><input type="checkbox"/> Head Caps / hats</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Firm padded resuscitation surface</li> <li><input type="checkbox"/> Overhead warmer</li> <li><input type="checkbox"/> Light for the area</li> <li><input type="checkbox"/> Clock with timer in seconds</li> <li><input type="checkbox"/> Warm receiving towels</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Stethoscope</li> <li><input type="checkbox"/> Head Caps / hats</li> <li><input type="checkbox"/> Pulse oximeter with neonatal probe</li> <li><input type="checkbox"/> Transport incubator</li> <li><input type="checkbox"/> Sterile gloves</li> </ul>
<b>Airway Management</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Portable Suction Device like Penguin</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Suction apparatus                             <ul style="list-style-type: none"> <li><input type="checkbox"/> Suction catheters 6F</li> <li><input type="checkbox"/> Suction catheters 8F</li> <li><input type="checkbox"/> Suction catheters 10F</li> </ul> </li> <li><input type="checkbox"/> Oropharyngeal airways Size 0</li> <li><input type="checkbox"/> Oropharyngeal airways Size 00</li> <li><input type="checkbox"/> Laryngoscope handle                             <ul style="list-style-type: none"> <li><input type="checkbox"/> Miller Blade 00</li> <li><input type="checkbox"/> Miller Blade 0</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Spare working batteries</li> <li><input type="checkbox"/> Spare working bulb</li> <li><input type="checkbox"/> ETT introducer / stylet</li> <li><input type="checkbox"/> Supplies for fixing ETT</li> <li><input type="checkbox"/> McGill forceps (paediatric size)</li> <li><input type="checkbox"/> ETT uncuffed 2.5                             <ul style="list-style-type: none"> <li><input type="checkbox"/> ETT uncuffed 3.0</li> <li><input type="checkbox"/> ETT uncuffed 3.5</li> </ul> </li> </ul>
<b>Breathing support</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Bag valve mask ventilator (e.g.Laerdal Neonatal Ventilation Bag)</li> <li><input type="checkbox"/> Mask for ventilation bag Size 0</li> <li><input type="checkbox"/> Mask for ventilation bag Size 1</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Bag valve mask ventilator (e.g.Laerdal)</li> <li><input type="checkbox"/> Mask for ventilation bag                             <ul style="list-style-type: none"> <li><input type="checkbox"/> Size 0</li> <li><input type="checkbox"/> Size 1</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Source of oxygen with flow meter</li> <li><input type="checkbox"/> Oxygen tubing</li> </ul>
<b>Circulation support</b>		<ul style="list-style-type: none"> <li><input type="checkbox"/> Umbilical venous catheter Size 3.5F</li> <li><input type="checkbox"/> Umbilical venous catheter Size 5F</li> <li><input type="checkbox"/> IV cannula 24 G</li> <li><input type="checkbox"/> Skin prep e.g. Webcol</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Tapes/devices to secure UVC/IV cannula</li> <li><input type="checkbox"/> Syringes and needles (assorted sizes)</li> <li><input type="checkbox"/> 2 X 3 way taps</li> <li><input type="checkbox"/> Umbilical Vein Catheterisation sterile pack</li> </ul>
<b>Drugs and fluids</b>		<ul style="list-style-type: none"> <li><input type="checkbox"/> Adrenaline 1:1000</li> <li><input type="checkbox"/> Water for Injection</li> <li><input type="checkbox"/> (Naloxone)</li> <li><input type="checkbox"/> Normal Saline 0,9%</li> <li><input type="checkbox"/> Neonatolyte or 10% glucose</li> <li><input type="checkbox"/> 60 drops / min drip set</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Buretol</li> <li><input type="checkbox"/> Dial- a- flow</li> <li><input type="checkbox"/> 3 way tap</li> <li><input type="checkbox"/> Glucose test strips and glucometer</li> <li><input type="checkbox"/> Vitamin K (Konakion)</li> <li><input type="checkbox"/> Chloramphenicol (Chloromax) eye ointment</li> </ul>
<b>Documentation</b>		<ul style="list-style-type: none"> <li><input type="checkbox"/> Equipment checklist</li> <li><input type="checkbox"/> Neonatal examination tick sheet</li> </ul>	

## MODULE 1: PREPARING FOR THE BIRTH

### TEST THE FUNCTION OF THE VENTILATION BAG AND MASK.

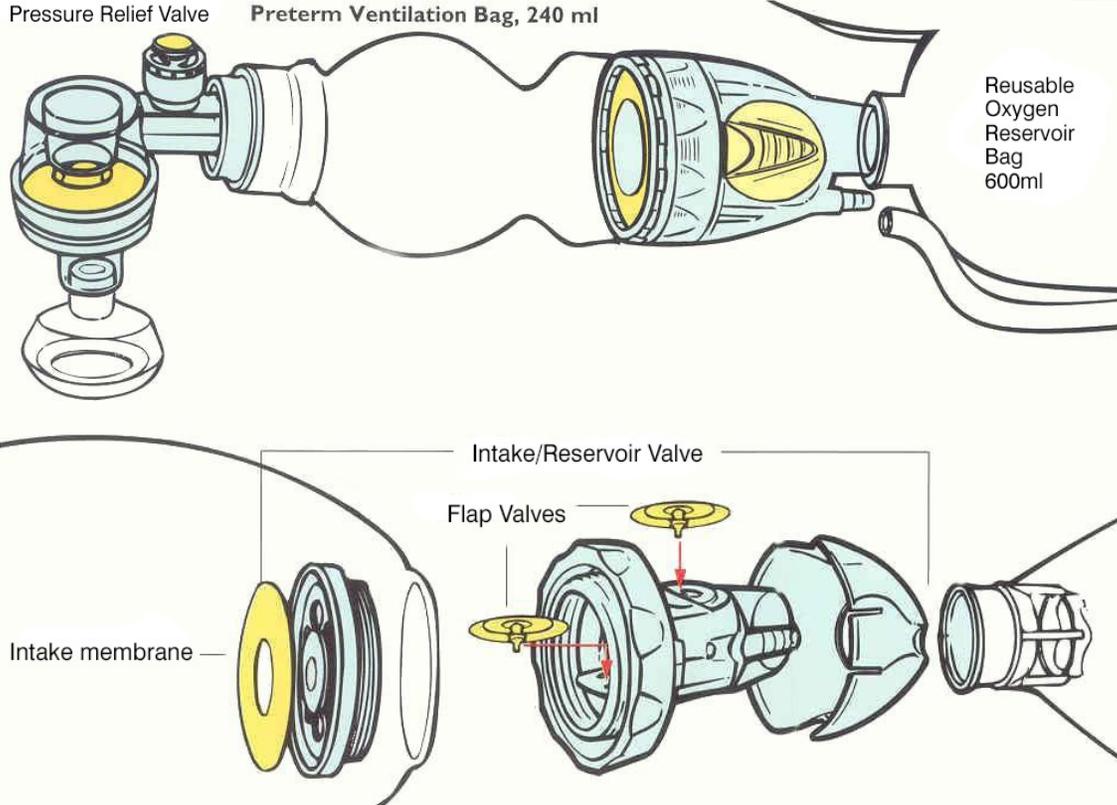
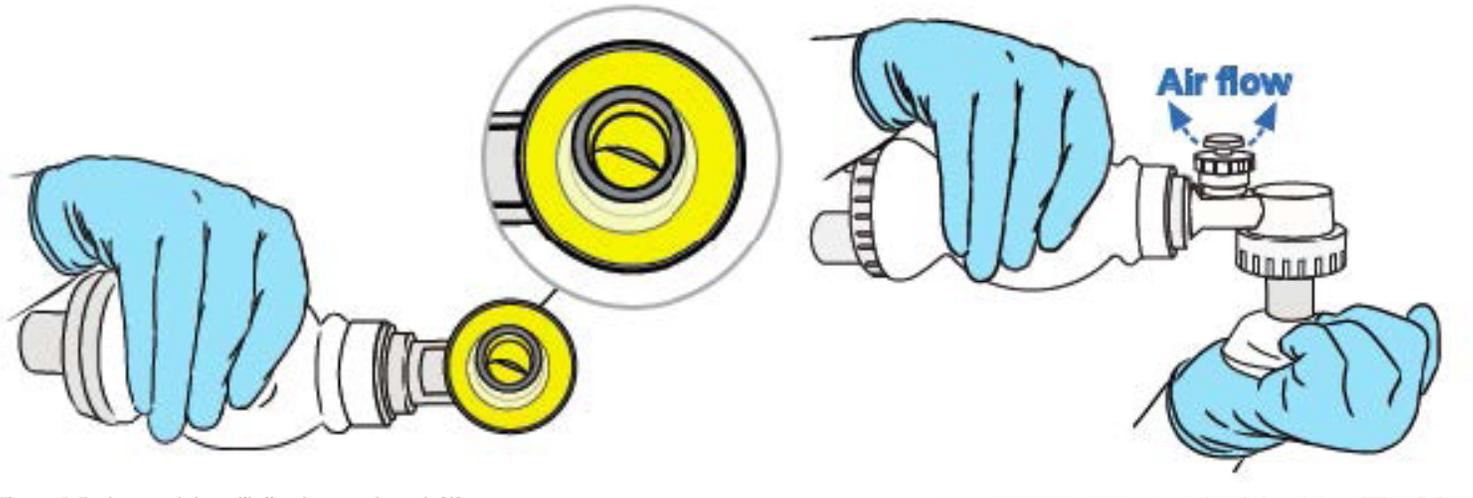


Figure 4: Bag valve mask ventilator for newborns



**Figure 5: Test neonatal ventilation bag and mask (8)**

1. Squeeze the bag and look for the valve in the patient outlet open as you squeeze. This shows the device is ready to deliver air to the patient.

3. Check the mask rim for any damage that may prevent an airtight mask seal on the face.

**Watch LINC Video: Check the Neonatal Bag-valve-mask** (available on [lincare.co.za](http://lincare.co.za))

2a. Seal the mask tightly to the palm of your hand and squeeze hard enough to open the pressure release valve. This shows that air, which cannot be delivered through a blocked airway, will escape through the pressure relief valve.

2b. If on squeezing the bag, no air pops out of the safety valve, open the obstructed outlet to allow air to escape through the safety valve. If this does not happen, use another bag.

## MODULE 1: PREPARING FOR THE BIRTH

### CLEANING EQUIPMENT

Disinfect all used equipment and keep it clean. Check the equipment list twice a day, with each change in nursing shift. Repair or replace any equipment that is damaged or does not function. Correct a problem when it occurs.

#### To clean equipment:

- Disassemble the ventilation bag and mask, suction device or tubing.
- Wash the equipment in warm soapy water to remove visible blood, secretions and other contaminated matter.
- Disinfect all parts by immersion in an appropriate disinfectant solution (according to the manufacturer's instructions then rinse in boiled water. Alternatively boil the equipment in water for 10 minutes.
- Allow all parts of the equipment to air dry before reassembly.
- Reassemble according to manufacturer's instructions.
- Place in a clean plastic bag.
- Wipe the blood and secretions from the laryngoscope blade and padded surface with a damp cloth, followed by an alcohol or disinfect solution.

Dispose of contaminated supplies and handle linen. Restock clean linen and supplies.

## MODULE 1: SELF ASSESSMENT QUESTIONS

Answer the multiple choice or true / false questions below. If you do not get the questions correct, review the material before answering the questions again. Once you have successfully completed the questions you may move to the next section.

### 1.1 Tick the statement that is correct regarding neonatal resuscitation. There is only 1 correct answer.

- About 3-6% of babies will require assisted ventilation with tracheal intubation
- Most babies will not need any neonatal resuscitation to breathe
- About 75% of babies require basic support such as drying and stimulation
- 1% of babies require cardiac compression and drugs in neonatal resuscitation

### 1.2 Preparation for helping a baby breathe before birth includes the following :

- 1 Identify a helper and going through the emergency plan
- 2 Checking the equipment
- 3 Washing hands
- 4 Communicating with the mother

What is the correct sequence?

- 1,2,3,4
- 3,2,1,4
- 1,3,4,2
- 1,4,3,2

### 1.3 Neonatal resuscitation, when implemented systematically using standard guidelines and competency based training

- Has potential to avert 30% of intrapartum related deaths
- Has potential to avert 70% of intrapartum related deaths
- Has potential to decrease preterm mortality by 30-35%
- Has potential to decrease preterm mortality be 50-55%

## DRY THOROUGHLY

Check the time of birth and then dry the baby thoroughly. Drying thoroughly involves gently rubbing the body, legs, arms and head with a warm cloth. Drying helps keep the baby warm and clean, and also stimulates breathing. Blotting or patting does not stimulate breathing. A wet baby can easily become cold, and a cold baby can have difficulty breathing. Drying also removes blood, body fluids and stools of the mother. Remove the wet cloth. Place the baby skin-to-skin on the mother's abdomen, cover with a dry cloth and place a cap on the head.

**A NOTE ABOUT SUCTIONING AND MECONIUM:** Babies do not require routine suctioning at birth, even if there is meconium. Meconium in the amniotic fluid may be a sign of foetal distress, especially if there is thick meconium. While these babies may be at risk of Meconium Aspiration Syndrome (MAS), recent randomised control trials have found there to be no reduction in MAS when these babies are routinely suctioned on delivery or with routine intubation and suctioning of the vigorous baby with meconium. (7)

If at birth the baby has very poor tone and does not breathe, you may immediately visualise the cords with direct laryngoscopy. If meconium is seen through the cords, intubate and then apply suction and remove the ET tube. This procedure should not take longer than 15 seconds, and ventilation should never be delayed if this cannot be done immediately.

## CHECK IF THE BABY IS CRYING, CHECK BREATHING, KEEP WARM

**Check if the baby is crying and breathing.** If the baby is crying, then by implication, the baby is breathing and has a heart rate that is usually above 100 beats per minute. In this situation, it is not necessary to physically check the heart rate immediately. If the baby is NOT crying; checking whether the baby is breathing normally is the first priority. Lack of breathing or an abnormal pattern of breathing warrants immediate intervention as discussed in module 3)

**Keep baby warm.** The baby who is crying or breathing well should be placed skin-to-skin, prone on the mother's abdomen with the baby's head cranially and turned to the side. This keeps the baby warm and helps the baby to breathe and facilitates early initiation of breastfeeding. Keep the baby covered with a warm cloth and with the cap on the head.

**Recheck breathing.** Continue to check the baby's breathing while the baby is on the mother's abdomen. Most babies who cry at birth continue to breathe well. Some babies have a large amount of fluid in their mouth and nose. Position these babies on their side to help drain the fluid. The baby's neck should be in the neutral position – not flexed or hyperextended to facilitate drainage of excess fluid from the mouth and nose as well to facilitate breathing.

## CLAMP AND CUT THE CORD.

Delay clamping and cutting of the cord for 1- 3 minutes in the newborn who is breathing well. Delaying cord clamping for at least one minute or until the cord stops pulsating improves the iron status of the baby for next 3 – 6 months. In preterm infants, delayed cord clamping to 3 minutes improves blood pressure and results in a lower incidence of intra-ventricular haemorrhage, periventricular leukomalacia, late onset sepsis and fewer blood transfusions. Randomized control trials found that there was NO correlation between delayed cord clamping and hyper-bilirubinaemia. (10,11,12)

Keep the newborn on the mother's abdomen or at the level of the perineum while waiting to cut the cord. To cut the cord, place two clamps on the cord, with the first clamp placed two fingers away from the baby's abdomen and the second clamp three fingers away from the first clamp. Use sterile scissors to cut the cord between the clamps. Keep the baby skin-to-skin and encourage breastfeeding and routine care.

**Watch Global Health Media Video, Routine care in the first hour of birth:** <https://globalhealthmedia.org/videos/>

## MODULE 2: ROUTINE CARE AT BIRTH

### ROUTINE CARE OF BABIES BORN BY CAESAREAN SECTION

Babies born by caesarean section require the same initial steps of care, but usually require assistance with transition more frequently:

#### PREPARATION

- Find out why the mother is having a Caesarean section, the gestational age and condition of the foetus, any maternal illness that may affect the baby, and whether steroids were given to the mother in the case of a preterm delivery.
- Prepare for the transition and resuscitation.
  - Identify someone to assist with the transition, and an additional person to help with resuscitation
  - Discuss the following with the surgeon and anaesthetist
    - The possibility of delayed cord clamping or milking the cord
    - If the baby may be kept skin-to-skin with mom or dad after birth
    - Timing of initiation of breastfeeding
- Prepare the theatre, check the theatre temperature and eliminate any draughts
- Prepare the emergency and transport equipment
- Speak to the mother and birth companion about what to expect

#### TRANSITION

- Dry the baby thoroughly, place a cap on the head and keep warm
- If the baby does not need help with breathing, and the mother's condition allows, clamp and cut the cord after 1 – 3 minutes, otherwise clamp and cut the cord immediately and initiate resuscitation.
- Keep the baby warm, either skin-to-skin with the mother or father, or under a pre-warmed radiant warmer or in a warmed transport incubator.
- Monitor the baby to ensure the baby is breathing well, and keep the temperature of the baby between 36.5°C and 37.5°C.

### ROUTINE CARE OF PRETERM BABIES

Prepare for the premature baby in the same way, but anticipate that the baby may need assistance in breathing, and may need extra support to maintain warmth.

Babies who are < 32 weeks gestation or < 1,5kg are at a higher risk of hypothermia. In order to prevent this complication of preterm delivery, these babies can have their body placed in a polyethylene wrapping or open bag while still wet (before drying) and then be placed under a radiant heater. DO NOT cover the face. The head may however be wrapped in polyethylene. Monitor the baby closely. If you are not able to carefully apply this procedure and monitor the baby's temperature, it may be safer to dry the baby and then place skin-to-skin with the mother or father to keep the baby warm or to place the baby in a transport incubator pre-warmed to 35,5°C.

### MONITOR BABY WITH MOTHER AND INITIATE BREAST FEEDING

After cutting the cord, move the baby closer to the mother's breasts, and monitor to ensure that the baby is active and breathing well.

## MODULE 2: ROUTINE CARE AT BIRTH

### RAPIDLY ASSESS THE BABY IMMEDIATELY AFTER BIRTH

Rapidly assess the baby immediately after birth. Review the chart " B. Rapidly Assess Baby Immediately After Birth." Sourced from the Essential Newborn Care Chart Book.

Explain to the mother and birth companion that you are rapidly assessing that the baby for any serious illness or abnormality, and if none are found that the baby will have a more thorough assessment in the postnatal ward.

In order to assess the baby, ask, listen and feel

- Check the Apgar score at 1 and 5 minutes and document your findings. Is the Apgar < 8 at 5 minutes?
- Observe the breathing: is there any fast breathing, cyanosis, grunting or chest in-drawing?
- Observe the baby's tone and movement: Is the baby hypo or hypertonic and is the baby active and moving all limbs well?
- Is there a major abnormality? Is the head large? If so measure the head circumference? Is it > 39cm?
- What is the gender? Is the baby a boy or girl or are you unsure?
- Estimate the baby's weight, is it < 2kg?
- Is the mother diabetic or does the baby weigh more than 4,5kg?

In a well baby, the Apgar score will be more than 8 at 5 minutes. The baby will also be breathing well with good tone; no major abnormalities; with distinct male or female genitalia and a weight of 2-3,9kg and have been born to an otherwise healthy mother.

### THEREAFTER

- Keep the baby skin-to-skin with the mother. This is important for many reasons, including keeping the baby warm and breathing, supporting bonding and enabling breastfeeding in the first hour.
- You will see how a baby can crawl to breastfeed and will be able to provide support to the mother to enable feeding.
- After the initial feed, weigh the baby, measure the length and the head circumference, and document your findings and the care you provide.
- Administer Vitamin K 1mg IM and Chloramphenicol eye ointment into both eyes.
- Check if the mother is diabetic or if the birth weight is > 4.5kg, if so check the glucose hourly for the first 6 hours and breastfeed hourly or give 3ml/kg of breast milk or replacement feed every hour for the first 6 hours.
- Check if the mother is HIV positive, if so what treatment she is getting and initiate the first dose of ARV prophylaxis to the baby according to the current PMTCT standard guideline.
- Identify the baby with the mother and place the nametags on the baby's ankle.
- Keep the baby with the mother and maintain skin-to-skin contact with the mother if her condition allows it, otherwise place the baby in a warm transport incubator and monitor the condition.
- If the mother and baby are well transfer the mother and baby to the postnatal ward. Babies whose mothers have had a caesarean section but who are well should receive care with their mother, and not be transferred to the neonatal unit.

If any of the abnormal signs are found, the baby requires intervention. Check the blood glucose, oxygen saturation and fully assess the baby. Keep the baby warm and manage the baby for hypoglycaemia, hypoxia, hypothermia if this is found. If the baby is not well or is small, transfer the baby to the neonatal unit in a transport incubator, after initiating any necessary care for hypothermia, hypoglycaemia or hypoxaemia.

If the baby weighs < 2kg or the head circumference is more than 39cm, the baby will need care in the neonatal unit, but the baby can remain skin-to-skin with the mother if there is no other immediate care that is required.

All these guidelines are found in the Essential Newborn Care Chart Book. (15)

## RAPIDLY ASSESS BABY IMMEDIATELY AFTER BIRTH

Do a rapid assessment of baby soon after birth, to establish if baby needs any immediate care or referral to neonatal unit. Provide routine care and commence breastfeeding.

ASK, LOOK, LISTEN, FEEL						SIGNS	CLASSIFY	CARE, TREAT AND COUNSEL
Is the Apgar at 5 minutes < 8						<ul style="list-style-type: none"> <li>• Took &gt; 5 minutes to breathe</li> <li>• Apgar &lt; 8 at 5 minutes</li> <li>• Grunting OR</li> <li>• Chest in-drawing OR</li> <li>• Fast breathing (RR&gt;60)</li> <li>• Central cyanosis</li> <li>• Abnormal tone OR Not moving well</li> <li>• Major abnormality</li> <li>• Head circ. &gt; 39cm</li> <li>• Low birth weight &lt; 2 kg</li> </ul>	<p><b>POSSIBLE BIRTH ASPHYXIA</b></p> <p><b>and / or RESPIRATORY PROBLEM</b></p> <p><b>and / or SEVERE DISEASE</b></p> <p><b>and / or MAJOR BIRTH ABNORMALITY</b></p> <p><b>and / or LOW BIRTH WEIGHT &lt; 2kg</b></p>	<ul style="list-style-type: none"> <li>• Immediate drying and additional stimulation</li> <li>• Routine suction of newborn is not recommended</li> <li>• Delayed cord clamping ( after 1-3min) is recommended for all births while initiating essential newborn care</li> <li>• Keep baby warm, in skin-to-skin or in a transport incubator</li> <li>• Check blood glucose, and treat if low</li> <li>• Put on saturation monitor and start oxygen if oxygen saturation is &lt; 90%</li> <li>• Identify baby with mother</li> <li>• Administer vitamin K 1mg IM</li> <li>• Administer chloramphenicol eye prophylaxis into both eyes</li> <li>• Counsel about condition</li> <li>• If baby is breathing well, and not requiring oxygen and &gt; 1,8kg: breastfeed baby.</li> <li>• Refer to Neonatal Unit for further assessment and care</li> </ul>
	0	1	2	1min	5min			
Crying?	No response	Grimace	Vigorous cry					
Breathing?	Absent	Slow or irregular	Good, crying					
Colour?	Blue or pale	Pink but blue feet	Pink all over					
HR> 100?	Absent	<100 / min	>100 / min					
Is baby active?	Limp	Slight flexion	Active, moves					
<p>Did baby take more than 5 minutes to breathe on own?</p> <p>Observe the breathing. Is there?</p> <p><input type="checkbox"/> Grunting, in-drawing, fast breathing (&gt; 60/min), or cyanosis</p> <p>Observe baby while lying on the back and then hold the baby and turn over. Observe for movement, tone and major abnormalities. Does the baby have?</p> <p><input type="checkbox"/> Increased or decreased tone</p> <p><input type="checkbox"/> Less than normal movement</p> <p><input type="checkbox"/> Major abnormality on back, abdomen or head</p> <p>Weigh baby, is the weight?</p> <p><input type="checkbox"/> &gt;4,5kg      <input type="checkbox"/> &lt; 2kg</p> <p>Measure the Head circumference.</p> <p><input type="checkbox"/> Head circumference more than 39cm</p> <p><input type="checkbox"/> OR, &gt;P90 for gestational age</p> <p>Did the mother have diabetes in pregnancy?</p> <p>Poor feeding</p>						<ul style="list-style-type: none"> <li>• Baby weighs &gt; 4,5 kg</li> <li>• Mother has diabetes</li> </ul>	<p><b>INFANT OF DIABETIC MOTHER OR BIG BABY</b></p>	<ul style="list-style-type: none"> <li>• Breastfeed or give EBM 3ml/kg every hour by cup</li> <li>• Check blood glucose every hour for 6 hours</li> <li>• If hypoglycaemic treat for low glucose</li> <li>• Administer vitamin K 1mg IM</li> <li>• Administer chloramphenicol eye prophylaxis into both eyes</li> <li>• Identify baby with mother and counsel</li> </ul>
						<ul style="list-style-type: none"> <li>• No abnormal signs or measurements</li> </ul>	<p><b>BABY IS WELL</b></p>	<ul style="list-style-type: none"> <li>• Keep skin-to-skin with mother</li> <li>• Identify baby with the mother</li> <li>• Start breastfeeding</li> <li>• Do not give any prelacteal feeds or other supplemental feeds</li> <li>• Administer vitamin K 1mg IM</li> <li>• Administer chloramphenicol eye prophylaxis into both eyes</li> <li>• Transfer with mother to postnatal ward.</li> </ul>

## MODULE 2: SELF ASSESSMENT QUESTIONS

Answer the assessment questions before continuing to the next module. If you do not get the questions correct, re- review the material before answering the questions again. Once you have successfully completed the questions you may move to the next section.

### 2.1 When the baby is delivered by Caeserian section

- Suction all babies delivered by Caeserian section
- The cord must always be cut immediately by the surgeon
- These babies require admission to the neonatal unit
- Require the same initial steps of care

### 2.2 Babies who are < 32 weeks gestation or < 1,5kg are at a higher risk of hypothermia. Which of the following statements is correct?

- Hypothermia can be prevented by drying the baby and then wrapping the baby in polyethelene wrapping without covering the face.
- The delivery room temperature should be > 25°C
- Skin-to-skin contact does not work for preterm babies
- Suction all babies delivered preterm

### 2.3 Read the following Case study and then answer the question below

You are on duty for theatre and are informed about an emergency caeserian section for an otherwise well mother, with foetal distress. You make all the necessary preparations and await delivery of the infant. Upon delivery, thick meconium is mixed with the liquor and the baby has very poor tone and does not breathe. Which of the statements below is correct?

- The baby requires vigorous suctioning through the mouth and then the nose until no meconium is visible in the mouth or the nose
- The baby needs stimulation to breathe immediately
- Wait for 1 minute to avoid overstimulating the baby and to see if the baby will breathe spontaneously
- Visualize the cords and suction once for any meconium seen below the vocal cords within 20 seconds before the baby takes a breath.

## MODULE 3: HELP THE BABY WHO IS NOT BREATHING WELL

### 3.1 CLEAR THE AIRWAY AND STIMULATE BREATHING

If the baby is not crying or breathing well after drying, help the baby breathe in the first minute. This is a very important time and is called The Golden Minute® by Helping Babies Breathe®.

#### 1. CLEAR THE AIRWAY

If after drying, the baby is still not crying or breathing, position the baby on the side and ensure that the neck is in the neutral position to keep the airway open. When the baby is in the neutral position the nose will be more prominent than both the forehead or the chin. Reposition as necessary to open the airway.

If the baby still does not breathe, gently suction the mouth and then the nose with a suction device. The mouth is suctioned first to remove secretions closest to the airway. Insert the suction tubing into the side of the mouth advancing for approximately 3 – 4cm into the mouth, while still visualising the tip of the suction tubing. Suctioning for too long can damage the mucosa and cause bradycardia due to vagal stimulation.

#### 2. STIMULATE BREATHING

If after suctioning the airway the baby is still not breathing, gently stimulate the baby again by rubbing the back firmly. Do not lift the baby up, slap the baby or injure the baby in any way.

**IF THE BABY DOES START BREATHING AFTER STIMULATION, CONTINUE TO OBSERVE THE BREATHING TO MAKE SURE THAT ADEQUATE BREATHING IS SUSTAINED.**

#### 3. PLAN FURTHER CARE

Some babies will have shallow, irregular, slow, noisy or absent breathing immediately after birth. Others may have chest in-drawing and grunting. These babies will require further care.

There are 3 categories of babies to consider and make plans for further care.

If the baby is not breathing at all or is gasping, you will need to begin ventilation with a bag-valve-mask immediately. Quickly clamp and cut the umbilical cord before moving the baby to the area for resuscitation (clean, flat surface under a radiant warmer, with good lighting, prepared and checked prior to the birth) to begin BVM ventilation. A delay in ventilation may result in a preventable death or brain damage. In this scenario, ventilation clearly has priority over delay in clamping of the umbilical cord and is described in detail below.

If the baby is breathing but is cyanosed, breathing too fast (>60 breaths per minute) or grunting with chest in drawing, take the baby to the resuscitation area and assess whether the baby needs oxygen and further care or not. Begin by checking the oxygen saturation of the baby, using a pulse oximeter with a neonatal probe, and then checking the saturation against the age of the baby in minutes (table 2). If the saturation is below the target range, oxygen should be administered by face mask or nasal prongs. Generally, if saturation is less than 90%, oxygen should be administered.

If the baby is premature or weighs less than 2000g and has respiratory distress, he may need early initiation of nasal CPAP, which is best, administered in the neonatal unit as soon as possible.

All such babies will require referral to the neonatal unit for close monitoring including monitoring of oxygen saturation. Do not forget to speak to the mother and the birth companion about the baby's condition and to explain the plan for the baby's further care.

## MODULE 3: HELP THE BABY WHO IS NOT BREATHING WELL

### 3.2 VENTILATE WITH BAG AND MASK

Ventilation with a bag-valve-mask device is for babies who still have not initiated breathing after stimulation. Ventilation helps carry air into the lungs and in so doing, initiate the transition needed to allow spontaneous breathing. Delay in starting ventilation can result in serious injury to the brain as the result of tissue anoxia. Aim to initiate ventilation within 60 seconds of birth, or within the "golden minute®".

Ventilation with bag and mask is the most important and effective way to help the baby who is not breathing or is gasping. Ventilation opens the lungs with air.

#### INITIATE VENTILATION WITH A BAG-VALVE-MASK

**Stand behind the baby's head.** This enables control of the head position and visualisation of chest movement with ventilation.

**Select the correct mask.** The mask should cover the baby's chin, mouth, and nose, but not the eyes. The mask should make a tight seal on the face so that air will enter the baby's lungs and not escape under the mask. A mask that is too large will not seal well on the face. Air will escape under the mask. A mask that is too small will not cover both the mouth and nose and may block the nose. Air will not enter the lungs freely. As a general guide, a term baby usually requires a mask size 1 and a preterm baby a mask size 0.

**Position the head in the neutral position (avoid over-extension).** Help keep the baby's airway open by positioning the head into the neutral position and supporting the chin.

**Position the mask on the face.** Position the rim of the mask to rest on the tip of the chin, and then place the mask over mouth and nose.

**Form a firm seal between the mask and the face while squeezing the bag to produce a gentle movement of the chest.** Hold the mask on the face with the thumb and index finger on top of the mask. Use the middle finger to lift the chin up toward the mask. Use the 4th and 5th fingers along the jaw to lift it forward and help keep the airway open. Form a tight seal by pressing lightly on the top of the mask and gently holding the chin up toward the mask. If the seal is not tight, you will not move air into the lungs as you squeeze the bag. The air will escape under the rim of the mask. Do not push the mask down onto the face. This may change the head position and interfere with aeration of the lungs.

**Ventilate** by squeezing the bag to produce a gentle movement of the chest, as if the baby were taking an easy breath. Make sure there is no leak between the mask and the baby's face. Squeeze the bag harder if you need to deliver more air with each breath. For the first 5 breaths, maintain the inflation pressure for 2 – 3 seconds. This will aid lung expansion. Thereafter ventilate at a rate of about 30 - 40 breaths per minute. This can be achieved by counting aloud; "Bag...two...three...Bag...two...three....." If you squeeze the bag as you say, "Bag," and release while you say, "two... three," you will ventilate at the correct rate.

Ventilate the baby with room air and not oxygen. The efficacy of the ventilation can be seen by a rapid increase in the heart rate and observing chest rising and some abdominal rising.

## MODULE 3: HELP THE BABY WHO IS NOT BREATHING WELL

### TWO POINT HOLD OF FACE MASK



Figure 7: Two point hold of face mask

### EVALUATE THE BABY DURING VENTILATION BY ASKING: IS THE BABY BREATHING WELL?

Most babies requiring ventilation at birth will respond within 30 seconds of ventilation, and then begin breathing well. Stop ventilation when the baby starts to breathe well.

Other babies require continued ventilation with bag and mask. Such babies may have gasping respiration seen as a single deep futile breathing movement, followed by a long pause or several deep, irregular breathing movements followed by a pause. Continue ventilation with bag and mask in this scenario.

### TARGET OXYGEN SATURATION IMMEDIATELY AFTER BIRTH

TIME FROM BIRTH	TARGET OXYGEN SATURATIONS
1 minute	60 – 70 %
2 minutes	65 – 85 %
3 minutes	70 – 90%
4 minutes	75 – 90%
5 minutes	80 – 90%
10 minutes	85 – 90%
Term > 24 hrs	>96%
Preterm > 24 hrs	>90%

Table 2: Target oxygen saturation immediately after birth

## MODULE 3: HELP THE BABY WHO IS NOT BREATHING WELL

### 3.3 IMPROVE VENTILATION IF THE BABY IS STILL NOT BREATHING WELL

If the baby is not breathing, continue ventilation and call for help.

In the meantime, check that ventilation breaths produce movement of the chest as if the baby were breathing normally. Take steps to improve ventilation if the chest is not moving.

#### **MOUTH:**

- Check the mouth, the back of the throat, and the nose for secretions, and clear as necessary.
- Open the baby's mouth slightly before reapplying the mask.
- Reattempt ventilation

#### **HEAD:**

- Reapply the mask to the face to form a better seal.
- Reposition the head with the neck in the neutral position. In order to achieve this, one can place a cloth under the baby's shoulders.
- Reattempt ventilation

Consider an alternative airway- Insert an oral airway, or a nasopharyngeal tube, or intubate.

An air leak under the mask or incorrect position of the head is a common reason for poor chest movement. If you still do not see gentle movement of the chest, try to find the problem and repeat the necessary steps to improve ventilation. Recheck the function of the ventilation bag. Replace if another bag is available.

**Watch the LINC video: Bag and mask ventilation** (available on [lincare.co.za](http://lincare.co.za))

**Watch the LINC video: Improve ventilation** (available on [lincare.co.za](http://lincare.co.za))

## MODULE 3: SELF ASSESSMENT QUESTIONS:

### 3.1 The one most important skill that is required by health workers to help a baby breathe is (choose 1 correct answer)

- Correctly apply nasal prongs for oxygen administration
- Intubation
- Bag and mask ventilation
- Cardiac compression

### 3.2 To ensure that all babies breathe within 1 minute of birth (GOLDEN MINUTE ®), which step is correct to take?

- Cut the umbilical cord immediately
- If baby does not cry immediately stimulate, position airway and check breathing
- If baby does not breathe, commence bag and mask ventilation by 2 minutes
- Administer oxygen via endotracheal tube if baby does not breathe by 60 seconds

### 3.3 To successfully bag and mask ventilate the baby do the following, except for

- Stand or sit at the baby's head and select the correct mask
- Position the mask on the baby's face, make a firm seal between the mask and the face and gently squeeze the bag
- Ventilate the baby at about 20 breaths per minute
- Watch the chest / abdomen for movement

## MODULE 4: ADVANCED RESUSCITATION

If the baby is still not breathing after bag and mask ventilation and checking that this is effective, you will need to start advanced resuscitation. Advanced resuscitation refers to the addition of chest compressions and drugs to help the baby to recover. Before proceeding, take some time to review the pathophysiology on birth asphyxia.

### 4.1 PATHOPHYSIOLOGY OF BIRTH ASPHYXIA

If subjected to hypoxia in utero, the foetus will start gasping. If the hypoxic insult is sustained, the foetus will lose consciousness. The neural centres controlling the breathing efforts ultimately cease to function because of lack of oxygen. As a result, the foetus then enters a period known as primary apnoea. The heart rate, which was unchanged up to this point, now decreases to about half the normal rate and the myocardium reverts to anaerobic metabolism. The circulation to non-vital organs is reduced in an attempt to preserve perfusion of vital organs. Lactic acid, the result of anaerobic metabolism of glucose is produced, and causes metabolic acidosis.

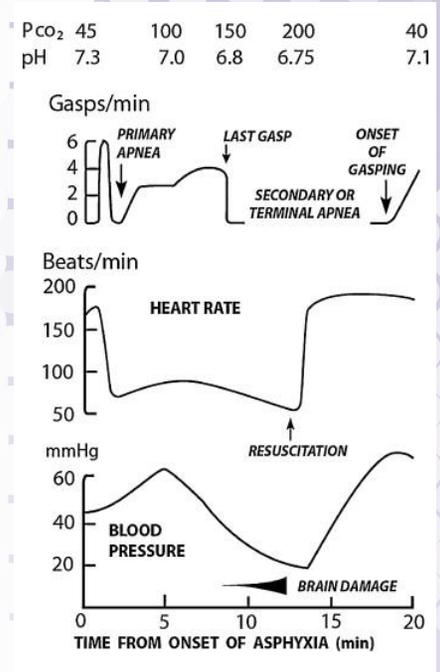
If the insult continues, the primitive basal ganglia initiate gasps at a rate of about 12 gasps per minute. If the foetus is still in utero, or if for some other reason these gasps fail to aerate the lungs, the gasps gradually fade away until the foetus enters a period known as secondary, or terminal, apnoea. Until now, the circulation has been maintained, however, as terminal apnoea progresses, the rapidly deteriorating biochemical milieu begins to impair circulation by hindering cardiac function. The heart eventually fails, in both frequency of contraction and contractility. Without effective intervention, the baby dies. In a term newborn, the entire process takes approximately 20 minutes.

It is important to note that, in the face of asphyxia, the baby is able maintain an effective circulation. From the period of primary apnoea, through the gasping phase, and even for a while after the onset of terminal apnoea, circulation is maintained. Thus, the most urgent requirement of any asphyxiated baby at birth is effective aeration of the lungs. Provided the baby's circulation is sufficient, oxygenated blood will be conveyed from the aerated lungs to the heart. The heart rate will increase and the brain will be perfused with oxygenated blood. Following this, the neural centres responsible for normal breathing will, in many instances, function once again and the baby will recover.

Review Figure 8. This figure summarises the changes in HR, BP, pH and the pattern of gasping respiration at the onset of asphyxia. The figure also demonstrates the recovery with the initiation of resuscitation.

Merely aerating the lungs is sufficient for recovery in the vast majority of cases. Although lung aeration is vital, there are a few cases in which cardiac function will have deteriorated to such an extent to result in inadequate circulation. An inadequate circulation (identified by a slow heart rate of less than 60 beats per minute) cannot convey oxygenated blood from the aerated lungs to the heart. In this scenario, a brief cycle of chest compression may be necessary. Furthermore, in very few cases lung ventilation and chest compression alone may not be sufficient, with the need for drugs to restore the circulation. The outlook in this small group of infants is generally poor. The management of babies who require chest compressions and drugs over and above effective bag mask ventilation is discussed in detail below.

**Watch the LINC video: Pathophysiology of perinatal asphyxia** (available on [lincare.co.za](http://lincare.co.za))



**Figure 8: Sequence of events following birth asphyxia (1)**

## MODULE 4: ADVANCED RESUSCITATION

### 4.2 ADVANCED CARE: HEART RATE

The algorithm for advanced resuscitation begins with assessment of the heart rate in a baby who has been ventilated effectively, but fails to breathe spontaneously and/or fails to restore heart rate to more than 60 beats per minute. If a baby does not begin to breathe spontaneously after 1 minute of effective ventilation (with chest movement), evaluate the heart rate to decide if ventilation alone is sufficient. Ask yourself the question: **Is the heart rate normal or slow?**

To evaluate the heart rate, palpate for umbilical cord pulsation or listen for a heartbeat with a stethoscope. Palpate or listen just long enough to recognize if the heart rate is normal or slow. If the heart rate is faster than your own, it is most likely normal. If the heart rate is slower than your own pulse, then it is slow.

In the resuscitation setting, it is important to communicate information about the heart rate quickly. As an aide, feel for a pulse in the umbilical cord or auscultate and then "tap what you feel" on a hard surface to get a better sense of the pulse rate.

**Watch the LINC video: Check the pulse rate** (available on [lincare.co.za](http://lincare.co.za))

#### IF THE HEART RATE IS NORMAL

If the heart rate is normal while you provide effective ventilation; continue to ventilate until the baby is breathing spontaneously. Gradually reduce the rate of ventilation while observing the baby's breathing. If the heart rate remains normal as the baby breathes spontaneously and regularly, stop ventilation.

**Ventilation can be stopped when the baby is breathing spontaneously and regularly whilst maintaining a normal the heart rate (more than 100 beats per minute).**

If the heart rate is normal and the baby still does not breathe, check whether the mother received pethidine or any opioids, in the preceding 4 hours. If pethidine or any opioids were given and the baby is not breathing, the baby may need naloxone (Narcan®). A baby who has a normal heart rate but does not breathe needs continued ventilation. Slowly decrease the rate of ventilation over several minutes to see if there is a return of normal, spontaneous breathing. If the baby still does not breathe, continue ventilation and consult a specialist with the view of inserting an alternative airway.

If the baby is breathing, but becomes blue when effective BVM ventilation is discontinued or if the baby is breathing and looks cyanosed, check the oxygen saturation and if necessary give supplemental oxygen. Supplemental oxygen can be administered through a head box, nasal prongs or catheter.

Assess the newborns response to oxygen by measuring the pre-ductal saturation. Pre-ductal saturation is measured by putting the pulse oximeter probe on the right hand of the baby. Target oxygen saturations for newborns from the time of birth are presented in table 2. Regardless of gestation, the goal of oxygen administration is an oxygen saturation resembling that of a healthy term newborn. High concentrations of oxygen have been associated with increased mortality, and do not improve recovery from asphyxia; in fact, the contrary might be true with delay in time of onset of spontaneous respiration. Provide as little oxygen as will be necessary to keep the saturation at 90%. You can add a venturi (60%, 40%, and 28%) to modify the percentage of oxygen provided. Compare the pre-ductal saturation with the post-ductal saturation, as a difference in saturation of more than 15% may be indicative of persistent pulmonary hypertension of the newborn. Reduce or stop oxygen if the newborns oxygen saturation is above 90% at any point in the first 10 minutes. (...continues on next page)

## MODULE 4: ADVANCED RESUSCITATION

(...continued from previous page) If the baby has severe chest in-drawing, very fast breathing, grunting, or frequent pauses in breathing (longer than 15 to 20 seconds) the baby requires nasal CPAP to support the aeration of the lungs. Transfer the baby to the neonatal unit where this care can be initiated.

Of note: If the baby shows regular breathing, and has low oxygen saturation, and does not improve on oxygen (i.e. there is no increase in saturation), the baby may have a congenital heart lesion with a right-to-left shunt.

All babies who have required bag and mask ventilation will require close monitoring in the neonatal unit afterwards. Speak to mother and the birth companion about the baby and the plan of care.

### ADVANCE CARE: SLOW HEART RATE, CHEST COMPRESSION AND DRUGS

If the heart rate is slow, make sure that you have taken all the steps to improve ventilation. A slow heart rate is a sign of hypoxaemia, which is most often the result of inadequate ventilation. If the chest is not moving well you may consider an alternative airway, or intubation. If ventilation seems adequate and the chest is moving well, with a slow heart rate, you will need to provide circulatory support. Start chest compression, to improve the circulation. If you are going to administer chest compression it is usually best to intubate the baby first and ventilate via the endotracheal tube.

### CHEST COMPRESSION

Circulatory support with chest compressions is only effective if the lungs are successfully inflated. Give chest compressions if the heart rate is less than 60 beats per minute. For this to be successful, one needs a skilled helper.

There are two techniques for chest compression. Firstly, you may use the 2-finger or secondly the 2-thumb method. The 2-thumb method is the most effective: grip the chest in both hands in such a way that the two thumbs can press on the lower third of the sternum, just below an imaginary line joining the nipples, with the fingers over the spine at the back. (Figure 9)

Compress the chest to a depth of  $\frac{1}{3}$  the AP diameter of the chest. Count 1,2,3 Bag, 1,2,3 Bag (3 compressions to each breath). As a team, one health care provider will compress the bag to provide ventilation and the other health care provider will do chest compression. By definition, the leader is the health care provider who is bagging and should therefore be the one responsible for counting.

Chest compressions move oxygenated blood from the lungs back to the heart. Allow enough time during the relaxation phase of each compression cycle for the heart to refill with blood. Ensure that the chest is inflating with each breath. Continue chest compressions for at least one minute and then evaluate heart rate again. If there is still bradycardia, then continue chest compressions, and prepare to administer adrenalin.

In less than one per thousand births, effective ventilation and effective chest compression will be insufficient to produce an effective circulation. In this scenario, administering drugs may be helpful.

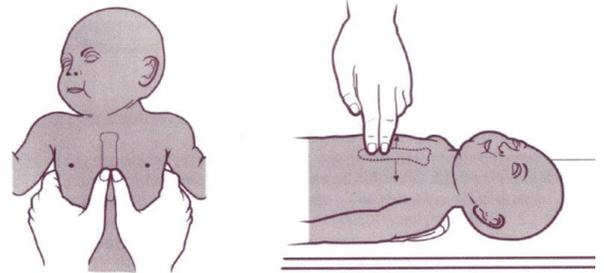


Figure 9: Chest compression, a) 2-thumb and b) 2-finger method

## MODULE 4: ADVANCED RESUSCITATION

### IF HEART RATE STILL SLOW, GIVE ADRENALINE

Bradycardia usually follows hypoxia due to inadequate ventilation and oxygenation of the brainstem, with resulting apnoea. Establishing adequate ventilation is the most important intervention to improve heart rate. If, however, the heart rate remains less than 60 beats per minute despite adequate ventilation, administering adrenaline is the next most important step to improve heart rate.

Adrenaline is to be administered if the heart rate is less than 60 beats per minute after one minute of effective ventilation with chest compression. Adrenalin is best administered via an umbilical venous catheter. See the section below on inserting of an umbilical venous catheter. Alternative access is via an endotracheal tube, peripheral vein, or intraosseous line.

Prepare adrenalin by mixing 1 ml of 1 in 1000 adrenaline with 9ml of Saline to get 1 in 10 000 Adrenaline solution. Administer 0.01-0.03mg/kg (equates to 0.1-0.3mL/kg of 1 in 10 000 adrenaline). Give as a rapid bolus followed by 0.9% Sodium Chloride flush of equal volume.

Alternatively, if resuscitating a term baby, draw up 1 mL of Adrenaline and administer it all intravenously. If the baby is 27 – 32 weeks gestation, then give 0.25 ml, if 33 – 37 weeks give 0.5 ml and if 38 – 43 weeks then give 1ml of adrenalin per CPR cycle of 1-2 minutes duration.

If adrenalin is to be given through the ET tube, the doses of adrenaline must be 3 times higher than the intravenous doses. Follow administration of ET tube adrenalin with positive pressure ventilation to ensure that the Adrenaline dose is ventilated into the lungs and is not left in the ETT or the adaptor!

Repeat every 1-2 minutes, if the heart rate remains less than 60 beats per minute. See section on when to discontinue or withhold life support below. (And continue for how long?) If an ETT dose is administered with inadequate effect, give an IV dose as soon as vascular access is obtained.

### WHEN WOULD YOU GIVE A FLUID BOLUS?

If, in a term infant, there is suspected blood loss or the infant has clinical signs of shock (pallor, poor perfusion, weak pulse, increased capillary refill time) and has not responded adequately to other resuscitation measures, then consider giving a bolus of fluid. Give an initial bolus of 10ml/kg of Normal Saline intravenously. If effective, it may need to be repeated to maintain improvement. In preterm babies, volume expansion is rarely needed, and has been associated with intraventricular and pulmonary haemorrhages.

### WHEN WOULD YOU USE BICARBONATE

There is insufficient data to recommend the routine use of bicarbonate in the resuscitation of the newborn. Bicarbonate is not recommended during brief Cardio Pulmonary Resuscitation (CPR). It may be considered during prolonged cardiac arrests unresponsive to other therapy. It should only be given after adequate ventilation and circulation is established with CPR. The use of bicarbonate should be limited to cases where an ABG has been done to guide correct dosing of bicarbonate.

## MODULE 4: ADVANCED RESUSCITATION

### 4.3 ENDOTRACHEAL INTUBATION

As discussed in the introduction to this course, bag and mask ventilation is usually adequate to ventilate the baby. However in some circumstances, ET intubation is unavoidable. Endotracheal intubation is indicated when the baby needs advanced care with chest compressions and adrenaline or when effective ventilation with bag and mask fails.

In summary, a decision to perform endotracheal intubation will depend on the newborn's gestation, degree of respiratory depression, response to facemask ventilation, and, of course, the skill and experience of the resuscitator.

Only clinicians with appropriate training and experience in the procedure should attempt neonatal endotracheal intubation. If successful intubation cannot be achieved within 20 seconds, then continued positive pressure ventilation (PPV) via a facemask is recommended.

**If there is no health care provider skilled in intubation present, continue positive pressure ventilation via a facemask, and wait for a skilled helper.**

### INDICATIONS

- Tracheal suctioning in a non-breathing and floppy newborn exposed to meconium stained liquor\*
- Unsuccessful ventilation via a facemask (e.g. heart rate remains slow, oxygen saturation falling or failing to rise or prolonged apnoea)
- Administration of endotracheal medications (e.g. adrenaline or artificial surfactant)
- Expected need for continued or prolonged ventilation and chest compression

### WHAT IS NEEDED

- Straight bladed laryngoscope with a bright light that has been checked
  - Miller blade size 00 or size 0
- Suction apparatus that has been checked
- ET tube
  - sizes 2.5 to 3.5 (see: table1)
  - Do not use size 2.0 tubes or shouldered tubes.
- McGill forceps with lubricating jelly for naso-tracheal intubation
- Guide wire for oro-tracheal intubation (make sure that the guide wire does not protrude outside the tube, as this may cause tracheal perforation).
- Strappings for securing the tube

## MODULE 4: ADVANCED RESUSCITATION

### POSITIONING OF THE BABY

- Place the baby on the resuscitaire with the head towards you.
- Ensure the head is in neutral position. Flexion, and hyperextension block visualisation of the vocal cords. A small cloth placed under the shoulders, or under the neck, may help with adequate positioning.

### TECHNIQUE

- To obtain good visualisation, the oropharynx should be gently, albeit adequately, suctioned.
- For nasal intubation, introduce ET tube, after lubrication, into one nostril and advance it to a position beyond the palate.
- Holding the laryngoscope in your left hand, introduce the blade into the right side of the mouth, moving the tongue to the left as the tip of the blade is advanced into the vallecula. The vallecula is the space between the epiglottis and the base of the tongue.
- Gentle vertical pressure of the laryngoscope, with a little pressure on the cricoid, will bring the vocal cords into view.
- Visualize the ET tube and grab it with the the McGill forceps before advancing the tube approximately 1 cm beyond the cords into the trachea.
- Verify equal and bilateral air entry by auscultating both axillae while ventilating with a bag and mask.
- Secure the ET tube position with the help help of another health care provider.
- Ventilating with a ventilation bag.

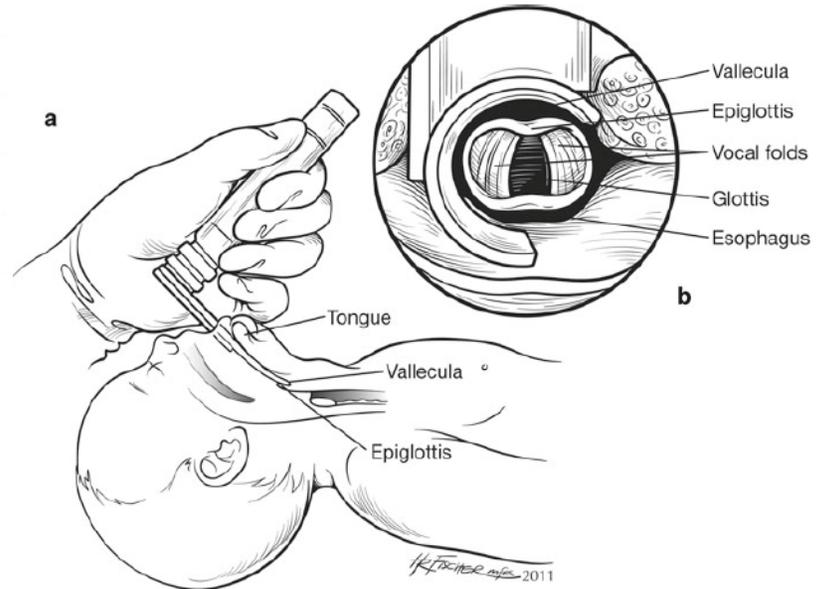


Figure 10: Neonatal Intubation

## MODULE 4: ADVANCED RESUSCITATION

### ETT TUBE SIZE

ETT size and insertion length are based on the newborn's weight and corrected gestation. ETT internal diameter can be calculated using the formula of gestational age in weeks divided by 10. Approximate ETT insertion depth from the middle of the upper lip can be calculated using the formula of weight in kg + 6cm and for nasotracheal intubation, weight in kg + 1 cm.

Weight in kg	ETT mark at upper lip (cm)	ETT inside diameter (mm)	ETT suction catheter size (F)
< 1 kg	6.0	2.5	5 or 6
1.1 – 1.9	7.0	3.0	6 or 8
2.0 – 3.0	8.0	3.5	8
> 3kg	9.0	3.5	8 or 10

### POSITION VERIFICATION

- ETT insertion depth must always be checked by comparing the markings on the tube with the formula or tabulated findings .
- Primarily, correct ETT position is confirmed by effective ventilation as demonstrated by:
  - Chest rise with each inflation
  - Heart rate increasing to above 100 bpm
  - Improving oxygenation (oximetry is more accurate than visual assessment, although false negatives may occur in newborns if there is very low or absent pulmonary blood flow)

**Only perform intubation for the purpose of suctioning meconium from the trachea in newborns with decreased muscle tone, immediately after birth and before the onset of breathing or crying. An experienced clinician should be the one to perform the procedure and even then, only if all the equipment required is immediately available. In this scenario, suctioning should only be done once followed by rapid commencement of resuscitation as required.**

**Watch LINC video: Endotracheal intubation** (available on [lincare.co.za](http://lincare.co.za))

## MODULE 4: ADVANCED RESUSCITATION

### 4.4 UMBILICAL VEIN CATHETERISATION

When intravenous (IV) access is required in the emergency situation, insertion of an umbilical vein catheter can facilitate rapid access.

#### INDICATIONS

- During resuscitation, if quick IV access is indicated for example for:
  - To administer a bolus of fluids for volume expansion
  - To administer adrenaline
  - To prevent or, correct severe hypoglycaemia
- If IV access is difficult
- In preparation for an exchange transfusion

#### WHAT YOU WILL NEED

- Size 5FG sterile nasogastric tube or umbilical vein catheter
- Sterile swabs
- Sterile scalpel and blade
- Umbilical cord ties
- Strapping
- Normal Saline ampoule
- 5ml syringe
- Artery forceps

#### STERILE UMBILICAL VEIN CATHETERISATION

- Position the infant under a radiant warmer with good lighting.
- Put on a mask, wash your hands thoroughly and put on sterile gloves.
- Attach the catheter / nasogastric tube to a syringe containing saline and flush it ( also eliminate any free air).
- Clean the umbilical cord area with spirits.
- Place a sterile towel around the umbilicus.
- Place the umbilical tape 1cm above the abdominal skin and tie loosely.
- Cut the cord 2cm above the skin.
- Identify the umbilical vein: there is one umbilical vein and two umbilical arteries, with the vein situated at the top (towards the baby's head) and the two arteries below.
- Insert the tip of the saline filled catheter or nasogastric tube into the vein and advance while aspirating until blood return is seen. Inserting the catheter 1-2cm beyond this point is an appropriate position for the emergency use without radiographic confirmation of position.
- Securely strap the umbilical catheter in place. Rugby post strapping works well.
- You can replace the syringe with an intravenous giving set or 3 way tap if you need to give medications.

## MODULE 4: ADVANCED RESUSCITATION

### PRECAUTIONS

- Bleeding if the base of the cord is not secured tightly.
- Ensure not to allow air to be introduced into the catheter, this is why you fill the catheter with saline and leave the syringe attached. If you see air in the catheter, withdraw on the end until there is no air and replace syringe.
- Don't give hypertonic solutions (e.g. 50% glucose and 8% soda bicarbonate) through the catheter.
- Portal vein thrombosis may complicate umbilical vein catheterization.
- Do not insert an umbilical vein catheter if it is possible to insert a peripheral vein infusion.

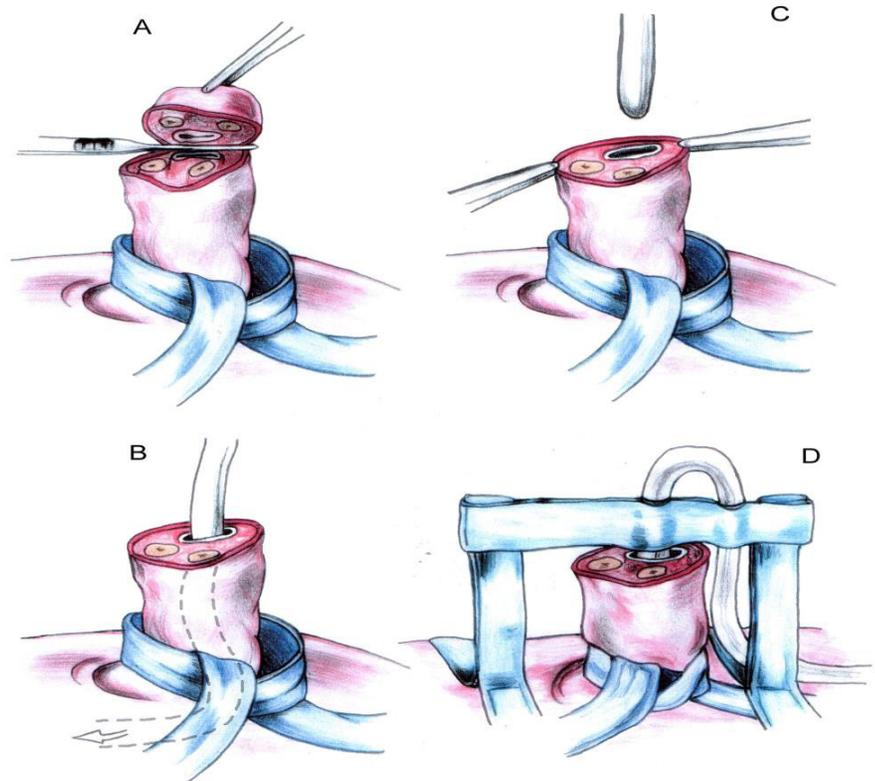


Figure 11: Umbilical venous catheterisation

## MODULE 4: ADVANCED RESUSCITATION

### 4.5 WHEN TO WITHHOLD OR DISCONTINUE LIFE SUPPORT

The decision to withhold or discontinue life support is not an easy one. The decision largely depends on the availability of resources and on your expectation of the functional survival of the baby being resuscitated, given the resources in the region in which you work. The decision is not easy, and one must be aware that the parents may want to be involved. The most senior health worker available should assist with the decision making. You may want to consult the paediatrician at your referral hospital. The following general guidelines may assist:

- If the baby has no heart rate after 10 minutes of ventilation it is appropriate to consider stopping resuscitation, as disability free survival is unlikely.
- When the possibility of functional survival is highly unlikely such as:
  - Extreme prematurity
  - Abnormalities such as anencephaly or Trisomy 13 or 18
- If there is no breathing effort whatsoever after 20 minutes, or only gasping respiration after 30 minutes.

When withholding or withdrawing resuscitation, talk respectfully to the family of the baby and provide comfort.

### 4.6 POST RESUSCITATION CARE OF THE NEONATE

If the baby has required bag and mask ventilation or advanced resuscitation, the baby needs further immediate care and monitoring and should be admitted to the neonatal unit for observation and further care.

Stabilise the baby prior to transfer to the neonatal unit.

1. Check blood glucose. A baby who has had asphyxia and required resuscitation will need maintenance glucose and possibly additional glucose. Establish a peripheral intravenous line, or put up an umbilical line. If there is hypoglycaemia, administer 2ml/kg of 10% glucose IV slowly, and in all babies put up Neonatolyte or 10% glucose iv at 2.5 – 3.0 ml/kg/hr. as maintenance. Monitor the fluid intake with an infusion controller or Buretrol and in line flow regulating device.
2. Keep warm. Ensure that the baby's temperature is kept in the thermoneutral range. If the baby is premature, ensure the baby's temperature is between 36.5 and 37.5°C. If the baby is a term baby with birth asphyxia, keep the temperature between 35 and 36°C. Transfer the baby in a temperature regulated transport incubator.
3. If the baby has respiratory distress (central cyanosis, fast breathing, chest – in-drawing, grunting) and the oxygen saturation is less than 90%, give supplemental oxygen by nasal prong or face mask. If the baby requires oxygen, provide oxygen even during transfer.

Transfer the baby to the neonatal unit, where the baby will have a full assessment and receive further care. The assessment and care are described in the Newborn Care Charts: Management of the sick and small newborn (MSSN). An e-learning course on MSSN is in development. The Newborn Care Charts are available from [www.lincare.co.za](http://www.lincare.co.za)

## MODULE 4: SELF ASSESSMENT QUESTION

### 4.1 Oxygen administration (indicate which one statement is correct)

- Is important for all babies who do not initiate breathing on their own
- Is not necessary for initial bag and mask ventilation, use room air
- Is given to all babies with meconium aspiration
- Is necessary for all preterm babies

### 4.2 If the baby has a slow heart rate and is not breathing, do the following except

- Intubate immediately and give adrenaline
- Improve ventilation with bag and mask ventilation
- If ventilation adequate initiate chest compression
- If heart rate remains slow despite adequate ventilation and chest compression give adrenaline

### 4.4. Discontinue life support to the baby if (choose the incorrect statement)

- The baby has no heart rate and no breathing after giving ventilation for 10 minutes
- There is no breathing effort after 20 minutes
- There is only gasping after 30 minutes
- After 45 minutes if the baby is "precious"

### 4.5 After successful resuscitation with bag and mask ventilation, you decide to admit a baby to neonatal unit for the following monitoring and/or treatment, except for:

- Oxygen saturation
- Glucose
- Temperature
- Antibiotics

## REFERENCES AND RECOMMENDED READING

1. Ersdal HL, Mduma E, Svensen E, Perlman JM. Early initiation of basic resuscitation interventions including face mask ventilation may reduce birth asphyxia related mortality in low-income countries. A prospective descriptive observational study. *Resuscitation* 83 (2012) 869 – 873
2. Perlman JM, Risser R. Cardiopulmonary resuscitation in the delivery room. Associated clinical events. *Arch Pediatr Adolesc Med* 1995;149:20-25
3. Wall SN, Lee AC, Niermeyer S, et al. Neonatal resuscitation in low resource settings: what, who and how to overcome challenges to scale up? *Int J Gynecol Obstet* 2009; 107: 47 – 64
4. Lee ACC, Cousens S, Wall SN et al. Neonatal resuscitation and immediate newborn assessment and stimulation for the prevention of neonatal deaths: a systematic review, meta-analysis and Delphi estimation of mortality effect. *BMC Public Health* 2011, 11(Suppl 3):S12 <http://www.biomedcentral.com/1471-2458/11/S3/S12>
5. Kattwinkel J. Addressing high infant mortality in the developing world. A Glimmer of hope. *Pediatrics*. <http://paediatrics.aappublications.org/content/early/2013/01/15/peds.2012-3171>
6. Padayachee N, Ballot DE. Outcomes of neonate with perinatal asphyxia at a tertiary academic hospital in Johannesburg, South Africa. *SAJCH* 2013, 7(3): 89 – 94
7. Bruikman, E.K. Intrapartum Asphyxia and Hypoxic Ischaemic Encephalopathy in a Public Hospital: Incidence and predictors of poor outcome. *MMED Thesis, Wits 18 May 2015*
8. *Helping Babies Breathe, Provider Guide, Second edition. (2016) American Academy of Pediatrics; <http://www.helpingbabiesbreathe.org/>.*
9. Wyllie J, Bruinenberg J, et al. European Resuscitation Council Guidelines for Resuscitation 2015. Section 7. Resuscitation and support of transition of babies at birth. *Resuscitation* 2015; 95: 249 – 263
10. Wyckoff MH, Aziz K, Escobedo MB et al. Part 13: Neonatal Resuscitation: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2015 Nov; 132(18 Suppl 2): S543-60
11. Delayed umbilical cord clamping after birth. Committee opinion no 684. *American College of Gynecologists. Obstet Gynecol* 2017; 129 e5 – 10
12. Weiner et al, Part 15: Neonatal Resuscitation: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care M. *Circulation*. 2010;122:S909-S919 [http://circ.ahajournals.org/content/122/18\\_suppl\\_3/S909](http://circ.ahajournals.org/content/122/18_suppl_3/S909)
13. *Newborn Life Support, Resuscitation Council (UK) 2010 Resuscitation Guidelines*
14. *Neonatal Resuscitation: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. <http://paediatrics.aappublications.org/content/early/2010/10/18/peds.2010-2972E.citation>*
15. *Essential Newborn Care 2013. NDOH. Limpopo Initiative for Newborn Care. [www.linicare.co.za](http://www.linicare.co.za)*
16. Singhal N, Lockyer J, Fidler H, et al. Helping Babies Breathe: Global neonatal resuscitation program development and formative educational evaluation. *Resuscitation* 2011
17. Msemo G, Massawe A, Mnbando D et al, Newborn Mortality and Fresh Stillbirth rates in Tanzania after HBB training. *Pediatrics* DOI: 10.1542/peds.2012-1795.
18. Little, GA, Keenan WJ, Niermeyer S, Singhal N, Lawn JE. Neonatal nursing and HBB: An effective intervention to decrease global neonatal mortality. *Newborn and infant nursing reviews. June 2011 Vol II no 2. [www.nainr.com](http://www.nainr.com)*

## CLINICAL PRACTICE SESSIONS

Once you have completed the reading, arrange for a facilitator to take you through the following demonstrations and skills sessions. Your facilitator will demonstrate each step and you will then practice in pairs, before doing the final 2 OSCE's. Satisfactory performances on all the skills stations are required. Preparation for birth

1. Routine care
2. Stimulate and clear airway if not breathing
3. Bag and mask ventilation
4. How to improve ventilation
5. Endotracheal intubation
6. Chest compression
7. Administration of drugs and fluids
8. Umbilical catheter insertion
9. OSCE 1
10. OSCE 2