



## Chapter 4. Monitoring vital signs - nursing

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*Parent educational material for app*

Imperial Neonatal Service, Imperial College Healthcare NHS Trust

## 1. Introduction to monitoring vital signs in the neonatal unit

Having a baby admitted to a neonatal unit is often an unexpected and unsettling experience for parents. The environment and equipment in the neonatal intensive care unit (NICU) can be scary and daunting at first. Babies are continuously and closely monitored: there are various monitors and leads connected to babies and various other machines providing intensive care such as infusion pumps or ventilators.

Vital signs such as heart rate, respiratory rate, blood pressure and saturation of oxygen in the blood are important signs to monitor in an intensive care set-up. Another important parameter which is monitored is your Baby's temperature. Term babies who are receiving whole body cooling treatment are also monitored for central and core temperature using a rectal probe.

All of these parameters are extremely important and provide vital information about the respiratory and haemodynamic status of the baby, helping us optimise the intensive care support. Your Baby's nurses and doctors are keeping a close eye on these numbers while observing your baby. As your Baby progresses the team will work together with you to wean down monitoring and also switched it off when preparing for home.

### Aims for this chapter

We want you as a parent to know and achieve:

- understanding of vital parameters
- how to check vital parameters
- what are the range of normal values
- what to do when values are beyond the normal ranges and next steps
- when to ask for advice.

### 1.1 Background to vital parameters monitoring – values and outcomes

Babies are different from adults and therefore the normal vital parameters in adults do not apply in babies. They have different:

- mechanisms for thermoregulation and loss of heat (see *temperature control*)
- breathing patterns (different musculature and bone design/strength) and mechanisms to adjust to distress (see *respiratory rate* and *respiratory distress signs*)
- heart rate, haemodynamics and heart mechanisms (see *heart rate*)

- oxygen saturation levels depending on their age (see *oxygen saturations*)

Initially when your Baby is admitted to neonatal unit all these parameters were checked closely and continuously, with leads and monitors, by the nurses and doctors. Later on as babies grow bigger and become more stable, they often no longer need continuous monitoring. Observing your Baby's color, activity and chest movement is the best way to assess your Baby and understand if he/she is well when they are no longer on the monitor. You can familiarise yourself with these parameters and with the help of our nursing team you can complete the vital signs section on your steps to home booklet.



Neonatal environment with continuous vital parameter recording in overhead monitor

## 1.2 Respiratory rate

### Normal range:

Normal respiratory rate in a newborn is between 40 and 60 breaths per minute.

### How do I measure it?

Measure the respiratory rate over a one minute period as babies can have irregular breathing. Assess the respiratory rate by placing your hand over your Baby's abdomen and counting the respirations.

Make a note of the breathing pattern and any signs of respiratory distress like grunting, recessions (marked retraction of subcostal spaces), nasal flaring (regular flaring of nostrils with each breath), change in Baby's colour.

### What do I do and when?

If the respiratory rate is between 60 and 70 breaths per minute, please check if there is any change in other parameters such as temperature, heart rate, colour, tone or if this is associated with any event (eg feeding, passing stools, crying, discomfort, posture and positioning etc).

Re-check respiratory rate and if it is still over 60 breaths per minute or under 30 breaths per minute, or there are any other associated signs, please inform the nurse looking after your Baby.

## 1.3 Heart rate

### **Normal range:**

The normal heart rate in neonates is 100 to 180 beats per minute. This depends on gestational age and normal range variations. This is different depending if the baby is awake (120 to 160 beats per minute) or asleep (term baby 70 to 80 beats per minute). In a healthy baby, heart rate increases with stimulation. Babies who are undergoing total body hypothermia have a lower heart rate of 70 to 80 beats per minute.

### **How do we measure it?**

This usually will be monitored by the nurse looking after your Baby. In neonatal units the heart rate is continuously monitored with ECG chest leads placed over your Baby's chest by the nurses. The heart rate can be seen as ECG trace in the overhead monitors. The saturation transducer, apart from measuring the oxygen saturation (SaO<sub>2</sub>), can also measure heart rate from the arterial pulses in the arms and legs. Heart rate can also be measured by placing a stethoscope directly over the chest and counting the number of heart beats over 30 seconds and multiplying this by two.

The increase of heart rate to over 180 beats per minute is known as tachycardia (tachy), whereas the decrease in heart rate to under 100 beats per minute is known as bradycardia (brady). These will also depend on gestational age and clinical situation.

### **How medication and medical treatment can affect it?**

Various medications can increase or decrease heart rates. The most commonly used medications that increase heart rate are caffeine, dopamine, dobutamine, adrenaline and nor-adrenaline. The most common medications that reduce heart rate are morphine and phenobarbitone. Various factors such as high temperature, heart failure, sepsis, feeds can lead to an increase in heart rate; whereas severe sepsis or total body cooling can reduce heart rate as well.

### **What do we do and when?**

The team looking after your Baby should always be nearby. If the overhead monitor is constantly showing a high or low heart rate please inform the nurse looking after the baby who will consult with the doctor and make the appropriate intervention.

## 1.4 Oxygen saturation (SaO<sub>2</sub>)

### What does SaO<sub>2</sub> mean?

Oxygen saturation is the percentage of oxygenated haemoglobin in comparison to the total haemoglobin in the arterial blood. It is a good non-invasive indication of how well oxygenated your body and all the organs are. SaO<sub>2</sub> is used to monitor resuscitation as well as for daily monitoring of babies in the neonatal unit. It is now well known that optimal oxygen saturation is directly related to mortality in preterm infants. It is also well known that high SaO<sub>2</sub> in preterm infants (32 weeks gestation or below) can lead to retinopathy of prematurity (ROP) which can potentially lead to blindness in preterm infants. Therefore it is very important to keep the SaO<sub>2</sub> within a certain range.

### What are the normal values and ranges?

The SaO<sub>2</sub> increases over the first 10 to 15 minutes after birth and remains stable in the high 80s (≥85 per cent) to mid-90s (≤95 per cent) in all preterm infants. In term infants the SaO<sub>2</sub> should be around 95 per cent or above.

In our unit we use certain target ranges and alarm limits based on gestational age and respiratory care. The nurses will check that this is appropriately set up for your Baby in each shift.

Corrected Gestational Age	Target range for saturation	Alarm settings if in oxygen	Alarm settings if in air
< 36 weeks	90 – 94%	90 - 94%	90% – no upper limit
≥ 36 weeks	≥ 92%	90 – 98%	90% – no upper limit

Oxygen saturation targets and alarm limits used in our neonatal units

SaO<sub>2</sub> depends on multiple factors like lung function, oxygen delivery, ventilator pressures, position of the endotracheal tube in the lung, haemoglobin level and other factors such as effective heart contractions, total blood volume and blood pressure. Babies with complex congenital heart disease can have much a lower SaO<sub>2</sub> of 75 to 85 per cent.

When there is a significant decrease in SaO<sub>2</sub> in babies receiving intensive care, the nurse or the doctor will intervene to optimise one or more of these above parameters.

### How do we measure it?

This usually will be monitored by the nurse looking after your Baby. SaO<sub>2</sub> is measured non-invasively by placing a white or orange tape which contains a transducer on the skin over the right hand at birth or any other hands and legs after birth. The SaO<sub>2</sub> transducers are easily recognisable from the red light that comes out of them, and their position is changed regularly during cares. You can help the nurses while changing the transducers in your baby.

Sometimes in term infants who are very sick with persistent pulmonary hypertension (PPHN) two transducers are used, one over the right hand and another over either of the legs.

In babies receiving intensive care, the measurements are continuously shown on the overhead monitor. For the purpose of recording the nurse will record hourly measurements in the electronic observation chart. Babies who are not receiving intensive care will have less frequent monitoring and will be downgraded to a less intensive monitor which will only show heart rate and SaO<sub>2</sub>. When there are no longer concerns in regards the breathing pattern of your baby and after stopping caffeine medication saturation monitoring can be discontinued and your Baby will be connected to an apnea monitor.



Measurement of saturation of oxygen in blood

### **What factors can interfere with a correct monitoring?**

Measurement of SaO<sub>2</sub> depends on various factors. Because of the nature of the technology involved, the measurement of SaO<sub>2</sub> is very motion sensitive and so becomes less accurate when the baby is moving.

Other factors such as cold periphery, poor circulation or a loosely attached transducer etc can have an impact on accurate recording of SaO<sub>2</sub>.

### **What do we do and when?**

The team looking after your Baby should always be nearby.

If the SaO<sub>2</sub> is persistently low and the monitor is beeping, look at your Baby and make sure that the transducer is in place and has not fallen off. Make sure that your Baby is not moving the arm or leg where the transducer is placed. Also make sure that they are not cold.

You can look at the trace of the SaO<sub>2</sub> on the monitor and make sure that there is a good uniform regular trace recorded.

If the SaO<sub>2</sub> still remains persistently low please inform the nurse looking after the baby. Any intervention needed should be performed by the nurses or doctors looking after your Baby.

## 1.5. Temperature

### Background

Temperature management is a significant area of clinical practice within neonatal nursing. Maintaining a constant body temperature is especially important in the neonatal population and they should be kept in a thermo-neutral environment to prevent excessive heat and water loss from the body.

You will notice that when in the neonatal unit, preterm infants are usually kept in pre-warmed humidified incubators to maintain a thermo-neutral environment.

Hypothermia and hyperthermia should be avoided equally as they can have severe adverse outcomes, increasing morbidity and mortality. Maintaining correct body temperature maximises metabolic efficiency, decreases oxygen use, protects enzyme function and decreases energy or caloric expenditure.

Your nurse will monitor your Baby's temperature when they are in the incubator either with a continuous temperature probe or intermittent temperature checks. When your baby has been moved into a cot it is still important to check axillary temperature intermittently, especially if your Baby is on a heated mattress.



### Where, how and when do we measure it?

#### Axillary temperature:

The axillary temperature can be measured using an electronic thermometer placed under your Baby's armpit and gently holding your Baby's upper arm against the side of the chest wall. It takes up to three minutes for the temperature to register and it makes a gentle pinging sound to alert you when the time is up.



Measurement of axillary temperature

### **Skin temperature:**

A temperature probe is lightly taped to your Baby's skin. This is usually placed on the stomach or trunk.

### **What are the normal values based on where was measured?**

Axillary: 36.5–37.5°C (On average 0.5°C lower than the rectal temperature)

Skin: Term babies 35.5- 36.5°C, preterm babies 36.2–37.2°C

Core (Rectal): 36.5–37.5°C

### **How to recognise signs and associated problems of temperature**

- central temperature below 36.5°C or above 37.5°C
- mottled and pale or plethoric
- lethargic or irritable
- increased oxygen requirements
- tachycardia or bradycardia
- hypoglycemia
- apneas
- feed intolerance

### **What do we do and when?**

#### **If your Baby has a low temperature:**

- Inform the nurse looking after your Baby.
- Assess environment and what clothing your Baby is wearing.
- If still under servo-controlled incubator the nurse will increase the temperature of the incubator by 0.5 – 1°C.
- With the help of nurses, correct any environmental factors (remove from draughts or add layer of clothing and extra blanket if needed).
- Re-measure your Baby's temperature 30 minutes to one hour after each intervention.



- If temperature is still below 36.5°C with the above layers and Baby is in a cot, then the use of an overhead warmer or heated mattresses might be needed.
- Consider skin-to-skin holding to stabilise temperature in more mature babies.

#### **If your Baby is too hot:**

- Inform the nurse looking after your Baby.
- Assess the environment and what clothing your Baby is wearing.
- With the help of the nurse correct environmental factors if relevant (ensure your Baby is appropriately dressed for environment, remove layer of clothing or blankets as necessary).
- The nurse will check and alter heater equipment if any in use. The nurse will turn the temperature down by 0.5°C at 30 to 60 minute intervals.
- Leave your Baby in an extended position to encourage heat loss.
- Re-measure your Baby's temperature 30 minutes to one hour after each intervention.

### **Key messages and reflection:**

After this chapter you should be able to:

- understand the importance of the vital parameters recorded
- understand the range and the normal values of the vital parameters and how they can be interpreted in your Baby's context
- learn how can you measure them
- be familiar with first steps when a value out of normal range
- when to ask for help in the unit, or after discharge

### **Further learning in this topic**

If you wish to know more:

- ask our neonatal team at any time
- ask for one to one support from one of our Family Delivered Care Project coordinators
- use this app or your Parent Binder to record notes and questions
- attend **our parent education sessions**

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## Resources

Roberton's Textbook of Neonatology, ed Janet M Rennie, fourth edition 2005

Local neonatal guidelines, Imperial College Healthcare NHS Trust

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