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Rationale

The aim of these guidelines is to present clear instructions in administering oxygen safely within the acute environment of Child Health, in non emergency situations as per NPSA Alert (2009). The target audience is the clinicians who prescribe and administer oxygen safely to children in non emergency situations in the hospital environment.

Oxygen Therapy in Non Emergency Care

Oxygen is one of the most commonly used medicines, used in a range of health care settings (NPSA 2009).

Oxygen therapy can be defined as the administration of oxygen at concentrations greater than ambient air (National Guideline Clearing House 2006). The main principle in the use of oxygen therapy is to decrease the work of breathing by increasing alveolar oxygen tension and is administered in pulmonary and non pulmonary conditions (Coyne et al. 2010)

Excessive use of oxygen has been demonstrated showing insufficient attention to responding to physiological and pharmaceutical principles (Jeffrey et al 1989, Albin et al 1992, Small et al 1992, Kor and Lim 2000, NPSA 2009)

Concentrations required are dependent upon the child condition. Inappropriate concentrations can have potentially serious effects for example:

- pulmonary damage,
- retinal damage particularly in neonates
- Mask Respiratory Depression
- Carbon dioxide retention
- Post operative patients receiving opiates

Some Indications for use of Oxygen Therapy

Hypoxia
Signs and symptoms of shock
Chronic respiratory disease
Respiratory failure
Dyspnoea
Post Operatively
Pneumothorax
Suspected carbon monoxide poisoning

This is not an exhaustive list
**Oxygen**

**Up to 60% concentration** reduces the risk of hyperventilation but high concentration oxygen can have detrimental effects on the respiratory system. This can occur following prolonged use of oxygen therapy and can lead to respiratory distress due to atelectasis.

In the premature infant high concentration oxygen can cause retrolental fibroplasia, a side effect due to vasoconstriction and can lead to permanent blindness.

**To ensure that high concentration oxygen is safely administered in the right concentration:**

- There is an ABM Patient Group Directive for the emergency administration of oxygen where there is hypoxia in a seriously ill child
- Oxygen therapy will be adjusted (through medical instructions) according to the child/young person’s respiratory effort and oxygen saturations.
- Low concentration of oxygen is used to correct hypoxia by using an accurate amount of oxygen without depleting maintenance of carbon dioxide and respiratory acidosis.
- Arterial blood gases can be undertaken to measure precise concentration of oxygen required for children in emergency situations.
- It is expected that medical staff will prescribe oxygen for children who are acutely and chronically unwell in non emergency situations (BTS 2009, NPSA 2009).
- If there is an oxygen prescription, a target oxygen saturation range should be indicated on the chart and medical notes (NPSA 2009).
- Safety rounds should be undertaken by the allocated/named Registrant, when undertaking vital signs of the patient to check the correct delivery of oxygen and the appropriate oxygen saturation range is obtained.
- Document amount of oxygen given in the nursing records, include as a part of the plan of care and evaluate outcome.
- Oxygen equipment is checked daily and at the start of every shift, check lists completed at every shift by the nurse.
Place an appropriate sized saturation probe around/on the child’s finger, ear lobe or toe. The site chosen should be warm and well perfused with good capillary refill.

**Summary of Facts Regarding Oxygen Therapy**  
(taken from BTS Guidelines for Home Oxygen in Children).

- Oximeters from different manufacturers may give different oxygen saturations
- The median baseline saturation in healthy term infants during the first year of life is 97-98%
- In only 5% of healthy infants is the arterial oxygen saturation measured by pulse oximetry less than 90% for more than 4% of the time.
- The median baseline SPO2 in healthy children aged 1 year or more is 98% with a 5th centile of 96%-97%
- A healthy child aged 5-11 years spend no more than 5% of the time below a SpO2 of 94% while asleep

BTS August 2009

**Target Oxygen Saturations for Children/young people**

- Oxygen saturations greater than 92% for infants/children and young people unless otherwise indicated by the paediatrician
- For children suffering from heart conditions target oxygen saturations will be determine individually by the condition and will be documented by the paediatrician on the prescription chart and the notes
- Oxygen saturation monitoring depends on right placement and application of the probe.

**The Provision of Long Term Oxygen Therapy for Patients with Chronic Hypoxaemia. (LTOT)**

Guidance for LTOT according to BTS Guidance (2009)

Long term oxygen therapy is defined as the provision of oxygen for continuous use at home for patients with chronic hypoxaemia in order to maintain target oxygen saturations.
Requirements vary between 24-hour dependency and dependency during periods of sleep. Principally aims to improve symptoms and prevent harm from chronic hypoxaemia. Indications for long term oxygen therapy:

- chronic lung disease
- neonatal lung conditions
- congenital heart disease with pulmonary hypertension
- pulmonary hypertension secondary to respiratory disease
- intra pulmonary shunting
- interstitial lung disease
- Obliterative bronchiolitis
- cystic fibrosis and other causes of severe bronchiectasis
- Chronic hypoventilation
- Sickle cell disease
- obstructive sleep apnoea and other sleep related disorders
- palliative care for symptom relief

**Child /Young Person and Families**

Age appropriate verbal information must be given to the child/young person. Family members must be adequately informed of the following information:

- need for oxygen therapy
- rationale and explanation for method of delivery
- positive/expected benefits of treatment
- possible side effects of treatment
- minimum duration of treatment

**Baseline Assessment**

A full set of baseline observations should always be obtained and be documented appropriately on relevant documents.

**Method of Administration**

The oxygen requirement and potential for tolerability of the child, delivery methods must be decided and potential methods of delivery. The selection of an appropriate oxygen delivery system must take into account clinical condition, the patient’s size, needs and therapeutic goals

- high concentration oxygen is usually delivered via incubator or humidified head box
- nasal cannula
- face masks
- re-breathe mask
- humidified oxygen
- wafting
• nebulisation
• tracheostomy
• ventilation circuit

**Face mask**

Supplied in child sizes, but has been found that children do not always tolerate masks. Ensure the mask covers both nose and mouth, tighten elastic to ensure a good fit.

Types of face masks dependant on the condition of the child.

**Simple oxygen mask (variable flow masks)**

Vents in the mask allow for the dilution of oxygen. This is the most commonly used mask.

**High Concentration oxygen masks**

Used for emergency situations with reservoir that allows oxygen only to be breathed in by the child. This prevents the inhalation of mixed gases. The approximate oxygen received is 99 per cent

**Humidified**

This can be delivered via a face mask or head box, dependent upon child age/co-operation. Humidified oxygen should be utilised when oxygen therapy is required for prolonged periods, and in those with chronic respiratory illness, to prevent drying of the mucosa and secretions

Humidified oxygen should be only administered when the flow of oxygen exceeds 4 litres per minute and via a face mask (as per NPSA 2009 Guidance and consultation with medical staff)

**Wafting**

When conventional delivery methods are not tolerated, wafting of oxygen via a face mask has been shown to deliver concentrations of 30-40 per cent with 10 litres oxygen per minute, to an area of 35x32cm from top of the mask. Wafting is only appropriate for short term use only, ie whilst feeding. A standard paediatric oxygen mask placed on the chest can give significant oxygen therapy with minimal distress to the patient

**Via nebulisation**

If the child is oxygen dependant the nebuliser is delivered via oxygen

**Tracheostomy**

Oxygen can be delivered via a tracheostomy mask, Swedish nose or headbox. Consider child’s individual needs.
**Nasal cannula**

Can be used for long-term oxygen use, whilst allowing the child to vocalise and eat. The concentration is often not controlled, resulting in a low inspiratory oxygen concentration. The cannula must always be used as described on the packaging.

The use of nasal cannulae can, in the sensitive child, produce dermatitis and mucosal drying.

Only low flow rates of up to two litres per minute can be given comfortably due to inadequate humidification.

Nasal cannula oxygen does not need to be humidified.

**Via a ventilation circuit**

Accurate measurement of inspired oxygen is difficult. The work of breathing/respiratory effort, and pulse oximetry must be observed and documented.

Can be delivered at various points throughout the ventilation circuit.

**Bag valve mask**

Comes in three sizes: 250mls, 500mls and 1,500mls. The smallest one is ineffective even at birth. Two smallest bags have a pressure limiting valve set at 4.41kPa (45cm H\(_2\)O) to protect the lungs from barotrauma (damage caused to tissues by a change in pressure inside and outside the body).
### Oxygen Delivery

**Selection of the most appropriate method of administration**

<table>
<thead>
<tr>
<th>Method</th>
<th>Concentration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple oxygen mask</td>
<td>High concentrations can be delivered safely</td>
<td>Flow below four litres could potentially result in carbon dioxide retention.</td>
</tr>
<tr>
<td>High concentration oxygen masks</td>
<td>10-15 litres required</td>
<td>For use in emergency situations. Nasal cannula oxygen should not be humidified.</td>
</tr>
<tr>
<td>Humidified</td>
<td>26-65 per cent FiO₂</td>
<td>Prolonged periods of high percentage oxygen should be humidified</td>
</tr>
<tr>
<td>Wafting</td>
<td>30-40 per cent with 10 litres oxygen per minute</td>
<td>Conventional methods of oxygen delivery recommended if tolerated</td>
</tr>
</tbody>
</table>

### Assessment to identify deterioration of the child and this would include:

- Change in colour
- Level of consciousness
- Respiratory rate
- Use of accessory muscles
- Presence of sounds such as wheeze, stridor, grunting
- Nasal flaring, tracheal tug, insuction, recession
- Capillary refill time
- Agitation/confusion
Procedure for Administering Oxygen

- Ensure adequate and working oxygen supply.
- If wall valve supply being utilised, then working order must be established first.
- If portable oxygen cylinders being used, these should enable adequate oxygen provision.

Litres in cylinders/litres needed per minute = minutes of oxygen available

<table>
<thead>
<tr>
<th>Calculate Oxygen requirements for journey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ie. Flow (1/min) x 60 x journey time in hours x 2 or</td>
</tr>
<tr>
<td>Minute volume x 60 x journey time in hours x 2</td>
</tr>
<tr>
<td>Lightweight CD cylinders = 460L</td>
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<tr>
<td>Other cylinders available</td>
</tr>
<tr>
<td>D cylinders= 340L</td>
</tr>
<tr>
<td>E cylinders= 680L</td>
</tr>
<tr>
<td>F cylinders= 1360L</td>
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</table>

- All valves on portable oxygen cylinders must be open.
- Refer to the patient's individual prescription.
- Give the oxygen via the approved, or tolerated, method for the patient.
- Tubing from chosen methods of delivery to be attached to oxygen supply device.
- Administration device set up to enable effective administration as per manufacturer's instructions.
- Initiate and maintain oxygen flow rate and concentration.
- Oxygen should be delivered at the lowest concentration possible and for the shortest possible time.
- Assess whether the delivery system requires humidification.
- Monitor the child's vital signs, level of consciousness and responsiveness during the administration of oxygen.
- Monitor the child's colour, respiratory rate and depth and for signs of respiratory distress.
- Determine the reason for the oxygen requirements.

Flow meters

Oxygen flow meters to deliver oxygen from the outlet are designed for high flow, (up to 15 litres) low flow (up to 1 litre).

Each bed space that is available for occupancy should have an oxygen high flow meter. The flow meter will be changed (to low flow) according to the needs of the infant/child/ young person.
**Safety**

Check and clean each oxygen outlet, oxygen cylinder and delivery system daily to ensure good working order. (Those in patient use)

Check each oxygen outlet, following the discharge of the patient, clean the oxygen equipment (as per Infection control policy) and replace used oxygen equipment for delivery such as tubing, mask.

Document that each oxygen outlet and delivery system is clean and checked

Oxygen should not be delivered near a naked flame.

Lubricating jells and paraffin should not be used on the lips or face of the patient or on the equipment.

Check oxygen cylinders prior to use to ensure sufficient oxygen is available for a journey/transfer see table

Ensure that **the air outlet is clearly labelled**.

Use top tips in cylinder care (April 2008) see appendix 1

If any aspect of the guidance is not followed, complete a risk assessment and escalate immediately.
Appendix 1

**Top tips on care and handling of Oxygen cylinders and their regulators**

MHRA

Staff should be fully trained in the use of oxygen cylinders, the attachment of regulators if required, and aware of all the related risks such as fire and manual handling.

Carry out full checks on oxygen cylinders and their regulators prior to each use and ensure that they contain enough oxygen for the required therapy.

In patient transfers ensure there is sufficient oxygen for the whole journey, allowing for changes in oxygen requirements and delays such as faulty lifts or heavy traffic.

Check the cylinder labels to make sure the oxygen is within its use-by date and any regulators attached are suitable for the cylinder pressure and have been serviced regularly.

Ensure hands are clean before handling oxygen cylinders due to the risk of combustion from oils and grease. In particular, make sure that hands are adequately dried after the use of alcohol gels.

Make sure that the oxygen cylinder outlet and oxygen regulator inlet are clean before attaching a regulator. Always open the cylinder slowly and check for leaks.

Close cylinder valves when not in use and before returning the cylinder to the supplier.

Handle oxygen cylinders with care. If the cylinder is dropped or knocked in use it must be checked before further use; cylinders with integral valves should be returned to the supplier; separate regulators should be sent to the service department for inspection.

Have spare cylinders available, ensure they are full and have an opening key if required.

Ensure oxygen cylinders are securely attached to beds, trolleys or walls when in use.

Modern light-weight oxygen cylinders can be damaged by sharp objects such as securing screws.
Store oxygen cylinders in a secure area that is well ventilated, clean and dry. This area must be free from any sources of ignition such as patients/staff smoking or machinery.

If using a bull-nose regulator, double-check you are attaching it to an oxygen cylinder as they can be mistakenly fitted onto cylinders of medical air and other gases.

Carry out magnetic testing of all oxygen cylinders, and their attachments, before taking them into an MRI environment.

Report defective oxygen cylinders to the Defective Medicines Reporting Centre (DMRC) and defective detachable regulators to the Adverse Incident Centre (AIC), both at the MHRA (www.mhra.gov.uk).

April 2008
References and Reading


Tucker SM, Canobbia MM, Paquette EV, Wells MF (1992) Patient Care Standards
### Directorate of Women & Child Health

**Checklist for Clinical Guidelines being Submitted for Approval by Quality & Safety Group**

<table>
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<tr>
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<th>Oxygen Therapy Administration in Non emergency Situations in Hospital</th>
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<tr>
<td>Name(s) of Author:</td>
<td>Sharon Littlehales, Rachel Evans</td>
</tr>
<tr>
<td>Chair of Group or Committee supporting submission:</td>
<td>Sian Passey/Eirlys Thomas/Rachel Evans</td>
</tr>
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<td>Issue / Version No:</td>
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<td>Next Review / Guideline Expiry:</td>
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<td>Details of persons included in consultation process:</td>
<td>Lead Nurses, Ward Managers, CNS, Consultant Paediatricians on both sites</td>
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<td>To have a document with clear guidance for oxygen therapy in non emergency situation as per NPSA guidance.</td>
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<td>Please list any policies/guidelines this document will supercede:</td>
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<td>Oxygen therapy</td>
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<tr>
<td>Date approved by Directorate Quality &amp; Safety Group:</td>
<td>23rd January 2013</td>
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<td>File Name: Used to locate where file is stores on hard drive</td>
<td>ABM_W&amp;CH_mgt\Clinical Governance\Policies &amp; Procedures etc - Ratified\Paediatrics</td>
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* To be completed by Author and submitted with document for ratification to Clinical Governance Facilitator