Trust Guideline for the Prescription and Administration of Oxygen in Adults

A clinical guideline recommended

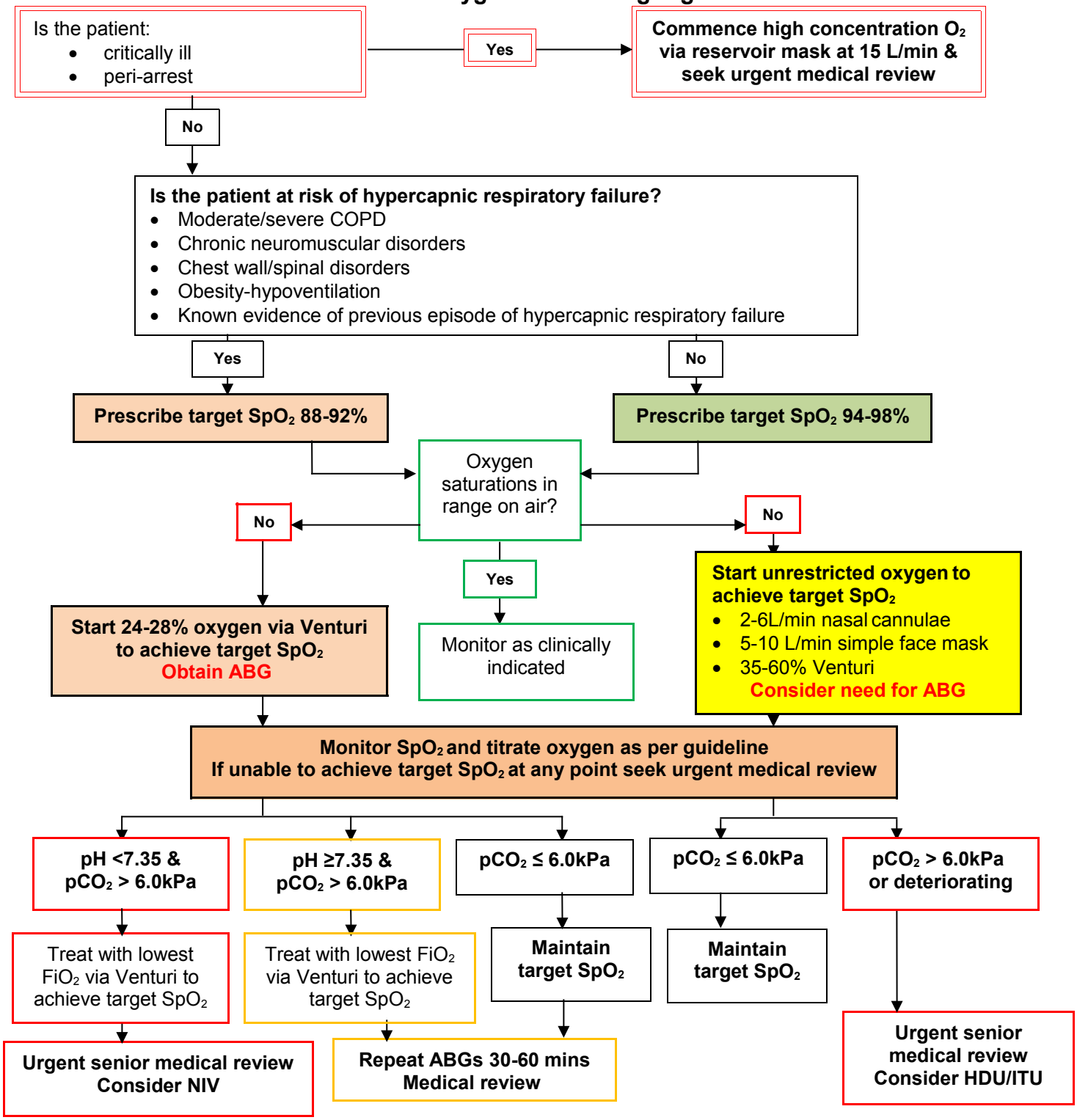
For use in:	All inpatient clinical areas
By:	All medical and nursing staff and allied health professionals
For:	All adult inpatients
Division responsible for document:	Trustwide
Key words:	Oxygen, hypercapnic respiratory failure, pulse oximetry, target oxygen saturation
Names and job titles of document authors:	Sandra Olive, Respiratory Nurse Consultant Helen Willimott, Clinical Pharmacy Team Leader (Medicine)
Name of document author's Line Manager:	Caroline Linkhorn
Job title of document author's Line Manager:	Senior Matron, Medicine 2
Supported by:	Dr Russell Phillips, Consultant Respiratory Medicine, Chief of Service, Medicine 2.
Assessed and approved by the:	Clinical Guidelines Assessment Panel (CGAP)
Date of approval:	04 June 2019
Ratified by or reported as approved to (if applicable)**:**	Clinical Safety and Effectiveness Sub-Board
To be reviewed before:	04 June 2022
To be reviewed by:	Sandra Olive, Respiratory Nurse Consultant Helen Willimott, Clinical Pharmacy Team Leader (Medicine)
Reference and / or Trustdocs ID No:	CA4062 – ID No: 1313
Version No:	6
Description of changes:	Updated to reflect current guidance
Compliance links: *(is there any NICE related to document)*	None
If Yes – does the strategy/policy deviate from the recommendations of NICE? If so, why?	N/A

Trust Guideline for the Prescription and Administration of Oxygen in Adults

Quick reference guideline/s

An appropriate target saturation range should be prescribed on EPMA for all patients at admission, whether or not they require oxygen administration at the time of admission.
Patients who move from being within target range breathing air to requiring oxygen **must have urgent medical review.**

Chart 1: Oxygen Prescribing Algorithm



Trust Guideline for the Prescription and Administration of Oxygen in Adults

Explanation of terms and abbreviations

- SpO_2 – Oxygen saturation measured with pulse oximetry.
- FiO_2 – Fractional inspired oxygen concentration.
- COPD – Chronic obstructive pulmonary disease (includes emphysema, chronic bronchitis and some chronic severe asthma).
- ABG – Arterial blood gas.
- EPMA – Electronic prescribing & medication administration system.
- NEWS2 – National Early Warning Score (version 2).
- Hypercapnic respiratory failure/type 2 respiratory failure; i.e. when $PaCO_2$ is above the normal range of 4.6-6.1kPa (34-46 mm Hg).
- LTOT – long term oxygen therapy, given for a minimum of 15 hours per day for those with evidence of chronic hypoxaemia.

Objective/s

- To ensure all patients who require supplementary oxygen receive therapy appropriate to their clinical condition and in line with national guidance (BTS guideline, Thorax 2017).
- To ensure oxygen therapy is prescribed, administered, monitored and recorded according to a target oxygen saturation range measured by pulse oximetry (SpO_2).

Rationale

Supplementary oxygen is given to improve tissue oxygenation whilst the underlying causes of hypoxaemia are diagnosed and treated. The administration of supplemental oxygen is an essential element of appropriate management for a wide range of clinical conditions; however, oxygen is a drug and therefore requires prescribing in all but emergency situations. Failure to administer oxygen appropriately can result in serious harm to the patient. Inadequate oxygenation may result in fatal hypoxaemia. Excessive oxygen administration in some vulnerable patients may result in hypercapnic respiratory failure and death.

Exclusions

- Patients receiving oxygen in specialist areas with specific clinical guidelines for oxygen therapy. Specific guidance should be agreed and approved through the appropriate clinical governance forum.

- Patients receiving oxygen for palliation on the end of life care pathway (prescriber should document that monitoring to target saturations is not required)

Normal Oxygen saturations

- In healthy adults less than 70 years of age at rest at sea level 96% - 98% when awake.
- Aged 70 and above at rest at sea level 94 - 96% when awake.

- Patients of all ages may have transient dips of saturation to around 90% during sleep.
- Some patients with chronic lung disease, congenital cyanotic heart conditions or chronic neuromuscular conditions have saturations below the normal range when clinically stable.

Broad recommendations

Prescription

- Oxygen is a drug. Inappropriate administration (either excessive or insufficient) may be harmful to any patient.
- All oxygen must be prescribed, except in an emergency (peri-arrest or critically ill) when it should be started immediately using a mask with reservoir bag at 15 L/min and immediate medical review obtained.
- **Administration of oxygen without a prescription (except in an emergency) or failure to adjust FiO_2 when saturations are recorded outside prescribed target range is considered a drug error.**
- Oxygen must be prescribed on EPMA and the appropriate range selected on NEWS2 observation chart; either 94-98% for most patients or 88-92% for those at risk of hypercapnic respiratory failure. (**Exception** – patients admitted for short stay procedures must have oxygen target saturation range prescribed in the oxygen section of the short stay/23hr drug chart UNH 036).
- For a minority of patients it may be appropriate to specify a different target range ONLY under the direction of specialist consultants (eg respiratory, sub-specialty surgical patients). For these patients there are two likely alternative target ranges (82-88% & 96-100%). The appropriate chart must be signed by the consultant and ”Oxygen – see paper chart” selected on EPMA
- Oxygen prescription should be reviewed at each medical review and EPMA/NEWS2 chart updated if necessary.
- The registered nurse responsible for the care of the patient must ensure that target oxygen saturation range is prescribed and communicated to the nursing team monitoring the patient.

Administration

- Oxygen should be administered by staff trained in its use with relevant competency level addressed at appraisal. Educational slides for doctors and nurses/Allied Health Professionals are available on the British Thoracic Society website: https://www.brit-thoracic.org.uk/quality-improvement/guidelines/emergency-oxygen/
- An appropriate delivery system should be selected to achieve and maintain saturations within the prescribed range (see Appendices: Oxygen administration algorithm & delivery devices for oxygen administration)
- In patients at risk of hypercapnia (i.e. those with a target range prescription of 88-92%) it is recommended that controlled oxygen is given via a Venturi device, until clinically stable as indicated by senior medical review.

- At each drug round the registered nurse must select the appropriate statement in EPMA to confirm either that:
    - Oxygen saturations are in range & flow rate maintained
    - Oxygen saturations below target range & flow rate increased
    - Oxygen saturations above target range & flow rate decreased
    - Patient on air and saturations in target range
- If resting saturations are outside the prescribed target range, FiO_2 must be adjusted and saturations rechecked within 10 minutes. Changes must be documented on the bedside observation (NEWS2) chart.
- FiO_2 should be increased if the resting saturation is below the target saturation range and decreased if the resting saturation is above the target saturation range (and eventually discontinued as the patient recovers).
- Where an increase in FiO_2 is required to meet target range, a full set of observations must be checked and recorded and NEWS2 score acted on as appropriate.
- Where a decrease in FiO_2 is required, in a patient who is clinically improving, it may be sufficient to recheck and document saturations (i.e. weaning off oxygen).

Monitoring

- Patients should be observed accurately for signs of improvement or deterioration, monitoring oxygen saturation, respiratory rate and skin colour, and observing their work of breathing.
- Pulse oximetry must be available in all areas where oxygen is administered in healthcare settings. The default choice should be a finger probe applied to a finger; where this is not possible, an ear lobe probe should be applied to an ear lobe. **A finger probe should never be applied to an ear.**
- All patients on oxygen therapy must have their saturations recorded at least 6 hourly or more frequently as indicated by clinical condition.
- Resting oxygen saturations, current FiO_2 and delivery device (nasal cannula/mask type) must be recorded on the NEWS2 observation chart and saturations outside the prescribed target range must be promptly reported to the registered nurse responsible for the care of the patient.
- Patients at risk of hypercapnic respiratory failure should have their arterial blood gases measured within 30-60 minutes of an increase in FiO_2 to identify worsening carbon dioxide retention. **Do not discontinue oxygen** to obtain arterial blood gas measurements. FiO_2 must be recorded alongside ABG results so that they can be interpreted accordingly.
- Any sudden fall in oxygen saturation or need to repeatedly increase FiO_2 should result in the patient being urgently reassessed by their medical team and measurement of blood gases.

Discontinuation

- Discontinuation of oxygen should be considered once a patient is clinically stable on low dose oxygen (1-2 l/min via nasal cannulae or 24% via Venturi mask) and their oxygen saturation is recorded at or above prescribed target range on two

consecutive drug rounds (**Exception** – those patients with chronic hypoxaemia established on LTOT).

- After stopping oxygen therapy, the patient's oxygen saturations should be monitored for 5 minutes and again after an hour to check that it remains within the specified target range.

Precautions / hazards

- Oxygen should be administered with caution in patients suffering from paraquat poisoning and with acid inhalation or previous bleomycin lung injury (target saturation range for these patients is 88-92%).
- Fire Hazard.
- Drying of nasal and pharyngeal mucosa. Treat with water-based gel e.g. aquagel.
- Do not use white paraffin based lip balm (Vaseline).
- Pressure ulcers over the ears from nasal cannula or mask elastic. Care must be taken not to overtighten and pressure relieving foam ear protectors can be used to protect the skin integrity.

Nebulised therapy & oxygen

- Nebulised therapy should be driven by compressed AIR for patients at risk of hypercapnia. Supplemental oxygen should be given concurrently by nasal prongs at 1- 4 L/min to maintain the prescribed oxygen saturation.
- All patients who require FiO_2 of 35% or more to meet target saturation range should have nebulised therapy prescribed to be driven by oxygen at a flow rate of >6 L/min.
- Refer to Medicines Policy and Procedures (sections on oxygen and nebulised therapy) for further information.
  C:\Users\sjo1\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\Z95ALY8Y\Medicines Policy and Procedures[423.20].pdf

Transfer of patients receiving oxygen

- Clear instructions must be provided for personnel involved in the transfer of the patient, which must include delivery device and flow rate and these should not be altered in transit. (as per Transfer Guideline for Intra-hospital (within hospital), Inter-hospital (between hospitals) and other supervised care settings Trustdocs ID No: 1091).

Clinical audit standards

Oxygen prescription and administration to be audited using national British Thoracic Society emergency oxygen audit standards, with data submitted to national audits as required and interim local audits undertaken in each clinical area.

Trust Guideline for the Prescription and Administration of Oxygen in Adults

Summary of development and consultation process undertaken before registration and dissemination

The original document was drafted by Sandra Olive, Respiratory Nurse Consultant, Dr Crichton Ramsay, Consultant Respiratory Physician & Helen Willimott, Pharmacist, based on national consensus guidelines published by BTS in 2008 (superseded by O'Driscoll et al 2017).

During its initial development it was circulated for comment to:

- Consultant Respiratory Physicians
- Acute Care Forum members
- Mary Edwards & team, Critical Care Outreach
- Medical Gas Committee
- Senior Nurses – medicine, surgery, emergency services
- Senior Clinicians across the Trust including those in Critical Care, Anaesthetics, Physiotherapy, Occupational Therapy

This version has been updated in accordance with national guidance published in 2017 and reviewed by representatives of acute medical and nursing teams.
This version has been endorsed by the Clinical Guidelines Assessment Panel.

Distribution list / dissemination method

The guideline will be disseminated via Trust Communications systems and will be available via Trust intranet. Updated guidance will be incorporated into current training including Deteriorating Ward Patient Study Day, NEWS2 training and department specific training.

References / source documents

- O'Driscoll B R, Howard L S, Earis J et al. BTS guideline for oxygen use in adults in healthcare and emergency settings. Thorax 2017; 72: i1-i90.
- Summary of BTS 2017 guideline recommendations, slide set for doctors and for nurses/allied health professionals, available via BTS website: https://www.brit-thoracic.org.uk/quality-improvement/guidelines/emergency-oxygen/
- NPSA Alert 2009 Oxygen Safety in Hospitals

  https://www.sps.nhs.uk/wp-content/uploads/2011/07/Oxygen_safety_in_hospitals_Info_for_doctors_and_non_med_prescribers_NPSA_2009_10_29_v2.pdf

  https://www.sps.nhs.uk/wp-content/uploads/2011/07/Oxygen_safety_in_hospitals_Info_for_nurses_midwives_and_AHPs_NPSA_2009_09_29_v2.pdf

- NHSI Patient Safety Alert October 2016 Reducing the risk of oxygen tubing being connected to air flowmeters https://improvement.nhs.uk/documents/408/Patient_Safety_Alert_-_Reducing_the_risk_of_oxygen_tubing_being_connected_to_a_bDUb2KY.pdf

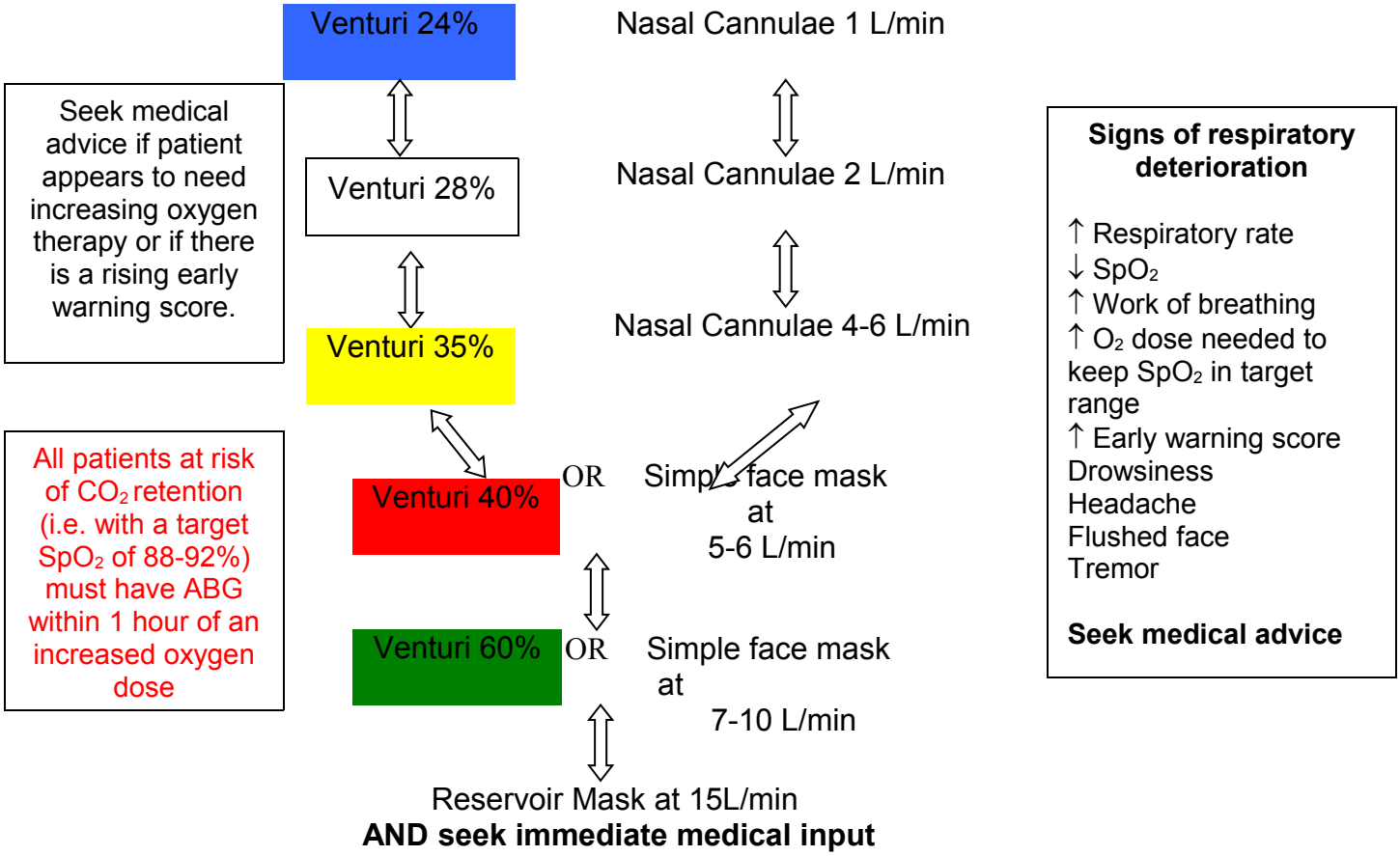
- NHSI Patient Safety Alert June 2018 Risk of death and severe harm from failure to obtain and continue flow from oxygen cylinders https://improvement.nhs.uk/documents/2206/Patient_Safety_Alert_-_Failure_to_open_oxygen_cylinders.pdf

- NHSI Patient Safety Alert December 2018 Risk of harm from inappropriate placement of pulse oximetry probes https://improvement.nhs.uk/documents/3603/Patient_Safety_Alert_-_Placement_of_oximetry_probes_FINAL.pdf

Trust Guideline for the Prescription and Administration of Oxygen in Adults

Appendix 1: Oxygen Administration Algorithm

1. Choose the most suitable oxygen delivery system and flow rate. For Venturi masks see manufacturer's information regarding appropriate flow rate to use for each valve.
2. Titrate oxygen up or down to maintain the target oxygen saturation. **ALWAYS monitor saturations for 5 minutes after any change to oxygen therapy.**
3. The algorithm below shows available options for stepping dosage up and down, the chart does not imply any equivalence of dose between Venturi masks and nasal cannulae.
4. Allow at least 5 minutes at each dose before adjusting further (except in major and sudden fall in saturation)
5. Once the patient has adequate and stable saturation on minimal oxygen dose, consider discontinuation of oxygen therapy.
6. Using a cold water humidified system for administering oxygen may be considered in patients who require high flow oxygen for more than 12 hours or who have difficulty expectorating respiratory secretions.



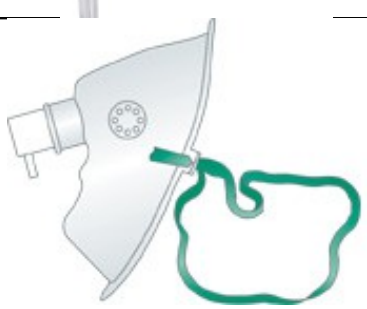
Peri-arrest and critically ill patients should be given maximal oxygen therapy via a reservoir mask whilst immediate medical help is arriving

Trust Guideline for the Prescription and Administration of Oxygen in Adults

Appendix 2: Delivery Devices for Oxygen Administration

Uncontrolled (variable) performance systems:

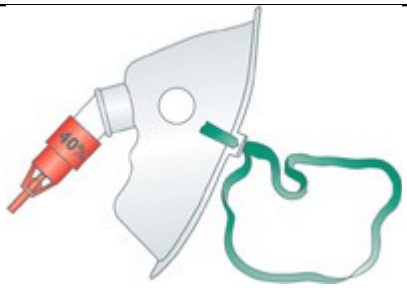
The oxygen supplied to the patient will be of variable concentration depending on the flow of oxygen and the patient's breathing pattern.

Device	Image	Flow rates (FiO_2)	Conc of Oxygen that can be delivered	Examples of use
Nasal cannulae		1-6 L/min	approx 24-50%	
Simple Face Mask Also referred to as: • MC Mask • Medium Concentration Mask • Mary Catterall Mask • Hudson Mask		6-10 Lmin *Flow rate must be at least 5 L/min to avoid CO_2 re-breathing*	approx 40-60%	
Reservoir Mask (Non Re-breathing Mask)		10-15 Lmin *Reservoir must be filled correctly before administration*	approx 60-90%	Short-term use Trauma Emergency Critical illness Post cardiac / respiratory arrest

Controlled (fixed) performance systems

Trust Guideline for the Prescription and Administration of Oxygen in Adults

Will give an accurate concentration of oxygen to the patient regardless of the patients breathing pattern and flow of oxygen (providing the minimum suggested flow rate as shown on the Venturi valve is used). Cold water humidification systems also deliver a fixed % of oxygen according to the flow rate set on the selector at the connection to the oxygen point.

Device	Image	Flow rates (FiO_2)	Conc of Oxygen that can be delivered	Examples of use
Venturi Masks	 	*As per instruction on Venturi valve*	24-60%	Patients at risk of hypercapnic respiratory failure (eg COPD)
Cold water humidification system		*As per valve at the bottle/oxygen connector. Ensure the valve is fully 'locked' into the required %/flow rate position.*	28-60%	Consider humidification for those patients needing high flow oxygen for >24hrs or with viscous secretions. Regular nebulised saline may be as effective for humidification to relieve discomfort.
Tracheostomy Mask		*Oxygen MUST be humidified*	24-70%	Patients with tracheostomy or laryngectomy