University Hospitals of Leicester NHS
NHS Trust

Policy for the Prescribing, Administration and Monitoring of Oxygen in Adults

Paper C

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Most Recent Review	16 December 2022 – Policy and Guideline Committee
Reviewed by	Padmavathi Parthasarathy (Respiratory ANP) Dr.Irene Valero-Sanchez (Respiratory Consultant)
Next Review Date	January 2026

Review date and details of Changes made during the review

November 2022

Section 3.4.b - 'Emergency department' 'Emergency department oxygen' removed. The 'PGD pages' has been added

Section 8.3 - 'cylinders' & 'other medical gas outlet' added

Section 9.7 added

Section 13 added

Section 14 - 'Prescription will incorporate an initial dose' has been removed

Section 14 – added 'The nerve centre eMeds prescription' removed 'prescription chart'

Section 18 – Removed 18.2

Appendix F – Nerve center emed oxygen prescription screen shot has been added

Appendix G, point-3 – removed 'designated nurses' added 'certain named health care professionals'

Table of Contents

1 Introduction

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 must be prescribed in all but emergency situations. Failure to administer oxygen appropriately can result in serious harm to the patient. The safe implementation of oxygen therapy with appropriate monitoring is an integral component of the Healthcare Professional's role.

2 Policy Aims

The aim of this policy is to ensure that oxygen is prescribed, administered and monitored appropriately and safely.

a) All patients who require supplementary oxygen therapy receive therapy that is appropriate to their clinical condition and in line with national guidance (BTS Guideline; Thorax, 2017)
b) Oxygen will be prescribed according to a target saturation range. The system of prescribing target saturation aims to achieve a specified outcome, rather than specifying the oxygen delivery method alone
c) Those who administer oxygen therapy will monitor the patient and keep within the target saturation range.

This policy covers the rationale for the oxygen policy and details the accepted policy for oxygen administration prescription and monitoring. It includes appendices of relevant materials to support this.

3 Policy Scope

3.1. This Policy is local adaptation of the BTS Guidelines for Emergency Oxygen Use in Adult Patients (2017) and supports the NPSA Rapid Response Report No. NPSA/2009/RRR006, NHS/PSA/D/2016/009: Oxygen safety in Hospitals & NHS/PSA/W/2018/009: Risk of harm from inappropriate placement of pulse oximeter probes

3.2. This policy is for use within general adult wards and departments and covers all personnel who may administer oxygen to include any Registered Nurse, Doctor, Registered Sick Children's Nurse, or Physiotherapist, and must be used in accordance with the Leicestershire Medicines Code

3.3. Exclusions from this policy include:

a. Patients admitted to specialist areas with a specialised oxygen prescribing policy approved via the appropriate clinical governance forum (see 3.4).
b. Patients receiving oxygen as part of palliative care or patients on the end of life care pathway (in which case, the prescriber should tick the box 'target saturations not indicated' on the drug chart).
c. Patients admitted for Long Term Oxygen Therapy (LTOT) assessment.
d. Patients under 16 although general principles may be agreed by specialist areas

3.4. Specialist areas including emergency department

a. Where specific clinical guidelines are required for oxygen administration within specialist areas, they must be approved via the appropriate clinical governance forum. They should reflect wherever possible the principles within this policy. Patients transferring from specialist areas must be transferred with a prescription for their oxygen therapy utilising target saturation, if the clinical indication is ongoing. If a patient transfers from an area not utilising the target saturation system, their oxygen should be administered as per the transferring area's prescription until the patient is reviewed and transferred over to the target saturation scheme, which should occur as soon as possible.

b. Patients requiring oxygen prior to medical review should be treated in accordance with the Core PGD (Patient Group Direction) for Oxygen which is available on the PGD pages of the Trust intranet.

4 Roles and Responsibilities

4.1. Medical Director is responsible for:

a. Monitoring the overall compliance with this policy on an annual basis
b. The Medical Director is the executive lead

4.2. CMG Senior Managers/Matrons are responsible for:

a. Ensuring all their staff are made aware of this policy and undertake training as appropriate
b. Monitoring and auditing compliance with this policy and procedures

4.3. Ward Sisters / Consultants / Heads of Service are responsible for:

a. Ensuring all their staff are made aware of this policy and undertake training as appropriate
b. Adhering to the procedures within this policy for prescribing, administration and monitoring of oxygen in adults

4.4. Ward / Clinical Staff are responsible for:

a. Ensuring they undertake training as appropriate to enable compliance with this policy
b. Adhering to the procedures within this policy for prescribing, administration and monitoring of oxygen in adults

4.5. Oxygen Champions:

The BTS has appointed oxygen champions in all Trusts to help introduce the Guideline, these are:

a. Dr. Ire Valero-Sanchez, Consultant Respiratory Physician
b. Dr. Neil Greening, COPD Consultant Respiratory Physician
c. Padma Parthasarathy Respiratory ANP
d. David Gaskell Clinical Specialist Physiotherapist

5 Principles of Prescribing, administering and monitoring oxygen

5.1. Identifying appropriate target saturation

Guidance on identifying appropriate saturations for patients is provided for the medical staff and other prescribers in appendices a-e (table 1-4 and chart 1 in the guideline). In summary oxygen should be prescribed to achieve a target saturation of 94-98% for most acutely unwell patients or 88-92% for those at risk of hypercapnic respiratory failure.

5.2. Prescribing oxygen on the prescription chart

An oxygen section on the prescription chart/electronic prescription has been designed to assist prescription and administration. Oxygen must be prescribed in the designated section of the hospital prescription chart (Appendix f) and the appropriate target saturation should be circled on the chart (or if target saturations are not indicated the relevant box should be ticked). In areas where the electronic prescribing system is being used, oxygen should be prescribed conveniently at the time of admission to hospital using the “Admissions bundle”. This allows the efficient prescription of oxygen at the same time as thromboprophylaxis and MRSA risk management.

5.3. Administering oxygen

Once the target saturation has been identified and prescribed, guidance regarding the most appropriate delivery system to reach and maintain the prescribed saturation is provided for those administering oxygen in Appendix (g), (h) and (i).

5.4. Humidification

This must only be used if specifically requested by the doctor or physiotherapist in the following circumstances:

- If the flow rate exceeds 4 liters per minute for several days
- Patients with a Tracheotomy or tracheostomy (“neck-breathing patients)”
- Patients with Cystic Fibrosis
- Patients with Bronchiectasis
- Patients with a chest infection retaining secretions
  (warm humidification should be used)

5.5. Monitoring and recording oxygen

a) The patient's oxygen saturation and, if the patient is requiring oxygen, the oxygen delivery system must be recorded in the electronic observation device alongside the NEWS score and other physiological variables.

b) All patients on oxygen therapy must have regular pulse oximetry measurements. The frequency of oximetry measurements will depend on the condition being treated and the stability of the patient. Critically ill patients must have their oxygen saturations monitored continuously and recorded every few minutes whereas patients with mild breathlessness due to a stable condition will need less frequent monitoring.

c) Oxygen therapy should be increased if the saturation is below the desired range and decreased if the saturation is above the desired range (and eventually discontinued as the patient recovers). See section 13 and appendix (i) for more details

d) Any sudden fall in oxygen saturation should lead to clinical evaluation of the patient and in most cases, measurement of blood gases.

e) Patients on oxygen must have their saturations recorded on the adult observation chart/electronic device and according to the Monitoring of Patients guidance (appendix k).

f) Patients should be monitored accurately for signs of improvement or deterioration.

g) Nurses should also monitor skin colour for peripheral cyanosis and respiratory rate. If peripheral circulation in the fingers is poor ear lobe oximetry can be monitored. But using appropriate probe is essential in order to get accurate reading. If an oximeter probe intended for the finger is attached to the ear (or vice versa), or a probe intended for an adult is attached to a baby or a child (or vice versa) can produce a reading up to 50% lower or 30% higher than the real value which can lead to inappropriate

management of the patients. Dedicated labelled ear lobe probes should be available in all clinical areas and used appropriately.

h) Oxygen saturations of less than 90%, with or without oxygen, noisy or labored breathing or respiratory rate of less than 8 or more than 25 must be reported immediately to the medical team.

i) If a patient shows an elevated NEWS purely due to oxygen administration with saturation above target range but is otherwise clinically stable, their nurse should reduce the concentration or flow of oxygen and repeat the NEWS measurement after about 5 minutes. It is not necessary to call a doctor to assess the patient just to reduce the oxygen saturation into the recommended range if there are no clinical concerns.

5.6. Emergency situations

a) In the emergency situation an oxygen prescription is not required. Any registered health care professional can commence oxygen therapy in an emergency. Oxygen should be given to the patient immediately and documented in the patient's record. Once a patient is stabilised if the oxygen is to be continued it must then be prescribed on the prescription chart.

b) All peri-arrest and critically ill patients should be given 100% oxygen (15 l/m reservoir mask) whilst awaiting immediate medical review. Patients with chronic obstructive pulmonary disease (COPD) and other risk factors for hypercapnia who develop critical illness should have the same initial target saturations as other critically ill patients pending the results of urgent blood gas results after which these patients may need controlled oxygen therapy or supported ventilation if there is severe hypoxaemia and/or hypercapnia with respiratory acidosis.

c) All patients who have had a cardiac or respiratory arrest should have 100% oxygen provided along with basic/advanced life support.

d) A subsequent written record must be made of what oxygen therapy has been given to every patient alongside the recording of all other emergency treatment.

6 Indications for Oxygen Therapy

6.1 The rationale for oxygen therapy is prevention of cellular hypoxia, caused by hypoxaemia (low PaO2), and thus prevention of potentially irreversible damage to vital organs. Therefore, the most common reasons for oxygen therapy to be initiated are:

a) Acute hypoxaemia (for example pneumonia, shock, asthma, heart failure, pulmonary

embolus)

b) Ischaemia (for example myocardial infarction, but only if associated with hypoxaemia (abnormally high levels may be harmful to patients with ischaemic heart disease and stroke).
c) Abnormalities in quality or type of haemoglobin (for example acute GI blood loss or carbon monoxide poisoning).

6.2 Other indications include:

a) Pneumothorax – Oxygen may increase the rate of resolution of pneumothorax in patients for whom a chest drain is not indicated.
b) Post-operative state (general anaesthesia can lead to decrease in functional residual capacity with in the lungs (especially following thoracic or abdominal surgery) resulting in hypoxaemia (Ferguson 1999). There is some evidence to suggest a decreased incidence of post-operative wound infections with short- term oxygen therapy following bowel surgery.

7 Contra-indications for Oxygen Therapy

There are no absolute contraindications to oxygen therapy if indications are judged to be present. The goal of oxygen therapy is to achieve adequate tissue oxygenation using the lowest possible FiO2. Supplemental O2 should be administered with caution in patients suffering from paraquat poisoning (BNF 2005) and with acid inhalation or previous bleomycin lung injury.

8 Cautions in Oxygen Therapy

8.1 Oxygen administration and carbon dioxide retention

In patients with chronic carbon dioxide retention, oxygen administration may cause further increases in carbon dioxide and respiratory acidosis. This may occur in patients with COPD, neuromuscular disorders, morbid obesity or musculoskeletal disorders. There are several factors which lead to the rise in CO2 with oxygen therapy in patients with hypercapnic respiratory failure and details are in the BTS guideline.

8.2 Other precautions/ Hazards/ Complications of oxygen therapy

a) Drying of nasal and pharyngeal mucosa
b) Oxygen toxicity
c) Absorption atelectasis
d) Skin irritation
e) Fire hazard

f) Potentially inadequate flow resulting in lower FiO2 than intended due to high inspiratory demand or inappropriate oxygen delivery device or equipment faults

8.3 Oxygen tubing & oxygen wall outlets

Oxygen tubing is needed to connect flow meters and regulators to the patient delivery device. It is important to ensure that all tubing is connected correctly at both ends. Special attention must be paid to the correct identification and differentiation of oxygen outlets / cylinders from compressed air and other medical gas outlets / cylinders. The National Patient Safety Agency has reported frequent adverse events related to oxygen use, including four reports of instances where an oxygen mask was connected in error to a compressed air outlet instead of an oxygen outlet. Compressed air outlets are often used to drive nebulisers in hospitals because they are quieter than electrical compressors. However, the flow meter looks very similar to an oxygen flow meter and is often mounted beside an oxygen flow meter, so it is very important to ensure that air flow meters are clearly labelled. Air flow meters are never required in an emergency and should be removed from wall sockets or covered by a designated ‘‘hood’’ when not in use, an example is shown appendix n. There have also been reports of cases where twin oxygen outlets were in use and the wrong one had been turned on or off.

As an example, one patient tried to turn off their air flow outlet after finishing a dose of nebulised treatment but accidentally turned off the oxygen flow to a neighbouring patient with serious consequences.

It is also recommended to advise patients not to adjust their oxygen flow meter, especially if there are dual outlets

- Air flow meters should be removed from the wall sockets or covered with a designated air outlet cover (appendix n) when not in use. Special care should be taken if twin oxygen outlets are in use

9 Transfer and transportation of patients receiving oxygen

9.1 Patients who are transferred across different areas must have clear documentation of their ongoing oxygen requirements and documentation of their oxygen saturations. Staff must ensure that adequate oxygen is provided during transfers and whilst patients are in diagnostic departments. Oxygen saturation should be monitored continuously by registered healthcare professionals for seriously ill patients who require escorted transfers.

9.2 Patients who are medically unstable and those requiring high dose oxygen therapy

(Reservoir mask, Venturi mask above 35% or Humidified oxygen above 35% or nasal or simple mask above 5 l/min) whilst being transferred between different areas should be accompanied by a registered healthcare professional. The use of portable oxygen cylinders is shown in appendix (M)

9.3 HCA staff may transfer stable patients with low Early Warning Score who are on low dose oxygen.

9.4 Clear instructions must be provided for the staff involved in the transfer of the patient, which must include delivery device and flow rate.

9.5 Staff must ensure there are adequate numbers of oxygen cylinders and that those are full when they leave the department/ward.

9.6 If a patient transfers from an area where the target saturation system is not used (see specialist areas 3.4) their oxygen should be administered as per the transferring area's prescription until the patient is reviewed and transferred over to the target saturation scheme, which should occur as soon as possible.

9.7 Oxygen cylinders should be appropriately secured during transfer, e.g. in size appropriate bed holders or in the designated space to the rear of wheelchairs.

10 Peri-operative and immediately post operatively

The usual procedure for prescribing oxygen therapy in these areas should be adhered to, utilising the target saturation. If a patient is transferred back to the ward on oxygen therapy and is not on the target saturation system, the need for ongoing oxygen therapy should be reviewed as soon as possible. If oxygen therapy is to be continued, it should be prescribed using the target saturation scheme unless there is an alternative time-limited instruction which is part of the Trust's Post-Operative care policy for selected patients.

11 Nebulised therapy and oxygen

When nebulised therapy is administered to patients at risk of hypercapnic respiratory failure (see section 8.1), it should be driven by compressed air. If necessary, supplementary oxygen should be given concurrently by nasal prongs at 1-4 litres per minute to maintain an oxygen saturation of 88-92% or other specified target range.

All patients requiring 35% or greater oxygen therapy should have their nebulised therapy by oxygen at a flow rate of >6 litres/minute.

12 Normal Oxygen saturations

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

c) Patients of all ages may have transient dips of saturation to 84% during sleep.

13 Housekeeping measures

When oxygen is not in use, the flow meter should be turned off (e.g if the patient is not in bed) to reduce fire risk and preserve oxygen. Ensure oxygen is turned on when the patient returns to bed space

14 Summary Oxygen Administration protocol (and weaning protocol)

ACTION	RATIONALE
All patients requiring oxygen therapy will have a prescription for oxygen therapy recorded on the patient's prescription chart. N.B exceptions- see emergency situations	Oxygen should be regarded as a drug and should be prescribed. BTS National guidelines (2017). British National Formulary (2018).
The prescription will incorporate a target saturation that will be identified by the clinician prescribing the oxygen in accordance with the Trust's oxygen guideline	Certain groups of patients require different target ranges for their oxygen saturation, see Tables 1-4. Certain groups of patients are at risk of hyperoxaemia, particularly patients with COPD.
The oxygen is prescribed on the nerve centre eMeds as PRN which should be signed at every medication round	To ensure that the patient is receiving oxygen if prescribed and to consider weaning and discontinuation
Once oxygen is in situ the nurse will monitor observations in line with appendix (k) on the bedside observation chart/ electronic device. All patients should have their oxygen saturation observed for at least five minutes after starting oxygen therapy. If a patient is receiving intermittent therapy, they may be monitored at least 8 hourly.	To identify if oxygen therapy is maintaining the target saturation or if an increase or decrease in oxygen therapy is required
The oxygen delivery device and oxygen flow rate should be recorded alongside the oxygen saturation on the bedside observation chart/ electronic device.	To provide an accurate record and allow trends in oxygen therapy and saturation levels to be identified.
Oxygen saturations must always be interpreted alongside the patient's clinical status incorporating the early warning score.	To identify early signs of clinical deterioration, e.g. elevated respiratory rate

ACTION	RATIONALE
If the patient falls outside of the target saturation range, the oxygen therapy will be adjusted accordingly The saturation should be monitored continuously for at least 5 minutes after any increase or decrease in oxygen dose to ensure that the patient achieves the desired saturation range.	To maintain the saturation in the desired range.
Saturation higher than target specified or >98% for an extended period of time.	
• Step down oxygen therapy as per guidance for delivery	The patient will require weaning down from current oxygen delivery system. See Appendix (i)
• Consider discontinuation of oxygen therapy	The patient's clinical condition may have improved negating the need for supplementary oxygen
Saturation lower than target specified	
• Check all elements of oxygen delivery system for faults or errors.	In most instances a fall in oxygen saturation is due to deterioration of the patient however equipment faults should be checked for.
• Step up oxygen therapy as per protocols in appendix (i). Any sudden fall in oxygen saturation should lead to clinical evaluation and in most cases measurement of blood gases	To assess the patient's response to oxygen increase, and ensure that $PaCO_2$ has not risen to an unacceptable level, or Ph dropped to an unacceptable level and to screen for the cause of deteriorating oxygen level (e.g. pneumonia, heart failure etc.)
• Monitor Early Warning Score and respiratory rate for further clinical signs of deterioration	Patient safety
Saturation within target specified	
• Continue with oxygen therapy, and monitor patient to identify appropriate time for stepping down therapy, once clinical condition allows	
• A change in delivery device (without an increase in O2 therapy) does not require review by the medical team.	(The change may be made in stable patients due to patient preference or comfort).
Oxygen delivery methods	
The Trusts recommended delivery devices will be utilised to ensure a standardised approach to oxygen delivery, see Appendix (h)	Previous audits have demonstrated wide variations in delivery devices across clinical areas, potentially increasing the risk of adverse incidents

15 Humidification

Humidification may be required for some patient groups, especially “neck-breathing patients” and those who have difficulty in clearing airway secretions or mucus. See Appendix (J).

16 Health and Safety issues

Health and Safety issues are covered in Appendix (L).

17 Education and Training Requirements

17.1 All medical doctors, nurses, registered nursing associates, health care assistants and other healthcare professionals involved in prescribing or administering oxygen must undertake training on the use of oxygen.

17.2 Registered Healthcare Professional receive underpinning theory on Oxygen therapy and its delivery as part of their Pre-registration programme.

17.3 Healthcare Assistants receive underpinning theory on the basics of Oxygen therapy on the HCA Trust Induction, competency assessment on recording Oxygen saturation is included in the annual HCA NEWS assessment.

17.4 Oxygen Therapy in an emergency is included in Basic Life Support for all clinical staff.

18 Process for Monitoring Compliance

University Hospitals of Leicester NHS Trust will participate in the national audits organized by the BTS.

19 Development, Consultation and Dissemination Process

This document has previously been widely circulated and discussed with the Leicestershire and Rutland Respiratory Prescribing Group, the Clinical Practice Committee and respiratory physicians, pharmacy colleagues and anaesthetic colleagues.

20 Document Control, Archiving and Review of this Policy

This Policy will be available on Insite and archived through the Trusts SharePoint System This policy will be reviewed in 3 years or sooner in response to clinical need

21 Equality Impact Statement

21.1 The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.

21.2 As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.

22 References

O'Driscoll, B.R., Howard, L.S., Earis, J. & Mak, V. (2017) British Thoracic Society Guideline for oxygen use in adults in healthcare and emergency settings. BMJ Open Respiratory Research, Available online at http://bmjopenrespres.bmj.com/

Summary guideline for prescribing oxygen emergency oxygen in hospital. Available on BTS website: www.brit-thoracic.org.uk/emergencyoxygen/

Summary of prescription, administration and discontinuation of oxygen therapy. Available on BTS website: www.brit-thoracic.org.uk/emergencyoxygen/

National Patient Safety Agency (NPSA) Rapid Response Report No. NPSA/2009/RRR006: Oxygen safety In Hospitals

National Patient Safety Agency (NPSA) Patient Safety Alert reference NO. NHS/PSA/D/2016/009 Reducing the risk of oxygen tubing being connected to air flowmeters

National Health Service (NHS) Patient Safety Alert (PSA) NO. NHS/PSA/W/2018/009 Risk of harm from inappropriate placement of pulse oximeter probes

Appendix (A) Table 1 Critical illnesses requiring high levels of supplemental oxygen

Table 1 Critical illness requiring high levels of supplemental oxygen

Section 8.10

The initial oxygen therapy is a reservoir mask at 15 L/min pending the availability of reliable oximetry readings.
For patients with spontaneous circulation and a reliable oximetry reading, it may quickly become possible to reduce the oxygen dose while maintaining a target saturation range of 94–98%.
If oximetry is unavailable, continue to use a reservoir mask until definitive treatment is available.
Patients with COPD and other risk factors for hypercapnia who develop critical illness should have the same initial target saturations as other critically ill patients pending the results of blood gas results after which these patients may need controlled oxygen therapy with target range 88–92% or supported ventilation if there is severe hypoxaemia and/or hypercapnia with respiratory acidosis.

	Additional comments	Recommendations
Cardiac arrest or resuscitation	Refer to resuscitation guidelines for choice of delivery device during active resuscitation. Give highest possible inspired oxygen concentration during CPR until spontaneous circulation has been restored.	Recommendation E1
Shock, sepsis, major trauma, drowning, anaphylaxis, major pulmonary haemorrhage, status epilepticus	Also give specific treatment for the underlying condition	Recommendations E2–E4
Major head injury	Early tracheal intubation and ventilation if comatose	Recommendation E5
Carbon monoxide poisoning	Give as much oxygen as possible using a bag-valve mask or reservoir mask. Check carboxyhaemoglobin levels. A normal or high oximetry reading should be disregarded because saturation monitors cannot differentiate between carboxyhaemoglobin and oxyhaemoglobin, owing to their similar absorbances. The blood gas PO2 will also be normal in these cases (despite the presence of tissue hypoxia).	Recommendation E6

COPD, chronic obstructive pulmonary disease; CPR, cardiopulmonary resuscitation; PO_2, oxygen tension arterial or arterialised blood gases.

Appendix (B) Table 2 Serious illnesses requiring moderate levels of supplemental oxygen if the patient is hypoxaemic

Table 2 Serious illnesses requiring moderate levels of supplemental oxygen if the patient is hypoxaemic

Section 8.11

The initial oxygen therapy is nasal cannulae at 2–6 L/min (preferably) or simple face mask at 5–10 L/min unless stated otherwise.
For patients not at risk of hypercapnic respiratory failure who have saturation below 85%, treatment should be started with a reservoir mask at 15 L/min and the recommended initial oxygen saturation target range is 94–98%. If oximetry is not available, give oxygen as above until oximetry or blood gas results are available. Change to reservoir mask if the desired saturation range cannot be maintained with nasal cannulae or simple face mask (and ensure that the patient is assessed by senior medical staff). If these patients have coexisting COPD or other risk factors for hypercapnic respiratory failure, aim at a saturation of 88–92% pending blood gas results but adjust to 94–98% if the PCO_2 is normal (unless there is a history of previous hypercapnic respiratory failure requiring NIV or IMV) and recheck blood gases after 30–60 min, see table 4.

	Additional comments	Recommendations
Acute hypoxaemia (cause not yet diagnosed)	Reservoir mask at 15 L/min if initial SpO_2 below 85%, otherwise nasal cannulae or simple face mask Patients requiring reservoir mask therapy need urgent clinical assessment by senior staff.	Recommendations D1–D3
Acute asthma pneumonia lung cancer		Recommendations F1–F3
Deterioration of lung fibrosis or other interstitial lung disease	Reservoir mask at 15 L/min if initial SpO_2 below 85%, otherwise nasal cannulae or simple face mask	Recommendation F4
Pneumothorax	Needs aspiration or drainage if the patient is hypoxaemic. Most patients with pneumothorax are not hypoxaemic and do not require oxygen therapy. Use a reservoir mask at 15 L/min if admitted for observation. Aim at 100% saturation. (Oxygen accelerates clearance of pneumothorax if drainage is not required.)	Recommendations F5–F6
Pleural effusions	Most patients with pleural effusions are not hypoxaemic. If hypoxaemic, treat by draining the effusion as well as giving oxygen therapy.	Recommendation F7
Pulmonary embolism	Most patients with minor pulmonary embolism are not hypoxaemic and do not require oxygen therapy.	Recommendation F8
Acute heart failure	Consider CPAP or NIV in cases of pulmonary oedema.	Recommendations F9–F10
Severe anaemia	The main issue is to correct the anaemia. Most anaemic patients do not require oxygen therapy.	Recommendations F11–12
Postoperative breathlessness	Management depends on underlying cause.	Recommendation J1

COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airway pressure; IMV, invasive mechanical ventilation; NIV, non-invasive ventilation; PCO_2, arterial or arterialised carbon dioxide tension; SpO_2, arterial oxygen saturation measured by pulse oximetry.

Appendix (C) Table 3 Conditions for which patients should be monitored closely but oxygen therapy is not required unless the patient is hypoxaemic

Table 3 Conditions for which patients should be monitored closely but oxygen therapy is not required unless the patient is hypoxaemic

Section 8.13

If hypoxaemic, the initial oxygen therapy is nasal cannulae at 2–6 L/min or simple face mask at 5–10 L/min unless saturation is below 85% (use reservoir mask) or if at risk from hypercapnia (see below).
The recommended initial target saturation range, unless stated otherwise, is 94–98%.
If oximetry is not available, give oxygen as above until oximetry or blood gas results are available.
If patients have COPD or other risk factors for hypercapnic respiratory failure, aim at a saturation of 88–92% pending blood gas results but adjust to 94–98% if the PCO_2 is normal (unless there is a history of respiratory failure requiring NIV or IMV) and recheck blood gases after 30–60 min, see table 4.

	Additional comments	Recommendations
Myocardial infarction and acute coronary syndromes	Most patients with acute coronary artery syndromes are not hypoxaemic and the benefits/harms of oxygen therapy are unknown in such cases. Unnecessary use of high concentration oxygen may increase infarct size.	Recommendation F13
Stroke	Most patients with stroke are not hypoxaemic. Oxygen therapy may be harmful for non-hypoxaemic patients with mild–moderate strokes.	Recommendation F14
Hyperventilation or dysfunctional breathing	Exclude organic illness. Patients with pure hyperventilation due to anxiety or panic attacks are unlikely to require oxygen therapy. Rebreathing from a paper bag may cause hypoxaemia and is not recommended.	See section 8.13.3
Most poisonings and drug overdoses (see table 1 for carbon monoxide poisoning)	Hypoxaemia is more likely with respiratory depressant drugs, give antidote if available, for example, naloxone for opiate poisoning. Check blood gases to exclude hypercapnia if a respiratory depressant drug has been taken. Avoid high blood oxygen levels in cases of acid aspiration as there is theoretical evidence that oxygen may be harmful in this condition. Monitor all potentially serious cases of poisoning in a level 2 or 3 environment (high dependency unit or intensive care unit).	Recommendation F15
Poisoning with paraquat or bleomycin	Patients with paraquat poisoning or bleomycin lung injury may be harmed by supplemental oxygen. Avoid oxygen unless the patient is hypoxaemic. Target saturation is 85–88%.	Recommendation F16
Metabolic and renal disorders	Most do not need oxygen (tachypnoea may be due to acidosis in these patients)	Recommendation F17
Acute and subacute neurological and muscular conditions producing muscle weakness	These patients may require ventilatory support and they need careful monitoring which includes spirometry. If the patient's oxygen level falls below the target saturation, they need urgent blood gas measurements and are likely to need ventilatory support.	Recommendation G4
Pregnancy and obstetric emergencies	Oxygen therapy may be harmful to the fetus if the mother is not hypoxaemic.	Recommendations H1–H4

COPD, chronic obstructive pulmonary disease; IMV, invasive mechanical ventilation; NIV, non-invasive ventilation; PCO_2, arterial or arterialised carbon dioxide tension.

Appendix (D) Table 4 COPD and other conditions requiring controlled or low-dose oxygen

Table 4 COPD and other conditions requiring controlled or low-dose oxygen therapy

Section 8.12

Prior to availability of blood gases, use a 24% Venturi mask at 2–3 L/min or 28% Venturi mask at 4 L/min or nasal cannulae at 1–2 L/min and aim for an oxygen saturation of 88–92% for patients with risk factors for hypercapnia but no prior history of respiratory acidosis. Adjust target range to 94–98% if the PCO_2 is normal (unless there is a history of previous NIV or IMV) and recheck blood gases after 30–60 min.

	Additional comments	Recommendations
COPD and other conditions causing fixed airflow obstruction (eg, bronchiectasis)	May need lower range if acidotic or if known to be very sensitive to oxygen therapy. Ideally use 'alert cards' to guide therapy based on previous blood gas results. Increase Venturi mask flow by up to 50% if respiratory rate is above 30 breaths/min.	Recommendations G1–G2 and section 8.12.1
Exacerbation of CF	Admit to regional CF centre if possible, if not discuss with regional centre or manage according to protocol agreed with regional CF centre. Ideally use 'alert cards' to guide therapy. Increase Venturi mask flow by up to 50% if respiratory rate is above 30 breaths/min.	Recommendations G1, G3, G6
Neuromuscular disease, neurological condition and chest wall deformity	May require ventilatory support. Risk of hypercapnic respiratory failure	Recommendations G1, G4, G6
Morbid obesity		Recommendations G1,G5, G6

CF, cystic fibrosis; COPD, chronic obstructive pulmonary disease; IMV, invasive mechanical ventilation; NIV, non-invasive ventilation; PCO_2, arterial or arterialised carbon dioxide tension.

Appendix (E) Chart 1 Oxygen prescription for acutely hypoxaemic patients

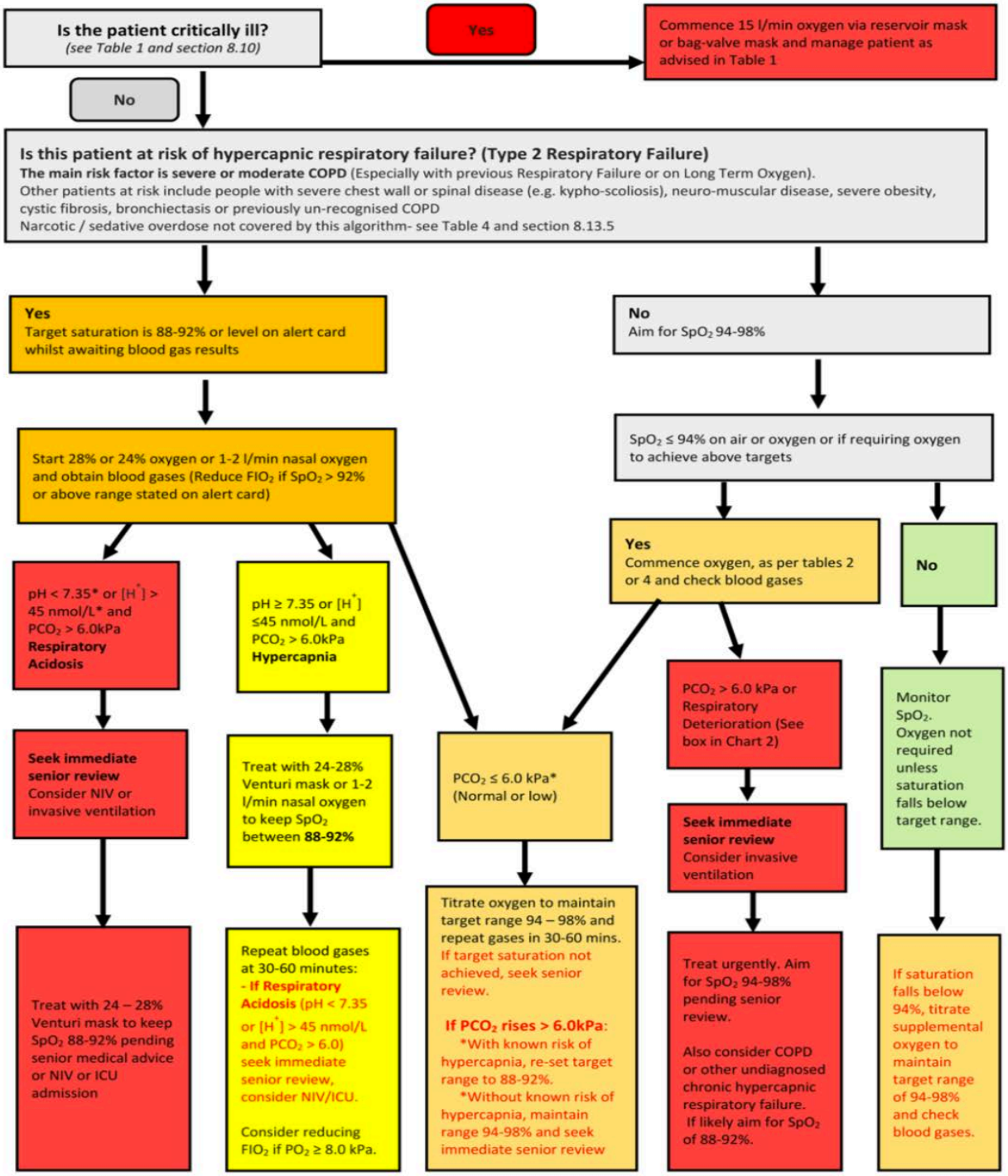
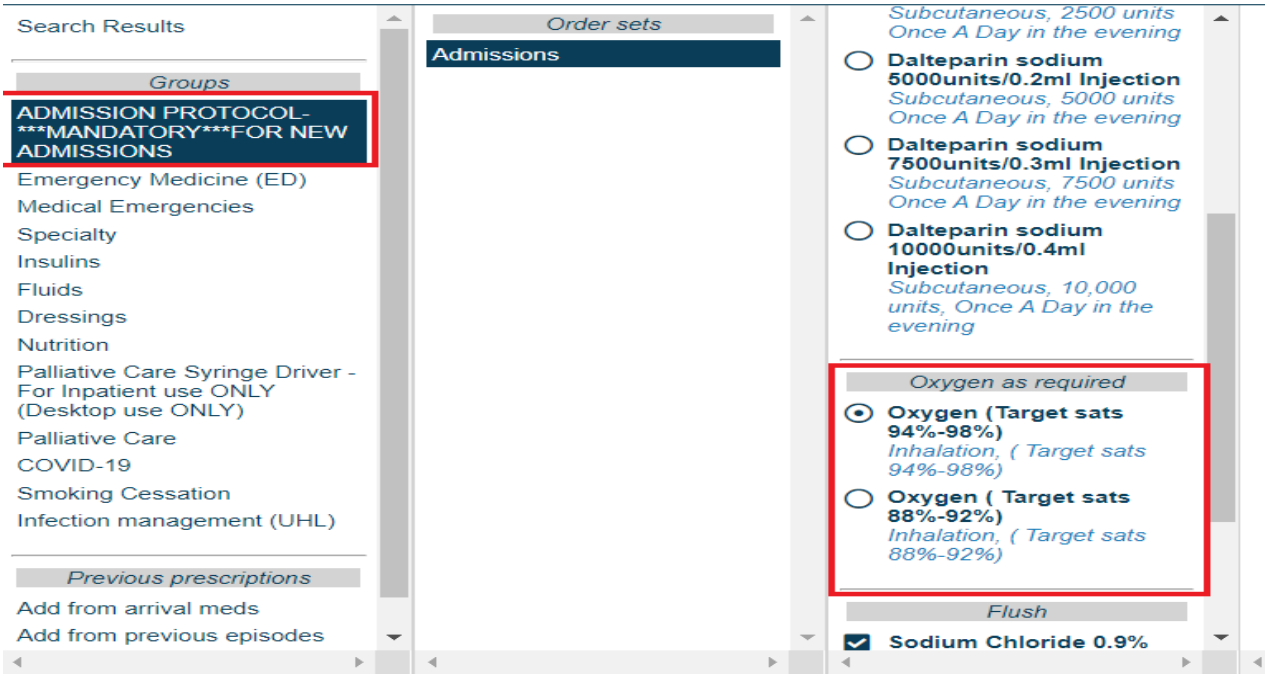


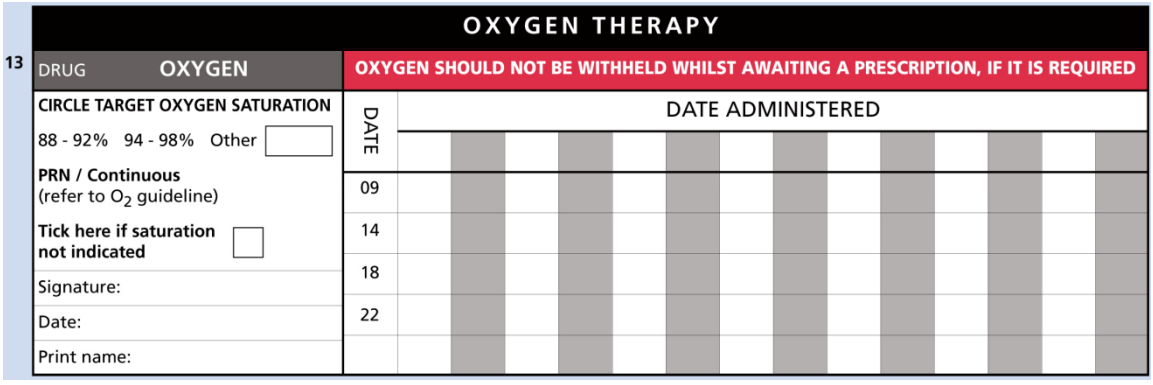
Figure 1 Chart 1 - Oxygen prescription for acutely hypoxaemic patients in hospital. Any increase in FIO_2 must be followed by repeat blood gases in 1 hour (or sooner if conscious level deteriorates). *If pH is < 7.35 ([H+] > 45 nmol/L) with normal or low PaCO2, investigate and treat for metabolic acidosis and keep SpO_2 94–98%. ABG, arterial blood gas; COPD, chronic obstructive pulmonary disease; FiO_2, fraction of inspired oxygen; ICU, intensive care unit; NIV, non-invasive ventilation; $PaCO_2$, arterial carbon dioxide tension; PCO_2, carbon dioxide tension; PO_2, oxygen tension; SpO_2, arterial oxygen saturation measured by pulse oximetry.

Appendix (F) UHL Oxygen Prescription

If your area uses eMeds, please choose protocol appropriate to your clinical area and prescribe VTE prophylaxis, MRSA treatment and oxygen. When prescribing oxygen choose appropriate target saturation



If your area uses prescription chart, please use oxygen therapy column shown below



Appendix (G) Administering Acute Oxygen Therapy

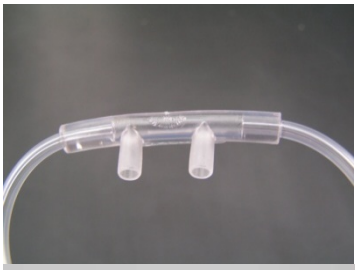
ACTION	RATIONALE
1. Ensure patency of airway	To promote effective oxygenation
2. The type of delivery system used will depend on the needs and comfort of It the patient. It is the nurse's role to assess the patient and use the prescribed system.	To provide accurate oxygen delivery. Most stable patients prefer nasal cannula to masks.
3. Ensure oxygen is prescribed on prescription chart/e-meds. In some situations, a patient group direction may be in place to allow certain named health care professionals to administer oxygen. In these cases, the doctor must review the patient's condition within the stated time and prescribe oxygen	To ensure a complete record is maintained and expedite patient treatment. The exception to this action would be during an emergency situation where the resuscitation guideline should be followed.
4. Ensure that the oxygen dose is clearly indicated. If nasal cannula or reservoir masks are being used check that the flow rate is clearly indicated	In accordance with the administration of medicines policy.
5. Inform patients and or relative / carer of the combustibility of oxygen	Oxygen supports combustion therefore there is always a danger of fire when oxygen is being used.
6. Show and explain the oxygen delivery system to the patient. Give the patient the information sheet about oxygen.	To obtain consent and co-operation.
7. Assemble the oxygen delivery system carefully as shown in Appendix (h)	To ensure oxygen is given as prescribed
8. Attach oxygen delivery system to oxygen source	To ensure oxygen supply is ready
9. Attach oxygen delivery system to patient according to manufacturer's instructions	For oxygen to be administered to patient
10. Turn on oxygen flow in accordance with prescription and manufacturers instruction	To administer correct % of oxygen
11. Ensure patient has either a drink or a mouthwash within reach	To prevent drying of the oral mucosa
12. Clean oxygen mask as required with general purpose detergent and dry thoroughly. Discard systems after use.	To minimise risk of infection (single patient device)

Appendix (H) EQUIPMENT USED IN THE DELIVERY OF OXYGEN

(Choose the appropriate delivery device)

1. Oxygen source (piped or cylinder)
2. Flow meter
3. Saturation monitor
4. Oxygen Delivery system - (see appendix j for advice on use of each device);

(H1) Nasal cannula

DEVICE	DESCRIPTION	PURPOSE
Nasal Cannulae  	**Uncontrolled oxygen therapy** Nasal cannulae consist of pair of tubes about 2cm long, each projecting into the nostril and stemming from a tube which passes over the ears and which is thus self-retaining.	Cannulae are preferred to masks by most patients. They have the advantage of not interfering with feeding and are not as inconvenient as masks during coughing and sneezing. It is not advisable to assume what percent oxygen (FI02) the patient is receiving according to the Litres delivered but this is not important if the patient is in the correct target range.

ACTION	RATIONALE
1.(When using nasal cannula). Position the tips of the cannula in the patient's nose so that the tips do not extend more than 1.5cm into the nose.	Overlong tubing is uncomfortable, which may make the patient reject the procedure. Sore nasal mucosa can result from pressure or friction of tubing that is too long.
2. Place tubing over the ears and under the chin as shown above. Educate patient re prevention of pressure areas on the back of the ear.	To allow optimum comfort for the patient. To prevent pressure sores.
3. Adjust flow rate, usually 2-4 l/min but may vary from 1-6 l/min in some circumstances.	Set the flow rate to achieve the desired target oxygen saturation.

(H2) Fixed performance mask (Venturi mask and valve)

DEVICE	DESCRIPTION	PURPOSE
Venturi mask  **Venturi devices come in different colours for %** Blue = 24% White = 28% Yellow = 35% Red = 40% Green = 60%	**Controlled oxygen therapy** A mask incorporating a device to enable a fixed concentration of oxygen to be delivered independent of patient factors or fit to the face or flow rate. Oxygen is forced out through a small hole causing a Venturi effect which enables air to mix with oxygen.	This is a high-performance oxygen mask designed to deliver a specified oxygen concentration regardless of breathing rate or tidal volume.

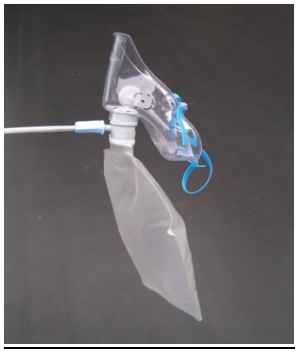
ACTION	RATIONALE
1. (When using Venturi mask) Connect the mask to the appropriate Venturi barrel attached firmly into the mask inlet.	To ensure that patient receives the correct concentration of oxygen
2.Fasten oxygen tubing securely.	Correctly secured tubing is comfortable and prevents displacement of mask/cannulae.
3.Assess the patient's condition and functioning of equipment at regular intervals according to care plan.	To ensure patient's safety and that oxygen is being administered as prescribed.
4. Adjust flow rate. The minimum flow rate is indicated on the mask or packet. The flow should be doubled if the patient has a respiratory rate above 30 per minute.	Higher flows are required for patients with rapid respiration and high inspiratory flow rates. This does not affect the concentration of oxygen but allows the gas flow rate to match the patient's breathing pattern.

(H3) Simple face mask (variable flow)

DEVICE	DESCRIPTION	PURPOSE
Simple face mask  Variable Percentage (Delivers unpredictable concentrations that vary with flow rate) *Nasal cannulae should be used for most patients who require medium dose oxygen but a simple face mask may be used due to patient preference or if the nose is blocked*	**Uncontrolled Oxygen therapy** Mask has a soft plastic face piece; vent holes are provided to allow air to escape. Maximum 50%-60% at 15ltrs/minute flow.	This is a variable performance device. The oxygen concentration delivered will be influenced by**:** a. the oxygen flow rate (liters per minute) used, leakage between the mask and face; b. the patient's tidal volume and breathing rate. **NOT to be used for CO_2 retaining patients.**

ACTION	RATIONALE
(If using simple face mask) Gently place mask over the patient's face, position the strap behind the head or the loops over the ears then carefully pull both ends through the front of the mask until secure.	Ensure a comfortable fit and delivery of prescribed oxygen is maintained.
Check that strap is not across ears and if necessary, insert padding between the strap and head.	To prevent irritation.
Adjust the oxygen flow rate. Must never be below 5L/min	Flows below 5L/m may not give enough oxygen and cause increased resistance to breathing, particularly if the patient has a high inspiratory flow rate, and may also cause CO2 re-breathing due to insufficient wash-out of expired gases from the mask

(H4) Reservoir mask (non re-breathe mask)

DEVICE	DESCRIPTION	PURPOSE
Reservoir Mask (Non-rebreathe Mask) 	**Uncontrolled oxygen therapy** Mask has a soft plastic face piece with flap-valve exhalation ports which may be removed for emergency air-intake. There is also a one-way valve between the face mask and reservoir bag.	In non re-breathing systems, the oxygen may be stored in the reservoir bag during exhalation by means of a one-way valve. High concentrations of oxygen 80-90% can be achieved at relatively low flow rates. **NOT to be used for C02 retaining patients except in life-threatening emergencies such as cardiac arrest or major trauma.**
ACTION		**RATIONALE**
1. (Non-Rebreathe Reservoir Mask) Ensure the reservoir bag is inflated before placing mask on patient, this can be maintained by using 10-15 litres of oxygen per min. 2. Adjust the oxygen flow to the prescribed rate. To ensure the optimal flow of oxygen to the patient. Inadequate flow rates may result in administration of inadequate oxygen concentration to the patient.		To ensure the optimal flow of oxygen to the patient. Inadequate flow rates may result in administration of inadequate oxygen concentration to the patient.

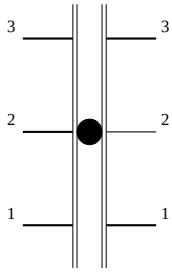
In disposable reservoir, oxygen flows directly into the mask during inspiration and into the reservoir bag during exhalation. All exhaled air is vented through a port in the mask and a one-way valve between the bag and mask, which prevents re-breathing.

(H5) Tracheostomy mask for patients with tracheostomy or laryngectomy

DEVICE	DESCRIPTION	PURPOSE
Tracheostomy mask Variable Percentage (Delivers unpredictable concentrations that vary with flow rate) 	**Uncontrolled Oxygen therapy** Mask designed for "neck breathing patients". Fits comfortably over tracheostomy or tracheotomy. Exhalation port on front of mask.	This is a variable performance device for patients with tracheostomy or tracheotomy. The oxygen concentration delivered will be influenced by**:** **a.** the oxygen flow rate(litres per minute) used. **b.** the patient's tidal volume and breathing rate. **Use cautiously at low flow rates in CO2 retaining patients as there may be no alternative.**

ACTION	RATIONALE
Gently place mask over the patient's airway, position the strap behind the head then carefully pull both ends through the front of the mask until secure. Adjust the oxygen flow rate to achieve the desired target saturation range. Start at 4 l/min and adjust the flow up or down as necessary to achieve the desired oxygen saturation range.	Ensure a comfortable fit and delivery of prescribed oxygen is maintained. To ensure that the correct amount of oxygen is given to keep the patient in the target range.

(H6) Oxygen Flow Meter

DEVICE	DESCRIPTION	PURPOSE
Oxygen flow meter Delivers oxygen to the patient.  	Device to allow the patient to receive an accurate flow of oxygen, usually between 2 and 15 litres per minute. May be wall-mounted or on a cylinder. **Take special care when using twin oxygen outlets or if there are air outlets which may be mistaken for oxygen outlets.**	To ensure that the patient receives the correct amount of oxygen.  **Correct Setting for 2 l/min**

ACTION	RATIONALE
Attach the oxygen tubing to the nozzle on the flow meter. Turn the finger-valve to obtain the desired flow rate. The CENTRE of the ball shows the correct flow rate. The diagrams shows the correct setting to deliver 2 l/min.	To ensure that the patient receives the correct amount of oxygen.

H7) High Flow Nasal cannula

DEVICE DESCRIPTION

Soft nasal cannula which delivers heated humidified oxygen through a blended oxygen delivery system such as Dragar.

There are 3 components:

1. patient interface,
2. gas delivery device(s) to control flow and F_{IO2}
3. humidifier.

The nasal prongs are held in place on the upper lip with an elastic over-ear head band. There is a larger diameter flex tubing proximal to the prongs and an around-the-neck elastic that connects to support the weight of the connecting tubing. They are available in large, medium, and small sizes

Used in level two and above (Critical care, SHDU, MHDU, NHDU)

High flow nasal cannulae, flow generator and humidifier system

Controlled oxygen therapy

Oxygen is generally delivered in flow rates in excess of 30L /min therefore providing controlled oxygen therapy

The flow rate however can be reduced as the patient improves, therefore at rates below 30L/min the flow will be insufficient to deliver oxygen to meet the patients peak inspiratory flow and the oxygen concentration will therefore become variable.

PURPOSE

The HFNC can effectively be used to treat patients with moderate levels of hypoxemic respiratory failure.

HFNC could be considered as an initial appliance in certain settings (eg, ED), as flow could be titrated based on response over a full range without having to change to other devices. It could also be viewed as an alternative delivery interface for situations in which hypoxemia or dyspnea was not corrected after a trial of low-flow cannula, NRB and/or air-entrainment mask with F_{IO2} > 0.4.

HFNC systems offer independent adjustment of F_{IO2} and flow. This allows greater flexibility to match the needs of acutely ill patients. Higher flow can match the inspiratory flow demands of tachypnoeic patients, which can prevent secondary air entrainment at the facial interface

A small amount of airway distending pressures, similar to CPAP, can be achieved with HFNC, however, this is difficult to measure and not predictable.

Heated and humidified gas from HFNCs may improve comfort and allow greater tolerance. It also has the advantage of easier speech, eating, drinking, and allows frequent expectoration.

ACTION RATIONALE

1. Set up high flow nasal cannula in line with delivery device and humidification

2. Adjust the air/oxygen flow of the delivery device to meet the prescribed percentage of oxygen and delivery flow.

3. Inadequate flow rates may result in administration of inadequate oxygen concentration to the patient.

Appendix (I) Flow chart for oxygen administration on general wards in hospitals

See patient's drug chart and Chart 1 and tables 1-4 for starting dose and target saturation
Choose the most suitable delivery system and flow rate

Titrate oxygen **up** or **down** to maintain the target oxygen saturation.

The table below shows available options for stepping dosage up or down.
The chart does NOT imply any equivalence of dose between Venturi masks and nasal cannulae.
Allow at least 5 minutes at each dose before adjusting further upwards or downwards
(except with major and sudden fall in saturation – falls ≥ 3% also require clinical review)
Once your patient has adequate and stable saturation on minimal oxygen dose, consider discontinuation of oxygen therapy.

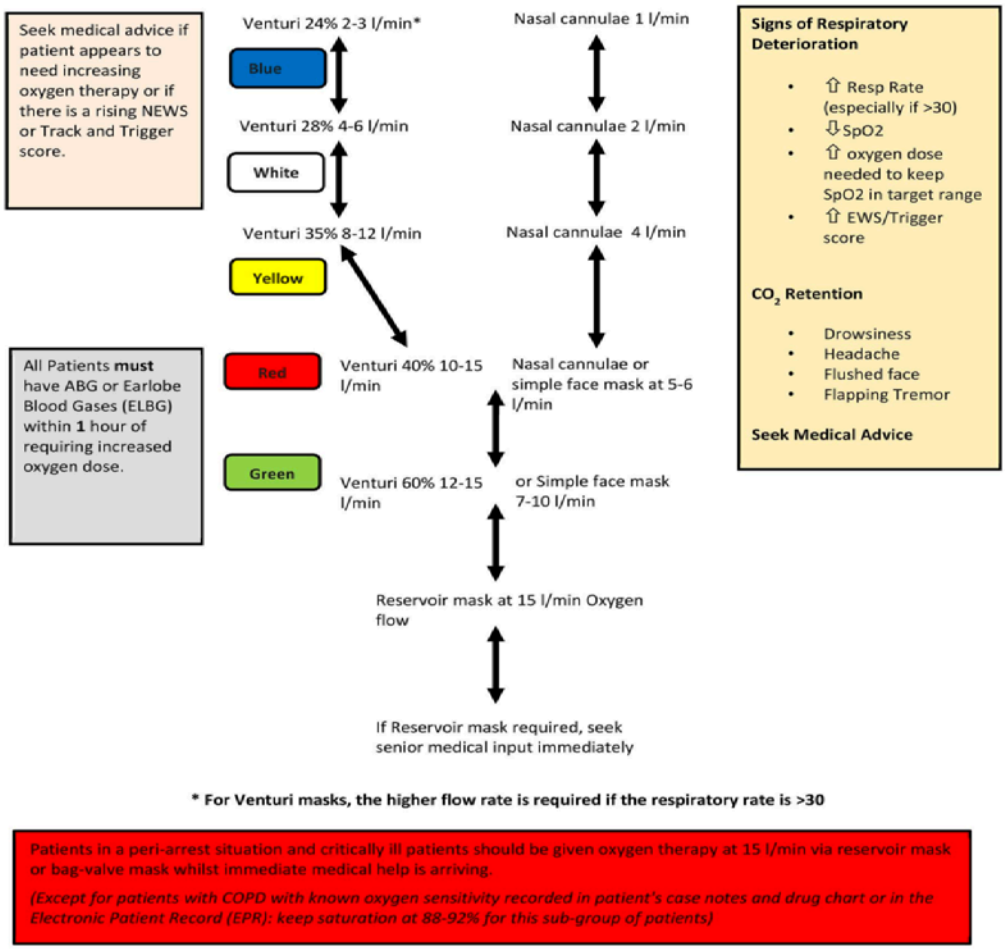


Figure 2 Chart 2 - Flow chart for oxygen administration on general wards in hospitals. *For Venturi masks, the higher flow rate is required if the respiratory rate is >30. ABG, arterial blood gas; COPD, chronic obstructive pulmonary disease; EPR, electronic patient record; EWS, early warning score; NEWS, National Early Warning Score; SpO_2, arterial oxygen saturation measured by pulse oximetry.

Appendix (J) HUMIDIFICATION

This should only be used if specifically requested by the doctor or physiotherapist in the following circumstances.

1. If the flow rate exceeds 4 litres per minute for several days
2. Tracheotomy or tracheostomy patients (“neck-breathing patients)”
3. Cystic Fibrosis patients
4. Bronchiectasis patients
5. Patients with a chest infection retaining secretions

Can be given by warm or cold humidifier systems
(warm humidifier systems are mainly used in critical care areas)

Appendix (K) MONITORING OF PATIENTS

Action	Rationale
1. Observe the following a. Monitor arterial oxygen saturation levels according to Trust Oxygen policy b. Visual observations of skin color for central cyanosis (blue lips) c. Respiratory rate d. Any sign of respiratory distress should be immediately	In order to accurate monitor the patient for signs of improvement or deterioration
2. If the arterial oxygen saturation is above or below the target saturation the observer (often a Health Care Assistant) must inform the registered staff who are responsible for the patient care, to administer oxygen (usually a Nurse)	Patient safety
3. Check the patients mouth, nose & behind the ears	To identify signs of infection and pressure sores as soon as possible
4. Record all observations on appropriate Chart, hourly if on continuous oxygen, 8-hourly if on intermittent oxygen	To ensure adequate record keeping

Appendix (L) HEALTH AND SAFETY

Action	Rationale
1. Inform patients and carers about the combustibility of oxygen 2. Oxygen should be stored in an area designated as no smoking 3. Electrical appliances should be kept at least five feet away from the source of oxygen 4. Avoid grease or oil coming into contact with apparatus 5. Store unused cylinders in a dry well-ventilated place 6. Appropriate racking should be used where available	Oxygen supports combustion, there is always a danger of fire when oxygen is being used Oxygen can be potentially dangerous when in contact with sources of ignition and flammable material

Appendix (M) How to Guide for the use of Portable Oxygen Cylinders in UHL

HOW TO GUIDE FOR THE USE OF PORTABLE OXYGEN CYLINDERS IN UHL

STEP 1.

Check the OXYGEN Cylinder to see if it is FULL or EMPTY

If the Arrow is pointing into the **RED then the Cylinder is EMPTY**

Check that the cylinder contains **OXYGEN** and not air (or any other gases)

If the Arrow is pointing into the **GREEN then the Cylinder is FULL.**

A full cylinder delivering 15 l/min will be empty in approximately 20 minutes

STEP 2.

SWITCH ON using the OPEN / CLOSE Valve

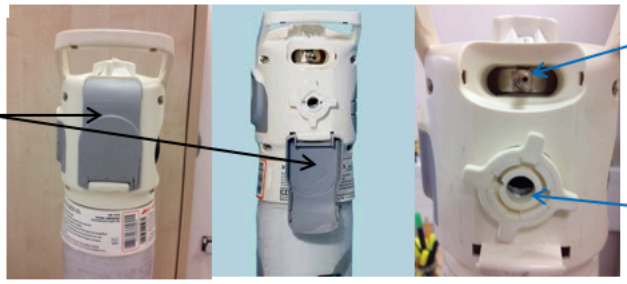
Remove the cover by pulling at the **Plastic Handle this will reveal the OPEN / CLOSE VALVE.**

For Oxygen to flow you MUST TURN the OPEN / CLOSE VALVE ANTI Clockwise.

STEP 3.

ACCESS the OXYGEN Outflow ports to connect tubing

Pull down the **Hinged Plastic Cover to reveal the OUTFLOW PORTS.**

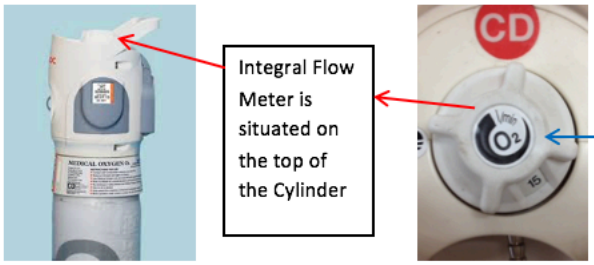


Outflow port for connection to OXYGEN TUBING.

Outflow port for connection to Ventilator or Flow meter.

STEP 4.

SET the OXYGEN FLOW RATE



Integral Flow Meter is situated on the top of the Cylinder

Integral Flow Meter **TURN CLOCK WISE to deliver OXYGEN Range 0 – 15 L / min**

Remember to regularly monitor the clinical progress of your patient: use pulse oximetry and if oxygen saturations do not respond to treatment consider rechecking the equipment and checking that oxygen is flowing. **USE a CAGE to safely hold the oxygen cylinder** Oxygen must always be prescribed.

Remember: oxygen supports combustion – keep away from sparks, shocks, naked flames and electronic equipment.

Appendix (N) Air outlet cover