

OXYGEN THERAPY AND PULSE OXIMETRY

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Introduction

This organisation believes that every individual has the right to receive oxygen therapy if prescribed for them. The organisation will ensure that such oxygen therapy will be administered or supervised by suitably qualified staff and that oxygen cylinders and equipment will be kept and maintained in such a way as to be compliant with all relevant health and safety legislation and guidelines.

With respect to the prescribing, supply, storage and administration of oxygen, this organisation adheres fully to the Medicines Act 1968, The Misuse of Drugs Act 1971, the Misuse of Drugs (Safe Custody) Regulations 1973, the Nursing and Midwifery Council Guidelines for the Administration of Medicines and current guidance from the National Institute for Health and Care Excellence <https://www.nice.org.uk/Search?q=Oxygen+therapy> This policy is intended to set out the principles and values underpinning this organisations approach to oxygen therapy.

Procedure

- ☑ Oxygen therapy should only be administered or supplied on prescription.
- ☑ Oxygen therapy should only be administered by suitably qualified and trained care staff.
- ☑ Oxygen should be administered as prescribed and full details recorded in each individual's medication and care plan
- ☑ In each case advice and support relating to oxygen administration can be obtained either from the individuals G.P. or the specialist community team who prescribed the oxygen.
- ☑ Individuals who wish to self-administer oxygen will receive an appropriate assessment carried out by suitably qualified and trained care staff. This assessment will include; the individual, the family where appropriate and any health professional involved in their oxygen therapy. The assessment will be recorded in the individual's oxygen therapy plan and reviewed monthly or more frequently if required. Suitably trained, designated care staff will be provided to support self-administering as identified in the assessment.
- ☑ Staff will work with the relevant Home Oxygen Therapy Service to ensure that suitable oxygen supplies are provided and are kept in serviceable condition.
- ☑ Records will be kept of all oxygen supplies received, administered and leaving the service to ensure that there is no mishandling.
- ☑ All staff handling oxygen should ensure that all health and safety requirements are complied with at all times; oxygen in the custody of the care service will be handled according to the requirements of the Medicines Act 1968, guidelines from the Royal Pharmaceutical Society of Great Britain, the requirements of the Misuse of Drugs Act 1971. All nursing staff will abide by the NMC Standards for the administration of medicines and current guidance from the National Institute for Health and Care Excellence

1. Safety Procedures: Oxygen presents a considerable risk of explosion or fire and should therefore be handled with great care and according to guidelines from the Health and Safety Executive. When using or storing oxygen cylinders staff must:

- ☑ complete a risk assessment for each individual to minimise the risks associated with the storage and use of oxygen
- ☑ ensure that when not in use oxygen cylinders are turned off and kept in a dry, secure, well-ventilated area well away from sources of combustion
- ☑ display warning notices
- ☑ never allow untrained persons to operate or tamper with oxygen cylinders and equipment

- 👉 never let a concentration of oxygen build up in a confined area
- 👉 never use oxygen near any naked flame or fire or smoke in the vicinity of oxygen cylinders or equipment
- 👉 always handle cylinders with care and never to knock or allow cylinders to fall over
- 👉 In the event of accidental release of oxygen from a cylinder staff should:
- 👉 evacuate the area
- 👉 ensure adequate air ventilation
- 👉 eliminate ignition sources
- 👉 post warning notices, including No Smoking
- 👉 try to stop release and notify manufacturer or supplier as soon as possible
- 👉 **inform emergency service personnel about the oxygen cylinder storage areas (Fire Service Personnel)**
- 👉 Maintenance of oxygen cylinders and equipment is the responsibility of the Home Oxygen Service. A maintenance record is kept on the premises and part of our quality audit.

2. Pulse Oximetry (oxygen saturation machine)

- a) The pulse oximeter is used for evaluating the oxygen status of individuals in a variety of clinical settings and has become an increasingly common piece of monitoring equipment.
- b) It provides continuous, non-invasive monitoring of oxygen saturation of haemoglobin in arterial blood. Its results are updated with each pulse wave.
- c) Pulse oximetry provides an opportunity for deviations from an individual's oxygen baseline to be noticed immediately, as an early warning signal to clinicians to help prevent the consequences of desaturation and detect hypoxaemia before it produces cyanosis.
- d) Pulse oximeters measure the absorption of specific wavelengths of light in oxygenated haemoglobin as compared with that of reduced haemoglobin. Arterial oxygenated blood is red due to the quality of oxyhaemoglobin it contains, causing it to absorb light of certain wavelengths. The oximeter probe has two light-emitting diodes (LEDs), one red and one infrared, located on one side of the probe. The probe is placed on a suitable part of the body, usually a fingertip or ear lobe, and the LEDs transmit light wavelengths through pulsating arterial blood to a photodetector on the other side of the probe. Infrared light is absorbed by the oxyhaemoglobin; red light by the reduced haemoglobin. Pulsatile arterial blood during systole causes an influx of oxyhaemoglobin to the tissue, absorbing more infrared light, and allowing less light to reach the photodetector. The oxygen saturation of the blood determines the degree of light absorption. The result is processed into a digital display of oxygen saturation on the oximeter screen, which is symbolised as SpO₂ (Jevon, 2000).
- e) There are various makes and models of pulse oximeters available. Most provide a visual digital waveform display, an audible display of arterial pulsations and heart rate, and a variety of sensors to accommodate individuals regardless of age, size or weight. Selection depends on the setting in which it is used. All staff using the pulse oximeter must be aware of its functions and correct usage.
- f) Arterial blood gas analysis is more accurate; however, pulse oximetry is considered sufficiently accurate for most clinical purposes, having recognised that there are limitations.

3. Factors which affect accuracy of readings

- a) **Condition of the individual:** To calculate the difference between full and empty capillaries, oximetry measures light absorption over a number of pulses, usually five (Harrahill, 1991). In order for a pulsatile flow to be detected, there must be sufficient perfusion in the monitored area. If the individual has a weak or absent peripheral pulse, pulse oximeter readings will not be precise. Individuals most at risk of low perfusional states are those with hypotension, hypovolaemia and hypothermia and those in cardiac arrest. Individual who are cold but not hypothermic may have vasoconstriction in their fingers and toes that may also compromise arterial flow (Carroll, 1997).
- 👉 Non-arterial pulses may be detected if the probe is secured too tightly, creating venous pulsations in the finger. Venous pulsations are also caused by right-sided heart failure,

- tricuspid regurgitation (Schnapp and Cohen, 1990), and the tourniquet effect of a blood pressure cuff above the probe.
- 🟢 Cardiac arrhythmias may cause very inaccurate measurements, especially if there are significant apex/radial deficits (Woodrow, 1999).
 - 🟢 Intravenous dyes used in diagnostic and haemodynamic testing may cause inaccurate, usually lower, estimates of oxygen saturations (Jenson et al, 1998). The effects of deeply pigmented skin, jaundice or bilirubin levels should also be considered.
 - 🟢 Using pulse oximetry correctly involves more than just reading the number display, since not all Individual with the same SpO₂ have the same amount of oxygen in their blood. A saturation of 97% means that 97% of the total amount of haemoglobin in the body is filled with oxygen molecules. Therefore the interpretation of oxygen saturations must be in the context of the individual's total haemoglobin level
 - 🟢 Another factor that affects the oximeter readings is how tightly the haemoglobin and oxygen are bound together, which may change with various physiological conditions.
- b) **External influences:** Because the pulse oximeter measures the amount of light transmitted through arterial blood, bright light that shines directly on the sensor, whether artificial or natural, may affect readings. Dirty sensors (Sims, 1996), dark-coloured nail polishes (Carroll, 1997) and dried blood (Woodrow, 1999) may affect the accuracy of the readings by hindering or altering the light absorption of the contact probes.
- 👉 Optical shunting affects accuracy and occurs when the sensor is improperly positioned so that light goes directly from the LED to the photodetector without passing through the vascular bed.
 - 👉 Moving and dislodging of the sensor, which may be caused by a rhythmic movement such as the tremors of Parkinsonism, seizures or even shivering, may leads to inaccurate readings. Exercise and vibrations can also make it difficult for the pulse oximeter to determine which tissue is pulsatile.
- c) **False high readings:** Pulse oximeters can give a falsely high reading in the presence of carbon monoxide. Carbon monoxide binds to haemoglobin about 250 times more strongly than oxygen and, once in place, prevents the binding of oxygen. It also turns haemoglobin bright red. The pulse oximeter is unable to distinguish between haemoglobin molecules saturated in oxygen and those carrying carbon monoxide (Casey, 2001). False high readings are also always obtained from smokers - readings are affected for up to four hours after smoking a cigarette (Dobson, 1993). Other sources of carbon monoxide include fires, car-exhaust inhalation and prolonged exposure to heavy-traffic environments. There is also some evidence that anaemia leads to false high readings (Jensen et al, 1998).
- d) **Hazards of using a finger probe:** Continuous use of the probe may cause blisters on the finger pad or pressure damage to the skin or nail bed. Burns are also a hazard of continuous use of the probe, which should be repositioned every two to four hours. If a probe is placed on a paralysed limb, the individual may not be able to warn staff of any discomfort and potential burns. Pulse oximetry is, like any other form of monitoring, an adjunct to care. Care should remain focused on the person and not the machine. The accuracy of routine pulse oximetry should not be taken for granted and nursing and medical staff should be aware that the technology benefits Individual only if the staff using it are able to use the equipment correctly and interpret the results knowledgeably

Training

All nursing and care staff are required to read this procedure as part of their induction process and to be remember that oxygen is potentially dangerous and will strongly support combustion. Existing staff will be updated regularly in the basic information about health and safety and oxygen. All staff will be offered appropriate skills training or refresher courses in use of oxygen therapy and the use of pulse oximetry as identified in supervision or appraisal and as dictated by their need for continuous professional development and the individual's needs. Non-care staff will receive appropriate training to identify the potential dangers of oxygen in the establishment as it relates to their role. Outside professionals will also be involved in training related to specific equipment or procedures as required.

HOME OXYGEN TREATMENT

If a person has a medical condition that leads to a low oxygen level in a person's blood (hypoxia), He or she may feel [breathless](#) and tired, particularly after walking or coughing. A person may also have a build-up of fluid around a person's ankles ([oedema](#)) and blue lips.

Breathing air with a higher concentration of oxygen can help increase the amount of oxygen in a person's blood. This makes it easier to do activities that might otherwise be more difficult. It also helps reduce the symptoms mentioned above.

Oxygen therapy can help people with a range of health conditions that affect breathing or blood circulation, including:

-  [chronic obstructive pulmonary disease](#) (COPD) - a long-term disease of the lungs
-  severe long-term [asthma](#)
-  [cystic fibrosis](#) - an inherited disease that causes the lungs to become clogged with thick, sticky mucus
-  [pulmonary hypertension](#) - high pressure inside the arteries to the lungs, which causes damage to the right-hand side of the heart
-  [obstructive sleep apnoea](#) - a condition that causes interrupted breathing during sleep
-  diseases of the nerves and muscles or ribcage
-  [heart failure](#) - when the heart struggles to pump enough blood around the body

People who have oxygen therapy have different requirements. Some people only need oxygen therapy for short periods during the day, when they're walking about (ambulatory oxygen). Others need it for longer periods and during the night.

GETTING ASSESSED FOR OXYGEN TREATMENT

If an individual has a long-term medical condition and his or hers doctor thinks oxygen treatment might be helpful, the person will be asked to go for an assessment. This involves taking a blood sample, usually from a person's earlobe or wrist, and measuring the amount of oxygen in it. If the amount of oxygen in a person's blood is low, regular oxygen therapy might be recommended.

If a person decides to have oxygen therapy at home, a healthcare professional at the oxygen clinic will work out with the individual how much oxygen is needed and how long will be needed it for. They'll also discuss the different ways in which a person can get oxygen at home (see below).

The person will need to fill in a consent form to get home oxygen treatment. This is because, in order to provide a person with the equipment and oxygen in his or her home, the oxygen clinic will need to share some information about a person's requirements with other organisations in the NHS. They will also need permission to send an engineer to the individual's home to install the equipment and explain how to use it, deliver new supplies of oxygen and check the equipment every so often.

Once a person has agreed this with the oxygen clinic, they will fill in a home oxygen order form. This is a bit like a prescription that goes to the company delivering the person's oxygen and equipment. The equipment will be brought to his or her home, installed and explained fully by one of the oxygen company's engineers.

DIFFERENT TYPES OF HOME OXYGEN

Oxygen can be obtained from:

- compressed oxygen cylinders
- liquid oxygen in cylinders
- an oxygen concentrator machine, which extracts oxygen from the air

OXYGEN CYLINDERS

If oxygen is needed for short periods to relieve attacks of breathlessness after an illness, it will probably be prescribed oxygen cylinders. However, this should be reviewed after a certain time so that the short-term relief does not hide more serious underlying heart or lung conditions.

The oxygen comes through a mask or through soft tubes in positioned in the nose, called nasal cannulae. That does not obstruct talking, eating and drinking while using cannulae.

Cylinders containing oxygen compressed into liquid form can contain more oxygen than standard cylinders. This type of oxygen supply will last for longer, and the tank may also be lighter.

OXYGEN CONCENTRATOR MACHINE

An oxygen concentrator machine is convenient and beneficial when having oxygen for a large number of hours a day, including sleeping. It ensures a source of oxygen that never runs out.

An oxygen concentrator is a machine, about two-and-a-half feet (75cm) high, which plugs into an electrical socket. It filters oxygen from the air in the room and delivers it through plastic tubing to a mask or nasal cannulae.

Long tubing can be fixed around the floor or skirting board of your house, with two points where it can be "plug in" to the oxygen supply.

When the machine is installed, the engineer or nurse will discuss the length of tubing needed. The machine is very quiet and compact, and the engineer will explain how to use it and will answer any questions. A back-up cylinder of oxygen is also provided in case the machine breaks down. Regular maintenance visits will be made to make sure the concentrator is always working properly.

PORTABLE (AMBULATORY) OXYGEN

If a small portable cylinder to take oxygen outside the home is needed, it should be discussed with the specialist. A full assessment will be required to see whether portable oxygen (also known as ambulatory oxygen therapy) is likely to be helpful. Portable oxygen is not recommended in case of [heart failure](#) or if the person is a smoker.

Portable cylinders can provide oxygen at a rate of 2 litres or 4 litres a minute, or have an adjustable scale up to 4 litres a minute. The flow required is determined by a lung specialist or the oxygen service healthcare professional. When full, these cylinders weigh just over five pounds (2.3kg) and hold just under two hours of oxygen (at 2 litres a minute).

SUPPLIERS OF OXYGEN SERVICES

There are three companies in England that provide home oxygen services for the NHS. Each covers a certain geographical area. All these companies hold contracts with the NHS.



'[Air Liquide](#)' South London, south east and south central England. Call them on **0500 823 773** (freephone number).

GOING ON HOLIDAY

If you are going on holiday in England or Wales, you can make arrangements to have home oxygen supplied to you at your destination. Before you arrange your holiday, check with your doctor that you are well enough to travel.

BASIC INSTRUCTIONS

- ✘ Candles, lanterns, fires, cookers or cigarettes should not be lit while oxygen is used There is a serious risk of fire or burns.
- ✘ The setting of the oxygen should not be changed without talking to the doctor / nurse or member of the Oxygen Team first. Turning the flow rate up or down could put person's life in danger.
- ✘ Alcohol should not be drunk or drugs taken that relax, such as sleeping pills, sedatives or recreational drugs, while using oxygen. They can cause slow breathing.
- ✘ It should be kept track of how much oxygen is in the cylinder / tank (in case it is not an oxygen concentrator – a machine that plugs into an electric socket), and should be ordered in advance
- ✘ GP should be called if there is a feeling of increased shortness of breath, restless or confusion, early morning headaches, tiredness.

IF NASAL CANNULAE (PRONGS) IS USED:

- 👉 Nasal prongs should be washed with soap and water once or twice a week. The manufacturer's instructions on caring for equipment should be followed.
- 👉 The prongs should be replaced every two to four weeks. If the person has a cold or the flu, should change them when your symptoms pass. The home oxygen supplier can provide this.
- 👉 A water-based moisturiser (such as KY Jelly or similar) should be used on lips and in nose to prevent drying and cracking. Labels should be read, and it should be looked for a product that lists water as the first ingredient
- 👉 A piece of gauze should be put under the tubing to keep the skin behind the ears from getting sore.

- ✘ Petroleum-based products (such as Vaseline petroleum jelly) should not be used as these can plug the air holes and are also a fire hazard and can potentially cause chemical burns.

IS IT SAFE TO USE OXYGEN?

YES. However, it must be used it safely. Oxygen is a fire hazard. Safety measures should be followed.

- ✘ No smoking while the oxygen is being used. No smoking signs should be displayed and visitors should not be allowed to smoke while the oxygen is being used.
- ✘ Not to be used flammable products, such as cleaning fluid, paint thinner, petroleum based creams or aerosols, while the oxygen is used.
- 👉 Oxygen should be kept at least six feet (two metres) away from flames or heat sources such as gas cookers, paraffin or gas heaters, candles, cigarettes, cigars and fireplaces.
- 👉 A fire extinguisher should be kept at home within easy reach.
- 👉 Oxygen cylinders should be kept upright. It should be ensured that they do not fall over and get damaged, especially when travelling in a vehicle. A transport box should be requested from the supplier.
- 👉 Ensure there are smoke / fire alarms within the home that are in working order.
- 👉 If it is portable (ambulatory) oxygen, an oxygen sticker should be displayed on the car (available from the Fire Service) in case of an accident.

CAN A PERSON BECOME DEPENDENT ON OXYGEN?

NO. Oxygen has been prescribed as the blood oxygen levels are low. It will be advised on how many hours per day oxygen should be used.

WOULD THE TREATMENT WITH OXYGEN CONTINUE FOREVER?

Every person is different and it is impossible to tell if a person will always need oxygen therapy. Blood tests look at the amount of oxygen the blood. This determines if more or less oxygen is needed, or if it can be stopped and removed from the home.

CAN A PERSON HAVE TOO MUCH OXYGEN?

YES. It is important have oxygen review with the GP / Nurse.

Oxygen is a prescribed drug that all patients must be carefully assessed for. It is not true that oxygen can cause no harm. Only a small number of people who have been assessed will need oxygen prescribing and benefit from it. People who take oxygen when they do not have low oxygen levels in their blood may get several short and long term harmful effects such as loss of independence, muscle wasting and an increase of carbon dioxide levels in the bloodstream, and as the breathing may become poor this may become life threatening.

If oxygen was provided to be taken home when a patient was poorly in hospital, there is a need for an assessment again. Oxygen may be taken unnecessarily and there is risk of harmful side effects.

⚠ DANGER



Oxygen
in use



No
smoking



No open
flames



OXYGEN: CAUTION WHEN USE



- a) **Open the valve slowly**
- b) **Close regulator outlet valve before opening the oxygen cylinder valve**
- c) **When not in use: close the cylinder valve**



Rapid opening, particularly of cylinder valves, can result in brief, high oxygen speeds, causing frictional heat, particularly if any dirt or dust is present. Alternatively, if the system has a dead end, such as where a pressure regulator is connected to an oxygen cylinder, heat can be generated through oxygen. Both cases can result in a fire;



make sure that the regulator outlet valve is closed before opening the oxygen cylinder valve, particularly when opening the cylinder valve for the first time after changing cylinders;



make sure that cylinder valves are closed and piped supplies isolated whenever work is stopped. Do not try to cut off the supply of oxygen by nipping or kinking flexible hose when changing equipment, eg blowpipes;



or



Cleanliness



keep oxygen equipment clean. Contamination by dust, sand, oils, greases or general atmospheric debris is a potential fire hazard. Portable equipment is particularly susceptible to contamination, and precautions should be taken to keep it clean;



use clean hands or gloves when assembling oxygen equipment, eg attaching the pressure regulator, making connections;



wear suitable clean clothing, free from oil and easily combustible contaminants.



Soap or liquids that may contain grease should not be used.



Don't use oil or grease to lubricate oxygen equipment.