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Guidance on oxygen use in prisons providing enhanced primary care and end-of-life services during the COVID-19 pandemic

December 2020, Version 1

Annex A: Oxygen equipment

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The following equipment is required to deliver oxygen therapy to the patient:

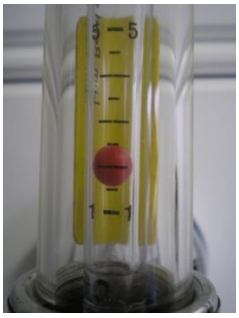
1. Oxygen source
2. Flow meter and oxygen tubing
3. Oxygen delivery devices
4. Pulse oximeter for saturation monitoring.

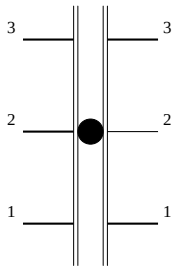
1. Oxygen source

It is expected that prisons supporting enhanced primary care and end of life (EOL) will have access to cylinder oxygen therapy.

2. Flow meter and oxygen tubing

Oxygen cylinders have pressure and flow regulators to allow the flow and pressure of oxygen to be matched to the patient's needs and mask being used. Most oxygen flow meters use a floating ball to indicate the flow rate. The centre of this ball should align with the appropriate flow rate marking – the images below show the correct setting to delivery 2 L/min. The oxygen tubing will be connected to the nozzle of the flow meter.

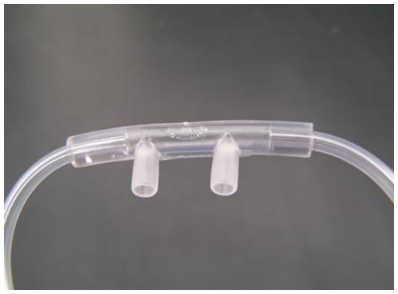




3. Oxygen delivery devices

Nasal cannula – uncontrolled oxygen therapy

Use water-based emollient (eg aquagel, aqueous cream) to treat dry skin secondary to oxygen therapy (do not use paraffin-based products). Regularly check pressure areas behind the ears.



- Position tips of cannula in patient's nose so they do not extend >1.5cm into nose.
- Place tubing over the ears and under chin.
- Adjust flow rate – usually 2–4 L/min.

- Preferred by most patients.
- Do not interfere with feeding or coughing/sneezing.
- If nose is blocked, use simple face mask.
- Cannot predict % oxygen (FiO_2) patient receives according to litres delivered via cannula.

Venturi mask and valve – controlled oxygen therapy

Use water-based emollient (eg aquagel, aqueous cream) to treat dry skin secondary to oxygen therapy.

- Connect mask to appropriate Venturi barrel.
- Fasten oxygen tubing securely.
- Assess patient's condition and equipment at regular intervals according to care plan.
- Adjust flow rate (minimum flow rate is indicated on the mask/packet).
- Flow should be doubled if patient has respiratory rate >30/min.

- Delivers a specified oxygen concentration regardless of breathing rate or tidal volume.
- Available in different colours for % concentration delivered:
  - blue = 24%
  - white = 28%
  - yellow = 35%
  - red = 40%
  - green = 60%.

24% blue and **28% white** Venturi masks are sufficient to meet the needs of patients requiring oxygen therapy in the community hospital setting.

Simple face mask – uncontrolled oxygen therapy

Not to be used for CO_2 retaining patients.

Use water-based emollient (eg aquagel, aqueous cream) to treat dry skin secondary to oxygen therapy.

- Gently place mask over patient's face, position strap behind head or loops over the ears, then carefully pull both ends through front of mask until secure.
- Check strap is not across ears.
- If necessary insert padding between strap and head.
- Adjust oxygen flow rate – **must never be below 5 L/min.**

Simple face mask – variable percentage, delivers unpredictable concentrations that vary with flow rate. Maximum 50–60% at 15 L/min.

Oxygen concentration delivered by the simple face mask is influenced by:

- flow rate
- leakage between mask and face
- patient's tidal volume and breathing rate.

Nasal cannula should be used for most patients who require medium-dose oxygen, but a simple face mask may be used if the patient prefers this or their nose is blocked.

Reservoir mask (non-rebreathe mask) – uncontrolled oxygen therapy

Not to be used for CO_2 retaining patients, except in life-threatening emergencies.

Use water-based emollient (eg aquagel, aqueous cream) to treat dry skin secondary to oxygen therapy.

- Ensure the reservoir bag is inflated before placing mask on patient. This can be maintained by using 15 L/min of oxygen.
- Gently place mask over patient's face, position strap behind head or loops over the ears, then carefully pull both ends through front of mask until secure.
- Check strap is not across ears.
- If necessary insert padding between strap and head.

Oxygen flows directly into the mask during inspiration.

During exhalation, oxygen flows into and is stored in the reservoir bag, by means of a one-way valve. All exhaled air is vented through a port in the mask, and a one-way valve between the bag and mask, which prevents rebreathing (of exhaled air).

Never reduce the flow of oxygen below 15 L/min as a reduction in the flow of oxygen increases entrainment of room air, thus diluting the delivered oxygen concentration.

Bag valve mask

Used for patients who are not ventilating or are not ventilating sufficiently (tidal volume too low or rate too slow).

- The bag valve mask can be used in conjunction with an airway adjunct (Guedel) if required.
- Attach oxygen to bag valve mask at 15 L/min (the system will self-inflate with oxygen).
- Connect self-inflating bag to face mask and place mask over the patient's mouth and nose, ensuring an adequate seal. Open the airway with a head tilt chin lift or a jaw thrust.
- Gently squeeze the self-inflating bag until the chest wall is seen to rise (do not excessively compress the bag as this will force more gas into the stomach).

	• A two person technique is recommended, with one maintaining the airway and seal and the other gently compressing the bag. • The self-inflating bag can be attached to an I gel in an arrest.
• Oxygen flow needs to be set at 15 L/min to deliver 85% oxygen to the patient. • As the bag is squeezed, the oxygen is delivered to the patient's lungs. On release, the gas is diverted to the atmosphere via a one-way valve. • Care is needed when using this system to ensure the pressures generated do not cause aspiration of stomach contents.	
Tracheostomy mask (for patients with tracheostomy or laryngectomy) – uncontrolled oxygen therapy **Use cautiously at low flow rates in CO_2 retaining patients (there may be no alternative).** Use water-based emollient (eg aquagel, aqueous cream) to treat dry skin secondary to oxygen therapy.	
	• Gently place mask over 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. • For any prolonged period of oxygen treatment via a tracheostomy mask, consider humidification. As an alternative, saline nebules may be considered.
Tracheostomy mask (variable percentage) delivers unpredictable concentrations that vary with flow rate. The oxygen concentration delivered will be influenced by: • oxygen flow rate (L/min) • patient's tidal volume and breathing rate.	

4. Pulse oximeter for saturation monitoring

A pulse oximeter passes specific wavelengths of light through the blood, usually via a finger, to measure the peripheral capillary oxygen saturation (SpO_2).

Sources of error

Staff should use devices as per manufacturer's instructions and be aware of the following sources of error.

- pulse oximetry cannot differentiate between different forms of haemoglobin
- pulse detection due to movement, rigors or shivering, poor circulation, vasoconstriction, atrial fibrillation, arterial constriction, shock, cardiac arrest or hypothermia
- barriers or obstruction to light transmission due to nail varnish, dirt, foreign objects, bright or fluorescent room lighting, infrared heat lamps or intravascular dyes used in imaging.

Using a pulse oximeter

Only staff trained in pulse oximeter use, interpretation and limitations should use them.

Resting readings should be taken for at least five minutes. Leaving the oximeter on a single digit for a protracted time may cause pressure damage to the patient's skin or nail bed, or the probe may burn them. If the patient requires continuous monitoring, reposition the probe at least four hourly, or more frequently if specified in the manufacturer's instructions.

- Explain the use of the pulse oximeter to the patient and obtain consent.
- Ensure the patient is comfortable and warm enough. If the patient has cold hands, warm the extremity.
- Wash and dry patient's hands and remove any nail polish.
- Ensure probe and equipment are clean and in good working order.
- Select a suitable area for the probe (usually a finger).
- Place probe as directed by manufacturer's instructions. If a finger probe is used, the hand should rest on the chest at the level of the heart (to minimise movement errors from holding the finger in the air – as patients commonly do).
- Switch the pulse oximeter on.
- Make sure the probe sensor is detecting the pulse (usually indicated by a bleep in time with each detected pulse or a graphical indication of the pulse on a display panel), and that it corresponds to the patient's pulse.

- Take the oxygen saturation reading and record it on the observation chart.
- Report any abnormal reading or observation to the medical team.
- Once oxygen saturation monitoring is completed, follow manufacturer's instructions and local protocol to decontaminate and clean equipment, and return it to storage as appropriate.