Auditing the non-emergency use of a fan or oxygen to relieve breathlessness at rest: Background form

Background

Breathlessness is a common and distressing symptom that can be difficult to treat. Oxygen and electric fans are reported to be helpful, but how and when they are used can vary even within the same unit. A previous audit at Hayward House revealed such variation in practice with oxygen sometimes being used ineffectively. Oxygen has risks as well as benefits. To maximise the benefits and minimise the risks, it requires accurate assessment, prescription, evaluation and titration.

This audit is based on what evidence there is available to allow a standardised approach to be evaluated.

Which patients may benefit from oxygen?

The likelihood of benefit is greatest for severely hypoxic patients (SaO₂ <90%).

Which patients may benefit from an electric fan?

In mildly hypoxic patients (SaO₂ 90–94%), as the benefit of oxygen is less predictable, we will encourage the use of an electric fan before offering oxygen.

Methods 1: Using oxygen

- To gain maximum benefit, the oxygen should be titrated to keep the SaO₂ ≥90%. To minimise the risks, oxygen should be avoided where simpler techniques such as an electric fan would be equally or more effective
- oxygen may be delivered in a variety of ways:

Source	% oxygen	Can be effectively humidified	Comments
Piped	100%	Yes	Rare in hospices
Cylinders	100%	Yes	Quiet (except when humidified) but cumbersome and require frequent changes at higher flow rates
Oxygen concentrators	Flow rate dependent: 1–3.5 L/min 95% 4 L/min 90% 5 L/min 80%	No	Noisy but more convenient for hospice and home settings. Higher flow rates can be obtained by using a 'Y' connector to join two concentrators. Output becomes less accurate at higher flow rates

Hayward House will generally use oxygen concentrators. At lower flow rates (2–4L/min), one oxygen concentrator and nasal cannulae will be used. For higher flow rates (6–8L/min), two oxygen concentrators will be joined using a 'Y' connector along with a Lifecare 2000 *medium concentration* face mask (Table 1, Figures 1 and 2)

Desired oxygen concentration	Oxygen source	Flow rate	Delivery device
28% ^a	Concentrator	2L/min	Nasal cannulae
36% ^a	Concentrator	4L/min	
50% ^b	2 concentrators joined with a 'Y' connector, each set at 3L/min ^c	6L/min	Lifecare 2000 medium concentration face mask ^d
70% ^b	2 concentrators joined with a 'Y' connector, each set at 4L/min ^c	8L/min	

Table 1 Use of oxygen concentrators to deliver a range of oxygenconcentrations

a. manufacturer's data

- b. Hayward House data using two Devilbiss 4L oxygen concentrators. Approximate concentration of oxygen inside the mask determined by Fisher-Packel oxygen analyser with a healthy volunteer breathing at a resting tidal volume and respiratory rate
- c. If insufficient concentrators are available, oxygen concentrations of 50 and 70% can be obtained by using cylinders with a flow rate of 6 and 8L/min respectively and a Lifecare 2000 medium concentration face mask
- d. higher oxygen concentrations were not seen with a high concentration face mask.
- since the source, flow rate and delivery device all effect the amount of oxygen delivered, they should all be specified on the prescription
- the desired oxygen concentration is a guide only. What the patient actually receives will vary with tidal volume and respiratory rate.

Methods 2: Humidification (Table 2)

- Generally, patients on longterm oxygen therapy using nasal cannulae or a face mask will adequately humidify the oxygen as it passes through their nose and mouth
- some patients however, may benefit from humidified oxygen when there are specific problems such as nasal crusting or viscid sputum
- 'bubble-through' humidifiers are not effective connected via small-bore tubing. A Kendall Respiflo MN 'cold nebuliser' with a Respiflo 21000 water for inhalation reservoir using wide-bore 'elephant tubing' (no longer than 1.2m) is recommended (Figure 3). This requires a driving pressure that can only be achieved from piped or cylinder oxygen.

Table 2 Use of oxygen cylinders and a Kendall Respiflo MN cold nebuliser

Oxygen concentration setting on cold nebuliser	Oxygen concentration delivered ^a	Oxygen cylinder flow rate	Delivery device
28%	30%	5L/min	A converted Lifecare 2000 medium concentration face mask: ^b
35%	33%	8L/min	 remove the swivel connector to allow the elephant tubing to
40%	40%	8L/min	 attach remove the plastic discs to enlarge the holes in
60%	56%	8L/min	the side of the mask.
80%	65%	8L/min	
98%	75%	8L/min	

a. Hayward House data using an oxygen cylinder. Approximate concentration of oxygen inside the mask determined by Fisher-Packel oxygen analyser with a healthy volunteer breathing at a resting tidal volume and respiratory rate

b. higher oxygen concentrations were not seen with a high concentration face mask.

Methods 3: Pulse oximetry

- There is considerable variation between machines. For consistency only use the handheld yellow ('TuffSat') oximeter
- apply the probe to the index finger as indicated by the picture of the finger on the probe. Ensure the light of the probe is at the base of the fingernail and that there is a good signal. Nail varnish affects the reading and should be removed
- allow sufficient time for the reading to stabilise. This may take up to 15 minutes
- carbon monoxide (CO) levels are also 'read' by pulse oximeters. Smokers have elevated levels of CO (typically 5–10%) and hence could be hypoxic despite normal SaO₂ readings. This may only be important if the patient has smoked that day. The levels of CO return to normal (<2%) approximately 24h after cessation of smoking.

Methods 4: CO₂ retention ('narcosis')

- In patients with carbon dioxide (CO₂) retention who depend upon hypoxia for their respiratory drive, oxygen therapy can result in ventilatory depression
- this is associated with increasing drowsiness (CO₂ 'narcosis') and other symptoms/signs, e.g. headache, peripheral vasodilatation (warm extremities, bounding pulse), sweating, muscle twitching and flapping tremor
- if suspected clinically, do not exceed an oxygen concentration of 28% and consider blood gas measurements to guide oxygen therapy.

Figure 1 The 'Y' connector

Figure 2 How to join two oxygen concentrators using a 'Y' connector





Figure 3 Kendall Respiflo MN 'cold nebuliser' with a Respiflo 21000 water for inhalation reservoir



Summary of oxygen audit

