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:

<table>
<thead>
<tr>
<th>Source</th>
<th>% oxygen</th>
<th>Can be effectively humidified</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped</td>
<td>100%</td>
<td>Yes</td>
<td>Rare in hospices</td>
</tr>
<tr>
<td>Cylinders</td>
<td>100%</td>
<td>Yes</td>
<td>Quiet (except when humidified) but cumbersome and require frequent changes at higher flow rates</td>
</tr>
<tr>
<td>Oxygen concentrators</td>
<td>Flow rate dependent:</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>1–3.5 L/min</td>
<td>95%</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>4 L/min</td>
<td>90%</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5 L/min</td>
<td>80%</td>
<td>No</td>
</tr>
</tbody>
</table>

Hayward House Oxygen Audit Background Form  
September 2004 version 1.0  
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• Hayward House will generally use oxygen concentrators. At lower flow rates (2–4 L/min), one oxygen concentrator and nasal cannulae will be used. For higher flow rates (6–8 L/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).

**Table 1 Use of oxygen concentrators to deliver a range of oxygen concentrations**

<table>
<thead>
<tr>
<th>Desired oxygen concentration</th>
<th>Oxygen source</th>
<th>Flow rate</th>
<th>Delivery device</th>
</tr>
</thead>
<tbody>
<tr>
<td>28%&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Concentrator</td>
<td>2 L/min</td>
<td>Nasal cannulae</td>
</tr>
<tr>
<td>36%&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Concentrator</td>
<td>4 L/min</td>
<td></td>
</tr>
<tr>
<td>50%&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2 concentrators joined with a ‘Y’ connector, each set at 3 L/min&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6 L/min</td>
<td>Lifecare 2000 medium concentration face mask&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>70%&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2 concentrators joined with a ‘Y’ connector, each set at 4 L/min&lt;sup&gt;c&lt;/sup&gt;</td>
<td>8 L/min</td>
<td></td>
</tr>
</tbody>
</table>

a. manufacturer’s data
b. Hayward House data using two Devilbiss 4 L 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 8 L/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 1.2 m) 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**

<table>
<thead>
<tr>
<th>Oxygen concentration setting on cold nebuliser</th>
<th>Oxygen concentration delivered&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Oxygen cylinder flow rate</th>
<th>Delivery device</th>
</tr>
</thead>
<tbody>
<tr>
<td>28%</td>
<td>30%</td>
<td>5L/min</td>
<td>A converted Lifecare 2000 medium concentration face mask:&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>35%</td>
<td>33%</td>
<td>8L/min</td>
<td>• remove the swivel connector to allow the elephant tubing to attach</td>
</tr>
<tr>
<td>40%</td>
<td>40%</td>
<td>8L/min</td>
<td>• remove the plastic discs to enlarge the holes in the side of the mask.</td>
</tr>
<tr>
<td>60%</td>
<td>56%</td>
<td>8L/min</td>
<td></td>
</tr>
<tr>
<td>80%</td>
<td>65%</td>
<td>8L/min</td>
<td></td>
</tr>
<tr>
<td>98%</td>
<td>75%</td>
<td>8L/min</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> 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

<sup>b</sup> 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 \( \text{SaO}_2 \) 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: CO\(_2\) retention (‘narcosis’)**
- In patients with carbon dioxide (CO\(_2\)) retention who depend upon hypoxia for their respiratory drive, oxygen therapy can result in ventilatory depression
- this is associated with increasing drowsiness (CO\(_2\) ‘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

All Hayward House inpatients with breathlessness of gradual onset

Is oxygen audit appropriate?
Non-emergency oxygen use (i.e. for breathlessness of gradual onset) in a patient able to communicate their symptoms

yes

Commence oxygen audit

Get audit form (kept in oxygen audit folder) and follow directions on form

Additional information on using oxygen is also kept in the audit folder

Please return audit form to ‘completed forms’ section of audit folder

If patient is to remain on oxygen and is likely to go home allow time to arrange home oxygen (the ward SHO would usually liaise with the patients GP)

no

Audit inappropriate:
Sudden onset of breathlessness and/or Delirium or depressed level of consciousness

Finish