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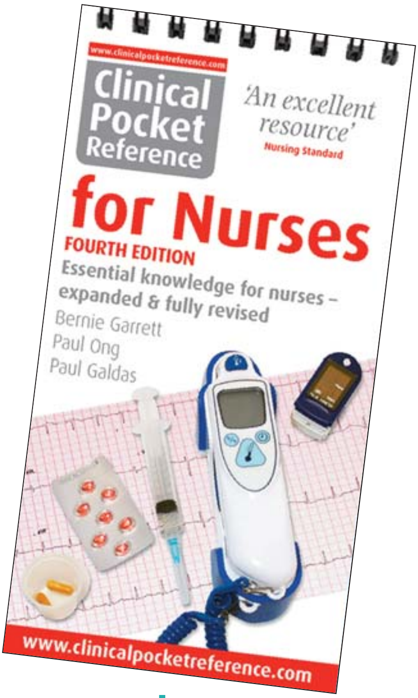

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SMARTPHONE VERSION

Handwashing technique

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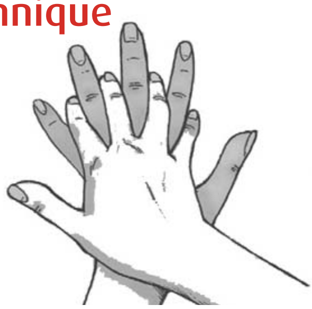
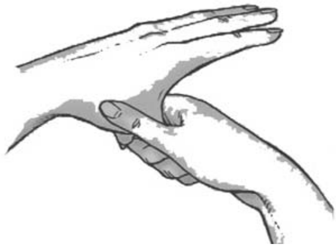
1 Palm to palm



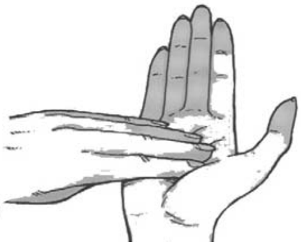
2 Right palm over left dorsum and left palm over right dorsum

3 Palm to palm, fingers interlaced

4 Backs of fingers to opposing palms with fingers interlocked



5 Rotational rubbing of left thumb clasped in right palm and vice versa



6 Rotational rubbing, backwards and forwards with clasped fingers of left hand in right palm and vice versa

Do not forget to include wrists, and dry well using paper towels

Source: Royal College of Nursing

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1.2 Respiratory assessment

Peak expiratory flow

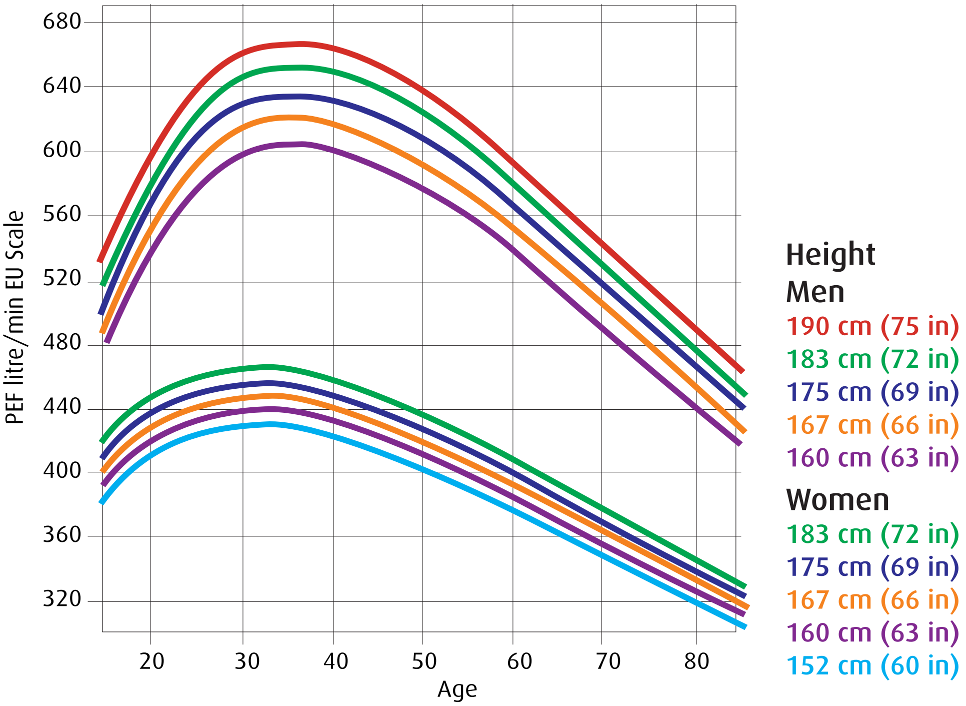
Peak expiratory flow (**PEF**) readings provide an objective measure of lung function. A PEF regimen should be closely adhered to as trends can be more important than isolated results (unless the isolated results reflect an exacerbation due to an acute event).

Procedure: Using a Wright peak flow meter

1. Ask the patient to stand or sit upright in the position in which they usually do their PEF measurements. They should be advised not to flex their neck.
2. Push the needle on the peak flow meter gauge down to zero.
3. Ask the patient to hold the peak flow meter horizontally, ensuring their fingers do not impede the gauge.
4. Ask the patient to take a full inspiration to their total lung capacity through their mouth.
5. Ask the patient to immediately place their lips tightly around the mouthpiece. The inspiration should be held for no longer than 2 sec at total lung capacity.
6. Ask the patient to blow out down the meter in a short sharp 'huff' as forcefully as they can.
7. Ask the patient to repeat the process a further two times and record the maximum measurement achieved.

Peak expiratory flow rate – normal values

For use with EU/EN 13826 scale PEF meters only



Source: www.peakflow.com/top_nav/normal_values

Respiratory examination

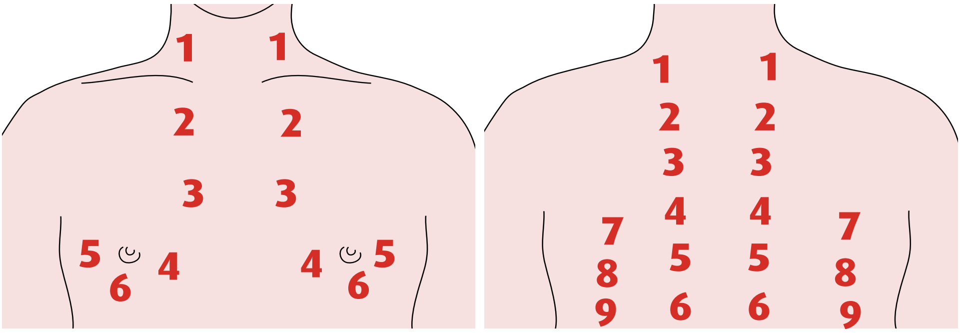
History
- onset and duration of symptoms (cough/shortness of breath)
- triggers (dust/aerosol/pollen).

Inspection/observation
- overall appearance of the patient (alert, orientated, active/hyperactive/drowsy, irritable)
- colour (centrally and peripherally): pink, flushed, pale, mottled, cyanosed, clubbing
- respiratory rate, rhythm and depth (shallow, normal, deep)
- respiratory effort (work of breathing, WOB): mild, moderate, severe, inspiratory:expiratory ratio, shortness of breath
- use of accessory muscles (UOAM): intercostal/subcostal/suprasternal/supraclavicular/substernal retractions, head bob, nasal flaring
- symmetry and shape of chest
- tracheal position, tracheal tug
- audible sounds: vocalization, wheeze, stridor, grunt, cough (productive/paroxysmal)
- monitor for O_2 saturation.

Auscultation
- listen for absence/equality of breath sounds
- auscultate lung fields with the diaphragm of the stethoscope in a pattern as shown in the figure below for bilateral adventitious noises (e.g. wheeze, crackles, etc.).

Palpation
- bilateral symmetry of chest expansion
- skin condition – temperature, turgor and moisture
- capillary refill (central/peripheral)
- fremitus (tactile)
- subcutaneous emphysema.

Anatomical sites for lung auscultation



Sources/bibliography: Meredith T, Massey D (2011) Respiratory assessment 2: More key skills to improve care, *Br J Cardiac Nurs,* **6**(2):63–8; Dougherty L, Lister S (eds) (2011) *The Royal Marsden Hospital Manual of Clinical Nursing Procedures,* 8th edn, Oxford: Wiley-Blackwell.

Airway suctioning

Suctioning aims to remove pulmonary secretions to maintain a patent airway and thus promote effective ventilation and oxygenation.

Routes for suctioning

- oral – to remove secretions from the mouth, usually performed using a Yankauer suction catheter
- oropharyngeal – requires insertion of a suction catheter through the mouth and pharynx into the trachea; if the patient is unable to maintain an open airway, an airway adjunct may be indicated
- nasopharyngeal – airway adjuncts may be used if patient is unable to tolerate suction; they may also be used on patients who are conscious, but are unable to cough adequately following surgery
- tracheal – usually occurs through a tracheostomy tube to ensure patency of the airway
- endotracheal – can be performed through an endotracheal or tracheostomy tube.

Considerations

- Care should be taken to avoid trauma to the mucosa, particularly with patients with clotting disorders.
- If tracheal secretions are tenacious, 0.9% sterile sodium chloride nebulizers or other mucolytic agents such as nebulized acetylcysteine can be used two-hourly or more frequently (as prescribed).
- If patient is oxygen dependent, hyperoxygenate for a period of 3 min, and reapply oxygen immediately after suctioning.
- Do not suction patients with a tracheostomy for more than 10 sec. No more than three suction passes should be made during any one suction episode.
- Ensure suction pressure is set to the appropriate level (use lowest pressure needed to remove secretions, usually ≤100–120 mmHg, 13–16 kPa). Suction should never be applied during insertion of a suction catheter.
- Use the correct size suction catheter. The following formula can be used: Suction catheter size (French gauge, Fg, or Charrière, ch) = 2 × (size of tracheostomy tube – 2).

  For example: 8.00 mm internal diameter tube: 2 × (8–2) = 12 Fg
- Infection can occur during suctioning technique. Use an aseptic technique throughout tracheal suctioning.

Sources/bibliography: Dougherty L, Lister S (eds) (2015) *The Royal Marsden Hospital Manual of Clinical Nursing Procedures*, 9th edn, Oxford: Wiley-Blackwell; Myatt R. (2017) Measuring peak expiratory flow rate: What the nurse needs to know, *Nurs Stand*, **31**(20):40–4.

1.3 Oxygen administration

Oxygen is a treatment for hypoxaemia. As it is a drug, it should be administered as prescribed. ***If misused, O_2 can be fatal.***

Types of oxygen deficiency

Type I respiratory failure: hypoxaemic with low or normal carbon dioxide (CO_2) level in arterial blood.

Type II respiratory failure: ventilatory failure with hypercapnia due to alveolar hypoventilation (hypoxaemia may also be present).

Hypoxia: lack of adequate O_2 in inspired air.

Anoxia: tissues almost completely without O_2.

Oxygen delivery

Humidification: when O_2 is delivered at a flow rate above 4 l/min for >6 hr, humidification is needed. The higher the O_2 concentration given, the less humidity there is in inspired air. Use humidification devices to reduce risks of drying/cracking of mucosal membranes, thickening mucosal secretions and general patient discomfort.

Type	Description	Comment
Low-flow devices (simple or variable-performance masks) • Deliver oxygen concentrations of 40–60%. • Concentration of O_2 delivered varies depending upon flow of oxygen and upon breathing rate and depth, because each breath is diluted by air drawn in from the atmosphere. • The concentration can be changed by increasing or decreasing the oxygen flow between 5 and 10 l/min.	If the patient's inspiratory flow rate (speed at which gas is drawn into the lungs) exceeds the flow of O_2, air will be drawn from the atmosphere via the holes in the mask. The patient's breathing rate and depth varies so the concentration of O_2 inspired will vary.	• This mask is suitable for patients with type 1 respiratory failure (without hypercapnia) but **not** for hypercapnic (type 2) respiratory failure. • The mask may deliver >50% O_2 and is therefore not recommended for patients who require low-concentration O_2 therapy because of the risk of CO_2 retention. • Flows of <5 l/min can cause increased resistance to breathing, possible build-up of CO_2 within the mask and rebreathing. • Patients using a simple face mask may have an inspiratory flow rate greater than the mask's gas flow rate, so the simple face mask should not be used at flow rates <5 l/min.
Nasal devices (e.g. nasal cannulae/ prongs) • These are low-flow devices (see above).	• Oxygen flow rate of 1–6 l/min gives FiO_2 ~24–50%. However, the wide variation in patients'	Nasal cannulae are better than simple face masks in most situations requiring medium-concentration oxygen therapy.

Type	Description	Comment
• Used to deliver oxygen at low and medium concentration. • Adjustable flow gives wide oxygen concentration range (flow rate of 1–6 l/min gives a fraction of inspired oxygen (FiO_2) from ~24% to ~50%), suitable for variable oxygen therapy and concentration titration.	breathing patterns means the same flow rate of nasal O_2 may have widely different effects on blood O_2 and CO_2 levels. • As there is marked individual variation in breathing pattern, the flow rate must be adjusted based on oximetry and, where necessary, blood gas measurements.	Advantages are: • more comfortable (a few patients dislike the flow of O_2 into the nose, especially >4 l/min) • no claustrophobic sensation • not taken off to eat or speak and less likely to fall off • less affected by movement of face • less inspiratory resistance • no risk of rebreathing CO_2.
Non-rebreather masks (high-concentration reservoir mask) These are low-flow or variable-flow devices (see above). O_2 can be delivered at 12–15 l/min and can provide an O_2 concentration of 80–90%. 'Preferred means for delivering high-concentration oxygen to critically ill patients until reliable pulse oximetry monitoring has been established' (BTS 2017).	• Differ from a simple face mask as they have one-way valves in the side ports and a reservoir bag attached. • One-way valve in side port prevents air being drawn into mask but enables exhaled CO_2 to leave (preventing rebreathing). • One-way valve between mask and reservoir bag prevents exhaled air entering the reservoir bag.	Before applying the non-rebreather mask the reservoir bag must be filled with O_2 as this then provides an O_2 reservoir available for the patient to breathe in.
High-flow devices Fixed-performance (Venturi) masks which are suitable for all patients needing a known concentration of oxygen. Venturi masks use the principle of jet-mixing (Bernoulli effect) to maintain O_2 concentration.	• As the O_2 from the outlet port is driven through the small jet hole, its velocity increases, pressure around it drops and atmospheric air is drawn in (Bernoulli effect). • The O_2 concentration is constant; if the flow	• Useful for accurately delivering low concentrations of O_2 (24–35%). • Used for patients who require a constant fixed concentration of O_2. • Recommended for patients with chronic obstructive pulmonary disease (COPD) (i.e. patients who retain CO_2)

Type	Description	Comment
They provide: • entire ventilatory requirements (40 l/min) so the inspired O_2 is not affected by breathing patterns • delivery of set percentages through a range of colour-coded valves • constant O_2 concentration regardless of flow rate or breathing patterns. The minimum suggested flow rate is written on each Venturi device. Available concentrations are: 24%, 28%, 31%, 35%, 40% and 60%.	rate is increased, the velocity at the jet also increases, so pressure drops further and more air is drawn in, maintaining the O_2 to air ratio. • With these masks, total gas flow can exceed the patient's peak inspiratory flow rate – thus this type of mask can be used where high concentrations of O_2 are needed.	and Type II respiratory failure, because these masks reduce the risk of CO_2 retention while improving hypoxaemia.

Measurement and monitoring

- **Pulse oximetry:** measures O_2 levels in blood (does not measure $PaCO_2$). When altering O_2 flow delivery, O_2 saturations should be monitored for 5 min to determine required response.
- **Blood gas analysis:** measures CO_2 levels, pH and O_2 levels.
- **Acid–base balance:** measures changes in pH caused by increasing/decreasing acid/alkaline ions.

Patients with acute breathlessness caused by asthma, heart failure, pneumonia, pulmonary embolism, pneumothorax or trauma require high-concentration O_2 therapy (40–60%), titrated to maintain O_2 saturation of 94–98%.

Patients with COPD may have reduced sensitivity to the circulating blood CO_2 level (main driver of respiration) and so administering high levels of O_2 will depress their respiratory drive as the need for O_2 is being met. However, in some instances, patients are more at risk from death by hypoxia (low O_2 levels) than from hypercapnia (high CO_2 levels in the blood). Therefore, if a patient is hypoxic, start O_2 therapy immediately and request immediate medical review. The medical team will investigate the cause of deterioration, request an arterial blood gas (ABG) test and implement titration of O_2 therapy. COPD patients generally require maintenance of O_2 saturations of 88–92%.

Nurses should remember that O_2 is a drug and should always be prescribed cautiously and tailored to individual patient needs.

As health professionals, we should avoid verbal orders whenever possible, and O_2 should be prescribed with written orders stating the proper dosage, flow rate and duration. However, in an emergency, if a patient requires oxygen therapy it should be given without delay, even if there is no prescription.

In ongoing therapy, consider the complications that can arise with prolonged use.

Sources/bibliography: British Thoracic Society (2017) *Guideline for Oxygen Use in Adults in Healthcare and Emergency Settings*, London: BTS: www.brit-thoracic.org.uk/quality-improvement/guidelines/emergency-oxygen/; McGloin S (2018) Oxygen Therapy, *BNF No 76*, London: British Medical Association, Royal Pharmaceutical Society; BMA, RPS (2008) Administration of oxygen therapy, *Nurs Stand,* **22**(21):46–8; Nippers I, Sutton A (2014) Oxygen therapy: Professional compliance with national guidelines, *Br J Nurs*, **23**(7):382–6; Resuscitation Council UK (2016) *Advanced Life Support*, 7th edn: www.resus.org.uk/publications/advanced-life-support-manual/; Woodrow P (2007) Caring for patients receiving oxygen therapy, *Nurs Older People*, **19**(1):31–5.