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Clinical practice guide for respiratory support in adults with COVID-19

This document provides a framework to guide clinicians in the delivery of respiratory supports to adult patients who have COVID-19 and are admitted to inpatient wards outside of intensive care. It is designed to inform local policies and procedures, which should be current and reviewed regularly.

When an adult patient has COVID-19 and cannot maintain adequate oxygen saturations (SpO_2), it is well recognised that the timely and effective use of respiratory supports plays a key role in reducing the length and severity of the course of COVID-19. It can also reduce the likelihood of admission to intensive care by up to 25%. Therefore, it is essential to develop the capability and capacity to provide these supports outside of intensive care to improve patient outcomes. In addition, this can prevent intensive care admissions which will support intensive care capacity during the current outbreak of the COVID-19 Delta variant of concern in NSW.

Intended audience and application

This guide is intended for use by clinicians in local health districts (LHDs) across NSW who are:

- working on inpatient wards outside of intensive care
- providing care to adult patients with COVID-19 who require respiratory support.

This information is not a substitute for healthcare providers' professional judgement. Specific information about the individual patient and consultation with other medical authorities must be considered as appropriate.

Background

There is now substantial evidence of the efficacy of stepwise escalation of respiratory supports for adult patients with COVID-19 who require ward-based care outside of intensive care. Timely delivery of the most appropriate respiratory support for a patient's condition can improve patient outcomes and support patient flow by reducing admissions to intensive care. The National COVID-19 Clinical Evidence Taskforce has made evidence-based recommendations for the use of respiratory supports for adults with COVID-19. This clinical practice guide is based on these recommendations as the best synthesis of current available peer-reviewed evidence.

To improve the applicability of this clinical practice guide within LHDs across NSW, verbal discussions with senior NSW Health respiratory physicians and nurses were conducted, summarised and themed. This has:

- contributed to an understanding of the various clinical environments where the recommended clinical practices within this guide would be delivered
- informed the recommendations in this guideline to support their delivery within the various inpatient ward environments where they may be used to guide care delivery within NSW Health.

Methodology

This guidance is based on current evidence and supported by the expert clinical consensus of a multidisciplinary team of senior clinicians from the ACI Respiratory Network. It was developed in consultation with senior clinicians from the Agency for Clinical Innovation's (ACI) Intensive Care NSW (ICNSW) COVID-19 Clinical Community of Practice.

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A stepped approach to respiratory support in adults with COVID-19

In all adults patients with COVID-19 admitted to an acute ward that require oxygen, discuss and document limits of therapy.

Determine target oxygen saturation (SpO_2) range:

- 92-96% in most patients
- 88-92% in patients at risk of hypercapnia (alter calling criteria)

Consider placing patient in the prone position as soon as possible.

If unable to maintain SpO_2 in target range commence O_2 via standard delivery device.

Consider the use of high flow nasal prong oxygen ($HFNPO_2$).

If unable to maintain SpO_2 with standard O_2 delivery device up to Fi02 0.4 commence continuous positive airway pressure (CPAP).

Discuss with intensive care unit (ICU).

If unable to maintain SpO_2 on CPAP at maximum FiO_2, consider appropriateness for non-invasive ventilation (NIV) in collaboration with ICU.

If intubation and mechanical ventilation is not required consider NIV.

NIV may be conducted in an appropriate ward setting or in the ICU.

If the patient is receving NIV on an acute inpatient ward and unable to maintain SpO_2 on NIV or their overall condition is deteriorating, escalate to intensive care to consider intubation and mechanical ventilation. If limits of therapy have been reached, prioritise patient comfort and follow local end of life pathway.

Delta variant of concern and respiratory supports

The Delta variant is a COVID-19 variant of concern (VOC) that poses issues for respiratory management as it is likely to be associated with more severe acute disease, particularly in a younger cohort of patients. It is predominantly transmitted through infected droplets and aerosols via the respiratory route, with the dominant mode of virus transmission through infected aerosols and droplets released while breathing and coughing.

> The addition of respiratory supports adds limited additional risk to the transmissibility of the Delta VOC in inpatient environments, if they are provided in alignment with the COVID-19 Infection Prevention and Control Manual. Further information on the respiratory supports outlined in this document in relation to aerosol generation can be found in Appendix 1.

Prone positioning

Prone positioning has been shown to improve ventilation and oxygenation in adult patients with COVID-19. Awake prone positioning of patients with hypoxaemic respiratory failure due to COVID-19 reduces the incidence of treatment failure and the need for intubation. It is a cost-effective, safe and comfortable intervention for most patients.

> Prone positioning should be initiated by the first clinician caring for an adult patient with COVID-19 who recognises oxygen desaturation.

The recommendations for prone positioning of adult patients with COVID-19 who require ward-based care outside of intensive care in NSW are:

- Prone positioning can be initiated as early as presentation to the emergency department. This will allow patient familiarisation and enhanced cooperation.
- Almost all patients can be placed in the prone position, though for some this is easier when assisted by healthcare staff or a dedicated proning team. There are very few contraindications to prone positioning.
- Patients who are obese or in the second and third trimester of pregnancy should be supported with the positioning of multiple pillows to assist with maintaining position.
- Aim for at least 3 hours of prone positioning per day. Each additional hour will add benefit and should be encouraged if tolerated. Evidence suggests that >8 hours is optimal.
- Proning can be done continuously, or in shorter stints as tolerated.
- Alternative lateral and semi-prone positions may be tried if the patient is unable to prone completely, or if this will promote comfort to encourage longer periods of proning.
- Respiratory supports should all continue in the prone position.
- Initial monitoring of vital signs should be every 15 minutes for the first 30 minutes. Thereafter monitoring should continue, as indicated by level of respiratory support and clinical condition, to monitor for signs of deterioration.
- Prone positioning should be continued until the patient is comfortable and maintaining SpO_2 within their target range with no respiratory distress.
- In an unwell patient, proning should be interrupted if there is evidence of increased work of breathing, worsening oxygenation with proning, hemodynamic instability or arrhythmias.
- Patient comfort should be incorporated into routine nursing care. This includes regular pressure area care, allowing for meal and toilet breaks and ensuring patients have their call bell within reach when in the prone position and can call for assistance if required.

Basic instructions for helping a patient into the prone position:

1. Explain the procedure to the patient and its benefits.
2. Calmly help the patient roll on to their side, and then on to their stomach.
3. Hugging the pillow as they roll will help to keep any monitoring equipment from becoming tangled or stuck during the manoeuvre.
4. Ensure respiratory supports and monitoring are still correctly in place.
5. Repositioning of pillows will be necessary for comfort. Additional pillows will be required to safely and comfortably position obese patients and women in their second and third trimester of pregnancy.
6. Place the call bell within the patient's reach.

Respiratory supports in adults with COVID-19

When caring for patients with COVID-19, clinicians need to determine an SpO_2 target range for if/when respiratory supports are required. The recommended target ranges are:

92-96% in most patients

88-92% in patients at risk of hypercapnia

Once the target range is set for patients, altered calling criteria should be considered as the suggested target ranges above are clinically appropriate for adults with COVID-19, but sit outside current NSW between the flags standard calling criteria. Respiratory supports can then be delivered to maintain SpO_2 within this target range.

All adult patients with COVID-19 requiring O_2 are at risk of further deterioration. At the time of admission and as required through their clinical journey, expectations and limits of therapy should be discussed and established. In addition, several evidence-based systemic therapeutics should be considered as per *Care of adults with COVID-19 in acute inpatient wards model of care for NSW Health clinicians*.

Standard oxygen delivery devices

Standard O_2 delivery devices deliver a fixed O_2 flow to patients requiring supplemental O_2. They do not provide any ventilatory assistance or additional positive end expiratory pressure (PEEP).

The recommendations for the use of standard O_2 delivery devices for adult patients with COVID-19 who require ward-based care outside of intensive care in NSW are:

- The use of O_2 via standard O_2 delivery devices should be considered for patients who cannot maintain SpO_2 within their target range on **room air**.
- Standard O_2 delivery devices that would be appropriate for use include standard nasal prongs and venturi masks.
- When using standard nasal prongs, deliver O_2 at 1-4L/min to achieve SpO_2 within the patient's target range.
- When using a venturi mask, select adapters ranging from 24-40% fraction of inspired O_2 (FiO_2) and deliver the recommended L/min of O_2 to achieve SpO_2 within the patient's target range.
- In patients with a high respiratory rate, the inspired O_2 concentration falls as more ambient air is entrained around standard O_2 delivery devices. This should be taken into consideration when selecting these devices to deliver O_2 therapy.
- The addition of standard O_2 therapy adds limited additional risk to the transmissibility of the Delta VOC of COVID-19 in inpatient environments. Further information in relation to standard O_2 therapy and risk of virus transmission can be found in Appendix 1.

High flow nasal prong oxygen

$HFNPO_2$ is an O_2 delivery system that delivers warm, moist gas at variable O_2 concentrations at high flow rates and generates a small amount of PEEP (provided the nasal cannula are well fitted and the patient's mouth is closed).

The recommendations for the use of $HFNPO_2$ for adult patients with COVID-19 who require ward-based care outside of intensive care in NSW are:

- The use of $HFNPO_2$ should be considered for patients who cannot maintain SpO_2 within their target range on **maximum levels of O_2 delivery via standard O_2 delivery devices**.
- Consider the use of HFO_2 in preference to conventional oxygen, if the patient requires oxygen >2L/min via nasal prongs or an FiO_2 by venturi mask >28%, with continuous use. [2,3]
- The predominant advantage of $HFNPO_2$ over standard O_2 delivery devices is humidification which preserves the airway epithelial integrity. Therefore, give **earlier consideration for the use of $HFNPO_2$**.
- $HFNPO_2$ should be delivered at 40L/min flow with FiO_2 at 21-40% to achieve SpO_2 within the patient's target range.
- FiO_2 can be judiciously increased above 40% with senior clinician oversight, but commencement of CPAP should not be delayed.
- $HFNPO_2$ only provides a **small** amount of PEEP (**no more than 2-4cmH_2O**). It is ***NOT*** an alternative to CPAP.
- Failure to maintain target SpO_2 on $HFNPO_2$ at 40L/min with 0.4 FiO_2 should be the trigger to commence CPAP.
- The addition of $HFNPO_2$ adds limited additional risk to the transmissibility of the Delta VOC of COVID-19 in inpatient environments. Further information in relation to $HFNPO_2$ and risk of virus transmission can be found in Appendix 1.

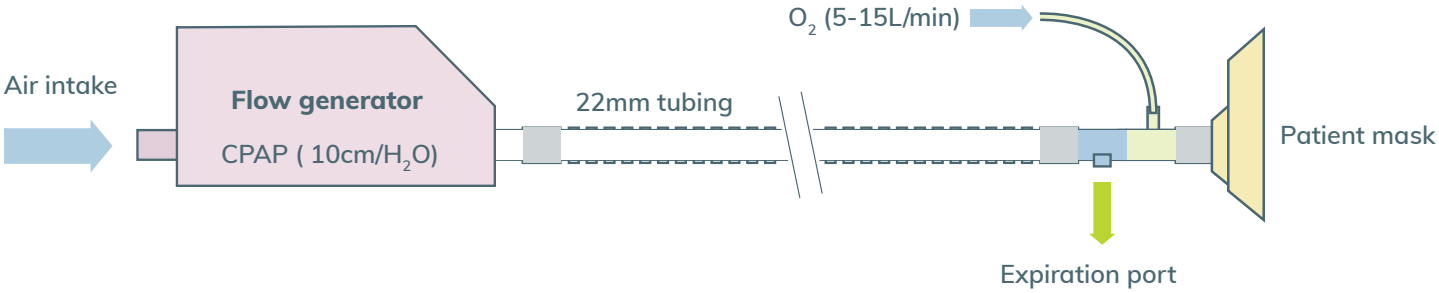
Continuous positive airway pressure

CPAP is the non-invasive application of PEEP (with or without entrained oxygen) using a mask rather than in conjunction with invasive techniques such as intubation.

The recommendations for the use of CPAP for adult patients with COVID-19 who require ward-based care outside of intensive care in NSW are:

- The use of CPAP should be considered for all patients who cannot maintain SpO_2 within their target range **despite an FiO_2 0.4 delivery via $HFNPO_2$ or conventional oxygen delivery**.
- A discussion should occur with intensive care when CPAP is commenced, as patients at this level of severity are at high risk of further acute deterioration.
- Begin using CPAP at 10cmH_2O (12cmH_2O in presence of obesity), plus entrained O_2 up at 10L/min to achieve SpO_2 within the patient's target range. Titrate O_2 to maintain SpO_2 in the targeted range (5-15L/min or FiO_2 of 0.4 to 0.6).
- If the patient's SpO_2 is unable to be maintained within their target range with this above CPAP configuration, increase the entrained O_2 up to 15L/min. If they are unable to maintain their target range SpO_2 at these settings or they develop clinical signs of hypercapnia or continue to have a high work of breathing, they are at high risk of further deterioration. Escalation to intensive care for consideration of intubation and mechanical ventilation must occur at this point. The application of BiPAP (bi-level positive pressure ventilation) may be an appropriate alternative if considered viable by a senior clinician caring for the patient.

- When setting up devices to deliver CPAP or NIV, the basic circuit configuration should look like this:



- The addition of CPAP adds limited additional risk to the transmissibility of the Delta VOC of COVID-19 in inpatient environments. Further information on the in relation to CPAP and risk of virus transmission can be found in Appendix 1.

Some special considerations around the use of CPAP are:

- CPAP will reduce the work of breathing during wakefulness. It does not provide pressure support and therefore does not increase minute ventilation. In patients with severe fatigue and severe ventilation/ perfusion mismatch, NIV may be more appropriate.
- In presence of COPD, morbid obesity, neuromuscular disease or severe chest wall deformity, consider commencing NIV rather than CPAP. More information on the use of NIV in these patients can be found in the Intensive Care NSW Non-invasive Ventilation Guidelines.

Non-invasive ventilation

Non-invasive ventilation (NIV) refers to the provision of ventilatory support through the patient's upper airway using a mask or similar device, so that invasive techniques such as intubation are not required. NIV can deliver a range of modes that provide additional respiratory support beyond CPAP. These modes can decrease carbon dioxide (CO_2) levels and reduce the work of breathing.

Provision of NIV should:

- be supervised by a senior clinician trained in managing acute respiratory failure and familiar with the devices in use (in most cases this will be a respiratory physician or intensivist)
- **only be delivered in acute inpatient wards that have experience in its use and policies and procedures in place to guide NIV delivery**
- **include ensuring that intensive care is aware of the patient and is ready to receive them if their condition deterio-rates.**

The recommendations for the use of NIV for adult patients with COVID-19 who require ward-based care outside of intensive care in NSW are:

- The use of NIV should be considered for patients who cannot maintain SpO_2 within their target range on **maximum levels of O_2 and PEEP via CPAP, in patients who develop hypercapnic respiratory failure, or in patients with an increased work of breathing who may be tiring despite CPAP therapy**.
- NIV is far less likely to be successful in the face of severe hypoxic respiratory failure with a PaO_2:FiO_2 <200mmHg.
- Patients receiving NIV need to be able to maintain an airway independently. They should have an adequate level of consciousness.
- NIV is not appropriate in patients with severe fatigue, patients with a Glasgow Coma Scale (GCS) <13, or in those patients who are haemodynamically unstable.
- NIV provides active pressure support during initial inspiratory positive airway pressure (IPAP) in addition to PEEP during expiratory positive airway pressure (EPAP). It is the most common NIV mode.
- Suggested starting settings for NIV are:
  - IPAP of 12-16cmH_2O and EPAP of 8-10cmH_2O (IPAP can be increased up to 20cmH_2O if required to support gas exchange and alleviate work of breathing).
- Ventilation mode should be set to spontaneous timed (S/T):
  - Back-up rate of 12-14 breaths per minute to ensure minute ventilation is maintained in the incidence of reduced ventilatory drive (i.e. if the patient is tiring or sleep deprived).
  - Inspiratory to expiratory ratio (I:E ratio) should be set to approximately 1:3. This will improve alveolar recruitment and should be adjusted according to the patient's level of comfort and respiratory rate.
- FiO_2 should be titrated to the target SpO_2 and delivered through the device, commencing at 0.4 and adjusted as needed.
- Note, the use of an in-line HME filter will typically reduce the delivered CPAP/NIV pressures by 1-2cmH_2O.
- There are other modes that can be delivered on various ventilators that may be used advantageously and judiciously (for example average volume assured pressure support (AVAPS) ventilation which provides for a range of IPAP and EPAP settings with a target assured volume to ensure adequate minute volumes, independent of lung and airway resistance). These should only be used by clinicians experienced in their use and in the detection and monitoring of unwell patients receiving NIV.
- The addition of NIV adds limited additional risk to the transmissibility of the Delta VOC of COVID-19 in inpatient environments. Further information in relation to NIV and risk of virus transmission can be found in Appendix 1.

Nursing care considerations for adults with COVID-19 receiving respiratory supports

There are special considerations for nursing staff caring for patients with COVID-19 who are receiving respiratory supports. The recommendations for this are:

- Continuous pulse oximetry monitoring is required for adults with COVID-19 receiving respiratory supports with $HFNPO_2$, CPAP and NIV. Non-invasive blood pressure monitoring should also be in place in addition to pulse oximetry for patients receiving NIV. Blood pressure measurements should be performed every 15 minutes for the initial hour of commencing CPAP or NIV.
- Consider a formal arterial blood gas (ABG) prior to commencing support and then daily or as clinically indicated. This will aid the assessment of deterioration in PaO_2:FiO_2 or the development of hypercapnia. A venous blood gas (VBG) could be considered if hypercapnia is suspected but cannot be used to assess the PaO_2:FiO_2.
- When using respiratory supports that require the application of a mask, apply a hydrocolloid dressing to the bridge of the nose before starting. This will alleviate any potential breakdown of the skin which will limit the usage of these respiratory supports.
- When applying the CPAP/NIV mask, avoid overtightening the straps. A slightly looser fit is sometimes preferable in order to allow the silicon to mould and grip the skin. An overtightened mask may cause a pressure injury on the bridge of the nose.
- Ensure patients are fitted with a mask that provides the most comfortable and effective fit. This can be supported by having a range of masks available on the ward.
- Most masks come with sizing guides. These are extremely useful and should always be used. It is often the length of the face, rather than the body mass index (BMI) of the patient, that determines the mask size.
- Ensure CPAP and NIV circuits are humidified whenever able to preserve airway epithelial integrity and assist with patient comfort.
- Minimise disruptions to therapy particularly in CPAP and NIV as any PEEP generated during therapy will be lost as soon as therapy is disrupted. Desired PEEP will take approximately 20 minutes to regain following recommencement of therapy. The overall result may be a compromise in gas exchange and work of breathing. The use of $HFNPO_2$ should be considered if a disruption to therapy is required for medication administration, mouth care or eating.
- Perform regular eye and mouth care to protect mucosa and promote patient comfort.
- Ensure the patient is repositioned regularly to prevent pressure injuries and promote comfort.
- Patients may experience some distress during therapy due to the discomforts associated with the use of respiratory supports. Provide support and coaching as required to promote successful continuous therapy.

Principles of weaning respiratory supports in adults with COVID-19

Weaning patients from respiratory support at the clinically appropriate time is essential to aid successful recovery from COVID-19. The recommendations for this are:

- Weaning should be undertaken when the patient has demonstrated evidence of clinical improvement.
- Initiating weaning should be a decision made in conjunction with senior medical staff caring for the patient.
- The plan for weaning from respiratory support should be clearly documented in the patient's clinical notes and updated regularly as the patient's clinical response requires.
- Weaning from NIV or CPAP is typically done by gradually increasing time off therapy, rather than reducing NIV/CPAP pressures.
- The patient may require psychological support during weaning and nursing staff should provide reassurance and support when necessary.

Escalation to intensive care in adults with COVID-19

When patients with COVID-19 deteriorate and reach the maximum level of respiratory support that can be provided safely in the ward environment, escalation to intensive care may be appropriate.

The recommendations for escalation to intensive care for adults with COVID-19 are:

- Intensive care admission should be considered for patients whose condition deteriorates and care including intubation and mechanical ventilation is required (provided this aligns with any documented goals of care or advanced care directives).
- Locally available resourcing and capabilities around the level of care that can be provided on inpatient wards and subsequent criteria for admission to ICU will factor into local decisions to escalate to intensive care.
- Local communication processes should be established between inpatient wards and intensive care units to facilitate early review by intensive care clinicians. Discussions should occur regularly between the senior medical officers responsible for adult patients with COVID-19 admitted to acute inpatient wards and intensive care.
- Processes to transfer patients earlier in the trajectory of their deterioration should be in place locally to ensure safe care is delivered in the right clinical environment.
- Structures such as joint rounds or daily huddles to discuss patients who may potentially require admission to intensive care, can be used to establish a patient-centred treatment and escalation plan. This will support early escalation to intensive care.

Limits of therapy and end of life in adults with COVID-19

When patients with COVID-19 deteriorate and their documented limits of therapy have been reached, end of life care is most appropriate and should be prioritised.

The recommendations for limits of therapy and end of life care in adults with COVID-19 are:

- All patients who are at high risk for poor outcomes should have a discussion regarding goals of care and use of potential respiratory supports upon admission to hospital.
- Goals of care discussions should be clearly documented in the patient's clinical record to accurately communicate the patient's limits of therapy.
- Advance care plans should be completed where appropriate in conjunction with the patient and their support people.
- If care within the agreed limits of therapy fails, prioritise symptom control and ensure end of life care is provided. This should be done in conjunction with any pre-existing treatment teams that may have been involved in the patient's ongoing care prior to testing positive to COVID-19 and being admitted to hospital, and with the palliative care team as appropriate.
- Local end of life pathways should be followed.

Glossary

ABG	Arterial blood gas
AVAPS	Average volume assured pressure support
BiPAP	Bi-level positive pressure ventilation
BMI	Body mass index
CPAP	Continuous positive airway pressure therapy
FiO_2	Fraction of inspired oxygen
EPAP	Expiratory positive airway pressure
$HFNPO_2$	High flow nasal prong oxygen
ICU	Intensive care unit
IPAP	Initial inspiratory positive airway pressure
LHD	Local health district
NIV	Non-invasive ventilation
PEEP	Positive end expiratory pressure
PPE	Personal protective equipment
SPO_2	Oxygen saturation
VBG	Venous blood gas
VOC	Variant of concern

Appendix 1: Risk of transmission of infection with respiratory supports[1]

The COVID-19 Delta variant of concern (VOC) outbreak saw high numbers of adult patients admitted to acute inpatient environments. There is now a new outbreak in NSW, driven by the omicron VOC. In the context of:

- entire wards having only confirmed COVID-19 patients
- staff working within these wards being full vaccinated and using appropriate personal protective equipment (PPE) as per the *COVID-19 Infection Prevention and Control (IPAC) Manual*.

The addition of respiratory supports adds limited additional risk to the transmissibility of the COVID-19 Delta and Omicron VOC.

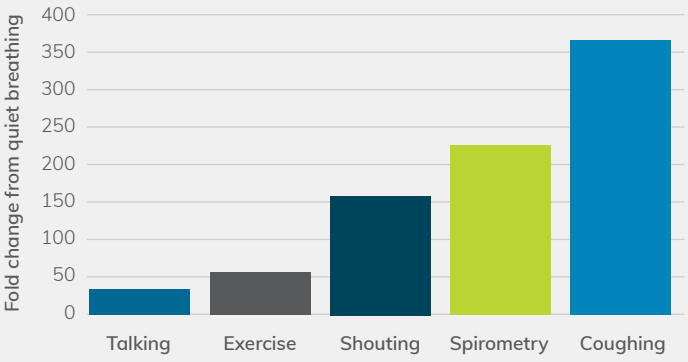
Breathing

Normal breathing generates particles that are potentially infectious. In adult patients with COVID-19 ensure staff wear appropriate PPE and patients are managed in areas as per IPAC manual.

Coughing and normal activities

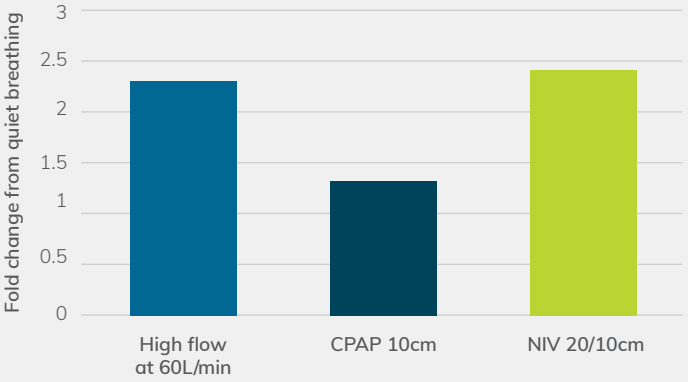
Coughing **produces many more particles than quiet breathing**. Therefore, the **risk of transmission** is high in adult patients with COVID-19. Clinical staff should stay out of the 'blast zone' of cough when possible.

Talking, exercise, shouting and spirometry also increase the generation of particles.



Respiratory support

This includes the following high flow humified oxygen, continuous positive airway pressure (CPAP) and non-invasive ventilation (NIV). These respiratory supports generate **limited additional risk of transmission** of virus particles. In adult patients with COVID-19, these therapies should be delivered when required and not withheld based on aerosol generation. They can be delivered in cohorted COVID-19 patient areas of designated COVID-19 wards. Outside of these environments, respiratory support should be delivered as per IPAC manual.



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