

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

Surgical masks and oxygen therapy

Evidence check question

What is the evidence for wearing a surgical mask at the same time as an oxygen mask?

- a) What does this do to the percentage of supplemental oxygen that is delivered to the patient?
- b) Should the oxygen mask be worn over the top of the surgical mask, or underneath it?

In brief

- In vitro and clinical studies have demonstrated that placing a surgical mask on patients significantly reduces dispersion distance and levels of virus-infected bio-aerosol 20cm away from patients while coughing.(1, 2)
- To mitigate the risk of spread of disease, a nasal cannula can be placed and covered with a surgical mask to limit the potential for environmental contamination.(3)
- Evidence on the percentage of supplemental oxygen that is delivered to the patient when wearing both a surgical mask and oxygen mask in the context of COVID-19 is lacking. A short report tested breathing air wearing a surgical mask on the face; second, breathing 6 l.min⁻¹ oxygen via a Hudson mask placed over the top of a surgical mask; and third, breathing 6 l.min⁻¹ oxygen via a Hudson mask placed underneath a surgical mask, where the F_IO₂ measured was 0.20, 0.50 and 0.54, respectively.(4)
- Evidence on whether an oxygen mask can be worn over the top of a surgical mask, or underneath it includes:
 - A joint international consensus document recommends keeping a simple surgical face mask on patient, over nasal prongs and under any type of oxygen face mask.(5)
 - A short report calls for a surgical mask to be placed over the patient's nose and mouth immediately following extubation, and for a Hudson mask to be placed on top due to the negligible difference in F_IO₂ when the Hudson mask is placed over a surgical mask.(4)
 - Chinese consensus guidelines also describe that the surgical or N95 mask is applied under the oxygen mask.(6)
 - While some consensus guidelines recommend placement of a surgical mask over patients being treated with high flow therapies.(2)

Limitations

Evidence on this topic is emerging and many of the studies included in this review are of low quality or consensus based.

Background

Many experts have patients who wear nasal cannula also wear a droplet mask, especially during transport or when staff are in the room. Data to support this practice are largely non-peer-reviewed or derived from simulation experiments predating COVID-19.(7-9)

Covering the nose and mouth with a face mask of individuals symptomatic with COVID-19 has been recommended by several organisations including in Australia. Recent consensus guidelines published in *Anaesthesia* recommend that patients wear a face mask in addition to their oxygen mask or nasal cannula following tracheal extubation, where this is practicable.(4)

Methods (Appendix 1)

PubMed and Google were searched on 12 August 2020.

Results

Table 1

Source	Summary
Peer reviewed journals	
<p>Oxygen: under or over a surgical facemask for COVID-19 patients?</p> <p>Binks, et al. 2020 (4)</p>	<ul style="list-style-type: none"> Using a carbon dioxide sample line attached to a 16G cannula, authors measured the F_IO₂ at the lips in a healthy volunteer in three situations. The first, breathing air wearing a surgical mask on the face; second, breathing 6 l.min⁻¹ oxygen via a Hudson mask placed over the top of a surgical mask; and third, breathing 6 l.min⁻¹ oxygen via a Hudson mask placed underneath a surgical mask. The F_IO₂ measured was 0.20, 0.50 and 0.54, respectively. Given the negligible difference in F_IO₂ when the Hudson mask is placed over a surgical mask, our COVID-19 extubation protocols now call for a surgical mask to be placed over the patient’s nose and mouth immediately following extubation, and for a Hudson mask to be placed on top.
<p>Minimising droplet and virus spread during and after tracheal extubation</p> <p>Kristensen, et al. 2020 (10)</p>	<ul style="list-style-type: none"> Surgical face masks reduce respiratory virus shedding in respiratory droplets and aerosols of symptomatic individuals. Applying a surgical mask to the patient’s face before removing the tracheal tube, and leaving the mask on the patient during transport, post-anaesthesia recovery room stay, and on the ward.
<p>Low-flow nasal cannula oxygen and potential nosocomial spread of COVID-19</p> <p>Goldhaber-Fiebert, et al. 2020 (3)</p>	<ul style="list-style-type: none"> Some institutions have begun covering low-flow nasal cannulae in certain contexts, although discussions with peers across specialities and institutions suggest that the practice is far from uniform and is sometimes limited to known COVID-19 patients. When low-flow oxygen via nasal cannula is clearly indicated, simple strategies can be used to mitigate the risk of spread. For example, before extubation, a nasal cannula can be placed and covered with a surgical mask to limit the potential for environmental contamination. Local conditions and supplies should guide considerations of using surgical masks to cover all low-flow nasal cannulae. If surgical masks are in short supply, other coverings, including cloth masks, might be of use.

Source	Summary
Peer reviewed journals	
<p>Respiratory support for adult patients with COVID-19 Whittle, et al. 2020 (2)</p>	<ul style="list-style-type: none"> • Narrative review. • Some guidelines recommend placement of a surgical mask over patients being treated with high flow therapies as a secondary safety measure. • High fidelity human mannequin simulation studies show surgical masks do, in fact, reduce exhaled air dispersion.
<p>High-flow nasal cannula for COVID-19 patients: low risk of bio-aerosol dispersion Li, et al. 2020 (1)</p>	<ul style="list-style-type: none"> • Letter. • In vitro and clinical studies have demonstrated that placing a simple surgical protection mask on patients significantly reduces dispersion distance and levels of virus-infected bio-aerosol 20cm away from patients while coughing. • Such a surgical mask can be worn by a patient oxygenated through a nasal cannula (standard nasal cannula or high-flow nasal cannula) but not when using simple, non-rebreathing or Venturi oxygen masks. • Taken together, compared to oxygen therapy with a mask, the utilisation of high-flow nasal cannula does not increase either dispersion or microbiological contamination into the environment. • The patient being able to wear a surgical mask on top of high-flow nasal cannula, in order to reduce the aerosol transmission during coughing or sneezing, represents an additional benefit.
<p>Just the Facts: Airway management during the coronavirus disease 2019 (COVID-19) pandemic Kovacs, et al. 2020 (11)</p>	<ul style="list-style-type: none"> • Case report. • On arrival at the emergency department (ED), the patient’s heart rate was 130 beats/min, respiratory rate 32 per/min, and oxygenation saturation 82% on room air. • As per emergency medical services (EMS) protocol, they placed him on nasal prongs under a surgical mask at 5 L/min and his oxygen saturation improved to 86%.
<p>Perioperative considerations for COVID-19 patients: lessons learnt from the pandemic Yek, et al. 2020 (12)</p>	<ul style="list-style-type: none"> • Case report. • The patient was transported with a plastic covering over the trolley and supplemental oxygen over a face mask.

Source	Summary
Peer reviewed journals	
<p>All India difficult airway association (AIDAA) consensus guidelines for airway management in the operating room during the COVID-19 pandemic</p> <p>Patwa, et al. 2020 (13)</p>	<ul style="list-style-type: none"> • Tracheal extubation should be performed under a transparent plastic sheet or COVID-19 box. A face mask may be threaded over the endotracheal tube prior to tracheal extubation, to further prevent spread of aerosols.
<p>Perioperative Management of Patients Infected with the Novel Coronavirus: Recommendation from the Joint Task Force of the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists</p> <p>Chen, et al. 2020 (6)</p>	<ul style="list-style-type: none"> • Spinal anaesthesia is still recommended as the primary choice of anaesthesia for caesarean delivery in a mother with COVID-19. • The infected mother must wear a surgical mask or N95 mask all the times. • When supplementary oxygen is needed, the oxygen mask is applied over the surgical mask or N95 mask.
<p>Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists</p> <p>Cook, et al. 2020 (14)</p>	<ul style="list-style-type: none"> • Tracheal extubation: After extubation, ensure the patient immediately wears a face mask as well as their oxygen mask or nasal cannulae, where this is practical.

Source	Summary														
Grey literature															
<p>Safe use of oxygen and ventilatory devices for adults and paediatrics during the COVID-19 outbreak</p> <p>Government of Western Australia Department of Health (15)</p>	<table border="1"> <thead> <tr> <th style="background-color: #0056b3; color: white;">Oxygen</th> <th style="background-color: #0056b3; color: white;">Device</th> <th style="background-color: #0056b3; color: white;">Setting (In order of preference, depending on availability)</th> <th style="background-color: #0056b3; color: white;">Precautions</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Oxygen</td> <td>Nasal Prongs (NP) (1-4L/min) Paediatric NP (0-3L/min)</td> <td><u>ED</u>: Single room or cohorted COVID area <u>Ward</u>: Single room or cohorted COVID area <u>ICU</u>: Single room or cohorted COVID area <u>Transit</u>: Surgical mask on patient</td> <td>Droplet</td> </tr> <tr> <td>Hudson Mask (4-8 L/m) or Non Rebreathing Mask (8-15 L/min) Humidified Oxygen (mask or nasal prongs) <15 L/min</td> <td><u>ED</u>: Single room or cohorted COVID area <u>Ward</u>: Single room or cohorted COVID area <u>ICU</u>: Single room or cohorted COVID area <u>Transit</u>: Surgical mask on patient if nasal device</td> <td>Droplet</td> </tr> <tr> <td>Humidified Oxygen (mask or nasal prongs) 15L- 60 L/min Nasal Hi Flow (NHF) >15 L/min</td> <td><u>ED</u>: NPIR if available or Single room or cohorted COVID area <u>Ward</u>: NPIR or Single room or cohorted COVID area <u>ICU</u>: NPIR or Single room or cohorted COVID area <u>Transit</u>: If possible change to NP, HM or NRM (surgical mask). Otherwise Surgical mask on patient.</td> <td>Airborne</td> </tr> </tbody> </table>	Oxygen	Device	Setting (In order of preference, depending on availability)	Precautions	Oxygen	Nasal Prongs (NP) (1-4L/min) Paediatric NP (0-3L/min)	<u>ED</u> : Single room or cohorted COVID area <u>Ward</u> : Single room or cohorted COVID area <u>ICU</u> : Single room or cohorted COVID area <u>Transit</u> : Surgical mask on patient	Droplet	Hudson Mask (4-8 L/m) or Non Rebreathing Mask (8-15 L/min) Humidified Oxygen (mask or nasal prongs) <15 L/min	<u>ED</u> : Single room or cohorted COVID area <u>Ward</u> : Single room or cohorted COVID area <u>ICU</u> : Single room or cohorted COVID area <u>Transit</u> : Surgical mask on patient if nasal device	Droplet	Humidified Oxygen (mask or nasal prongs) 15L- 60 L/min Nasal Hi Flow (NHF) >15 L/min	<u>ED</u> : NPIR if available or Single room or cohorted COVID area <u>Ward</u> : NPIR or Single room or cohorted COVID area <u>ICU</u> : NPIR or Single room or cohorted COVID area <u>Transit</u> : If possible change to NP, HM or NRM (surgical mask). Otherwise Surgical mask on patient.	Airborne
Oxygen	Device	Setting (In order of preference, depending on availability)	Precautions												
Oxygen	Nasal Prongs (NP) (1-4L/min) Paediatric NP (0-3L/min)	<u>ED</u> : Single room or cohorted COVID area <u>Ward</u> : Single room or cohorted COVID area <u>ICU</u> : Single room or cohorted COVID area <u>Transit</u> : Surgical mask on patient	Droplet												
	Hudson Mask (4-8 L/m) or Non Rebreathing Mask (8-15 L/min) Humidified Oxygen (mask or nasal prongs) <15 L/min	<u>ED</u> : Single room or cohorted COVID area <u>Ward</u> : Single room or cohorted COVID area <u>ICU</u> : Single room or cohorted COVID area <u>Transit</u> : Surgical mask on patient if nasal device	Droplet												
	Humidified Oxygen (mask or nasal prongs) 15L- 60 L/min Nasal Hi Flow (NHF) >15 L/min	<u>ED</u> : NPIR if available or Single room or cohorted COVID area <u>Ward</u> : NPIR or Single room or cohorted COVID area <u>ICU</u> : NPIR or Single room or cohorted COVID area <u>Transit</u> : If possible change to NP, HM or NRM (surgical mask). Otherwise Surgical mask on patient.	Airborne												
<p>Oxygen Therapy with Limited Resources</p> <p>Joint document: Australian and New Zealand College Of Anaesthetists, Australian college for emergency medicine, Pacific Community and World Federation of Societies of Anaesthesiologists (5)</p>	<ul style="list-style-type: none"> • Keep a simple surgical face mask on patients, over nasal prongs and under any type of oxygen face mask. This reduces viral spread to staff and other patients. • Caution: aerosolised droplet spread with high flow O2 from all devices. Keep simple surgical face mask over prongs or under oxygen mask at all times. Humidification should never be used: viral spread and equipment may be contaminated. 														
<p>Coronavirus disease 2019 (COVID-19): Critical care and airway management issues</p> <p>Anesi, 2020</p>	<ul style="list-style-type: none"> • Many experts have patients who wear a nasal cannula and a droplet mask, especially during transport or when staff are in the room. • Data to support this practice are largely non-peer-reviewed or derived from simulation experiments. 														

Source	Summary
Grey literature	
UpToDate, 2020 (16)	
<p data-bbox="203 368 589 400">ACEP COVID-19 Field Guide</p> <p data-bbox="203 472 629 536">American College of Emergency Physicians, 2020 (17)</p>	<ul data-bbox="723 376 2096 544" style="list-style-type: none"> • A high-fidelity mannequin study demonstrated that even at the highest setting of 60L/min, exhaled air dispersion was 17cm in a healthy lung scenario and 4.8cm in a severely diseased lung scenario. • Some guidelines recommend placing a surgical mask over patients being treated with high-flow therapies as a secondary safety measure. • High-fidelity human mannequin simulation studies show surgical masks reduce exhaled air dispersion.

Appendix

PubMed search terms

(((((2019-nCoV[title/abstract] or nCoV*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]))) AND ((mask*[title/abstract] OR facemask*[title/abstract]))) AND ((oxygen*[title/abstract] OR hudson*[title/abstract] OR "Nasal Cannula*" [title/abstract]))) AND (2019:2020[pdat])) NOT (protocol[title]) = 37 hits on 12 August

Studies were excluded if the full text was not available in English.

Google and Twitter search terms

Surgical mask with oxygen mask covid-19

Supplemental oxygen COVID19 with masks for patients

Supplemental oxygen with mask COVID19

Masks on patients using supplemental oxygen for COVID19

References

1. Li J, Fink JB, Ehrmann S. High-flow nasal cannula for COVID-19 patients: low risk of bio-aerosol dispersion. *Eur Respir J.* 2020;55(5).
2. Whittle JS, Pavlov I, Sacchetti AD, Atwood C, Rosenberg MS. Respiratory support for adult patients with COVID-19. *Journal of the American College of Emergency Physicians open.* 2020;10. doi:10.1002/emp2.12071.
3. Goldhaber-Fiebert SN, Greene JA, Garibaldi BT. Low-flow nasal cannula oxygen and potential nosocomial spread of COVID-19. *British Journal of Anaesthesia.* doi: 10.1016/j.bja.2020.05.011.
4. Binks AC, Parkinson SM, Sabbouh V. Oxygen: under or over a surgical facemask for COVID-19 patients? *Anaesthesia.* 2020. doi:10.1111/anae.15166.
5. World Federation of Societies of Anaesthesiologists. Oxygen Therapy with Limited Resources. COVID-19 Severe Acute Respiratory Infection (SARI) and Pneumonia [Internet]. WFSA; 2020. [cited on 12 August 2020] Available from: https://www.wfsahq.org/components/com_virtual_library/media/fd499c29e259cf2abb8a2181756e0114-23---oxygen-therapy.pdf.
6. Chen X, Liu Y, Gong Y, Guo X, Zuo M, Li J, et al. Perioperative Management of Patients Infected with the Novel Coronavirus: Recommendation from the Joint Task Force of the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists. *Anesthesiology.* 2020;132(6):1307-1316. doi: doi.org/10.1097/ALN.0000000000003301.
7. Leung CCH, Joynt GM, Gomersall CD, Wong WT, Lee A, Ling L, et al. Comparison of high-flow nasal cannula versus oxygen face mask for environmental bacterial contamination in critically ill pneumonia patients: a randomized controlled crossover trial. *J Hosp Infect.* 2019;101(1):84-7.
8. Hui DS, Chan MT, Chow B. Aerosol dispersion during various respiratory therapies: a risk assessment model of nosocomial infection to health care workers. *Hong Kong Med J.* 2014;20 Suppl 4:9-13.
9. Iwashyna TJ, Boehman A, Capelcelatro J, Cohn AM, Cooke JM, Costa DK, et al. Variation in Aerosol Production Across Oxygen Delivery Devices in Spontaneously Breathing Human Subjects. *medRxiv.* 2020:2020.04.15.20066688.

10. Kristensen MS, Thomsen JLD. Minimising droplet and virus spread during and after tracheal extubation. *British Journal of Anaesthesia*. 2020;125(1):e197-e8.
11. Kovacs G, Sowers N, Campbell S, French J, Atkinson P. Just the Facts: Airway management during the coronavirus disease 2019 (COVID-19) pandemic. *Cjem*. 2020;22(4):440-4.
12. Yek JLJ, Kiew S, Ngu JC, Lim J. Perioperative considerations for COVID-19 patients: lessons learnt from the pandemic. *Korean Journal of Anesthesiology*. 2020. DOI: 10.4097/kja.20182. [Epub ahead of print].
13. Patwa A, Shah A, Garg R, Divatia JV, Kundra P, Doctor JR, et al. All India difficult airway association (AIDAA) consensus guidelines for airway management in the operating room during the COVID-19 pandemic. *Indian Journal of Anaesthesia*. 2020;64(Suppl 2):S107-s15.
14. Cook TM, El-Boghdady K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. *Anaesthesia*. 2020;75(6):785-99.
15. Government of Western Australia Department of Health. Safe use of oxygen and ventilatory devices for adults and paediatrics during the COVID-19 outbreak. Perth: Department of Health; 2020. [cited 12 August 2020]. Available from: <https://www.healthywa.wa.gov.au/-/media/Files/Corporate/general-documents/Infectious-diseases/PDF/Coronavirus/COVID19-Safe-use-of-oxygen-and-ventilatory-devices-for-adults-and-paediatrics.pdf>.
16. G. A. UpToDate. Coronavirus disease 2019 (COVID-19): Critical care and airway management issues. South Holland: UpToDate; 2020. [cited 12 August 2020]. Available from: https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-critical-care-and-airway-management-issues?search=surgical%20masks%20and%20supplemental%20oxygen%20COVID19&source=search_result&selectedTitle=5~150&usage_type=default&display_rank=5.
17. American College of Emergency Physicians. COVID-19 Field Guide. Washington: ACEP; 2020. [cited 12 August 2020]. Available from: <https://www.acep.org/corona/covid-19-field-guide/work-safety/aerosolization>.