

COVID-19 Scientific Advisory Group Rapid Response Report

Updates on Recommended use of Non-invasive ventilation in AHS

Key Research Questions:

- 1. What guidance should be given to front line clinicians when trying to decide whether to proceed with using noninvasive ventilation (NIV) for a COPD exacerbation or CHF?**
- 2. What is the evidence for helmet CPAP use? Is it a reasonable alternative to NIV/HHF02?**
- 3. What guidance should be given to front line clinicians for use of ongoing CPAP or BiPAP therapy on hospital wards for patients who use home CPAP or BiPAP as chronic therapy?**

Context

- Questions have arisen from the respiratory and emergency department health care professional community about whether the use of NIV in the context of patients not felt to have COVID-19 is preferable to intubation
- The rapid review was based upon limited literature and existing published guideline documents
- This review does not address the use of chronic NIV or the use in settings such as neuromuscular disease or obesity hypoventilation syndrome
- The information in this rapid review is meant to be used in addition to clinical judgment

Key Messages from the Evidence Summary

- Noninvasive ventilation (NIV) is an aerosol generating medical procedure (AGMP) and requires expanded personal protection equipment (PPE) precautions.
- Current evidence and clinical guidelines do not recommend NIV for individuals with suspect/confirmed COVID-19.
- These recommendations target patients with M level Goal of Care (GOC). If R level GOC with respiratory failure, critical care involvement is necessary due to very high failure rates of NIV and the need to be ready for emergent intubation. In a patient who is a candidate for intubation/ventilation, decisions around NIV should be made by critical care physicians. NIV is not appropriate for C level GOC given that it is an AGMP.

- Patients with a known history of COPD/CHF, but without suspected/ confirmed COVID-19, may benefit from NIV. However due to the possibility that their disease worsening is associated with a viral infection, patients should be treated as suspect COVID-19 and health care workers (HCW) should use PPE precautions with N95 for AGMP.
- As the CPAP 'helmet' (also called a hood) is not currently used within AHS, it is not considered an alternative therapy to NIV/HHF02.

Recommendations regarding question 1:

Note that these recommendations are intended for patients with M GOC. If R level GOC with respiratory failure, critical care involvement is necessary due to very high failure rates of NIV and the need to be ready for emergent intubation. NIV is not appropriate for patients with C GOC due to the increased risk of AGMP to health care workers.

1. **Acute Hypoxemic respiratory failure not due to AECOPD or CHF:** A patient with acute persistent hypoxemia despite High flow nasal prongs (HFNP) and Non rebreather (NRB) is NOT a candidate for NIV. This is due to the risks of AGMP during a COVID pandemic and the lack of evidence for effectiveness, this applies to all causes of hypoxemic respiratory failure, except those with acute pulmonary edema and acute hypercapnic respiratory failure in a patient with known COPD (see below). Patients with respiratory failure who are candidates for intubation/ventilation should be managed in the ICU and decisions regarding intubation will be made by Critical Care physicians*.
2. **Acute Hypoxemic respiratory failure due to CHF:** A patient with acute pulmonary edema who meets criteria based on AHS protocol- *Non Invasive Ventilation in the management of acute respiratory failure* (available on INSITE) may be considered for NIV. Given that the acute decompensation of a CHF patient may be due to concomitant viral infection (including COVID-19), a short BiPAP trial should be undertaken ONLY in a private, 4 wall room with PPE precautions (including N-95 for AGMP). If improvement in respiratory status is not seen with a trial of adequate BiPAP it is unlikely the acute hypoxemic respiratory failure is due to CHF.
3. **Acute hypercapnic respiratory failure in a patient with known COPD:** A patient meeting criteria based on AHS protocol- *Non Invasive Ventilation in the management of acute respiratory failure* may be considered for a trial of NIV. Given that the "trigger" for AECOPD may be due to concomitant viral infection (including COVID-19), a short BiPAP trial should be undertaken ONLY in a private room with PPE precautions (including N-95 for AGMP). As per AHS protocol, if after two hours of adequate ventilation with NIV, an ABG reveals pH <7.25 (i.e., clinical parameters are not improving) then it would be strongly recommended to discontinue NIV and provide appropriate palliation. If the trial of BiPAP is effective then continuation of BiPAP until no longer clinically indicated may be appropriate.

Recommendations regarding question 2:

1. As the CPAP 'helmet' (also called a hood) is not currently used within AHS, it is not considered an alternative therapy to NIV/HHF02.

Recommendations regarding question 3:

1. Many indications for home NIV are not necessary to continue in hospital as the discontinuation is unlikely to result in respiratory decompensation (ie CPAP for Obstructive Sleep Apnea (OSA)). Given that nocturnal CPAP is an AGMP it should not be routinely used for patients with OSA while in hospital. If NIV is essential (i.e., hypoventilation in patients with neuromuscular compromise), as per AHS protocol, consult pulmonary medicine regarding continuation of home therapy. If NIV/BiPAP is life-sustaining then the patient must be cared for in a private room with Contact, Droplet and Aerosol precautions including door closed, PPE and N95 whenever the therapy is used.

Summary of Evidence

Credible information sources were identified through a rapid online search. One reference is original research (retrospective cohort of critically ill MERS patients from 14 participating tertiary care hospitals),¹ three studies were reviews of therapeutics or experiential papers^{2,5,6}, one letter to the editor³, and an abstract (article was not published in English) were included in the review.⁴ Seven references are publications produced by local, national and international health organizations and/or authorities in response to managing the COVID-19 pandemic⁷⁻¹³, which use a range of research sources and likely expertise consensus within these organizations. Two published review articles^{14,15} were identified that reviewed risk of transmission for HCW while providing care to patients receiving AGMP.

Key limitations of this review:

- Rapid turnaround time resulted in a limited time to conduct a thorough search of the research and grey literature.
- Given the rapidly changing information and literature related to COVID-19, the literature available is limited primarily to guideline documents, published letters, and descriptive papers.

Research Question 1

NIV for individuals with viral related infection is associated with a high failure rate, resulting in delayed intubation, increased risk to HCW, and therefore not recommended.^{1-3,5-6,8-10,12-13} Review articles identified NIV as presenting an increased risk to HCW of transmission of acute respiratory infections, although data was limited to two low quality studies and suggest future research would be beneficial.^{14, 15} If mechanical ventilation is appropriate, early intubation is advocated.¹¹ Therefore, if the individual has confirmed COVID-19, NIV should NOT be used, regardless of co-existing diagnosis – given that NIV is an AGMP associated with an increased risk of viral transmission.

In contrast, one abstract indicated that early use of NIV may improve prognosis⁴, however given only the abstract was published in English, it is difficult to fully assess the significance of this statement when in contradiction with other evidence sources.

While there is consensus that NIV should NOT be used for individuals with COVID-19, it is not feasible to ban the use of NIV in all clinical settings.¹¹ For example, NIV may remain appropriate in patients with hypoxemic respiratory failure, with ongoing monitoring.¹¹ The AHS practice support document: Noninvasive ventilation in the management of acute respiratory failure can provide further detail of NIV use in appropriate populations (<https://insite.albertahealthservices.ca/Main/assets/Policy/clp-non-invasive-ventilation-acute-respiratory-failure-protocol.pdf#search=Non%20Invasive%20Ventilation%20in%20Management%20of%20Acute%20Respiratory%20Failure>)

When using NIV for any patients during a pandemic, careful considerations are required. All patients with influenza like illness (ILI) should be assessed for the need for additional precautions as per AHS (<https://www.albertahealthservices.ca/assets/healthinfo/ipc/hi-ipc-respiratory-additional-precautions-assessment.pdf>). The recommendation (from the AHS policy for the use of NIV in acute respiratory failure) around early reassessment of NIV treatment in hypercapneic respiratory failure (ie recheck ABG after 2 hours to ensure that the pH has improved to >7.25) is based on RCT evidence of very high failure rate if NIV does not result in significant correction of acidosis over a 2 hour period.¹⁶

Any patient (including those presenting with a known history of COPD, or CHF patients) who clinicians decide require NIV to treat pulmonary edema or AECOPD will require additional precautions in both the Emergency Department or inpatient unit including:

- Contact and Droplet precautions (<https://www.albertahealthservices.ca/assets/healthinfo/ipc/hi-ipc-contact-and-droplet-sign.pdf>)
- Hand hygiene
- N95 mask
- Eye protection
- Single room with 4 walls and closed door
- Only essential staff in room
- If available, place patient in an airborne isolation room

Where these precautions cannot be practiced (e.g. due to space limitations) NIV should not be implemented.

Lastly, patients that receive NIV in the home setting with confirmed or suspected COVID-19 should remain in a separate well ventilated room, away from family members to avoid potential spread of the virus.³

Research Question 2

As the CPAP 'helmet' (also called a hood) is not currently used within AHS, it is not considered an alternative therapy to NIV/HHF02. However, to provide context, indicated summary of 2016 meta-analysis of NIV with a helmet is provided. A total of 11 studies (6 RCTs and 5 case controlled studies) were identified (including 621 patients) for helmet use with patients with acute respiratory failure. NIV with a helmet was associated with reduction in intubations and in hospital mortality and complications.¹⁷ There were no difference in gas exchange or length of

ICU stay.¹⁶ Study results were confirmed by pooled RCTs or case-control trials separately and demonstrated low heterogeneity among the studies.¹⁷ However, additional research is required to validate the findings, and it is suggested (by clinician experts) that given the helmet requires placement and removal, helmets offer no additional advantage in decreasing HCWs to aerosolized virus.

Evolving Evidence

We acknowledge that the evidence regarding the care and management of individuals that are suspect or confirmed COVID-19 is rapidly evolving. Therefore significant changes in clinical guidelines may occur and impact this rapid review.

Date question received by advisory group: March 26, 2020

Date report submitted to committee: March 30, 2020

Date of first assessment: April 1, 2020

(If applicable) Date of re-assessment:

Committee discussion:

There was consensus among the committee about these recommendations.

Authorship & Committee Members

This report was written by Heather Sharpe and Patrick McLane and scientifically reviewed by Brandie Walker. The full Scientific Advisory Group was involved in discussion and revision of the document: Braden Manns (co-chair), Lynora Saxinger (co-chair), John Conly, Alexander Doroshenko, Shelley Duggan, Jing Hu, Nelson Lee, Andrew McRae, Jeremy Slobodan, and Nathan Zelyas.

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Research Question • 6

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Appendix

List of Abbreviations

NIV Noninvasive ventilation

AGMP Aerosol generating medical procedure CPAP Continuous Positive Airway Pressure

Literature Search Details

Search Strategy – Covid-19 and NIV

Medline

- 1 exp Coronavirus/ (11483)
- 2 exp Coronavirus Infections/ (9799)
- 3 coronavirus*.mp. (13168)
- 4 "corona virus*".mp. (226)
- 5 (nCov adj2 "2019").mp. (213)
- 6 ncov.mp. (225)
- 7 (novel adj3 coronavirus*).mp. (808)
- 8 (novel adj3 "corona virus").mp. (9)
- 9 COVID-19.mp. (494)
- 10 SARS-COV-2.mp. (122)
- 11 SARSCOV2.mp. (0)
- 12 SARSCOV19.mp. (0)
- 13 Sars-Cov-19.mp. (1)
- 14 "severe acute respiratory syndrome coronavirus*".mp. (1688)
- 15 "severe acute respiratory syndrome corona virus*".mp. (12)
- 16 (coronavirus* adj3 disease*).mp. (256)
- 17 ("corona virus*" adj3 disease*).mp. (13)
- 18 (new adj3 coronavirus*).mp. (233)
- 19 (new adj3 "corona virus").mp. (6)
- 20 (coronavirus* adj3 infection*).mp. (5325)
- 21 ("corona virus*" adj3 infection*).mp. (19)
- 22 (SARS adj2 coronavirus*).mp. (2480)
- 23 (SARS adj2 "corona virus").mp. (38)
- 24 "severe acute respiratory syndrome cov 2".mp. (0)
- 25 (wuhan adj4 coronavirus*).mp. (47)
- 26 (wuhan adj4 "corona virus").mp. (0)
- 27 WN-cov.mp. (0)
- 28 Hcov-19.mp. (0)
- 29 (wuhan adj4 virus*).mp. (37)
- 30 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 (18629)

- 31 Noninvasive Ventilation/ (1967)
- 32 NIV.mp. (2916)
- 33 exp Positive-Pressure Respiration/ (25505)
- 34 bipap.mp. (633)
- 35 cpap.mp. (8039)
- 36 31 or 32 or 33 or 34 or 35 (31348)
- 37 30 and 36 (35)
- 38 limit 37 to (yr="2019" and last year) (1)

Lit Covid

"non-invasive mechanical ventilation" OR NIV OR "positive-pressure respiration" OR bipap OR cpap OR "Bilevel Positive Airway Pressure" OR "continuous positive airway pressure"

TRIP Pro/Google Scholar/Global Research on Coronavirus Disease/Google

(NIV OR "non-invasive ventilation" OR "non-invasive mechanical ventilation" OR "positive pressure respiration" OR "positive-pressure respiration" OR "bilevel positive airway pressure" OR "continuous positive airway pressure" OR bipap OR cpap) AND ("covid-19" OR coronavirus OR "novel coronavirus" OR "new coronavirus" OR "coronavirus infection" OR Ncov-19 OR sars-cov-19 OR Sars-Cov-2 OR "corona virus" OR "severe acute respiratory syndrome coronavirus" OR "sars coronavirus" OR wuhan)

Search Strategy – Covid-19, NIV and N95 Use

Medline

- 1 exp Coronavirus/ (11483)
- 2 exp Coronavirus Infections/ (9799)
- 3 coronavirus*.mp. (13168)
- 4 "corona virus*".mp. (226)
- 5 (nCov adj2 "2019").mp. (213)
- 6 ncov.mp. (225)
- 7 (novel adj3 coronavirus*).mp. (808)
- 8 (novel adj3 "corona virus").mp. (9)
- 9 COVID-19.mp. (494)
- 10 SARS-COV-2.mp. (122)
- 11 SARSCOV2.mp. (0)
- 12 SARSCOV19.mp. (0)
- 13 Sars-Cov-19.mp. (1)
- 14 "severe acute respiratory syndrome coronavirus".mp. (1688)
- 15 "severe acute respiratory syndrome corona virus".mp. (12)
- 16 (coronavirus* adj3 disease*).mp. (256)
- 17 ("corona virus*" adj3 disease*).mp. (13)
- 18 (new adj3 coronavirus*).mp. (233)
- 19 (new adj3 "corona virus").mp. (6)
- 20 (coronavirus* adj3 infection*).mp. (5325)

- 21 ("corona virus*" adj3 infection*).mp. (19)
- 22 (SARS adj2 coronavirus*).mp. (2480)
- 23 (SARS adj2 "corona virus*").mp. (38)
- 24 "severe acute respiratory syndrome cov 2".mp. (0)
- 25 (wuhan adj4 coronavirus*).mp. (47)
- 26 (wuhan adj4 "corona virus").mp. (0)
- 27 WN-cov.mp. (0)
- 28 Hcov-19.mp. (0)
- 29 (wuhan adj4 virus*).mp. (37)
- 30 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 (18629)
- 31 Noninvasive Ventilation/ (1967)
- 32 NIV.mp. (2916)
- 33 exp Positive-Pressure Respiration/ (25505)
- 34 bipap.mp. (633)
- 35 cpap.mp. (8039)
- 36 31 or 32 or 33 or 34 or 35 (31348)
- 37 exp Masks/ (9253)
- 38 exp Respiratory Protective Devices/ (1997)
- 39 mask*.mp. (82586)
- 40 N95.mp. (1470)
- 41 37 or 38 or 39 or 40 (85062)
- 42 30 and 36 and 41 (4)

LitCovid

respiratory protective devices or N95 or mask or masks

TRIP Pro/Google Scholar/Global Research on Coronavirus Disease/Google

(NIV OR "non-invasive ventilation" OR "non-invasive mechanical ventilation" OR "positive pressure respiration" OR "positive-pressure respiration" OR "bilevel positive airway pressure" OR "continuous positive airway pressure" OR bipap OR cpap) AND ("covid-19" OR coronavirus OR "novel coronavirus" OR "new coronavirus" OR "coronavirus infection" OR Ncov-19 OR sars-cov-19 OR Sars-Cov-2 OR "corona virus" OR "severe acute respiratory syndrome coronavirus" OR "sars coronavirus" OR wuhan) AND (n95 OR "respiratory protective devices" OR mask OR masks)

Search Strategy – Covid-19 and NIV

Medline/PubMed

- 1 Continuous Positive Airway Pressure/ (6911)
- 2 Head Protective Devices/ (3494)
- 3 helmet*.mp. (5251)
- 4 2 or 3 (6195)
- 5 1 and 4 (62)
- 6 (helmet adj2 cpap).mp. (43)

7 "helmet continuous positive airway pressure".mp. (17)

8 5 or 6 or 7 (78)

LitCovid

"helmet cpap" OR "helmet continuous positive airway pressure" OR "helpet non-invasive ventilation" OR "helmet non-invasive mechanical ventilation" OR "helmet NIV"

TRIP Pro/Google Scholar/Global Research on Coronavirus Disease/Google/HTA Database

("helmet cpap" OR "helmet continuous positive airway pressure" OR "helpet non-invasive ventilation" OR "helmet non-invasive mechanical ventilation" OR "helmet NIV")

AND (aerosol OR "aerosol generating medical procedure" OR AGMP OR "infection prevention" OR "infection control")

("helmet cpap" OR "helmet continuous positive airway pressure" OR "helpet non-invasive ventilation" OR "helmet non-invasive mechanical ventilation" OR "helmet NIV")

("helmet cpap" OR "helmet continuous positive airway pressure" OR "helpet non-invasive ventilation" OR "helmet non-invasive mechanical ventilation" OR "helmet NIV")

AND ("covid-19" OR coronavirus OR "novel coronavirus" OR "new coronavirus" OR "coronavirus infection" OR Ncov-19 OR sars-cov-19 OR Sars-Cov-2 OR "corona virus" OR "severe acute respiratory syndrome coronavirus" OR "sars coronavirus" OR wuhan)

* In the peak of COVID crisis, it is possible that NIV could be utilized for an R-GOC patient IF the system's ventilator capacity was overwhelmed by demand. This decision would be made by the Critical Care team and is beyond the scope of this document.