

# COVID-19 Scientific Advisory Group Rapid Response Report

## Updates on Recommended Use of Non-invasive Ventilation in AHS Acute Care Facilities During the COVID-19 Pandemic

### Key Research Questions:

1. What guidance should be given to front line clinicians when trying to decide whether to proceed with using non-invasive 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 BPAP therapy on hospital wards for patients who use home CPAP or BPAP as chronic therapy?

#### Context

- Questions have arisen from the respiratory and emergency department health care professional community about the role and safe administration of NIV during the COVID-19 pandemic
- The rapid review was based upon limited literature and existing published guideline documents

### Key Messages from the Evidence Summary

- Non-invasive ventilation (NIV) is an aerosol generating medical procedure (AGMP) and requires expanded personal protection equipment (PPE) precautions if the patient is on Contact and Droplet precautions such as for COVID-19 disease (confirmed, probable, or possible). Appropriate history with a focus on ILI symptoms and the [expanded list of possible COVID-19 symptoms](#) as well as possible exposure to COVID-19 must be completed by the most responsible physician (MRP) and should be repeated as the clinical situation changes (i.e., if removal of isolation is considered, or new symptoms develop). Contact and Droplet precautions are instituted for any patient who is [symptomatic regardless of risk exposure OR if patient is asymptomatic and has a high risk exposure](#).
- In patients with acute respiratory failure, there is strong evidence for the use of NIV for treatment of acute hypercapneic respiratory failure due to acute exacerbation of COPD (AECOPD), and for acute hypoxic respiratory failure in congestive heart failure. When

NIV is clinically indicated, the COVID-19 status of the patient should be used to inform *where* NIV can safely be performed and PPE requirements.

- The recommendations for use of NIV in acute respiratory failure are subdivided by Goal of Care (GOC) (as per the AHS protocol *Non Invasive Ventilation in the management of acute respiratory failure* available on INSITE).
  - If R level GOC in a patient with COVID-19 disease (confirmed, probable or possible) with respiratory failure, critical care involvement is recommended due to very high failure rates of NIV and the need to be ready for emergent escalation of treatment.
  - M1 GOC patients presenting with acute respiratory failure due to AECOPD or acute pulmonary edema may be considered for NIV. Treatment should proceed with appropriate precautions for an AGMP (i.e., room with four walls, with N95 mask and eye protection in addition to contact and droplet precautions). NIV is not recommended for treatment of hypoxemic respiratory failure (COVID pneumonia) without AECOPD or Acute Pulmonary Edema (APE) in patients who are not candidates for intubation.
  - NIV is not appropriate for comfort measures (M2 or C level GOC) during the COVID-19 pandemic.
- As the CPAP 'helmet' (also called a hood) is not currently used within AHS, it is not considered an alternative therapy to NIV/HHF02. The use of CPAP helmet has been documented in Italy, however was used due to a lack of ventilators/resources and there is a lack of strong evidence of benefit at this time.
- Chronic NIV should be considered for continuation in hospital when appropriate isolation precautions are used. (If patient requires Contact and Droplet precautions then NIV can proceed in a room with four walls and a door, an N95 mask and eye protection in addition to standard PPE for Contact and Droplet precautions). If, after appropriate assessment completed by the MRP the patient is considered not to have COVID-19 and is not on contact and droplet isolation for another reason then NIV can be performed when indicated without additional isolation requirements.

### Recommendations regarding question 1:

Note that the recommendations below are for GOC M1 (i.e., does not address NIV use in critical care). Patients with respiratory failure who are candidates for intubation/ventilation (R GOC) should be managed in the ICU and decisions regarding clinical management with NIV vs intubation will be made by Critical Care physicians\*.

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 lack of evidence for effectiveness and the risks of AGMP during a COVID-19 pandemic.
2. **Acute Hypoxemic respiratory failure due to CHF:** A patient with acute pulmonary edema who meets criteria based on the AHS protocol: [Non Invasive Ventilation in the management of acute respiratory failure](#) may be considered for NIV. Given that the acute decompensation of a CHF patient may be due to concomitant viral infection

(including COVID-19), the NIV trial should be undertaken ONLY in a private, 4 wall room with PPE and additional precautions (Contact and Droplet, including N-95 respirator for the AGMP). By definition, an individual in acute hypoxemic respiratory failure is symptomatic and therefore considered to be at least probable or possible COVID-19. If improvement in respiratory status is not seen with a trial of adequate BPAP it is unlikely the acute hypoxemic respiratory failure is due to CHF and the NIV protocol would recommend discontinuation of therapy.

- 3 Acute hypercapnic respiratory failure in a patient with AECOPD:** A patient who meets the criteria for NIV outlined in the AHS protocol [Non Invasive Ventilation in the management of acute respiratory failure](#), may be considered for a trial of NIV. Because the “trigger” for AECOPD may be due to concomitant viral infection (including COVID-19), the NIV trial should be undertaken ONLY in a private room with Contact and Droplet precautions (including N-95 respirator for AGMP). By definition, an individual in acute hypoxemic respiratory failure is symptomatic and would be considered at least COVID-19 suspect. As per AHS protocol, if after **two hours of adequate ventilation with NIV**, an ABG reveals pH remains <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 NIV is effective then continuation of BPAP 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. **Chronic NIV (CPAP and BPAP) in COVID-19 (confirmed, probable, or possible) patient:** Many indications for home CPAP are not necessary to continue in hospital as the discontinuation is unlikely to result in respiratory decompensation (i.e., CPAP for mild to moderate Obstructive Sleep Apnea). If CPAP/BPAP is considered essential therapy (such as hypoventilation in patients with neuromuscular compromise), as per AHS protocol, plan for continuation of NIV and consult Pulmonary Medicine. The patient must be cared for in a private room with Contact and Droplet precautions including door closed, PPE and N95 respirator whenever the therapy is used. If a patient on Contact and Droplet precautions meets criteria for discontinuation of isolation after an appropriate history with a focus on ILI symptoms and the [expanded list of possible COVID-19 symptoms](#) as well as possible exposure to COVID-19 by the MRP or Infection Prevention and Control (IPC), then Contact and Droplet precautions are no longer required for BPAP/CPAP.
2. **Chronic NIV (CPAP and BPAP) in non-COVID-19 (COVID-19 Unlikely) patient:** As per IPC guidelines, if the patient is not on Contact and Droplet precautions then the patient should receive NIV as clinically indicated (private room not required) and IPC Routine Practices may be used. Chronic NIV should be ordered after an appropriate assessment by the MRP where a comprehensive history with a focus on ILI symptoms and the [expanded list of possible COVID-19 symptoms](#) as well as possible exposure to

COVID-19 is determined. If there are concerns that contact and droplet isolation may be necessary due to new symptoms or possible contact with a COVID-19 case, or any other degree of uncertainty, IPC may be consulted to assist with implementation of appropriate isolation.

3. **Chronic NIV (CPAP and BPAP) in Asymptomatic Patient with high risk exposure factors as per testing & screening criteria:** As per IPC guidelines, the patient must be cared for in a private room with Contact and Droplet precautions including door closed, PPE and N95 respirator whenever the therapy is used for 14 days after the point of risk exposure. Once IPC discontinues the Contact and Droplet precautions, NIV can proceed with [IPC Routine Practices](#).

### 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),<sup>1</sup> three studies were reviews of therapeutics or experiential papers<sup>2,5,6</sup>, one letter to the editor<sup>3</sup>, and an abstract (article was not published in English) were included in the review.<sup>4</sup> Seven references are publications produced by local, national and international health organizations and/or authorities in response to managing the COVID-19 pandemic<sup>7-13</sup>, which use a range of research sources and likely expertise consensus within these organizations. Two published review articles<sup>14,15</sup> 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 pneumonia is associated with a high failure rate, resulting in delayed intubation, increased risk to HCW, and therefore not recommended.<sup>1-3,5-6,8-10,12-13</sup> 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.<sup>14, 15</sup> If mechanical ventilation is appropriate, early intubation may be advocated, so NIV should only be considered with consultation to critical care if patients would be candidates for intubation.<sup>11</sup>

In contrast, one abstract indicated that early use of NIV may improve prognosis<sup>4</sup> however because only the abstract was published in English, it is difficult to fully assess the significance of this statement when it contradicts other evidence sources.

The AHS practice support document [Non-invasive ventilation in the management of acute respiratory failure](#) can provide further detail of NIV use in appropriate populations.

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.

**Any patient** (including those presenting with a **known history** of COPD, or CHF patients) who clinicians decide require NIV to treat acute pulmonary edema or AECOPD will require isolation precautions appropriate for an AGMP in both the Emergency Department or inpatient unit (as, by definition, they are symptomatic and therefore suspect COVID-19 until confirmed non-COVID):

- [Contact and Droplet precautions](#)
- 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 who 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.<sup>3</sup>

### *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, the 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.<sup>17</sup> There were no differences in gas exchange or length of ICU stay.<sup>16</sup> Study results were confirmed by pooled RCTs or case-control trials separately and demonstrated low heterogeneity among the studies.<sup>17</sup> 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. A recent pre-print publication by Duca and colleagues (2020) highlighted a retrospective observational study of Italian COVID-19 patients were given ventilator support including helmet NIV and found a 87% failure rate; where the treatment was used primarily due to a lack of intensive care resources.

### 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 31, 2020

Date of first assessment: April 1, 2020

(If applicable) Date of re-assessment: May 6, 2020

### Authorship and Committee Members

This review was written by Heather Sharpe and scientifically reviewed by Brandie Walker, Giovanni Ferrara (external reviewer), Kristin Fraser (external reviewer), Bernard Sowa (external reviewer) and Benjamin Sugars (external reviewer). 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, Nelson Lee, Elizabeth Mackay, Andrew McRae, Jeremy Slobodan, James Talbot, and Nathan Zelyas.

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# COVID-19 Scientific Advisory Group Rapid Response Report

## Appendix

### List of Abbreviations

NIV Non-invasive 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)

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