

Managing Acute Respiratory Failure in Small, Rural, and Critical Access Hospitals

Non-Invasive Ventilation & High-Flow Nasal Cannula



This material was developed by IPRO HQIC

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The Issue

During healthcare emergency response situations, like the COVID-19 pandemic, health care resources—such as essential ancillary staff like respiratory therapists and critical care nurses—can be limited. This is **especially true in rural and critical access hospitals**, possibly exacerbating adverse events and potentially increasing health disparities (due to access of specialty care issues).

In addition, respiratory-related pandemics increase the need for medical-surgical nurses in small, rural, and critical access hospitals to manage patients with acute respiratory failure. Under non-pandemic circumstances, these patients are typically transferred to another hospital with available respiratory therapists and critical care staff.

The Void

The old patient safety adage..... **“low-volume yet high risk”** situations are a patient safety concern.

Due to medical-surgical nurses’ limited exposure to managing acute respiratory failure, nurses in rural and critical access hospitals do not always have a comfort level with non-invasive ventilation (NIV) equipment and/or High-Flow Nasal Cannula (HFNC).

Managing this situation on medical-surgical floors within these smaller hospitals created a void, especially **without access to specialty staff** who have advanced clinical respiratory experience, lack of critical care beds, and/or the lack of respiratory therapy resources.

Filling the Void

There is a need to ensure nurses in these smaller hospitals have the effective skills, training, and confidence to understand NIV and HFNC, manage the associated equipment, and effectively and safely manage acute respiratory failure during emergency response situations.

For medical-surgical nurses in rural and critical access hospitals who may not have a respiratory therapist or ICU availability: Below, you will find quick and digestible information to help manage acute respiratory patients who may not require an endotracheal (ET) tube or a tracheostomy ventilator support. However, these patients do require the support of NIV or HFNC. At the end of this page, we have included additional resources to support the prevention of **respiratory device-related pressure injuries**.

Note: Some content for this resource comes directly from the resources noted in the tool.

Non-Invasive Ventilation (NIV)

Assistance of the spontaneous activity of the respiratory system by the administration of positive pressure into the lungs through an apparatus

– **CPAP** and/or **BiPAP** (facemask, nasal mask, nasal prong, helmet, etc.) with humidification system, which is NOT an ET tube or a tracheostomy.

High-Flow Nasal Cannula (HFNC)

Allows oxygen delivery at much higher rates than conventional oxygen nasal cannula.

The Tool: CPAP, BiPAP, and HFNC

Continuous Positive Airway Pressure (CPAP)

Bi-level Positive Airway Pressure (BiPAP)

High Flow Nasal Cannula

(HFNC)

Spontaneous Breathing Required

Yes

Yes

Yes

Equipment Settings

Only one setting:

- **Positive Pressure**

- Typically between 5-20cm H₂O
- Pressure is continuous and positive throughout the entire breathing cycle.

There are two settings (2 levels of pressure):

- **Inspiratory positive airway pressure (IPAP)**
 - Provides support when inhaling
 - Good starting point is 10cmH₂O (adjust by 1-2cmH₂O depending on needs).
 - Delivers a tidal volume with each inhalation.
 - If you increase IPAP, you increase the delivered tidal volume (which can help blow off CO₂).
- **Expiratory positive airway pressure (EPAP)**
 - Provides pressure upon exhaling to keep alveoli open (preventing alveolar collapse)
 - Works similar to PEEP.
 - Increasing EPAP improves oxygenation by increasing functional residual capacity.
 - Good starting point is 5cmH₂O (adjust by 1-2cmH₂O depending on needs).

There are two settings:

- **FiO₂ (21%-100%)**
 - Usually start at 40% and titrate to effect
- **Flow Rate (usually 20-60 L/min)**
 - Adjust flow rate by 5-10 L/min for labored breathing or increased respiratory rate
 - Goal is to try to keep FiO₂ <60% so adjust/maximize the flow rate first so you can try to keep FiO₂ <60%.
 - When weaning, reduce FiO₂ before reducing flow rate (wean to regular nasal cannula as tolerated)
 - Supports oxygenation (more enhanced than low flow nasal cannula) to decrease the work of breathing with less pressure than CPAP and BiPAP.
 - Adds to the patients' ability to consume PO fluid/food (comfort).

Typically Used for These Patients

- **Hypoxemia**
- Cardiogenic Pulmonary Edema
- Obstructive Sleep Apnea
- COPD
- **Hypercapnia (high CO₂)**
- Cardiogenic Pulmonary Edema
- Hypoventilation with obesity
- **Hypoxemia** (non-hypercapnic hypoxemia)
- ARDS
- Pneumonia

- Pulmonary Edema

Do Not Use in These Patients

- Do not use on patients who are not spontaneously breathing or reduced consciousness and inability to protect their airway.
- Do not use on patients who are not spontaneously breathing or reduced consciousness and inability to protect their airway.
- Do not use on patients who are not spontaneously breathing or reduced consciousness and inability to protect their airway.
- Do not use on patients with pneumothorax or suspected pneumothorax.

Equipment Needed

- CPAP Machine
- Tubing
- Face Mask, Nasal Mask, **or** Nasal Pillows/Prongs
- Headgear (to secure)
- BiPAP Machine
- Tubing
- Face Mask **or** Nasal Mask
- Headgear (to secure)
- Air/Oxygen Blender (allows 0.21 to 1.0 fraction of inspired oxygen)
- High Flow Nasal Cannula
- Tubing
- Large bore nasal cannula (nasal prongs)
- Heat the circuit to body temperature (must be heated)
- Use Humidifier (must be humidified)

Be Careful

- Increasing the positive pressure setting can also increase intrathoracic pressure, reducing pre-load into the heart.
- Watch for fatigue (dyspnea, tachycardia, use of accessory muscles for ventilation, etc.)
- Watch for aspiration
- Watch CO₂ levels, mentation/confusion, and acidosis/ph level (may need to increase inspiratory support setting to blow off more CO₂ in these cases).
- Watch for fatigue (dyspnea, tachycardia, use of accessory muscles for ventilation, etc.).
- Watch for aspiration
- May require invasive ventilation (intubation) if oxygen does not improve with high flow nasal cannula, there is an increased respiratory rate, or there is presence of thoracoabdominal asynchrony with high flow nasal cannula

Resources

The content above was galvanized from resources noted in the citations and additional content below.

- **Training and Deployment of Medical Students as Respiratory Therapist Extenders (RTE) During COVID-19 (April 2020).**
 - [View on the ATS Journals website](#)
 - Healthcare professionals, including medical students, can be quickly trained and deployed in the novel RTE role as a surge strategy during the COVID-19 pandemic.
 - [View the Training on Google Drive](#) (Lesson 6 is specific to non-invasive ventilation)
 - **About the Training:** The Respiratory Therapist Education is open source curriculum developed by the University of Michigan School of Medicine. This training was independently reviewed by two pulmonary and critical care physicians to verify the information's accuracy and ensure learning objectives were appropriate for the RTE role. These slides are available under a Creative Commons Attribution-Noncommercial 4.0 International, allowing non-commercial adaptation and sharing.
- **Using Non-Invasive Ventilation on Acute Wards: How to Provide an Effective Service**
 - [View on the Nursing Times website](#)
- **Non-Invasive Ventilation: Critical Care to Home Care**
 - Pam Garrett MN, APRN, ACNS-BC, CCRN-K, CMSRN
Clinical Nurse Specialist
Pulmonary Program Coordinator
 - [View the Slides](#)
 - Learning Objectives:
 - Differentiate CPAP, BiPAP and NIV; IPAP and EPAP
 - Identify patients who may benefit from non-invasive ventilation at home
 - Describe interventions to improve compliance with NIV
 - List indications and contraindications for NPPV on medical-surgical units
- **Case Study Courses: Non-Invasive Ventilation**
 - [View on the American Association for Respiratory Care \(AARC\) website](#)
- **Non-Invasive Positive Pressure Ventilation: Guidance for COVID-19 Associated Respiratory Failure (5-minute video)**
 - [View on the Society of Critical Care Medicine \(SCCM\) website](#)
- **High-Flow Nasal Oxygen Therapy and Non-Invasive Ventilation in the Management of Acute Hypoxemic Respiratory Failure**

- [View on the Annals of Translational Medicine website](#)
- High Flow Nasal Cannula: Management of COVID-19 Patients (April 2020)
 - Pen Medicine
Department of Nursing Education and Research
 - [View the Slides](#)
- Non-Invasive Ventilation Clinical Guide
 - [View on MedMastery.com](#)
- Non-Invasive Ventilation
 - Guy W Soo Hoo, MD, MPH
 - [View on the Medscape website](#)
- BiPAP vs. CPAP (Made Easy) | Non-Invasive Positive Pressure Ventilation (NPPV) (12-minute video)
 - [Watch the Respiratory Therapy Zone Video on YouTube](#)
- Nasal High Flow System Tutorial, Video, User Guides, Pocket Guides
 - *Note: These are examples of equipment and not endorsements of any kind.*
 - [Airvo™](#)
 - [Vapotherm](#)
- Non-Invasive Positive Pressure Ventilation in Patients With COVID-19
 - [View on the Mayo Clinic Proceedings website](#)

Device-Related Pressure Injury Prevention (Respiratory Devices)

- Managing Medical Device-Related Pressure Injuries
 - [View on The Joint Commission website](#)
- Pressure Ulcer/Pressure Injury Road Map
 - [View on the Minnesota Hospital Association website](#)
- List of COVID-19 Resources for Pressure Injury Prevention: COVID-19 patients being treated with CPAP and BiPAP often require high head of bed (HOB) elevation to facilitate breathing, making pressure injury a risk.
 - National Pressure Injury Advisory Panel (NPIAP)
 - [View NPIAP Letter](#)
 - [View Free Posters: Medical Device-Related Pressure Injuries](#)

Non-ICU Staff Training: For those who might have to manage a ventilator temporarily

- Ventilator Management: Essential Skills for Non-ICU Nurses
 - *This 60-minute on-demand webinar is free to all nurses from the ANA*
 - Many healthcare organizations might need to have nurses, with limited or no critical care experience, assist in caring for severely-ill patients with COVID-19. Many of these patients must be on a ventilator to survive. This program is taught by a highly-experienced, critical care nurse specialist and educator. The presenter covers key skills needed when caring for a patient on a ventilator.
 - [View the Training on ANA COVID-19 Resource Center](#)

