



NIV guide

This is made to simplify the initial settings in different clinical conditions

- What to choose to perform NIV
- Predictors of failure of NIV
- Contraindications for NIV
- What to Monitor during NIV

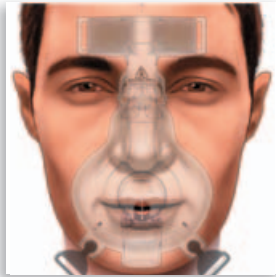
- Choice of the interface, ventilator and circuit is dependent on the illness severity of each patient and on the clinical expertise of the Physician and/or Respiratory Therapist
- Suggestions in this guide are NOT a substitute for good clinical judgement
- Settings values are proposed pressures to start the application of NIV and may go up to the upper limit or even more when needed
- Settings refer also only to Pressure Support Ventilation (that is by far the most used in clinical practice for NIV) unless specified
- Backup rate depends on the spontaneous breathing of the patient / "Rise Time" setting depends on the ventilatory demand
- For adult patient only

PHILIPS

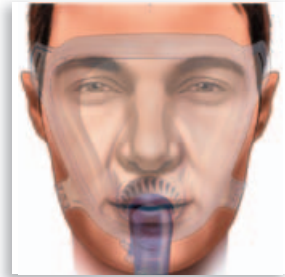
Patient interface classification



Nasal mask



Oro-nasal mask



Full face mask

How to read

Choose the best material & settings to perform NIV for different type of diseases

For each **category**, start with best choice first and if not available move to **alternatives**

	Mask	Circuit	Ventilator	Settings	Oxygen supply system
Best choice	Mask type #1	Circuit type #1	Ventilator type #1	Settings #1	O ₂ Supply system #1
1 st alternative	Mask type #2	Circuit type #2	Ventilator type #2	Settings #2	O ₂ Supply system #2
2 nd alternative		Circuit type #3	Ventilator type #3		

Example: depending on your compatible material stock you could choose the following:

→mask #1 + circuit type #3 + ventilator #2 + settings #1 +oxygen #1



Severe COPD exacerbation pH < 7.30

Protected environment (ICU, respiratory intensive care unit, step-down unit etc.)

	Mask	Circuit	Ventilator	Settings	Oxygen supply system
Best choice	Oro-nasal	Single limb with intentional leak	<ul style="list-style-type: none">Leak compensationBackup rateWaveform monitoring¹	<ul style="list-style-type: none">PEEP = 4-8 cmH₂O (caution not over 8)²PS above PEEP = 12-25 cmH₂O and upBackup Rate 8-12 bpm	Low flow external circuit to get SaO ₂ > 92%
1 st alternative	Full face	Single limb with expiratory valve		PAV ³	Air-oxygen blender
2 nd alternative		Dual limb			

1. D. Georgopoulos, G. Priniakis, E. Kondili: Bedside waveforms interpretation as a tool to identify patient-ventilator asynchronies. Intensive Care Med (2006); 32: 34-47

2. L. Appendini, A. Patessio, S. Zanaboni, et al: Physiologic effects of positive end-expiratory pressure and mask pressure support during exacerbations of chronic obstructive pulmonary disease. Am. J. Respir. Crit. Care Med (1994); 149: 1069-1076

3. PC. Gay, DR. Hess, NS. Hill: Noninvasive Proportional Assist Ventilation for Acute Respiratory Insufficiency Comparison with Pressure Support Ventilation. Am J Respir Crit Care Med (2001); 164: 1606-1611



Mild COPD exacerbation $7.30 \leq \text{pH} \leq 7.35$

Possibly out of ICU ¹

	Mask	Circuit	Ventilator	Settings	Oxygen supply system
Best choice	Nasal	Single limb with intentional leak	<ul style="list-style-type: none">Leak compensationBackup rate	<ul style="list-style-type: none">PEEP = 4-6 cmH₂OPS above PEEP = 8-15 cmH₂O and upBackup rate 8-12 bpm	Low flow external circuit to get SaO ₂ > 92% ³
1 st alternative	Oro-nasal	Single limb with expiratory valve ²		PAV ⁴	
2 nd alternative	Full face	Dual limb			

1. PK. Plant, JL. Owen, MW. Elliott: Early use of non-invasive ventilation for acute exacerbations of COPD on general respiratory wards. A multicenter randomised controlled trial. *The Lancet* (2000); 355: 1931-35
2. F. Lofaso, P. Aslanian, JC. Richard, et al: Expiratory valves used for home devices: experimental and clinical comparison. *Eur Respir J* (1998); 11: 1382-1388.
3. PK. Plant, JL. Owen, MW. Elliott: One year period prevalence study of respiratory acidosis in acute exacerbations of COPD: implications for the provision of non-invasive ventilation and oxygen administration *Thorax* (2000); 55: 550-554
4. PC. Gay, DR. Hess, NS. Hill: Noninvasive Proportional Assist Ventilation for Acute Respiratory Insufficiency Comparison with Pressure Support Ventilation. *Am J Respir Crit Care Med* (2001); 164: 1606-1611



Cardiogenic pulmonary edema

Pre-hospital, emergency, ICU, ...

	Mask	Circuit	Ventilator	Settings	Oxygen supply system
Best choice	High flow system generator with CPAP valve and oro-nasal mask ¹			<ul style="list-style-type: none"> • PEEP = ~10 cmH₂O to get a SaO₂ > 92%² 	High pressure oxygen & venturi
1st alternative	Full face	Single limb	In case of hypercapnia: Leak compensation	<ul style="list-style-type: none"> • CPAP = 6-10 cmH₂O³ • PS above PEEP = 6-10 cmH₂O 	Air-oxygen blender
2nd alternative	<ul style="list-style-type: none"> • Nasal mask • Helmet⁴ (only w/ High Flow CPAP)	Dual limb			

1. J. Masip, M. Roque, B. Sanchez, et al: Noninvasive Ventilation in Acute Cardiogenic Pulmonary Edema Systematic Review and Meta-analysis. JAMA (December 28, 2005); 294: No. 24
2. M. Park, MC. Sangan, M. de S. Volpe, et al: Randomized, prospective trial of oxygen, continuous positive airway pressure, and bilevel positive airway pressure by face mask in acute cardiogenic pulmonary edema. Crit Care Med (2004); 32: 2407-2415
3. S. Nava, G. Carbone, N. Dibattista, et al: Noninvasive ventilation in cardiogenic pulmonary edema: a multicenter, randomized trial. Am J Respir Crit Care Med (2003); 168: 1432-1437
4. D. Chiumello, P. Pelosi, E. Carlesso, et al: Noninvasive positive pressure ventilation delivered by helmet vs. standard face mask. Intensive Care Med (2003); 29: 1671-1679



Hypoxic respiratory failure

Pre-hospital, emergency, ICU, ...

	Mask	Circuit	Ventilator	Settings	Oxygen supply system
Best choice	Oro-nasal	Single limb with intentional leak	<ul style="list-style-type: none">• Leak compensation• Backup rate• Waveform monitoring	<ul style="list-style-type: none">• PEEP = 4-8 cmH₂O¹• PS above PEEP = 12-25 cmH₂O and up²• Backup Rate 12-16 bpm	Air-oxygen blender
1 st alternative	Full face	Single limb with expiratory valve		PAV ³	
2 nd alternative	Helmet ⁴ (possible patient/ventilator asynchrony)	Dual limb			

1. E. L'Her, N. Deye, F. Lellouche, et al: Physiologic Effects of Noninvasive Ventilation during Acute Lung Injury. Am J Respir Crit Care Med (2005); Vol 172: 1112-1118

2. M. Antonelli, G. Conti, A. Esquinas, et al: A multiple-center survey on the use in clinical practice of noninvasive ventilation as a first-line intervention for acute respiratory distress syndrome. Crit Care Med. (2007); 35: 288-90

3. M. Fernandez-Vivas, J. Caturla-Such, J. Gonzalez de la Rosa, et al: Noninvasive pressure support versus proportional assist ventilation in acute respiratory failure. Intensive Care Med (2003); 29: 1126-1133

4. P. Navalesi, R. Costa, P. Ceriana, et al: Non-invasive ventilation in chronic obstructive pulmonary disease patients: helmet versus facial mask. Intensive Care Med (2007); 33: 74-81



Contraindications to non invasive ventilation



Absolute contraindications¹

- Cardiac or respiratory arrest
- Non-respiratory organ failure
(i.e, GI bleeding, hemodynamic instability...)
- Upper airways obstruction
- Need to protect the airways
- Inability to clear secretion
- Facial surgery or trauma

Relative contraindications

- Coma and severe sensorium impairment²
- Agitation or diaphoresis³
- Severe hypoxia (i.e. $\text{PaO}_2/\text{FiO}_2 < 100$)⁴
- Very limited spontaneous breathing

1. Timothy W. Evans: International Consensus Conferences in Intensive Care Medicine: Non-invasive positive pressure ventilation in acute respiratory failure. Intensive Care Med (2001); 27: 166-178
2. R. Scala, M. Naldi, S. Nava: Non-invasive positive pressure ventilation in COPD patients with acute hypercapnic respiratory failure and altered level of consciousness. Chest (2005); 128: 1657-1666
3. JM. Constantin, E. Schneider, S. Cayot-Constantin, et al: Remifentanyl-based sedation to treat noninvasive ventilation failure: a preliminary study. Intensive Care Med (2007); 33: 82-87
4. M. Antonelli, G. Conti, A. Esquinas, et al: A multiple-center survey on the use in clinical practice of noninvasive ventilation as a first-line intervention for acute respiratory distress syndrome. Crit Care Med (2007); 35: 18-25



Mode	Rate	Flow	Pressure	Volume	Apnea	Flow	Flow	Flow	Flow
APV	12	50	35	35	10	5	5	5	5

The table shows various respiratory parameters and their settings.

Predictors of failure for NIV

COPD exacerbation¹

- Arterial blood gases at 2 hrs²
- Breathing frequency at 2 hrs
*If pH does NOT improve ≥ 7.25
and/or respiratory rate is still
 ≥ 35 breath/min then rate of NIV
failure is very high*
- SAPS II > 29 at admission

Cardiogenic pulmonary edema³

At admission

- pH < 7.25
- Acute myocardial infarction
- Hypercapnia
- Ejection fraction < 30%
- Blood pressure < 140 mmHg

Acute hypoxic respiratory failure⁴

- SAPS II > 34 at enrolment
- PaO₂/FiO₂ < 175 after 1 hr of NIV

1. S. Nava, P. Ceriana: Causes of failure of non-invasive ventilation. *Respir Care* (2004); 49: 295-303

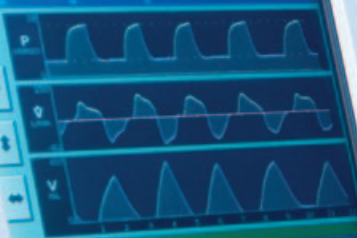
2. M. Confalonieri, G. Garuti, M.S. Cattaruzza, et al: A chart of failure risk for non-invasive ventilation in patients with COPD exacerbation. *Eur Respir J* (2005); 25: 348-355

3. J. Masip, J. Paez Montserrat, MS. Parejo, et al: Risk factors for intubation as a guide for noninvasive ventilation in patients with severe acute cardiogenic pulmonary edema. *Intensive Care Med* (2003); 29: 1921-1928

4. M. Antonelli, G. Conti, A. Esquinas, et al: A multiple-center survey on the use in clinical practice of noninvasive ventilation as a first-line intervention for acute respiratory distress syndrome. *Crit Care Med* (2007); 35: 18-25

PHILIPS

Spont: Rate 19 V_T 580 V_E 10.9 PIP 9
Pt. Leak 19 Pt. Trig 70 T_I/T_{TOT} 47



Active Mode: S/T

IPAP 7

Rate 15

I-Time 1.00

Rise 8

OFF

EPAP 4

FiO2 21

S/T Settings

Alarm Settings

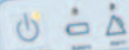
Modes

Menu

Standby

RESPIRONICS

V60



What to monitor during NIV

- Breathing frequency
- SaO₂ (continuous monitoring)
- SAPS II
- Heart rate (continuously) and eventually EKG
- Sensorial status (Kelly scale)¹
- Leaks
- Accessory muscles activities
- Compliance to NIV²
- Expired tidal volume (measured or estimated)

Warning³: if necessary do not delay intubation

1. B.J. Kelly, MA. Matthay: Prevalence and Severity of Neurologic Dysfunction in Critically Ill Patients* Influence on Need for Continued Mechanical Ventilation. Chest (1993); 104: 1818-1824
2. M. Moretti, C. Cilione, A. Tampieri, et al: Incidence and causes of non-invasive mechanical ventilation failure after an initial (>48 hrs) successful attempt. Thorax (2000); 55: 819-825
3. NS. Hill, MD, J. Brennan, MD, E. Garpestad, MD, et al: Noninvasive ventilation in acute respiratory failure. Crit Care Med (2007); 35, No. 10: 2402-2407



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