Optiflow Nasal High Flow (NHF) delivers respiratory support to your spontaneously breathing patients, by providing heated, humidified air and oxygen at flow rates up to 60 L/min through the unique Optiflow nasal cannula.

Read on to discover more about:
- mechanisms
- physiological effects
- clinical outcomes and how using Optiflow NHF can reduce escalation, thereby avoiding its associated costs.

With Optiflow NHF, you can independently titrate flow and oxygen concentration (FiO2 21 - 100%) according to your patient’s needs.

The mechanisms of action differ from those of conventional therapies, as do the resulting physiological effects and clinical outcomes.

Read more about mechanisms at:
[Link]
Respiratory support

- Reduction of dead space
- Dynamic positive airway pressure
- Airway hydration

Optimal Humidity
- Prevents desiccation of the airway epithelium
- Improves mucus clearance

Clearance of expired air in the upper airways
- Reduces rebreathing of gas with high CO₂ and depleted O₂
- Increases alveolar ventilation

Breath- and flow-dependent airway pressure
- Promotes slow and deep breathing
- Increases alveolar ventilation

Optimal Humidity
- Prevents desiccation of the airway epithelium
- Improves mucus clearance

Patient comfort
- Open system
- No seal required
- Comfortable and easy to use

Supplemental oxygen when required
- Confidence in the delivery of blended, humidified oxygen, from 21% to 100%

The effects of flow rate on clearance of rebreathing CO₂

The effects of NHF on airway pressure, end-expiratory lung volume and tidal volume

The effects of high flows of warm, humidified air on mucociliary transport

Adapted from Möller et al.
Adapted from Corley et al.
Adapted from Tatkov et al.
**PHYSIOLOGICAL EFFECTS & CLINICAL OUTCOMES**

The mechanisms of respiratory support, airway hydration, patient comfort and supplemental oxygen contribute to distinct physiological effects...

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMPROVES</strong> ventilation and gas exchange</td>
<td></td>
</tr>
<tr>
<td><strong>REDUCES</strong> respiratory rate</td>
<td>$^{5,8,11,13-16}$</td>
</tr>
<tr>
<td><strong>REDUCES</strong> carbon dioxide</td>
<td>$^{1,3,17}$</td>
</tr>
<tr>
<td><strong>INCREASES</strong> tidal volume</td>
<td>$^5$</td>
</tr>
<tr>
<td><strong>INCREASES</strong> end-expiratory lung volume</td>
<td>$^5$</td>
</tr>
<tr>
<td><strong>IMPROVES</strong> mucus clearance</td>
<td>$^7$</td>
</tr>
<tr>
<td><strong>IMPROVES</strong> oxygenation</td>
<td>$^{2,5,8-10,12,13,16,18}$</td>
</tr>
</tbody>
</table>
REDUCES escalation of care when used:

- as a first-line respiratory support\textsuperscript{10}

- post-extubation\textsuperscript{9,19-22}

REDUCES mortality rate\textsuperscript{10}

IMPROVES symptomatic relief\textsuperscript{8,10,11}

IMPROVES comfort and patient compliance\textsuperscript{8,9,11,19,22}
**Frat 2015**

*The New England Journal of Medicine*

**STUDY**

A 23-center study compared NHF to use of a non-rebreather mask (standard oxygen) and NIV as a primary treatment. The primary outcome was the number of patients intubated at day 28 (not attained).

**METHOD**

310 pre-intubation patients in acute hypoxemic respiratory failure (PaO₂:FiO₂ ≤ 300 mmHg) were randomized to receive NHF, non-rebreather mask or NIV.

**RESULTS**

- **NHF significantly reduced ICU** (p=0.047) and **90-day mortality** (p=0.02)
- The primary outcome was not met for all patients (p=0.18), however, **NHF significantly reduced the need for intubation in more acute patients** (PaO₂:FiO₂ ≤ 200 mmHg) (p=0.009)
- Significant increase in ventilator-free days on NHF (p=0.02)
- **NHF significantly reduced intensity of respiratory discomfort** (p<0.01) and dyspnea (p<0.001)

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**Ischaki 2017**

*European Respiratory Review*

**Acute hypoxaemic respiratory failure***

Criteria for immediate or imminent intubation are present.

- **NO**
  - **NHF initiation**
    - FiO₂ 100%
    - Flow rate 60 L·min⁻¹
    - Temperature 37°C
  - **Intubation and invasive MV**
    - NHF for improving pre-oxygenation and peri-laryngoscopy oxygenation
    - FiO₂ 100%
    - Flow rate 60 L·min⁻¹
- **YES**

**Monitoring**

Presence of prognostic factors

- **NO**
  - **Titration**
    - FiO₂ based on target SpO₂ [>88-90%]
    - Flow rate based on < 25-30 breaths·min⁻¹ and patient comfort
    - Temperature based on patient comfort.
  - **Noninvasive MV**
    - Short trial [1-2 h]
  - **Monitoring**
    - Presence of prognostic factors within hours [maximum 48 h]
- **YES**

**Weaning from NHF**

Firstly decrease FiO₂. When FiO₂ <0.4% decrease flow rate by 5 L·min⁻¹.

**Intubation and invasive MV**

NHF for improving pre-oxygenation and peri-laryngoscopy oxygenation
- FiO₂ 100%
- Flow rate 60 L·min⁻¹

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*Adapted from original paper*; used under Creative Commons licence 4.0.

MV = mechanical ventilation; SOT = standard oxygen treatment.

Please note that this material is intended exclusively for healthcare practitioners and the information conveyed constitutes neither medical advice nor instructions for use. This material should not be used for training purposes or to replace individual hospital policies or practices. Before any product use, consult the appropriate user instructions.
Hernández (Apr) 2016

Journal of the American Medical Association

STUDY

A 7-center study compared the efficacy of NHF to use of conventional oxygen therapy (COT) post-extubation. The primary outcome was reintubation within 72 hours.

METHOD

527 patients at low risk of reintubation (age < 65; APACHE score < 12; BMI < 30 etc.) were randomized to receive NHF or COT (via nasal prongs or a non-rebreather).

RESULTS

- **NHF significantly reduced reintubation** (p=0.004) and post-extubation respiratory failure (p=0.03)
- Successfully extubated patients (in both groups) had a shorter duration of mechanical ventilation (p<0.001), ICU stay (p<0.001) and hospital stay (p=0.005)

Hernández (Oct) 2016

Journal of the American Medical Association

STUDY

A 3-center non-inferiority study compared use of NHF to bi-level positive airway pressure (BPAP) post-extubation. The primary outcomes were reintubation and post-extubation respiratory failure within 72 hours.

METHOD

604 patients at high risk of reintubation (age > 65; APACHE score > 12; BMI > 30 etc.) were randomized to receive NHF or BPAP. The non-inferiority margin was 10%.

RESULTS

- NHF was non-inferior to BPAP for **preventing reintubation**: 22.8% (66/290) NHF group vs. 19.1% (60/314) BPAP group reintubated
- NHF was non-inferior to BPAP for **preventing post-extubation respiratory failure**: 26.9% (78/290) NHF group vs. 39.8% (125/314) BPAP group had post-extubation respiratory failure
- No patients in the NHF group suffered adverse effects requiring withdrawal of the therapy, compared to 42.9% of patients in the BPAP group (p<0.001)
- Median ICU length of stay was lower in the NHF group: 3 days (NHF) vs. 4 days (BPAP) (p=0.048)

Read clinical studies and other evidence at: fphcare.com/opti/evidence-library
**When are the effects of Optiflow NHF seen?**

Sztymf\(^1\) associated Optiflow NHF with sustained beneficial effects on oxygenation and physiological parameters for patients with acute respiratory failure.

Similarly Rittayamai\(^2\) showed significant improvement in post-extubation patients.

These studies may provide guidance on patient responses to the therapy.

**USAGE**

There is an ever-increasing body of clinical literature which may provide guidance on the day-to-day application of Optiflow NHF.
Is there a way to predict the outcome of NHF?

The validated ROX index\(^{25}\) predicts failure in adults with AHRF receiving NHF, at 4 time intervals: 2, 6, 12 and > 12 hours. It’s an easy-to-use dynamic bedside tool.

\[
\text{SpO}_2 / \text{FiO}_2 / \text{Respiratory Rate} = \text{ROX index}
\]

In the example above, the resulting score of 4.48 is greater than the score for predicted failure at 6 hours (3.47 as shown in the ROX Score table right). Therefore, continued NHF treatment should be considered.

<table>
<thead>
<tr>
<th>Time Point (Hours of NHF use)</th>
<th>ROX Score</th>
<th>Positive Predictive Value %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hours</td>
<td>&lt; 2.85</td>
<td>98</td>
</tr>
<tr>
<td>6 hours</td>
<td>&lt; 3.47</td>
<td>98–99</td>
</tr>
<tr>
<td>12 hours</td>
<td>&lt; 3.85</td>
<td>99</td>
</tr>
<tr>
<td>&gt; 12 hours</td>
<td>&lt; 4.88</td>
<td>80</td>
</tr>
</tbody>
</table>
What flow rates and ranges are used?

The adjacent table lists starting flows and flow ranges used in clinical studies.

<table>
<thead>
<tr>
<th>Guidance source</th>
<th>Category description</th>
<th>Flow L/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macé et al 2019</td>
<td>acute hypoxemic respiratory failure (pneumonia)</td>
<td></td>
</tr>
<tr>
<td>Hernández et al Oct 2016</td>
<td>extubated patients at high risk of reintubation</td>
<td></td>
</tr>
<tr>
<td>Hernández et al Apr 2016</td>
<td>extubated patients at low risk of reintubation</td>
<td></td>
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<tr>
<td>Bell et al 2015</td>
<td>acute undifferentiated shortness of breath in the ED</td>
<td></td>
</tr>
<tr>
<td>Frat et al 2015</td>
<td>acute hypoxemic respiratory failure (pre-intubation)</td>
<td></td>
</tr>
<tr>
<td>Stéphan et al 2015</td>
<td>hypoxemic patients post cardiothoracic surgery</td>
<td></td>
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<tr>
<td>Maggiore et al 2014</td>
<td>post extubation with acute respiratory failure</td>
<td></td>
</tr>
<tr>
<td>Peters et al 2013</td>
<td>do not intubate patient with hypoxemic respiratory distress</td>
<td></td>
</tr>
<tr>
<td>Sztrymf et al 2011</td>
<td>acute respiratory failure</td>
<td></td>
</tr>
<tr>
<td>Parke et al 2011</td>
<td>mild-to-moderate hypoxemic respiratory failure</td>
<td></td>
</tr>
<tr>
<td>Corley et al 2011</td>
<td>post-cardiac surgery</td>
<td></td>
</tr>
<tr>
<td>Storgaard et al 2018</td>
<td>COPD</td>
<td></td>
</tr>
<tr>
<td>Nagata et al. 2018</td>
<td>COPD</td>
<td></td>
</tr>
<tr>
<td>Cirio et al 2016</td>
<td>stable severe COPD patients</td>
<td></td>
</tr>
<tr>
<td>Rea et al 2010</td>
<td>COPD and/or bronchiectasis</td>
<td></td>
</tr>
</tbody>
</table>

What is the approximate average dynamic pressure generated?

Average pressure increases approximately 0.5 - 1 cmH₂O per 10 L/min.²,₄,32

Pressure ranges are cannula and patient dependent. For illustrative purposes only.
COST BENEFITS

Use Optiflow NHF to reduce escalation\textsuperscript{10,20} thereby avoiding associated costs.

A patient’s journey through the hospital may include periods of escalation and de-escalation of care. Consider this conceptual model, showing two patients’ journeys through the hospital. The costs for these journeys are denoted by the areas of blue and red.

Using Optiflow NHF as a first-line therapy (both pre-intubation and post-extubation) may reduce a patient’s escalation ‘up the acuity curve’, resulting in better patient outcomes and reduced costs of care.
Introducing Optiflow to the Royal Berkshire Hospital

This video shows the usage of AIRVO 2 & Optiflow Nasal High Flow therapy in different departments of the Royal Berkshire Hospital in Reading, UK. It shows the benefits they have found to both patients and hospital since its introduction.

Evaluate F&P Optiflow

Publications in the NEJM and JAMA suggest Optiflow NHF may improve patient outcomes\(^ {10}\) and reduce the need for higher level support\(^ {20,21}\) thereby avoiding the associated costs\(^ {33}\).

Fisher & Paykel Healthcare will provide training and equipment during an Optiflow NHF evaluation to help you achieve these goals in your hospital. Let us customize an evaluation to suit you. Visit fphcare.com/opti/eval


REFERENCES


34. Takov S. Mucociliary Transport Video Microscopy. https://www.youtube.com/watch?v=HMdrhwEnY6M&list=PLonAnS_1BEgrljk745MrBNpRoZfwNIl4e