

Humidified High Flow Therapy



Fisher & Paykel
HEALTHCARE



Humidified High Flow may reduce escalation and improve outcomes in patients with COPD,¹⁻⁴ bronchiectasis,⁴ mucositis,⁵ and tracheostomies.^{6,7}

Humidified High Flow therapy delivers respiratory support to your spontaneously breathing patients, by providing heated, humidified air and oxygen at flow rates of up to 60 L/min through unique interfaces.

- Read on to discover more about:
- Clinical outcomes
 - Physiological effects
 - Mechanisms
 - Usage

SECRETION MANAGEMENT

Humidified High Flow may improve mucociliary clearance⁸

What are the effects of impaired mucociliary clearance?



Frequent and productive coughs



Recurring sinus and pulmonary infections



Dyspnea due to airflow obstruction

Who has impaired mucociliary clearance?

COPD⁹

Bronchiectasis⁹

Cystic fibrosis⁹

Asthma⁹

Tracheostomy⁷

Mucositis¹⁰

Primary/secondary

ciliary dyskinesia⁹

CLINICAL OUTCOMES WITH HUMIDIFIED HIGH FLOW

STORGAARD et al. 2018¹
Hypoxemic COPD on LTOT

REDUCED escalation

REDUCED exacerbations

IMPROVED quality of life

REDUCED hypercapnia

REDUCED CO₂

IMPROVED oxygenation

NAGATA et al. 2018²
Hypercapnic COPD on LTOT

BRÄUNLICH et al. 2019³
Hypercapnic COPD on LTOT

REA et al. 2010⁴
COPD and/or bronchiectasis

REDUCED exacerbations days

MACANN et al. 2013⁵
Adult mucositis

REDUCED hospitalization days

DOLIDON et al. 2019⁶
Adult hypoxemic/tracheostomy patients

REDUCED tracheostomy exacerbations

MCNAMARA et al. 2014⁷
Pediatric tracheostomy patients

REDUCED adverse events tracheostomy

IMPROVED comfort

AMADDEO et al. 2019¹¹
OSA pediatric with CPAP intolerance

REDUCED AHI

HAWKINS et al. 2017¹²
OSA pediatric with CPAP intolerance

REDUCED AHI

PUBLICATION SUMMARIES

Evidence suggests that **humidified Nasal High Flow (NHF)** improves patient outcomes in chronic care.^{1,2,4}

Storgaard et al. 2018

International Journal of Chronic Obstructive Pulmonary Disease

STUDY

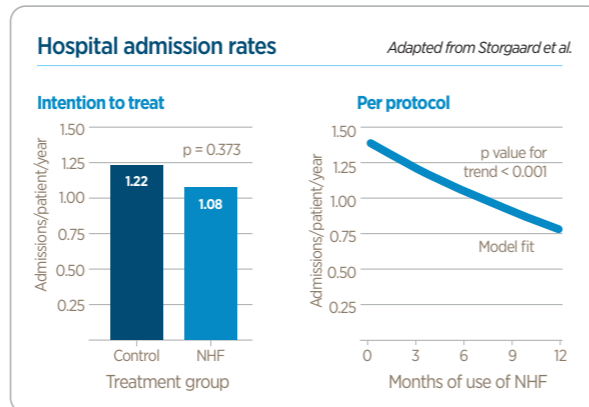
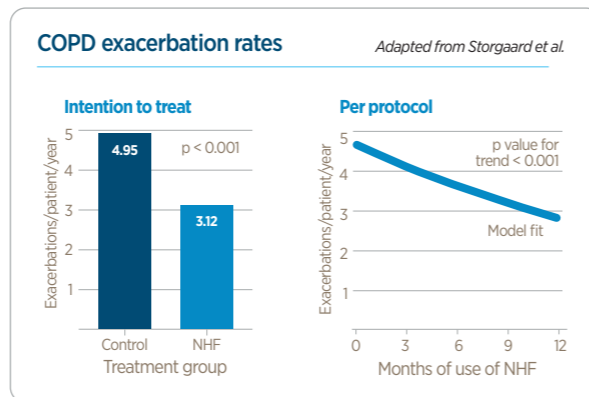
A prospective, randomized, controlled trial in COPD patients with chronic hypoxemic respiratory failure comparing NHF plus long term oxygen therapy (LTOT) with LTOT only (control).

METHOD

200 patients were randomized to receive either NHF plus LTOT or LTOT only for 12 months. Patients were instructed to use NHF for at least 8 hours per day, preferably at night, at a flow rate of 20 L/min.

RESULTS

- ▶ NHF significantly reduced exacerbation rates **4.95 (control) vs 3.12 (NHF)**
- ▶ Hospital admission rates reduced with increasing duration of NHF use (modelled fit)
- ▶ NHF significantly improved SGRQ, CO₂ retention, 6MWT, dyspnea compared to control
- ▶ There was no significant difference in terms of all-cause mortality between the two groups



Nagata et al. 2018

Annals of the American Thoracic Society

STUDY

A prospective, randomized, cross-over trial in stable hypercapnic COPD patients comparing NHF plus LTOT with LTOT only (control).

METHOD

30 patients were randomized to receive either NHF plus LTOT or LTOT only for 6 weeks, then crossed over to the alternative treatment. Patients were instructed to use NHF for at least 4 hours per night during sleep at flow rates of 30-40 L/min.

RESULTS

- ▶ NHF significantly improved the total SGRQ-C score compared to control by **7.8 points**
- ▶ NHF significantly reduced CO₂ retention compared to control
- ▶ SpO₂, dyspnea, pulmonary function tests, 6MWT, EQ-5D-5L and physical activity did not differ significantly between treatment groups
- ▶ NHF was well tolerated with no related severe adverse events

SGRQ-C

| SGRQ-C | ADJUSTED TREATMENT EFFECT (95% CI) | P VALUE |
|---------------------|------------------------------------|------------------|
| Total score* | -7.8 (-11.9, -3.7) | < 0.01 |
| Symptom score | -10.8 (-15.3, -6.3) | < 0.01 |
| Activity score | -4.7 (-8.7, -0.6) | 0.03 |
| Impact score | -8.7 (-15, -2.5) | 0.01 |

Adapted from Nagata et al.

Arterial blood gas and nocturnal PtcCO₂

| | ADJUSTED TREATMENT EFFECT (95% CI) | P VALUE |
|---|------------------------------------|---------|
| Arterial blood gas | | |
| pH | 0.02 (0.01, 0.02) | 0.01 |
| PaCO ₂ (mmHg) | -4.1 (-6.5, -1.7) | < 0.01 |
| Nocturnal PtcCO₂ (mmHg) | | |
| Median | -5.1 (-8.4, -1.8) | < 0.01 |

Adapted from Nagata et al.

PUBLICATION SUMMARIES

Evidence suggests that **humidified Nasal High Flow (NHF)** improves patient outcomes in chronic care.^{1,2,4}

Rea et al. 2010

Respiratory Medicine

STUDY

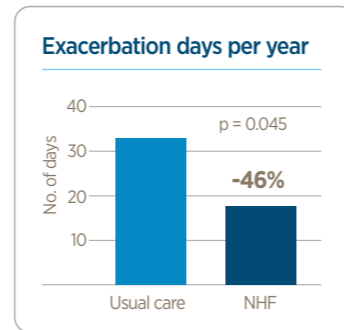
A comparison of long-term humidification therapy using nasal high flow (NHF) with usual care in COPD and bronchiectatic patients. The primary outcome was the rate of exacerbations per patient over a 12-month period.

METHOD

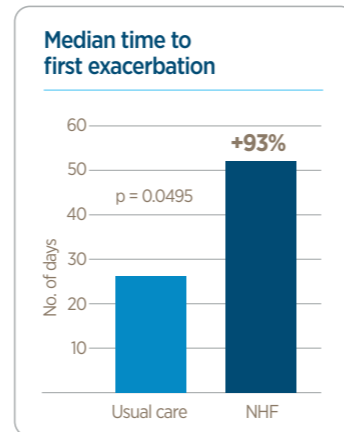
108 patients were randomized to usual care (n=48) or NHF therapy (n=60) at a flow rate of 20-25 L/min for ≥ 2 hours per day.

RESULTS

- Exacerbation frequency was **3.63 (Usual care) vs 2.97 (NHF)** per patient per year, but was not statistically significant ($p=0.067$)
- NHF **significantly reduced the number of exacerbation days** over a 12-month period from **33.5 to 18.2 days** ($p=0.045$)
- Median time to first exacerbation was significantly longer on NHF: **27 to 52 days** ($p=0.0495$)
- NHF **significantly reduced antibiotic use** from **38.5% to 22.8%** of patients ($p=0.008$). All other medication use was similar.
- The mean use time was **1.6 hours** per day



Adapted from Rea et al.



Adapted from Rea et al.

PHYSIOLOGICAL EFFECTS

The mechanisms of airway hydration, respiratory support, patient comfort and supplemental oxygen contribute to distinct physiological effects.^{8,13-18}

| | ↑ IMPROVED mucociliary clearance | ↓ REDUCED work of breathing | ↓ REDUCED respiratory rate | ↓ REDUCED carbon dioxide |
|--|----------------------------------|-----------------------------|----------------------------|--------------------------|
| HASANI et al. 2008⁸ Bronchiectasis | ● | | | |
| PISANI et al. 2017¹³ COPD, NHF vs. standard oxygen and NIV | | ● | ● | |
| BISELLI et al. 2016¹⁴ COPD and healthy, NHF vs. low flow oxygen | | ● | | ● |
| FRASER et al. 2016¹⁵ COPD, NHF vs. low flow oxygen | | | ● | ● |
| BRÄUNLICH et al. 2016¹⁶ COPD, NHF vs. CPAP and BiPAP | | | ● | ● |
| MCKINSTRY et al. 2018¹⁷ COPD, NHF vs. room air | | | ● | ● |
| MCKINSTRY et al. 2019¹⁸ COPD, NHF vs. NIV | | | | ● |

PUBLICATION SUMMARY

Evidence suggests that **humidified Nasal High Flow (NHF)** improves mucociliary clearance.⁸

Hasani et al. 2008

Chronic Respiratory Disease

STUDY

An examination of the impact of humidification on mucociliary clearance in bronchiectatic adult patients within their homes.

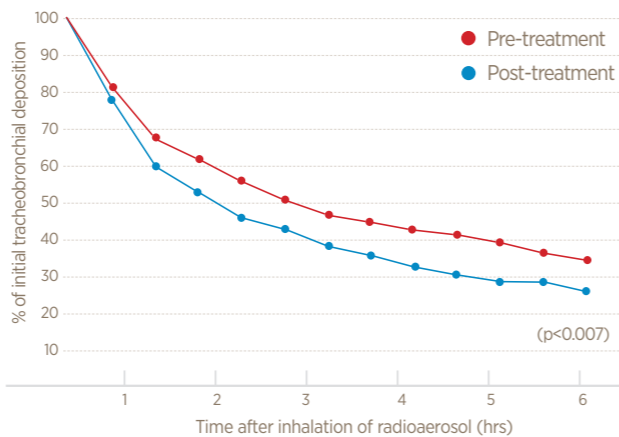
METHOD

10 patients with bronchiectasis were delivered warmed, humidified air at a flow of 20–25 L/min through nasal cannula for 7 days, 3 hours per day.

RESULTS

- ▶ Following humidification, **mucociliary clearance significantly improved** ($p < 0.007$)
- ▶ There were no significant differences in lung function tests between pre- and post-treatment

Mucociliary clearance



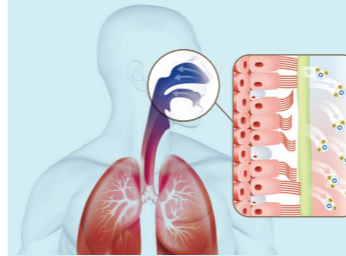
Adapted from Hasani et al.

Airway hydration

Enable the comfortable delivery of high flows¹⁹

Helps prevent damage to the epithelium²⁰

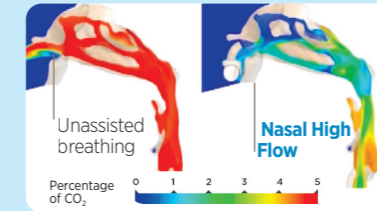
Improves mucociliary clearance^{8,20}



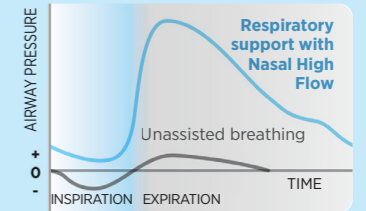
Washout of dead space

Respiratory support

Dynamic positive airway pressure



Based on CFD simulation Geoghegan et al.²¹



Adapted from Ritchie et al.²²

Clearance of expired air in the upper airways²²

Breath- and flow-dependent airway pressure^{24,25}

Reduces rebreathing of gas with high CO₂ and depleted O₂²²

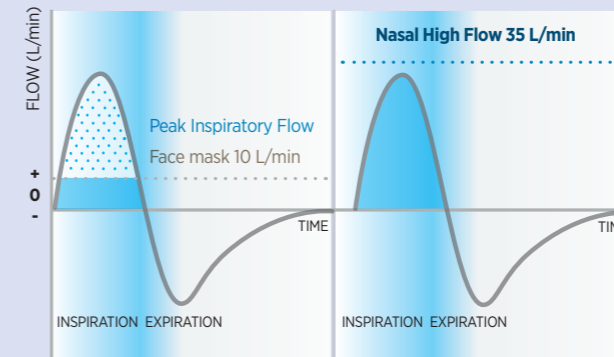
Promotes slow and deep breathing²⁴

Increases alveolar ventilation²²

Increases alveolar ventilation²⁵

Supplemental oxygen when required

Confidence in the delivery of blended, humidified oxygen^{23,27}



Adapted from Masclans et al.

Patient comfort

Open system
No seal required

Comfortable and easy to use²⁸

USAGE

There is an ever-increasing body of clinical literature which may provide guidance on the day-to-day application of humidified NHF.^{1-4,6}

What patient groups has the device been used on?

| Publication | Patient group |
|--|--|
| STORGAARD et al. 2018¹ | Hypoxemic COPD on LTOT with NHF |
| NAGATA et al. 2018² | Hypercapnic COPD on LTOT with NHF |
| BRÄUNLICH et al. 2019³ | Hypercapnic COPD on LTOT with NHF |
| REA et al. 2010⁴ | COPD and/or bronchiectasis with NHF |
| DOLIDON et al. 2019⁶ | Hypoxemic respiratory failure with NHF |
| DOLIDON et al. 2019⁶ | Tracheotomized patients treated with THF |

What therapy durations were used?

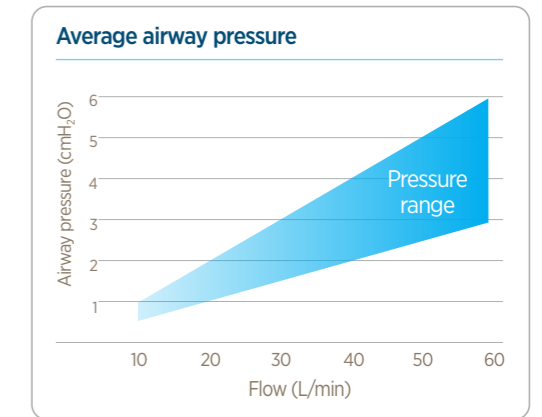
| Daily use |
|---------------------------------|
| 6 hours/day during day or night |
| >7 hours/day during night |
| >5 hours/day |
| >1.6 hours/day during day |
| Not reported |
| Not reported |

What flow rates and levels of supplemental oxygen were used?

| Flow rate | Supplemental oxygen |
|------------|---------------------|
| 20L/min | 1.7L/min |
| 30L/min | 1.2-1.4L/min |
| 20L/min | 2L/min |
| 20-25L/min | Not applicable |
| 25L/min | 12.9L/min |
| 32L/min | 2.3L/min |

What is the approximate average dynamic pressure generated?

Average pressure increases approximately 0.5-1 cmH₂O per 10 L/min.²³⁻²⁵



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

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