

# A Novel Active Airway Humidifier for Non-Invasive Ventilated Patients

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## Introduction

Humidification is a practised and accepted adjunct treatment during NIV. There are currently two modes of operation for humidifiers - active humidification using a heated humidifier (HH) and passive humidification through a heat and moisture exchanger (HME).

The RespirAq™ humidifier is a novel, active heated humidifier that humidifies without the need for additional water. Within 100 milliseconds, the humidifier switches between a super-hydrophilic state to capture moisture during expiration, and a super-hydrophobic state, returning moisture during inspiration. The device delivers gases at 37°C fully humidified (95% relative humidity) to individuals requiring humidification, including those with tracheostomies.

## Aims

This study aimed to compare the performance of the novel humidifier with a heated humidifier - HH (MR850™ Fisher & Paykel Healthcare) and a heat and moisture exchanger - HME (DAR™ -

## Results

The humidification performance of the RespirAq Active Humidifier was assessed using a pass/fail analysis to the ISO 80601-2-74 standard. Absolute humidity delivered to each participant was compared with the minimum humidity level required for NIV (12 mg/L), according to the ISO 80601-2-74 standard.

A Pass result was obtained since all absolute humidity measurements met the humidification requirements (see Figure 2).

## Aims cont.

Covidien) in healthy volunteers during non-invasive ventilation (NIV) using a Simplus™ full face mask (Fisher & Paykel Healthcare).

We have recently demonstrated that the device meets EN ISO 80601-2-74:2020 during bench testing.

## Methodology

Ten healthy volunteers were recruited. NIV was performed at different settings (inspiratory positive airway pressure (IPAP) range 5-20cmH<sub>2</sub>O, expiratory positive airway pressure (EPAP) = 5cmH<sub>2</sub>O) over a one-hour period. Humidity and temperature were collected continuously during the study.

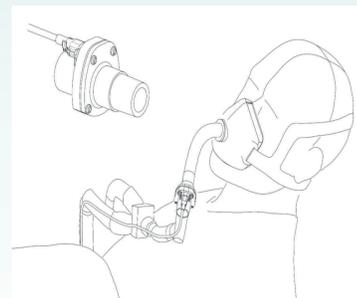


Figure 1 RespirAq Active Humidifier Drawings Showing Patient Connections for NIV and Mask Therapies

## Results cont.

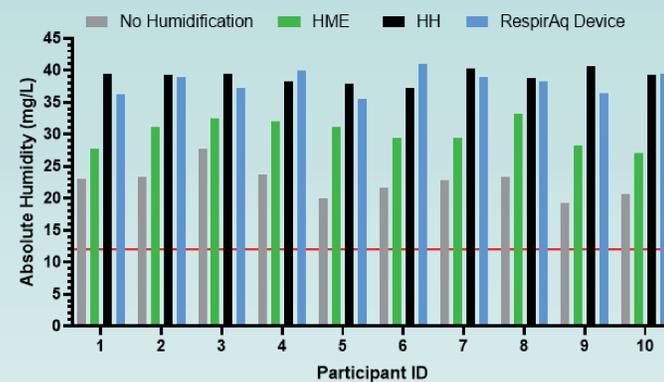


Figure 2. Absolute Humidity - without supplemental humidification (grey bars), with an HME (green bars), with a water-based heated humidifier HH (black bars), and with the RespirAq Active Humidifier (blue bars) for each participant. The Red line indicates the minimum humidity levels a humidifier must reach as described in the ISO 80601-2-74 standard

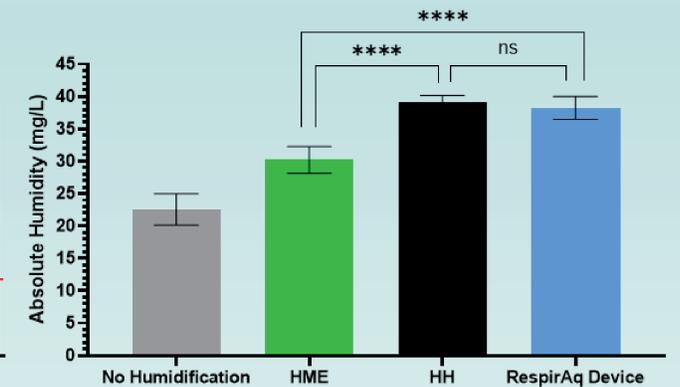


Figure 3 Absolute Humidity comparison - Without supplemental humidification (grey bar), with an HME (green bar), with a water-based heated humidifier HH (black bar), and with the RespirAq Active Humidifier (blue bar)

Absolute humidity inside the face mask increased from 22.55 ± 2.41 mg/L without humidification to 30.18 ± 2.07 mg/L with an HME, and 39.09 ± 1.05 mg/L and 38.23 ± 1.78 mg/L when using a water-based heated humidifier and RespirAq novel Active Humidifier, respectively. When comparing the performance of the humidification devices head-to-head, the two heated humidifiers significantly outperformed the HME (HME vs Novel = P < 0.0001, HME vs HH = p < 0.0001) and there was no significant difference seen between the two active humidifiers (p = 0.2047) (see Figure 3).

## Conclusion

Results show that the device meets the 33 mg/L absolute humidity established by the EN ISO 80601-2-74:2020 standards and that there is no significant difference in performance compared to traditional heated humidification. This suggests that the novel device can deliver the performance of a heater humidifier at the size, reliability and ease of use of a heat and moisture exchanger. Due to the mechanism of action, droplet/aerosol transmission of COVID-19 may also be mitigated. Further studies are warranted to confirm these findings.

## Acknowledgements

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