

# Does Spacer/Adapter Device Choice Affect Delivery of a Pressurized Metered Dose Inhaler (pMDI) through a Humidified Circuit to a Simulated Patient on Mechanical Ventilation

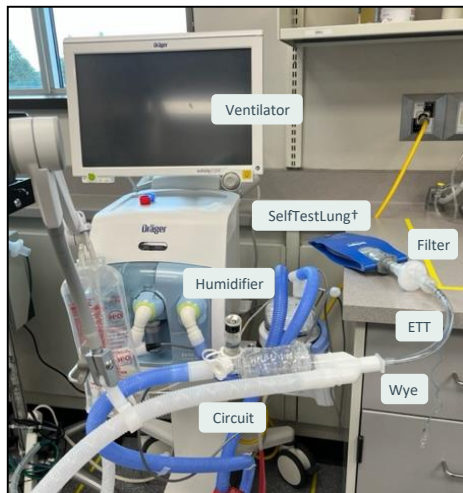
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## INTRODUCTION

- Delivery of aerosolized medication to mechanically ventilated patients is a key element of their treatment.
- It is desirable to not break the ventilation circuit during aerosol therapy to reduce the risk of infection or derecruitment.
- This study evaluates the effect pressurized metered dose inhaler (pMDI) delivery devices that stay in line have on drug delivery in a simulated adult ventilator setting.

## METHODS

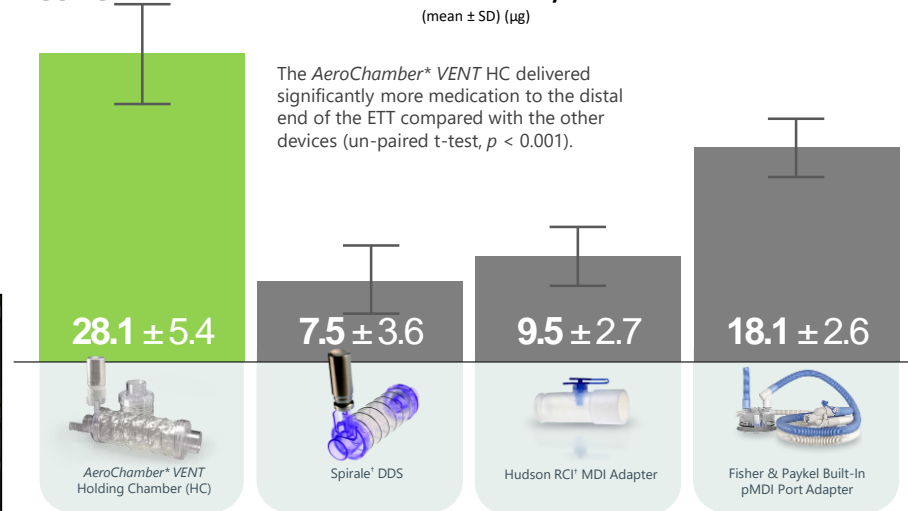
- An adult mechanical ventilation circuit (Fisher & Paykel RT210) was humidified ( $T = 37^{\circ}\text{C}$ , 100% RH), and a simulated ventilated adult model (tidal volume = 500 mL, duty cycle = 33%, rate = 13 breaths/minute) was generated using a Dräger Infinity<sup>+</sup> C500 ventilator.
- An aerosol collection filter was located at the distal end of the 8.0 mm diameter endotracheal tube (ETT) and the far-side of the filter was coupled to a Dräger SelfTestLung<sup>+</sup> simulating the patient.
- 5 actuations of a Ventolin<sup>+</sup> pMDI were delivered through the device on test, each time followed by 6 complete breathing cycles, shaking the canister between actuations.
- This procedure ( $n = 5/\text{device}$ ) was performed with four devices: the AeroChamber<sup>+</sup> VENT Holding Chamber (HC) (also marketed as AeroVent Plus<sup>+</sup> Collapsible Holding Chamber), the Spirale<sup>+</sup> drug delivery system (DDS), the Hudson RCI<sup>+</sup> MDI Adapter (these three devices were placed in the inspiratory limb), and via the built-in pMDI port adapter within the wye connector of the ventilator circuit.
- Assay of recovered salbutamol was undertaken by HPLC-UV spectrophotometry.



## RESULTS

### Total Mass of Salbutamol/Actuation

(mean  $\pm$  SD) ( $\mu\text{g}$ )



The AeroChamber<sup>+</sup> VENT HC delivered significantly more medication to the distal end of the ETT compared with the other devices (un-paired t-test,  $p < 0.001$ ).

## CONCLUSIONS

- In this study, we have shown device type influences aerosolized drug delivery during simulated adult mechanical ventilation.
- Although Spirale<sup>+</sup> DDS closely resembles AeroChamber<sup>+</sup> VENT HC, the Spirale<sup>+</sup> bellows had difficulties keeping a spacer-like shape when expanded for aerosol delivery.
- This study highlights the variability in drug delivery using a pMDI and that spacer/adapter choice are critical factors to be considered when using these devices as a treatment option.