# The Impact of different Valved Holding Chambers (VHCs) on Lung Drug Delivery: Using Functional Respiratory Imaging (FRI) and a single Metered Dose Inhaler (MDI) type

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## RATIONALE

- One of the most common MDI use errors is the failure to coordinate inhalation with actuation of the inhaler.
- Chambers are often prescribed to reduce the severity of this error.
- This FRI based study assessed a few different chambers, comparing their impact on modelled lung delivery, in addition to when the MDI was used alone.

## METHODS

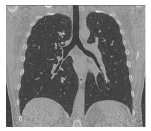
- 3D geometries of airways and lobes were extracted from a CT scan of a 67-year-old male COPD Stage III patient.
- Drug delivery and airway deposition of MDI delivered albuterol was modelled using FRI with measured particle and plume characteristics with and without three VHCs.
- For the MDI alone, in addition to the 'perfect coordination' 0 second delay, a short inhalation delay of 0.5 second was evaluated. For the MDI/VHC systems, a typical 2 second delay was evaluated.


***AeroChamber Plus* Flow-Vu****
Antistatic Chamber (ACPlusFV)


OptiChamber† Diamond
Antistatic Chamber (OD)

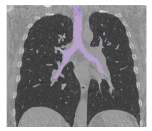

Compact Space Chamber plus†
Antistatic Chamber (CSCP)

### FUNCTIONAL RESPIRATORY IMAGING



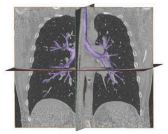
HRCT

**1.** Patient data is obtained by taking low dose CT scans



Structure segmentation

**2.** Patient-specific airway and lung structures are extracted

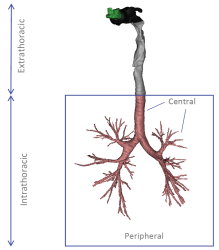


Patient-specific 3D Model

Flow simulation (CFD)

**3.** Flow and particle simulations are applied to the 3D models

### LUNG STRUCTURES AND ZONES

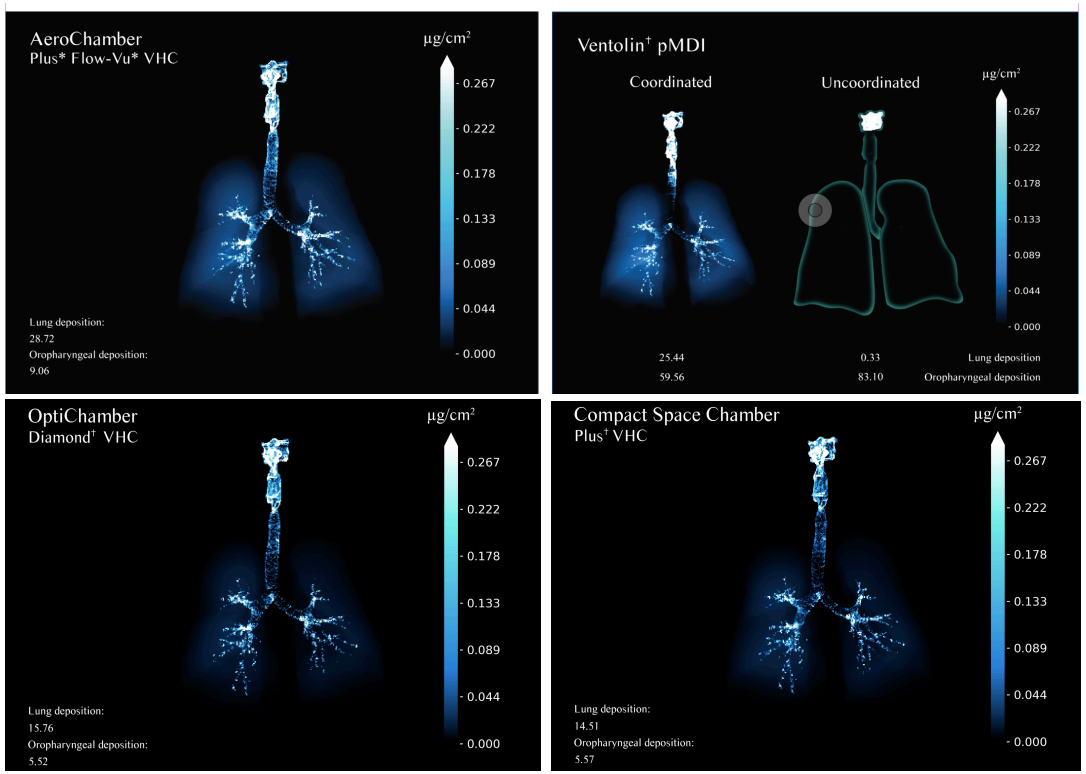



## RESULTS

| Deposition zone | MDI alone (zero delay) | MDI alone (0.5s delay) | MDI/ACPlusFV (2.0s delay) | MDI/OD (2.0s delay) | MDI/CSCP (2.0s delay) |
|---|---|---|---|---|---|
| Extrathoracic | 59.6 | 83.1 | 9.1 | 5.5 | 5.6 |
| Intrathoracic | 25.4 | 0.3 | 28.7 | 15.8 | 14.5 |
| Central Lung | 8.7 | 0.1 | 13.1 | 7.2 | 6.6 |
| Peripheral Lung | 16.7 | 0.3 | 15.7 | 8.5 | 7.9 |
| C/P ratio | 0.52 | 0.36 | 0.83 | 0.85 | 0.83 |

## RESULTS

To view the FRI results video, click here: https://www.trudellmed.com/fri-results-videos




## CONCLUSION

- The FRI deposition profiles highlighted significant differences between the VHCs on test, with intrathoracic delivery for the ***AeroChamber Plus® Flow-Vu®*** VHC system being almost double that of the other two VHC systems and being similar to the MDI alone with perfect coordination.
- When a short 0.5 second inhalation delay with the MDI alone was modelled, the intrathoracic lung delivery decreased from 25.4 mcg to 0.3 mcg.
- These results highlight that the use of an appropriate VHC should be considered as general practice for all MDI patients other than those with a highly proficient inhaler technique and that VHCs should not be considered interchangeable.

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