

# IMPACT OF SPACER DESIGN ON RESPIRATORY DRUG DELIVERY AND POTENTIAL DRUG COST IMPLICATIONS

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## INTRODUCTION

- Valved holding chambers, or 'spacers', enable inhaled medications to be delivered to animals.
- Inhaled steroids are effective therapeutics for the management of respiratory diseases and are an alternative to systemic steroids which may have short- and long-term side effects.
- However, the delivery process is a critical component of aerosol drug delivery and must be considered when assessing drug performance.
- Chambers are designed to decelerate and capture the aerosol plume from a Metered Dose Inhaler (MDI) in order to alleviate coordination issues to give animals time to inhale the medication properly.

## OBJECTIVE

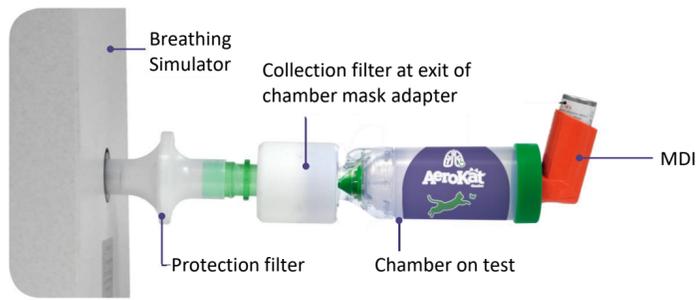
- Inhaler delivery performance, which impacts pulmonary deposition and desired therapeutic effect, can be influenced by inhalation chamber design elements such as volume and length, the use of electrostatic-dissipative materials, inhalation valve function, and the design of the mask interface.
- The purpose of this in-vitro study was to assess drug availability in a range of chambers in a clinically relevant setting to provide guidance to veterinarians when recommending a chamber.

## METHODS

- This study evaluated the impact of drug availability when using fluticasone (Flovent<sup>†</sup> HFA 110µg) MDI with a range of different chambers available on the market.



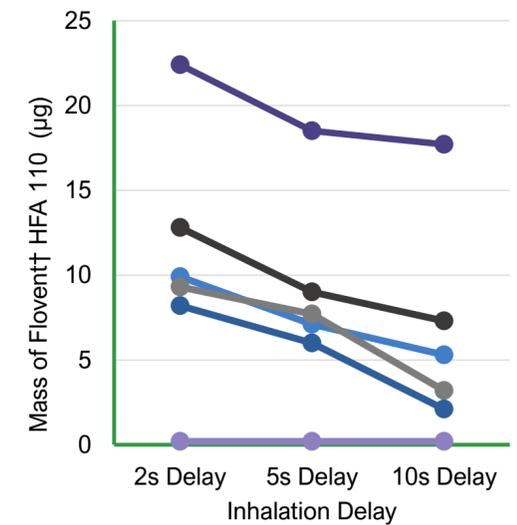
- Each chamber was evaluated by breathing simulator programmed to simulate the tidal breathing pattern of a cat (tidal volume 50 mL, Inspiratory/expiratory ratio = 1:2, 20 breaths per minute).
- Coordination delays between MDI actuation and inhalation by tidal breathing were imposed to simulate real-world use conditions.
- Delays of 2, 5, and 10 seconds were investigated to determine the impact on delivered drug mass.
- The breathing simulator was coupled to a filter which in turn was attached to the mouthpiece of the device on test.



- The mass of drug collected on the filter is indicative of total drug availability to the animal.
- Following activation of the MDI and appropriate delay interval, the filter was subsequently assayed via high performance liquid chromatography and the mass of fluticasone propionate determined.

## RESULTS

Drug Availability Over Time from Inhalation Chambers



	2s Delay	5s Delay	10s Delay
AeroKat* Chamber	22.4 ±5.2	18.5 ±0.5	17.7 ±0.9
VetOne† 2in1 FAC	12.8 ±2.4	9.0 ±1.6	7.3 ±1.4
Canack† Aerosol Chamber	9.9 ±0.3	7.1 ±0.4	5.3 ±1.1
AeroFlow FAC	9.3 ±0.4	7.7 ±2.1	3.2 ±0.5
PawGreet FAC	8.2 ±0.6	6.0 ±3.4	2.1 ±0.8
Inhaler Spacer for Cat	0.2 ±0.1	0.2 ±0.1	0.2 ±0.0

## DISCUSSION

- Different chambers deliver different amounts of medication.
- Chambers that make more medication available for a longer time may better support how animals' interface with these devices. For example:
  - the inhaler may be activated before the mask is applied;
  - animals with small tidal volumes take longer to empty the chamber; or,
  - animals may briefly hold their breath.
- Availability of medication has implications for disease control and owner expense.
- Animals not well controlled may experience more symptoms or need higher doses of medication to control the animal's disease. For example:
  - using the 2s Delay results and AeroKat\* Chamber as a reference, owners delivering a Flovent<sup>†</sup> HFA 110 inhaler (2 puffs per day, 60/month, \$280 per MDI) could experience increased drug costs of between \$1,246 - \$3,774 annually.

## CONCLUSION

- With new products entering the veterinary sphere and increasing access to online selling marketplaces, chambers need to be evaluated in order to validate drug delivery performance.
- Without this information, chambers that appear similar but perform differently could mean that some patients will not receive the intended dose and as a result may need their dose modified or be at heightened risk of poor disease control and potential for respiratory exacerbation.

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