

# A PERFORMANCE AND COST COMPARISON BETWEEN FOUR SPACERS USED IN AUSTRALIAN HOSPITALS

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## Introduction

Due to regulatory changes regarding the reprocessing and reuse of metered-dose inhaler (MDI) spacers, Australian hospitals are seeking an effective, low-cost disposable spacer option. In this study, drug-output performances, particle size distributions and costs were compared for four spacers used in Australian hospitals: three made of rigid plastic (Volumatic™, GlaxoSmithKline; Breath-A-Tech Hospital Grade, Visiomed Group; AeroChamber Plus®, Trudell Medical), and one made of collapsible paperboard (LiteAir®<sup>®</sup>, Thayer Medical). Using these results and the unit cost of each VHC, a cost-to-performance ratio was calculated for each device.

## Materials and Methods

Five of each of the four spacers (n=5) were evaluated. The Volumatic, Breath-A-Tech and AeroChamber Plus were washed and dried prior to testing according to insert instructions; the LiteAir was used as-is out of the package. A patient was simulated using a USP throat model attached to a Harvard Apparatus large animal ventilator simulating tidal breathing of 750 mL at 12 breaths/minute and 1:1 inhalation:exhalation. Eight MDI actuations of salbutamol sulfate (Ventolin, GlaxoSmithKline) were delivered to each spacer at the beginning of inhalations.



Figure 1. Volumatic, LiteAir, Breath-A-Tech, AeroChamber Plus

## Materials and Methods (continued)

Drug delivered through each spacer was captured on a filter connected just downstream of the throat model, eluted by rinsing twice with an 18 mL aliquot of 1 M KCl buffer, and quantified via ultraviolet spectroscopy at 276 nm. Drug mass delivered per MDI actuation was calculated as the mean of five unit results for each VHC tested. Device performances were compared via two-tailed T-tests with  $p < 0.05$  indicating a significant difference between VHCs.

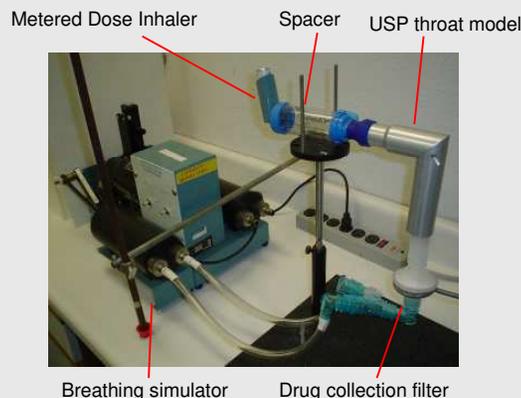


Figure 2. Drug output testing apparatus

## Results

The results are summarized in Table 1. The Breath-A-Tech ( $35 \pm 10 \mu\text{g}/\text{dose}$ ) and the LiteAir ( $32 \pm 2 \mu\text{g}/\text{dose}$ ) provided significantly higher drug outputs per actuation than the Volumatic and the AeroChamber Plus, and were not significantly different from each other. The LiteAir offered the lowest cost-to-performance ratio (spacer unit price/drug mass delivered per dose), costing \$0.12 per  $\mu\text{g}$  of drug delivered. This was significantly lower than all of the plastic spacers, which ranged from \$0.65 per  $\mu\text{g}$  to \$1.35 per  $\mu\text{g}$ . The particle size distributions for drug delivered from all four spacers were similar.

## Results (continued)

Holding Chamber Comparisons	Breath-A-Tech			AeroChamber Plus
	Cost (AU\$)	LiteAir	Volumatic	Plus
Mass Median Aerodynamic Diameter (MMAD) ( $\mu\text{m}$ )	2.7	2.4	2.5	2.5
% of drug mass in respirable range (MMAD < $4.7 \mu\text{m}$ )	91%	93%	88%	91%
Drug mass delivered per actuation ( $\mu\text{g}$ )	$35 \pm 10^*$	$32 \pm 2^{\#}$	$16 \pm 2$	$24 \pm 3$
Cost-To-Performance Ratio <sup>2</sup>	\$0.65 <sup>*</sup>	\$0.12 <sup>@</sup>	\$0.76	\$1.35

<sup>1</sup>Asthma Foundation of Western Australia 2006/7 Catalogue Price

<sup>\*</sup>Not significantly different from LiteAir or AeroChamber Plus; significantly higher than Volumatic

<sup>#</sup>Not significantly different from Breath-A-Tech; significantly higher than Volumatic and AeroChamber Plus

<sup>2</sup>Spacer Unit Cost/drug mass delivered per actuation; higher value = higher cost/drug mass delivered ( $$/\mu\text{g}$ )

<sup>@</sup>Significantly lower than AeroChamber Plus; significantly higher than LiteAir

<sup>\*</sup>Significantly lower than all three plastic spacers

Table 1. Results Summary

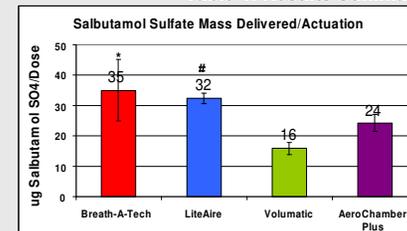


Figure 3. Mass of salbutamol sulfate delivered per MDI actuation

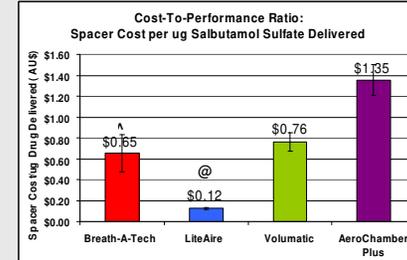


Figure 4. Cost-to-performance ratio: Spacer cost per  $\mu\text{g}$  salbutamol sulfate delivered

## Conclusions

Under the conditions tested, the Breath-A-Tech and LiteAir yielded the best performance in terms of drug mass delivery. When spacer cost was factored in, the LiteAir offered a cost-to-performance ratio that was superior to the three rigid plastic spacers tested. This ratio may be of importance to institutions seeking a viable disposable spacer option.