



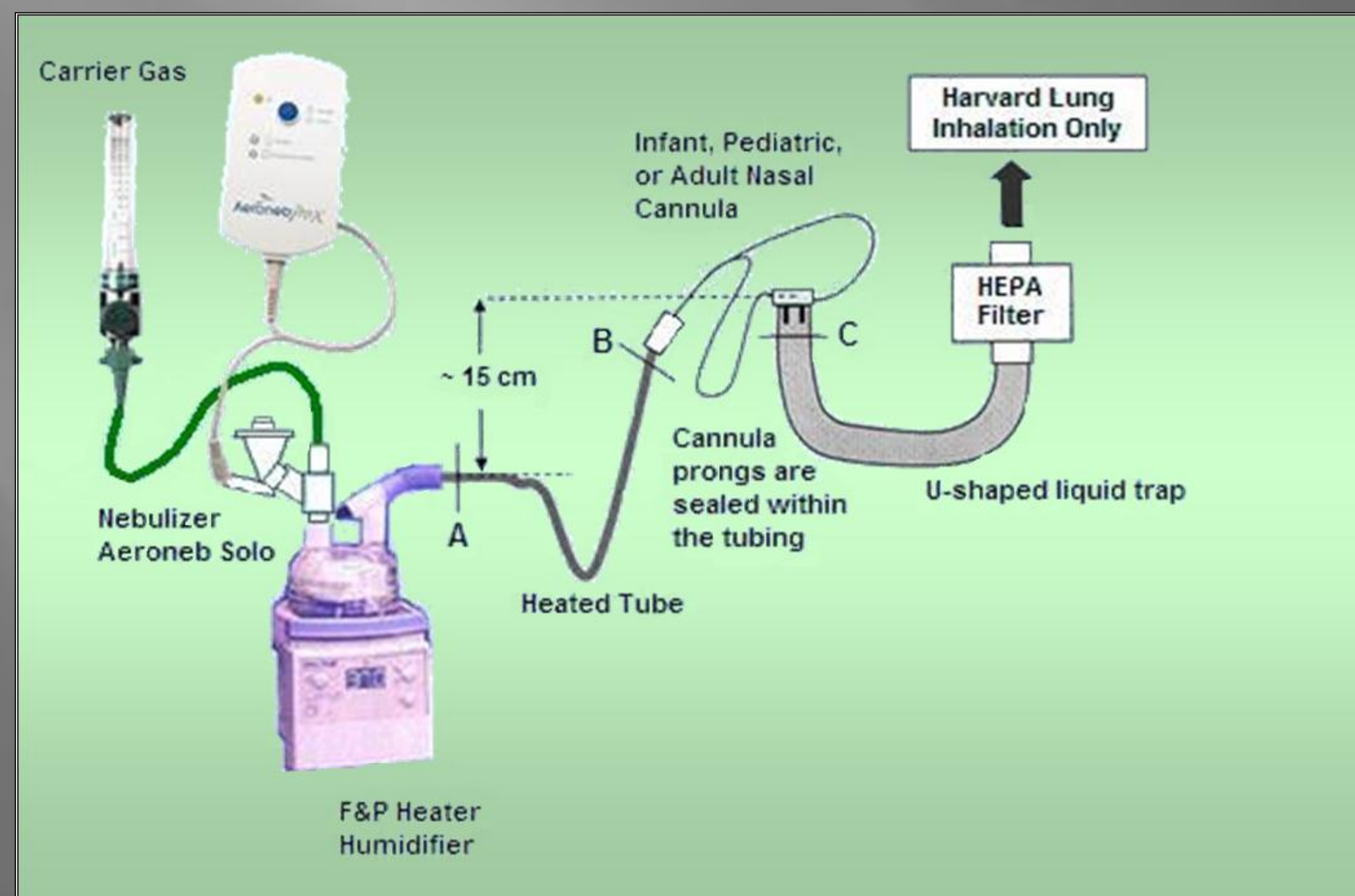
Baystate Health

# AEROSOL DELIVERY THROUGH ADULT HIGH FLOW NASAL CANNULA: AN IN VITRO COMPARISON WITH HELIOX AND OXYGEN

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## INTRODUCTION

Heliox has been shown to reduce turbulence and improve aerosol delivery in a range of clinical settings. Delivery of aerosol with high flow nasal cannula (HFNC) has been applied to adults with severe asthma. A previously described model (Blaysham JAMPDD 2008) was modified to compare inhaled mass of albuterol with heliox and oxygen.



- References:
1. Dailey P. Administration of Heliox and Bronchodilator Aerosol via High Flow Nasal Cannula in A Severe Asthmatic. *Respir Care* 2008 November
  2. Dailey P, Liautaud S. High Flow Nasal Cannula Application in an Acute Asthma Exacerbation. *Respir Care* 2008 November
  3. Meyer R. Helium/oxygen (Heliox) in the Emergency room: Comparison of Open System via High Flow Cannula vs. Closed System. *Respir Care* 2002 September. 47(9)
  4. Bhashyam A, Wolf M, Marcinkowski A, Saville A, Carcillo J, Corcoran T. Aerosol Delivery through Nasal Cannulas: An *In Vitro* Study. *J Aerosol Med* 2008 December Vol. 21(2)
  5. O'Callaghan C, White J, Jackson J, Crosby D, Douglill B, Huber B. The Effects of Heliox on the Output and Particle-Size Distribution of Salbutamol Using Jet and Vibrating Mesh Nebulizers

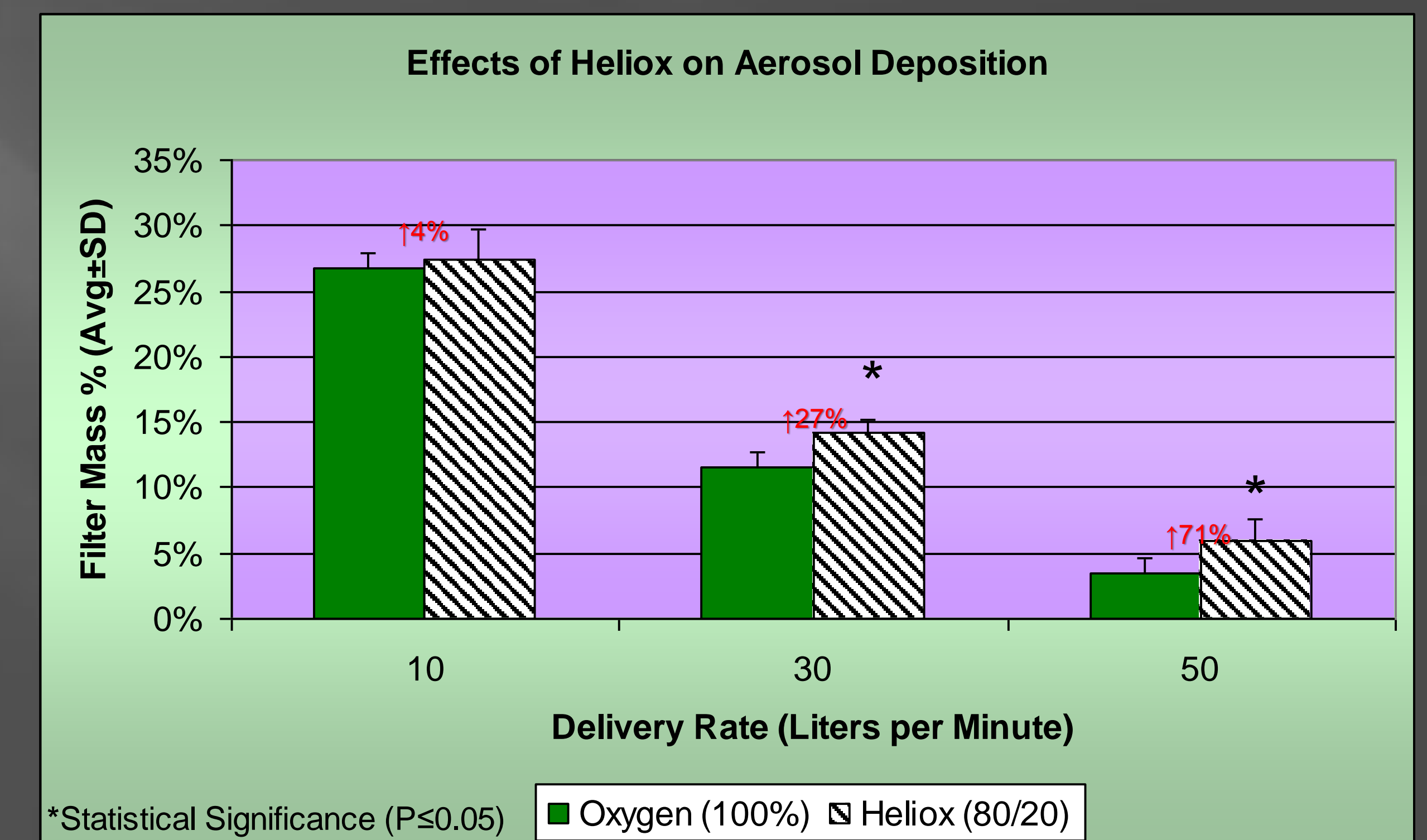
## METHODS

A vibrating mesh nebulizer (Aeroneb Solo, Aerogen) was placed at the inlet of a HFNC (Fisher & Paykel) A small adult cannula (Optiflow) was placed distal to the heated wire circuit with prongs placed into loose orifices simulating nares with a T-shaped trap and absolute filter connected to a breathing simulator (Vt 500 ml, 12 bpm, I:E of 1:2) 2.5 mg of albuterol sulfate in 3 mL was nebulized with Heliox (80:20) and Oxygen at 10, 30 and 50 lpm (n=3). Drug was eluted from the filter and assayed with UV spectrophotometry (276 nm).

| Small Adult Cannula- Oxygen (100%)  |        |        |        |        |        |        |        |        |        |
|-------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                                     | 10 LPM |        |        | 30 LPM |        |        | 50 LPM |        |        |
| Trial #                             | 1      | 2      | 3      | 1      | 2      | 3      | 1      | 2      | 3      |
| Filter Absorb                       | 0.1631 | 0.1486 | 0.1593 | 0.0745 | 0.0617 | 0.0721 | 0.0234 | 0.0217 | 0.0234 |
| Filter mass, mg                     | 0.6930 | 0.6305 | 0.6766 | 0.3111 | 0.2559 | 0.3008 | 0.0909 | 0.0835 | 0.0909 |
| Filter mass, %                      | 27.72% | 25.22% | 27.06% | 12.44% | 10.24% | 12.03% | 3.63%  | 3.34%  | 3.63%  |
| Mean                                | 26.67% |        |        | 11.57% |        |        | 3.53%  |        |        |
| Standard Deviation                  | 1.29   |        |        | 1.17   |        |        | 0.17   |        |        |
| Small Adult Cannula- Heliox (80/20) |        |        |        |        |        |        |        |        |        |
|                                     | 10 LPM |        |        | 30 LPM |        |        | 50 LPM |        |        |
| Trial #                             | 1      | 2      | 3      | 1      | 2      | 3      | 1      | 2      | 3      |
| Filter Absorb                       | 0.1457 | 0.1725 | 0.1646 | 0.0793 | 0.086  | 0.0894 | 0.0472 | 0.0348 | 0.0273 |
| Filter mass, mg                     | 0.6180 | 0.7335 | 0.6994 | 0.3318 | 0.3607 | 0.3753 | 0.1934 | 0.1400 | 0.1077 |
| Filter mass, %                      | 24.72% | 29.34% | 27.98% | 13.27% | 14.43% | 15.01% | 7.74%  | 5.60%  | 4.31%  |
| Mean                                | 27.35% |        |        | 14.24% |        |        | 5.88%  |        |        |
| Standard Deviation                  | 2.37   |        |        | 0.89   |        |        | 1.73   |        |        |

## RESULTS

At 50 and 30 lpm, inhaled mass of albuterol was greater (p<0.05) with heliox than O<sub>2</sub> {50 lpm - O<sub>2</sub>=3.5% & heliox=6%; 30 lpm - O<sub>2</sub>=11% & heliox=14%} but not at 10 lpm {O<sub>2</sub>=27% & heliox=28%}. Heliox produced an increase of 71%, 27% & 4% respectively. Aerosol delivery was inversely related to flow with both heliox and O<sub>2</sub>.



## CONCLUSIONS

Heliox increased aerosol delivery via HFNC up to 71%. Decreasing flow increased aerosol delivery via HFNC in this model.