Introduction:
Patients with acute exacerbations such as asthma are prescribed aerosol therapy from presentation in the Emergency Department to progression through to the Intensive Care Unit. However, the variability in dose delivery to the lung across the possible patient interventions is not well characterized. Here, we assess the predicted lung dose of a bronchodilator in a simulated spontaneously breathing adult patient via both facemask and nasal cannula, and via tracheostomy during mechanical ventilation.

Methods:
A standard dose of 2.5mg in 2.5mL salbutamol was aerosolized using the Aerogen Solo nebulizer (Aerogen, Ireland). For facemask testing, the nebulizer was used in combination with the Aerogen Ultra with 2LPM supplemental oxygen flow. For nasal cannula testing, the nebulizer was used in combination with the Airvo 2 system (Fisher and Paykel, NZ) system at both 10 and 50LPM gas flow rate. Tracheostomy-mediated ventilation was assessed in combination with a HME, with the nebulizer placed between the HME and the tracheostomy tube. International Standard ISO27427 adult breath settings (Vt 500mL, BPM 15, I:E 1:1) were used across all tests, and generated using a breathing simulator (ASL5000, Ingmar Medical, USA) or mechanical ventilator (Servo-U, Maquet, Sweden). The dose delivered to the lung was assessed using a capture filter at the level of the trachea, with drug mass determined using UV Spectrophotometry at 276nm and interpolation on a standard curve.

Results:
The results of testing are illustrated in Figure 1.

Conclusion:
The bronchodilator dose delivered to the simulated patient was seen to be relatively consistent between progressive interventions, except during high flow therapy, with the more clinically relevant 50LPM gas flow rate having a profound effect on the dose. These results may go some way towards explaining how different patient interventions can affect aerosol dose.