

Ann D Cuccia<sup>1</sup> • Janice A Lee<sup>2</sup> • Michael McPeck<sup>2</sup> • Gerald C Smaldone<sup>2</sup>

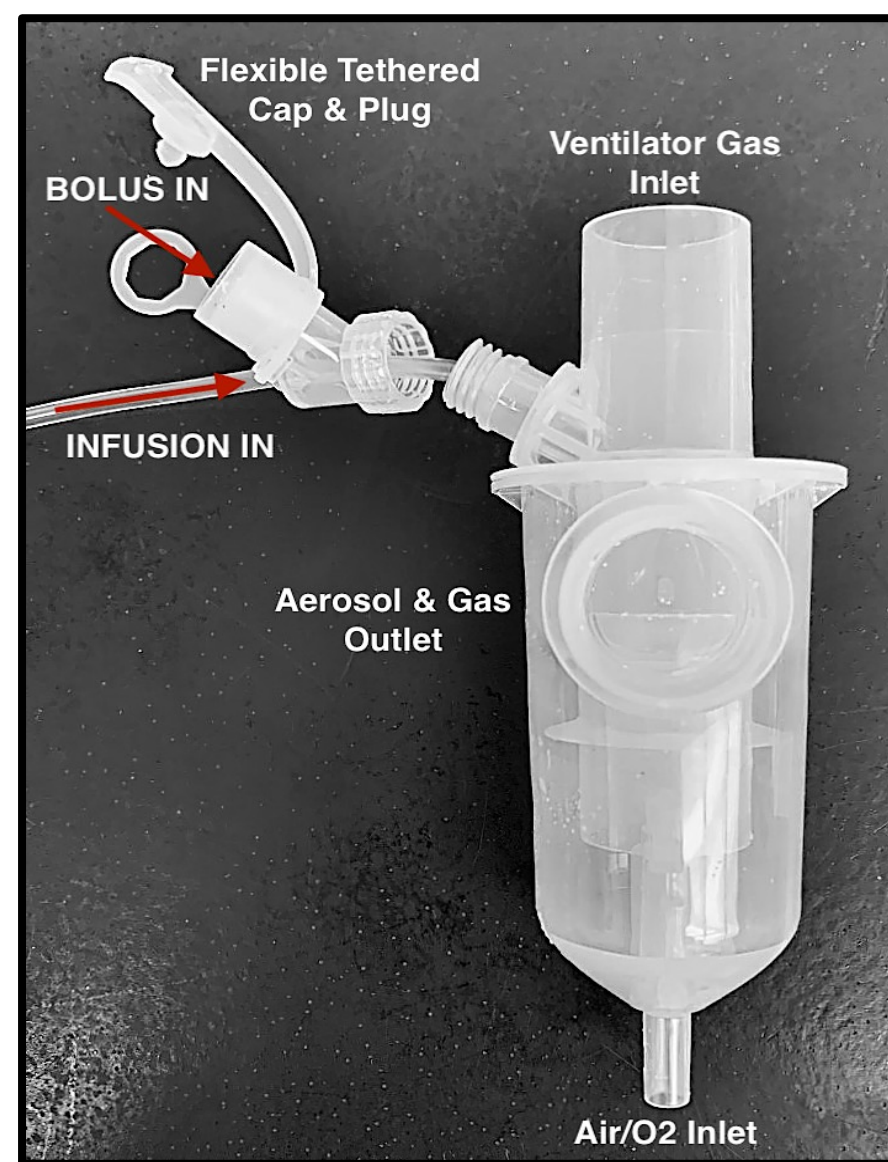
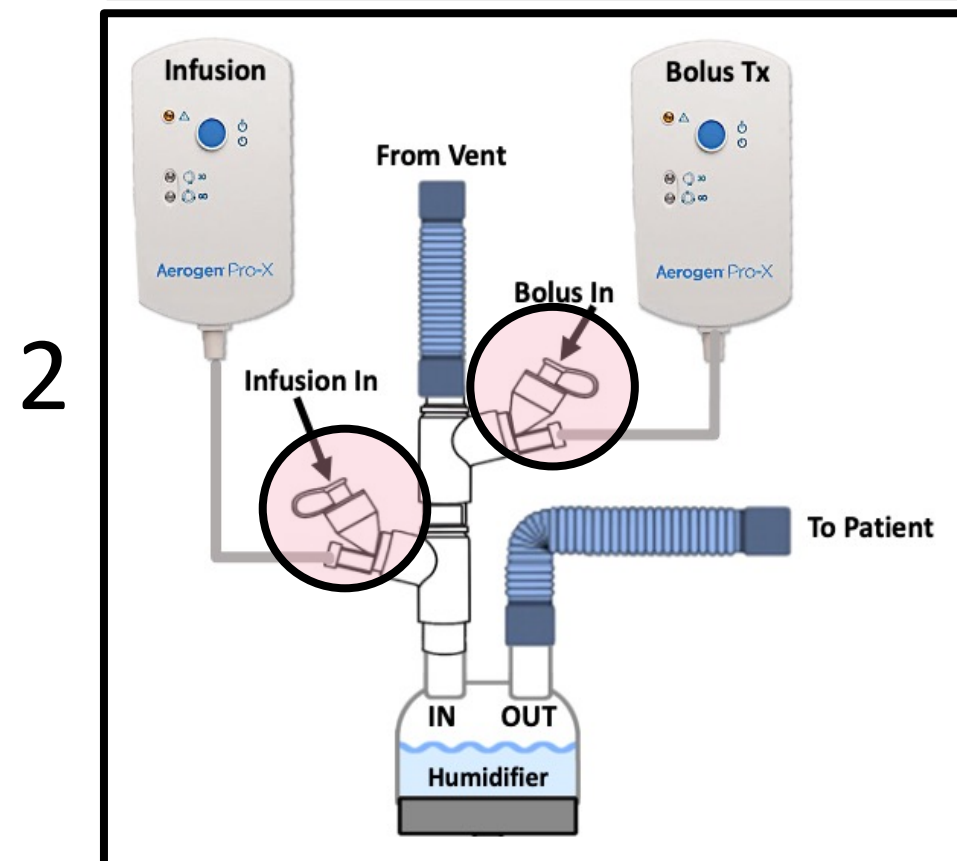
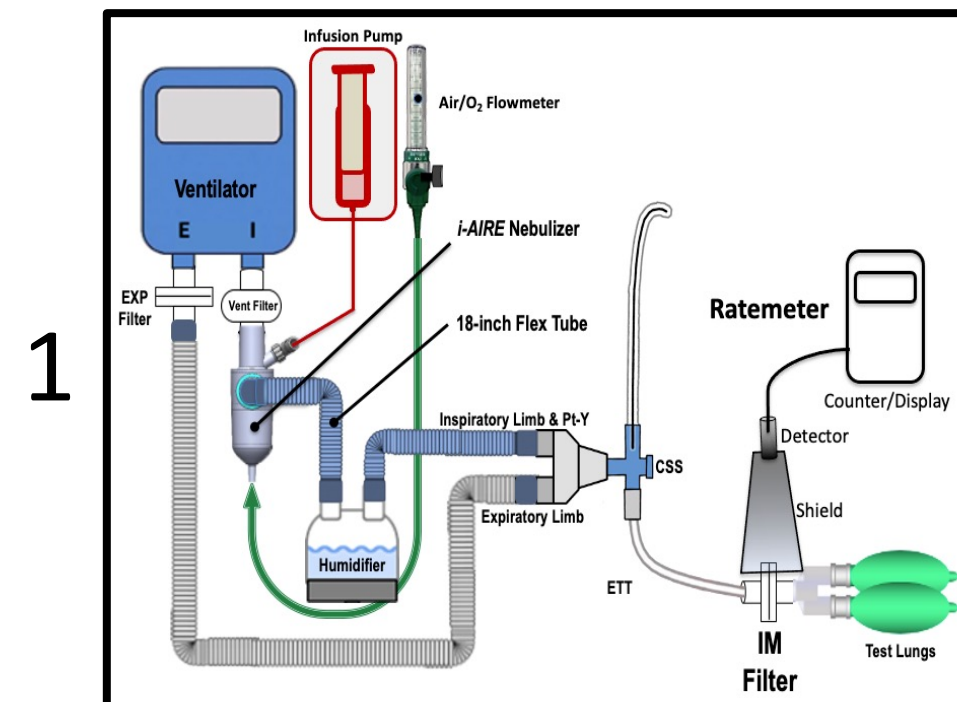
<sup>1</sup>Respiratory Care Program & <sup>2</sup>Division of Pulmonary, Critical Care and Sleep Medicine; Stony Brook University, State University of New York, Stony Brook

## BACKGROUND

During mechanical ventilation, patients may require multiple aerosol drug therapies. For example, continuous prostacyclin plus intermittent bronchodilators or antibiotics.<sup>1</sup> The dynamics of this approach to therapy are defined in this study. Real time aerosol delivery was measured during continuous nebulization with superimposed bolus injection via a single BEJN<sup>2</sup> and 2 VMNs.<sup>2</sup>

## METHODS

- Radiolabeled <sup>99m</sup>Tc/normal saline nebulizer charge used as a tracer
- IM filter proximal to test lungs monitored continuously by gamma ratemeter
- Steady-state continuous infusion of <sup>99m</sup>Tc-NS (~92 µCi/mL)
- 3- & 6-mL bolus instillations of <sup>99m</sup>Tc-NS (~600 & 1,200 µCi)
- 2 infusion pump flows: 5 & 10 mL/hr + 2 ventilator duty cycles (DC): 0.13 & 0.34

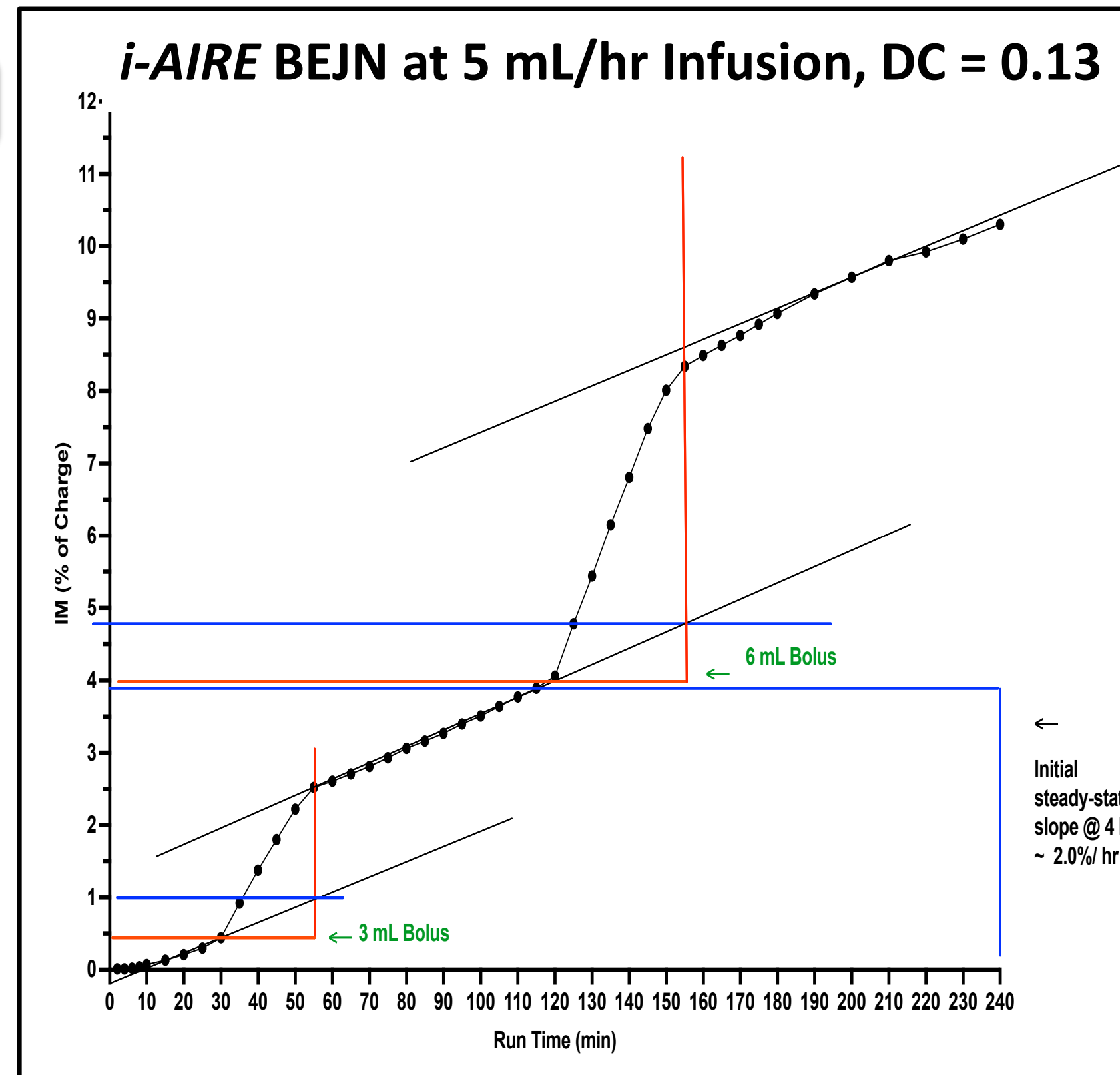


3. Single InspiRx *i-AIRE*<sup>3</sup> BEJN with dual medication port adapter allows instillation of bolus from a unit dose vial concomitantly during continuous infusion with no break in vent circuit.

1. Schematic of complete experimental setup. 2. "Stacked" Aerogen Solo VMNs on the humidifier inlet with 2 Aerogen Pro-X Controllers; one for the infusion, one for the bolus drug treatments (drawing adapted from reference 1 in Footnote).

## RESULTS

**Figure.** Radioactivity delivered over time to Inhaled Mass filter from *i-AIRE* BEJN expressed as % of Infusion Syringe Initial Charge. Dotted black lines indicate aerosol delivery to IM filter starting with continuous infusion. Bolus injections at 30 and 120 min. Red and blue lines represent contribution of the continuous infusion or bolus delivery to facilitate calculation of IM (% of bolus) of each bolus instillation. Bolus delivery was measured as the vertical height of rapid change minus projected infusion.



**Table.** Comparison of Inhaled Mass (IM %) during continuous infusion aerosol delivery with 2 bolus volumes, 2 ventilator duty cycles (DC) and 2 infusion pump flows against bolus delivery without continuous nebulization (data from companion poster by Lee, et al).

IM% OF BOLUS DURING INFUSION						WITHOUT INFUSION	
Neb	Bolus Volume	10 mL/hr DC 0.34	10 mL/hr DC 0.13	5 mL/hr DC 0.34	5 mL/hr DC 0.13	DC 0.34	DC 0.13
i-Aire	3 mL	21.9	13.3	20.9	12.9	14.5 ± 1.7	13.7 ± 2.5
	6 mL	30.1	17.4	31.8	18.7	19.9 ± 4.5	15.5 ± 4.0
Solo	3 mL	36.2	17.4	33.6	21.3	25.5 ± 5.7	13.6 ± 2.0
	6 mL	46.1	24.8	43.6	20.0	19.3 ± 5.9	13.4 ± 3.4

## CONCLUSIONS

- Simultaneous continuous infusion and bolus nebulization of 2 drugs is possible for both VMN and jet nebulizer technology without opening the ventilator circuit or interruption of continuous infusion.
- Added bolus delivered over 30 to 40 minutes.
- Nebulizer efficiency maintained during bolus delivery.

### Footnotes

1. Elnadoury O, et al. Uninterrupted continuous and intermittent nebulizer therapy in a COVID-19 patient using sequential vibratory mesh nebulizers: A case report. *J Aerosol Med Pulm Drug Del* 2020;33(6):1636.
2. VMN = Vibrating Mesh Nebulizer; BEJN = Breath-Enhanced Jet Nebulizer. 3. InspiRx *i-AIRE* nebulizer is pending FDA 510(k) clearance.