



# Automatic Inhalation Resuscitator

## Breathing AIR into Patients

### Goal

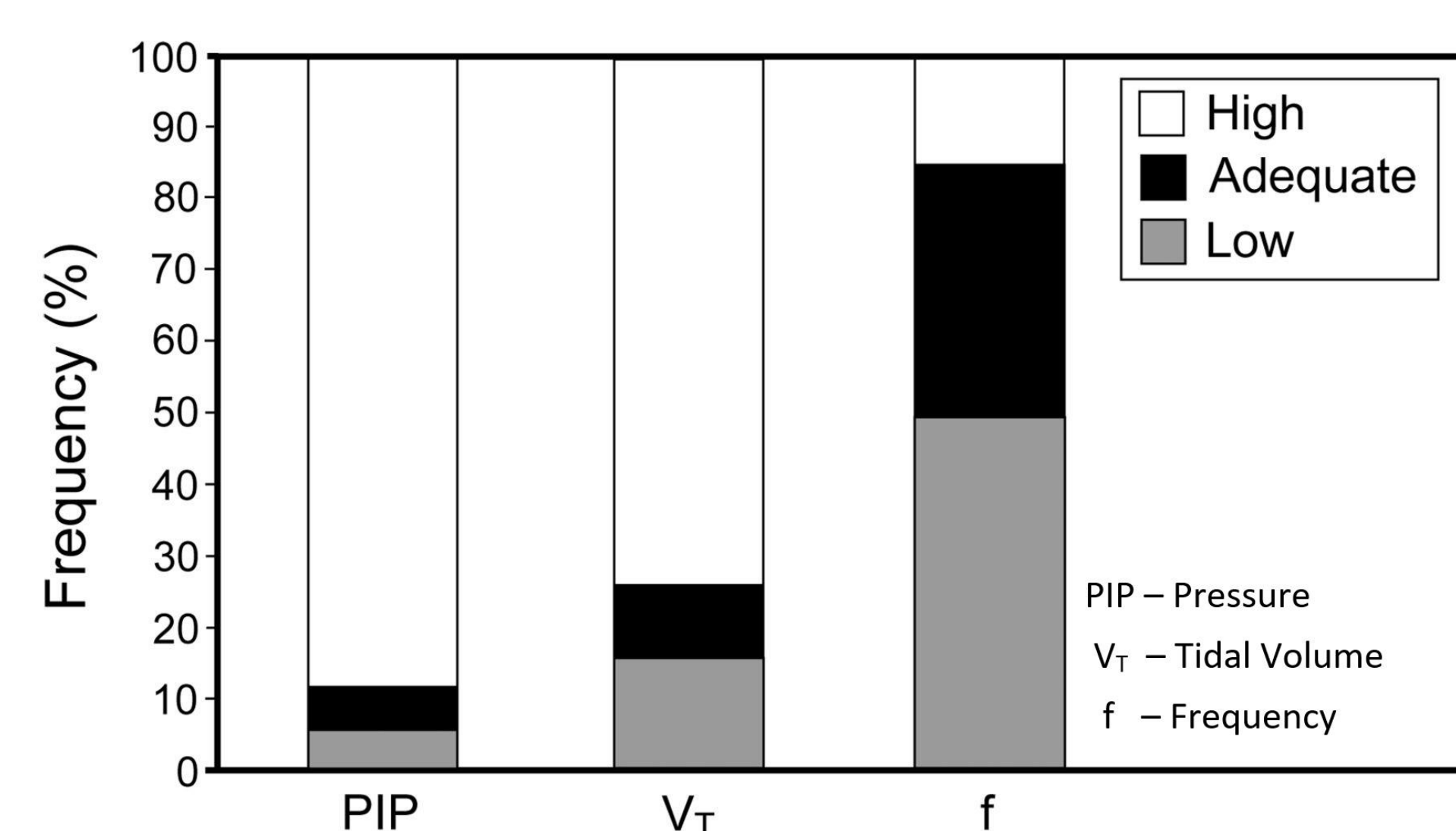
Reduce the amount of medical attention and expertise required to operate a bag valve mask

### Features

- Configurable settings for pressure, volume, and breath rate
- Pre-set configurations between adults, children, and infants
- Bag valve mask remains accessible under operation
- Detects airway blockages and alerts operator
- Adjustable bag support

### Existing Challenges

Inconsistencies in BVM Operation [1]



Amongst 174 Medical Professionals:

- 88% delivered excessive pressure
- 74% delivered excessive volume
- 49% delivered insufficient breath rate

Average Adult Requires:

- 400 - 500 mL per breath
- 20 - 30 cm H<sub>2</sub>O of pressure

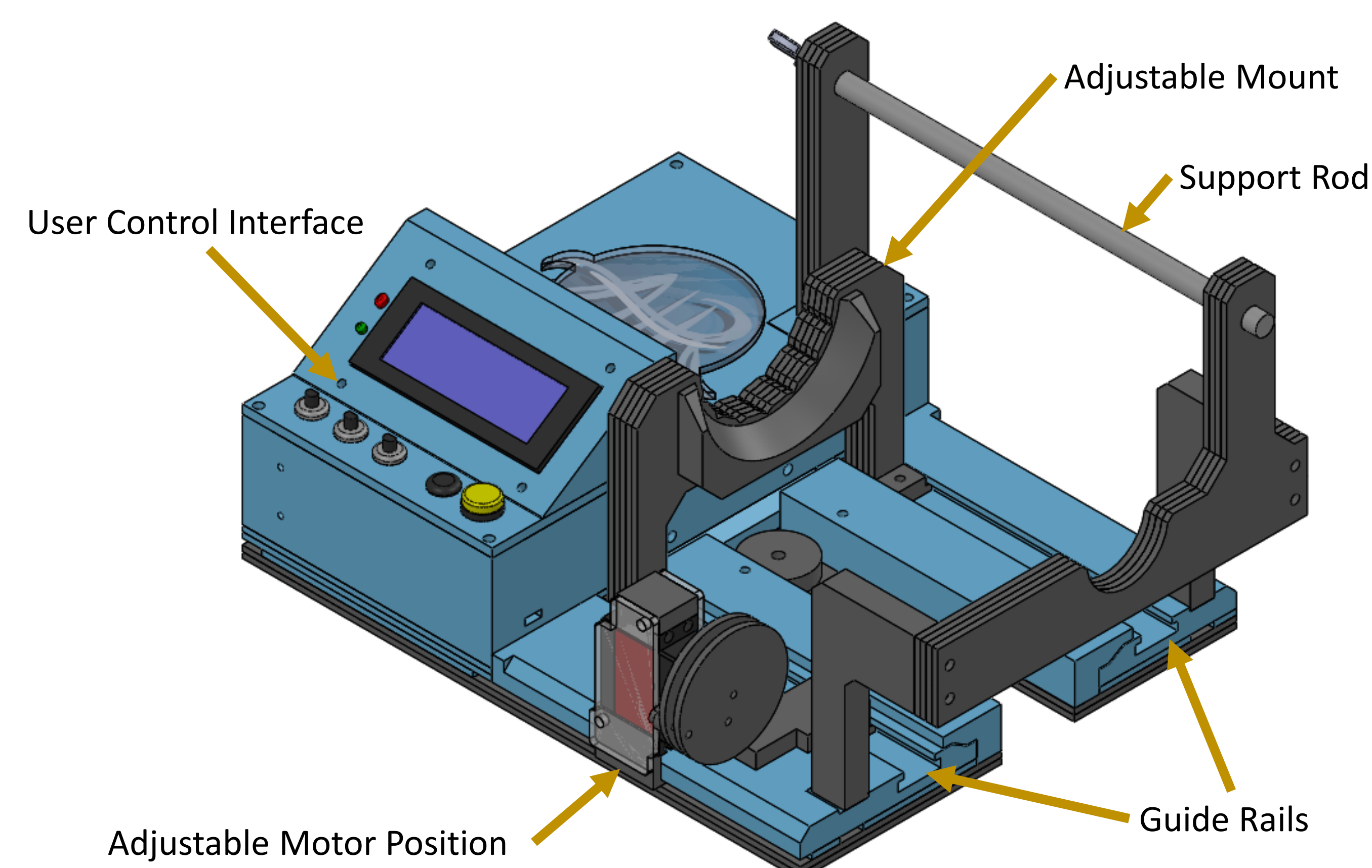
Average Infant Requires: [3]

- 21 - 29 mL per breath
- 13.6 - 24.8 cm H<sub>2</sub>O of pressure

Breath Rates Vary Between Patients

Infants	Children	Adults
40 - 60	20 - 30	10 - 12
Breaths per Minute		

### Design Details



### Developing Countries

- Modern ventilators are not easily accessible
- Family members are often trained to perform manual bag valve mask resuscitation for hours at a time
- Inconsistencies in breath parameters become even more significant when operated by someone less experienced, or for prolonged periods

### First Responders

- 73,500 calls requiring resuscitation per year to emergency services in Ontario, totalling \$1.52 billion [2].
- Performing bag valve mask resuscitation improperly can result in complications, such as hypoventilation
- Long term resuscitation can lead to fatigue and inconsistencies
- Inconsistencies are more prevalent in high-stress situations

*"I believe that paramedics and other emergency personnel would benefit greatly from a solution to this problem"*

- Noah McEvoy

Leads and Grenville Paramedic Service

### Financial Sponsors

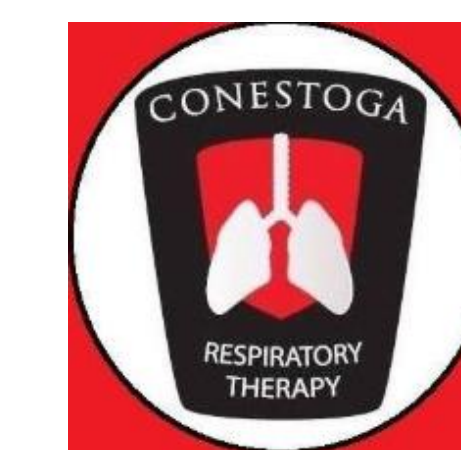


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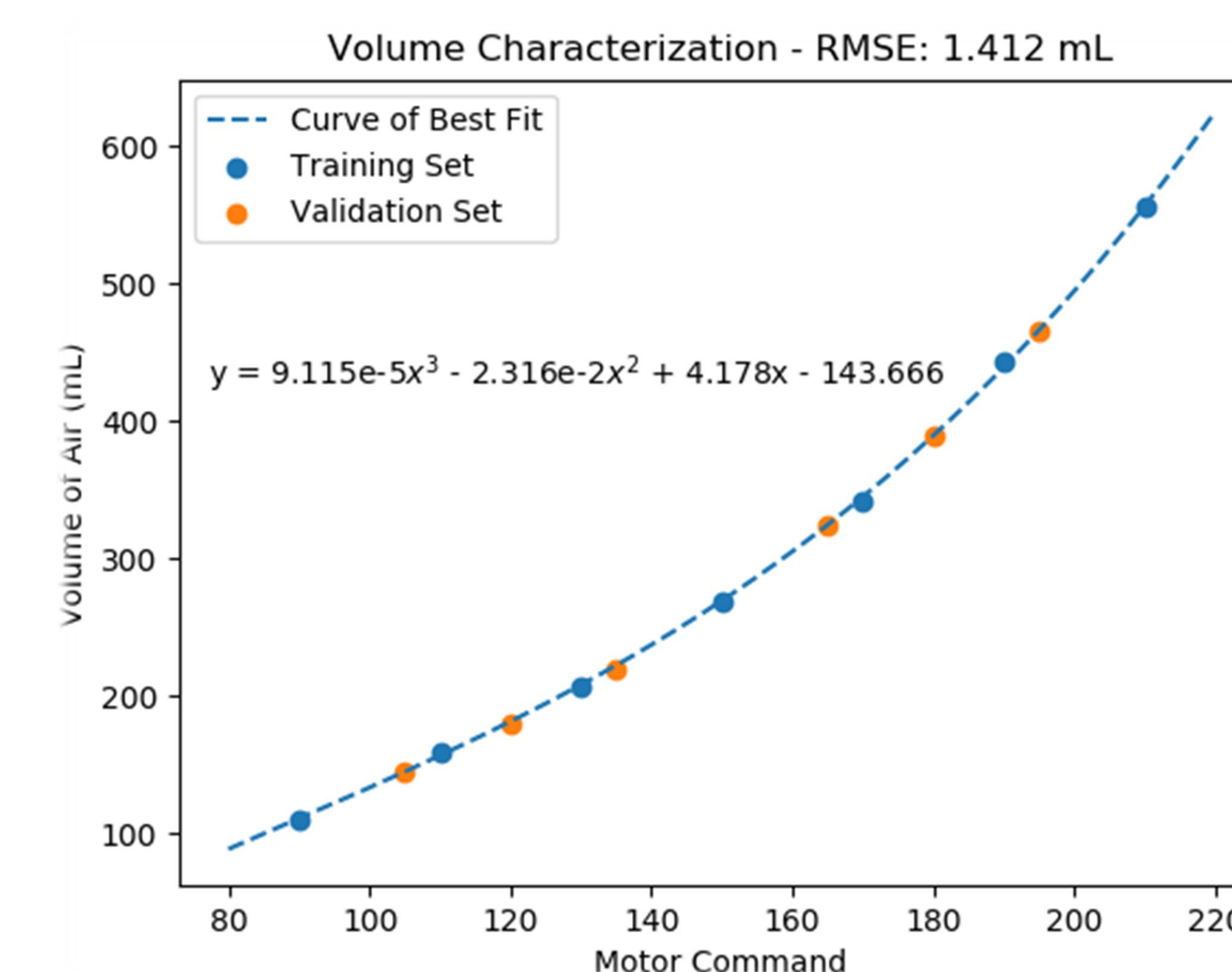
**Baylis**  
MEDICAL

### Consultants

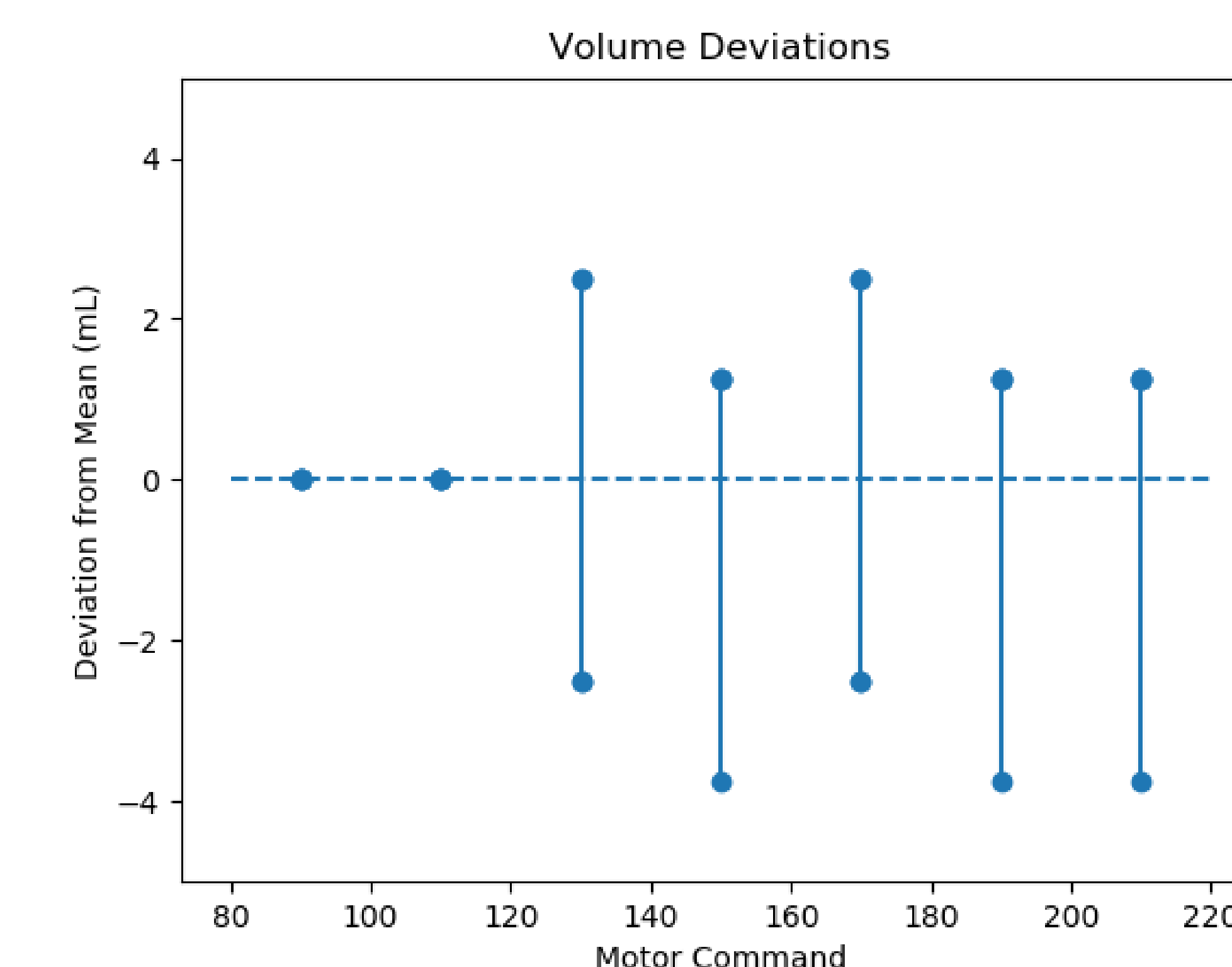
**SickKids**



### System Verification



- Recorded volume output at different servo commands
- Generated a curve of best fit
- Validated with data from a test lung
- Average prediction error of 0.47%



- Multiple trials taken at various motor commands
- Deviation from average volume is shown for each trial
- Maximum deviation is 3.75 mL or 1.9% on average



- Test setup in the Respiratory Therapy Lab at Conestoga College
- Equipment included a Michigan Instruments Simulated Test Lung
- Wright Respirometer used for precision volume measurements
- Experiments performed under supervision and guidance of program director

[1] Bassani et al. "An Evaluation of Peak Inspiratory Pressure, Tidal Volume, and Ventilatory Frequency During Ventilation With a Neonatal Self-inflating Bag Resuscitator," 2012.

[2] M. MacIsaac et al. "Ontario's Emergency Health Services – Sector Overview," 2019

[3] C. Doershuk, L. Matthew "Airway Resistance and Lung Volume in the Newborn Infant," 1969