INTRODUCTION

Background
- Tracheostomies are surgical procedures to relieve an obstruction to the airway in 3 million patients currently live with tracheostomies in the US.
- Patients suffer from excess of mucus buildup in their tracheostomy tube caused by dry air.

Problem
- There is no current technology that allows tracheostomy patients to speak while directly addressing humidification of breath.

Need Statement
- A reusable device that allows tracheostomy patients to conveniently switch between speech and humidification, while maintaining low risk of infection.

PROPOSED SOLUTION

Final Design
- Features a sleek and portable design inspired by the natural profile of the human airway, gently curving to reduce its outward profile.
- Speaking plug allows for modification of resistance in cases of heavy breathing, such as walking up a flight of stairs.

Humidification
- Humidifies inhaled air by capturing moisture from exhaled air in hygroscopic filter.

MOISTURE RELEASING TESTING

Methods
- Multiple pumps of air travel through the filter, releasing moisture from device.
- Commercial HME and several prototypes were tested using this method.

Results
- Multiple pumps of air travel through the filter, releasing moisture from device.
- Commercial HME and several prototypes were tested using this method.

SIMULATED BREATHING TESTING

Methods
- Experimental set-up of simulated breathing shows function of device under normal conditions.
- Commercial with foam, commercial, prototype 3, and prototype 2 were tested using this method.

Results
- Prototype 3 has the most efficient form factor in capturing and releasing humidity.
- Commercial device with its own foam is better at capturing moisture but not as good at releasing moisture.
- Prototype is a better form factor than the current devices on the market.

SPEECH CAPABILITY TESTING

Methods
- Testing was done to confirm speech capability by mimicking airflow in natural airway.

Results
- If pressure increases at the gauge, the patient would be able to speak.
- By performing this test, speech mode activation was confirmed (shown in video).

MANUFACTURING COST, MARKET ANALYSIS, PATENT, REIMBURSEMENT

Manufacturing Info

<table>
<thead>
<tr>
<th>Part</th>
<th>Small Scale Mg</th>
<th>Large Scale Mg</th>
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<tbody>
<tr>
<td>HME</td>
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<tr>
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Price of device is comparable to those currently on the market and promises a longer-term of function, it should be covered under Medicare/Medicaid.

CONCLUSIONS

- In comparison to current devices and previous prototypes, our final design was found to be more effective at humidification of air and successful at allowing speech.
- This prototype can significantly improve the quality of life of millions of people by reducing the need for frequent suctioning and allowing patients to easily switch between speech and humidification modes of operation.
- Provisional patent filed.
- Future work includes implementing a gasket material into the prototype and designing a manufacturing procedure for a sturdier prototype.

ACKNOWLEDGEMENTS

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REFERENCES

[6] Patentability
- Patient pending for this invention.
- Non-obvious as a result of slitted form factor, speech plug activation, multiple modes of adaptability.

Reimbursement
- Price of device is comparable to those currently on the market and promises a longer-term of function, it should be covered under Medicare/Medicaid.
- Estimated $150/month saved by reducing amount of devices needed per month by ~80%.