

3D-Printed, Anatomy-Based Model for Patient and Caregiver Education in a Multidisciplinary Aerodigestive Clinic

Hannah Benjamin MS, Joel Friedlander MD, Sparrow Helland BSN, RN, CPN CN IV, and Emily DeBoer MD.
University of Colorado School of Medicine; Aerodigestive Clinic Children's Colorado.
Aurora, CO

Background

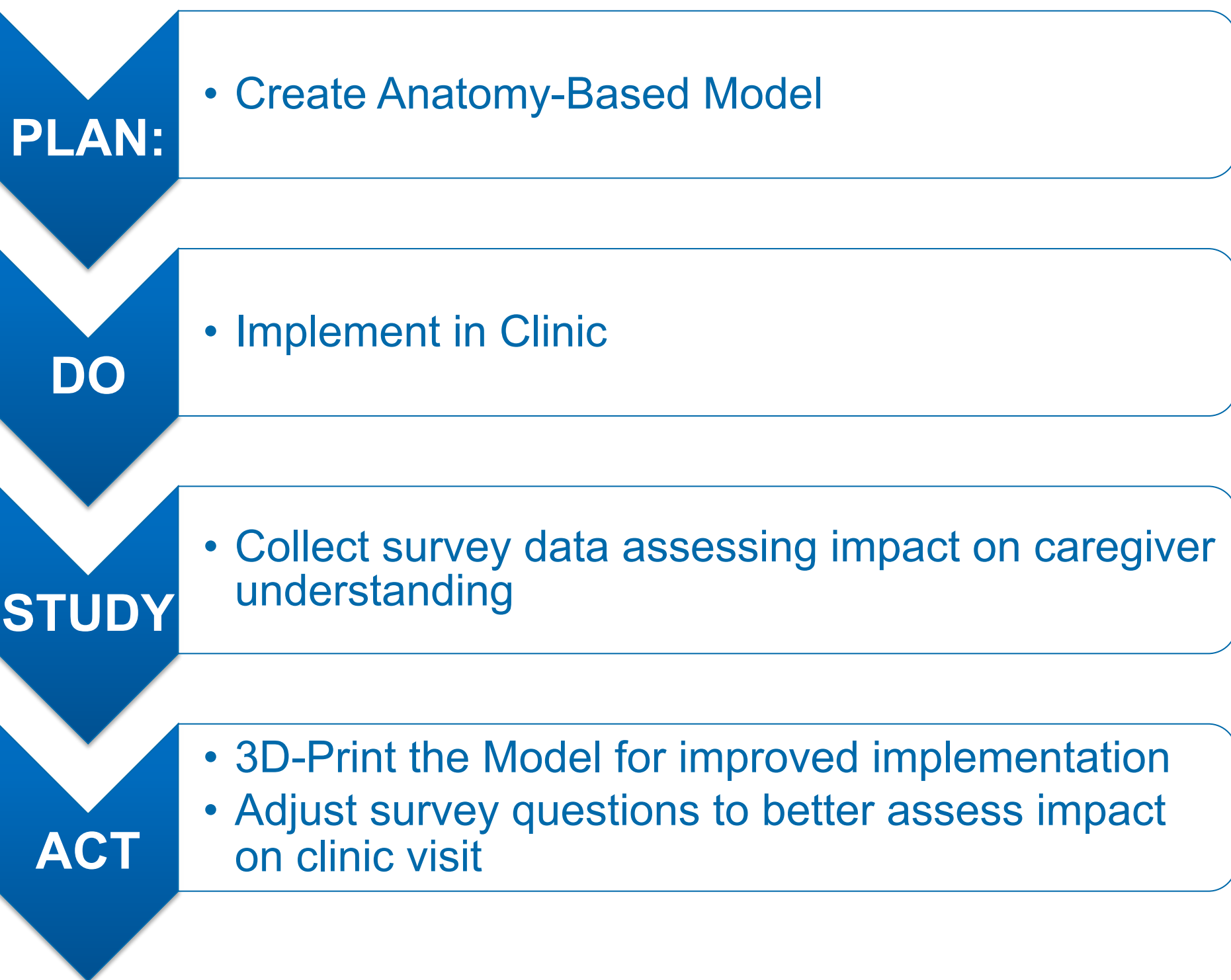
- Understanding aerodigestive disease is contingent on understanding the close anatomical relationship of the respiratory and digestive tracks.
- Consent for diagnostic aerodigestive endoscopies requires caregiver understanding of aerodigestive anatomy.¹
- Implementation of a computer-based digital anatomy model has been challenging for providers.

Aims

- Create a 3D-printed, anatomy-based model that is relevant and applicable to pediatric aerodigestive patients.
- Collect open-ended survey responses from caregivers to understand the impact of the model on clinic visits and caregiver understanding of aerodigestive pathology.

Methods

Quality Improvement using PDSA Cycle Design



- Study population: Families seen in-person in Aerodigestive clinic with cooperative children ≥ 2 years of age
- Administer survey at conclusion of family's visit. Survey includes Likert scale, yes/no, and free response questions.
- Assess survey data for applicability and themes of impact as described by families.

Results

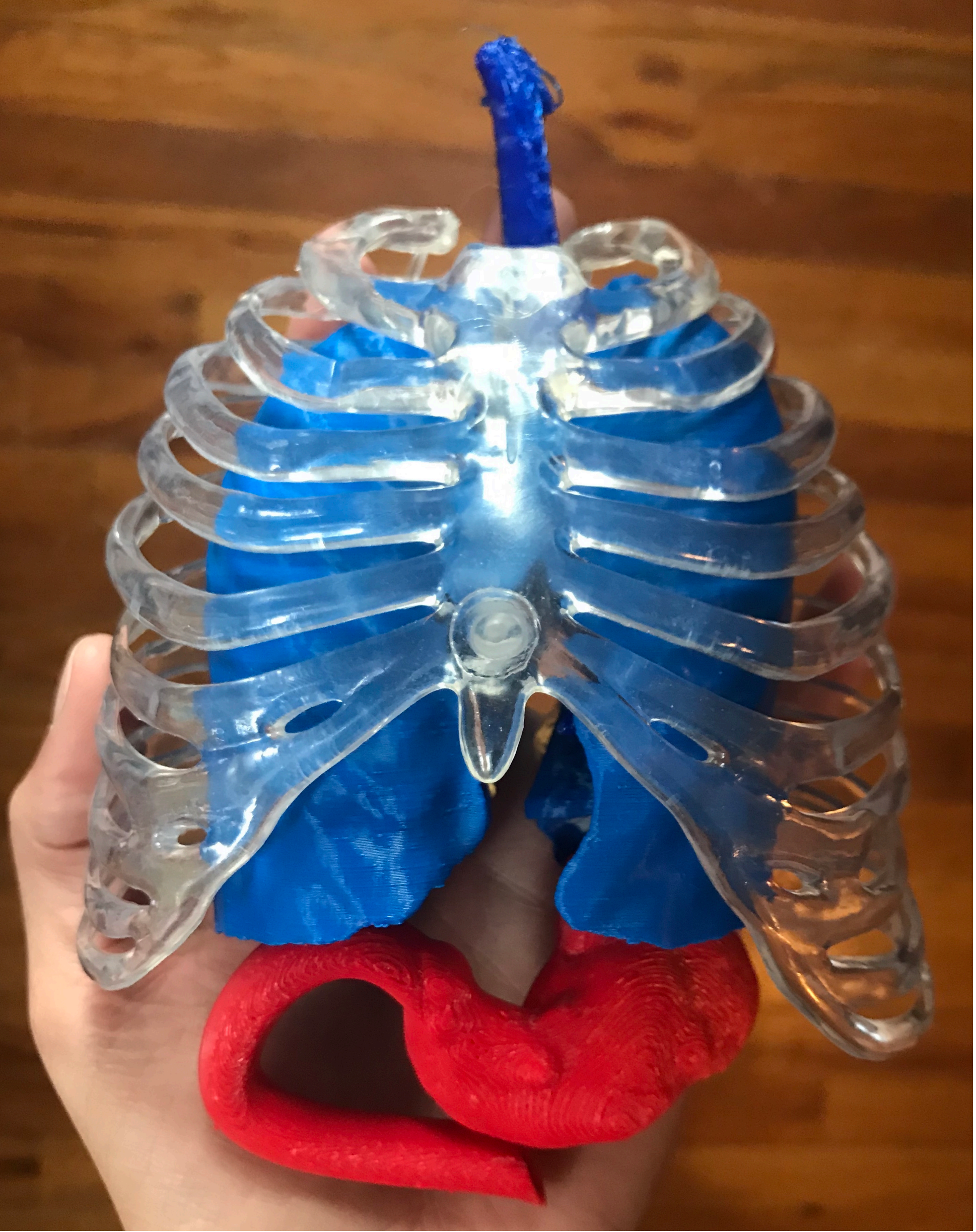


Figure 1. 3D-Printed Aerodigestive Model.

- Twelve surveys collected.** Data collection is ongoing. The model was not used during Telehealth visits and no surveys were collected during these visits.
- Mean age of children: 4.8 years (range: 2-9 years)

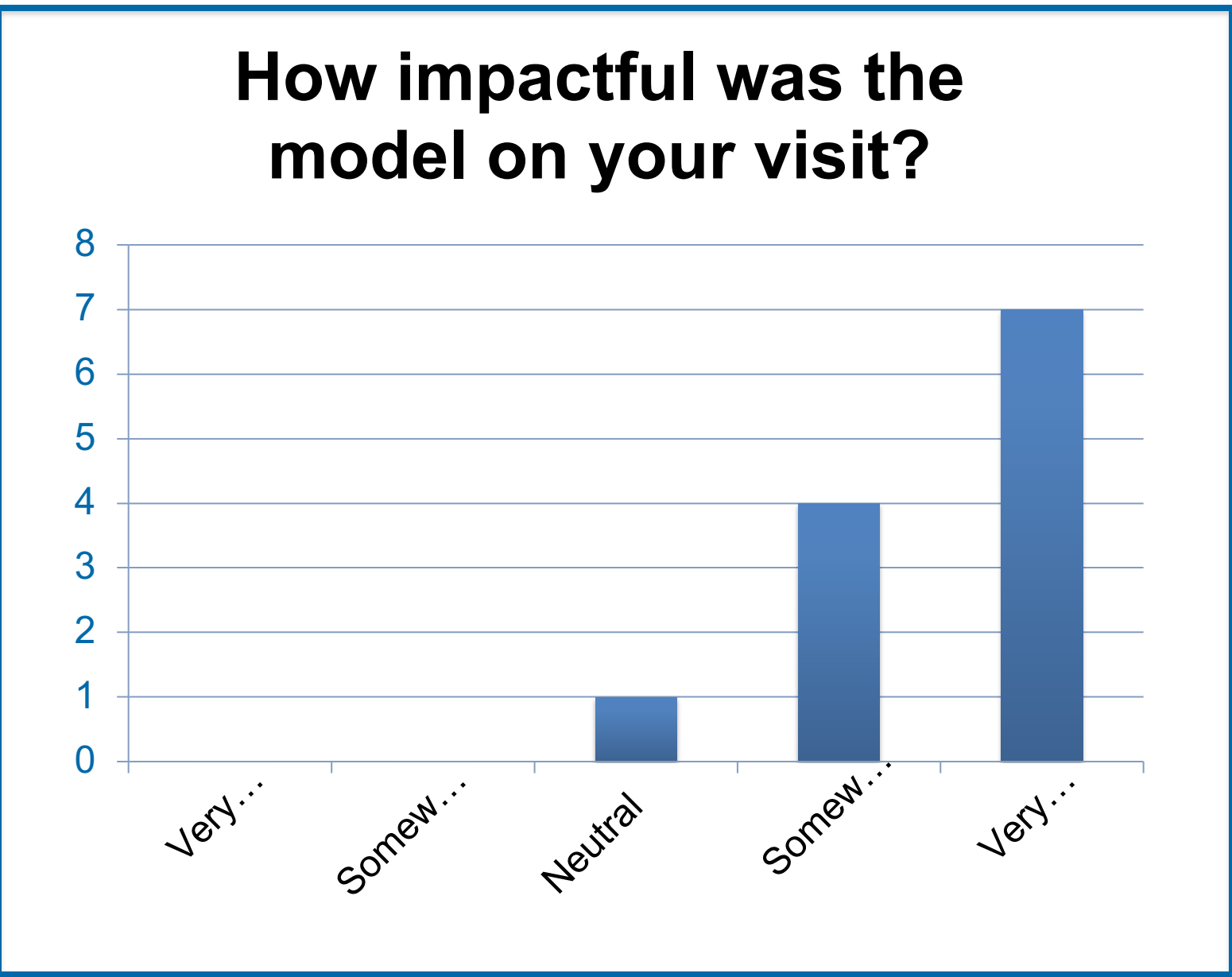
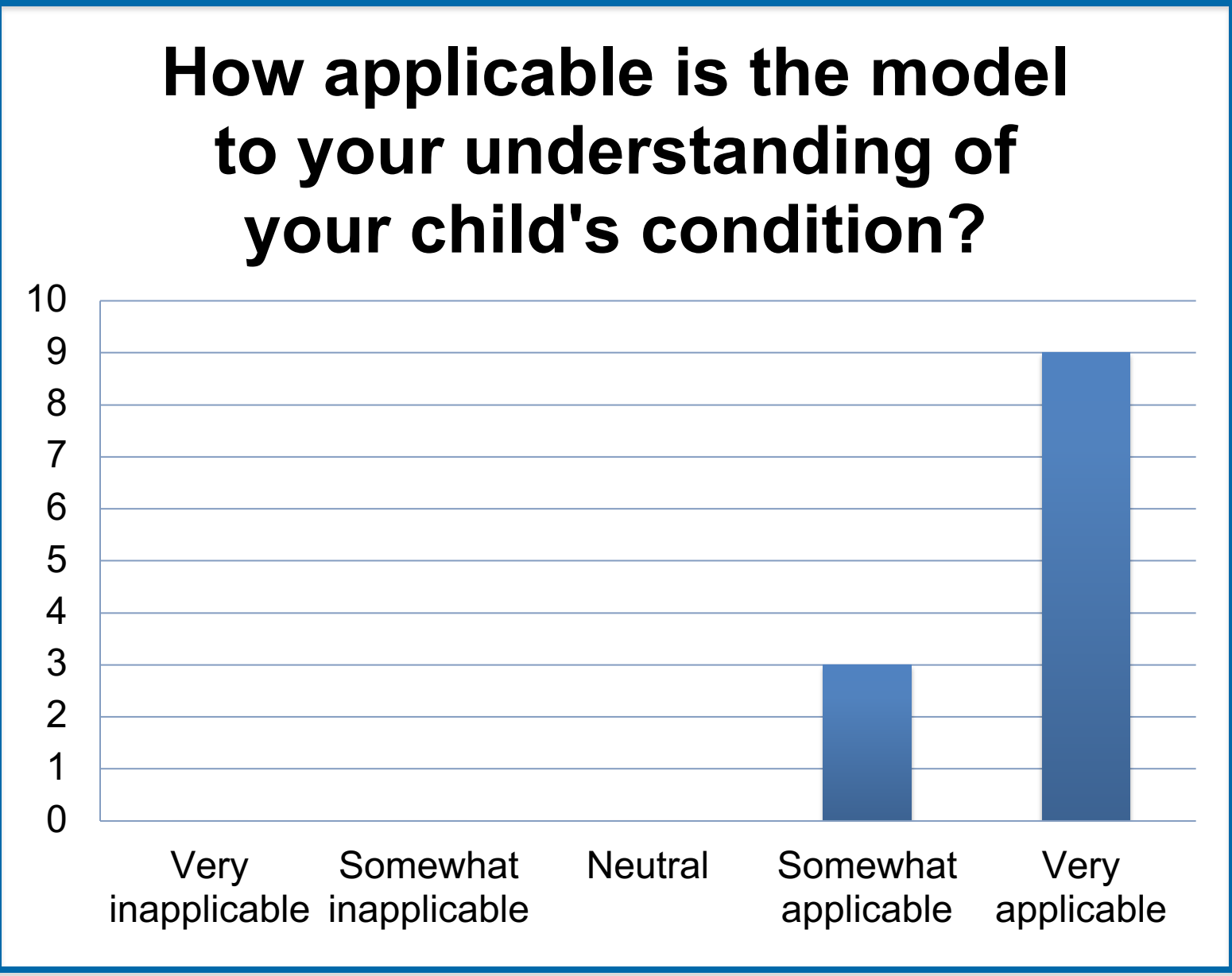


Figure 2. Survey responses. Nine families report that the model is very applicable to their child's condition. Seven families report that the model had a very positive impact on their clinic visit.

Please describe this impact in more detail:	Did your child engage with the model?	Age of child:
My little one was able to feel the similar texture of the ribs to her own body. We also pointed and explained what her G-tube is attached to on the stomach of the model. Very cool!	yes	3
The model was useful in seeing how the trachea and esophagus are next to/on top of each other to see how they can affect each other and the lungs. It is a tiny bit too fragile for smaller children to handle and may need to rethink its stability somewhat.	yes	3
Shows how close everything is together in the chest cavity	yes	2
We feel it would be more impactful if it had the ENT section attached to the model!	yes	6
She wanted to play with it. Loved the color.	yes	9
It let my child and I both see what exactly will be looked at during the scopes .	yes	3
It helped me to understand exactly what would happen in my child's procedure .	no	3
My child was highly interested in it . And it was helpful to explain to me the anatomy .	yes	3.5
Child got to see how his airway was encased in his rib cage . He was very interested in the model! The model was great when surgical procedure was explained.	yes	2.5

Figure 3. Survey responses continued. Common themes noted across free responses are highlighted.

Conclusions

- Implementation of a computer-based digital model was limited by technical inefficiencies and tablet availability.
- Implementation of a 3D-printed model has fewer limitations than a digital model.**
- 100% of children in the study were able to engage with the model.**
- Preliminary survey results show that caregivers report the aerodigestive model is applicable to their child, stimulates interest in pediatric patients, and positively impacts clinic visits for families.
- The preliminary survey highlights the positive impact described by families, including the anatomical relationship of the esophagus and trachea, explanation of aerodigestive procedures, and pediatric patient understanding of their body.
- Limitations of the 3D-printed model, as described by families, include its size, stability, and lack of upper airway anatomy.

Future Work

- Data collection will continue with in-person visits.
- Results will inform future directions for a 3D-printed educational aerodigestive resource.
- Family suggestions include printing the model in a larger and more stable size for improved implementation.
- Survey results regarding patient age and interaction with the model highlight a possible opportunity for pediatric patient-specific education in clinic.
- The impact of the model in Telehealth visits could be explored.

References

1. Friedlander JA, Brumbaugh DE. Informed Consent for Pediatric Endoscopy. *Gastroint Endosc Clin N Am*. 2016. 26(1): 35-46.