Flow Limitation
Progress Report #2

Date: 9/17/2026
Client: Dr. Chris Green
Advisor: Dr. Mehmet Orman
Team: "Flow State"

Lakshika Nanda Kumar Reddy: Co-Leader
Julia Shefchik: Co-Leader
Caroline Blust: Communications
Eliza Kubicek: BSAC
Brady Mayer: BPAG
Jillian Seibert: BWIG

Problem statement:

Flow limitation is the phenomenon in which increasing respiratory effort no longer increases airflow beyond a certain point during forced exhalation, because the airway itself becomes the limiting factor rather than muscles driving expiration [1, 2]. During forced expiration, intrathoracic pressure rises sharply and can exceed the pressure inside the airway, resulting in the airway walls, specifically the bronchi, to narrow and eventually reach a choke point past which further effort in exhalation cannot increase flow [3]. This mechanism is central to interpreting spirometry, since flow-volume curves reflect the mechanical properties of airways rather than respiratory muscle effort alone [4, 5]. It is most relevant to obstructive diseases such as asthma, cystic fibrosis, and COPD, where airway walls are more prone to premature collapse or are already narrowed by inflammation, mucus, or loss of elastic recoil. This leads to prominent flow limitation occurring during forced exhalation [6]. This device will model the branching anatomy of the airway and use flexible materials to replicate the compression and collapse that occurs in the affected patient population. This will allow the users to visualize the equal pressure point (EPP) and the resulting choke point as it moves distally through the airway. The device is intended to physically demonstrate flow limitation during forced expiration for use in an educational teaching video. The final video will be used to teach medical fellows and students how these airway mechanics underlie clinical measures such as spirometry, and how they explain and monitor these obstructive conditions that experience flow limitation.

Brief status update:

The team is doing preliminary research to understand more about the project, and what the previous team was able to accomplish. This includes research on forced expiratory flow limitation, thorough reviews of the previous team's documentation, and research on materials that could be used on the project. The team has already met with the client, which has provided guidance for research questions.

Difficulties/advice requests:

None at this time.

Current design:

The box from last year's group project will be used in our current design.

Materials and expenses:

None at this time.

Major team goals for the next week:

- Work on forming design ideas for the material of the airway, as well as methods for connecting branches and alveoli in the model airway.
- Complete the design matrices

Next week's individual goals:

Lakshika Nanda Kumar Reddy

- Continue brainstorming ideas for the project
- Continue researching materials to support design ideas
- Research compartment models more to understand the branching system

Julia Shefchik

- Brainstorm design ideas for the project
- Continue researching the project to support design ideas
- Research connection materials and ideas for the branching system

Caroline Blust

- Brainstorm design ideas for airway model structure
- Brainstorm material ideas for second design matrix
- Research competing designs to understand where research has been done and continue to understand how to practically create a visible choke point

Eliza Kubicek

- Brainstorm 2-3 design ideas, including by building on last year's project and by identifying new areas for innovation
- Continue conducting research on materials and designs that will best model human airways based on previous research

Brady Mayer

- Brainstorm design ideas for our 3d model.
- Research design materials and supporting literature for our possible designs.
- Meet with the client and discuss specification and design ideas

Jillian Seibert

- Work on having multiple design ideas
- Continue researching any design ideas
- Research materials we could use in our design

Previous week's goals and accomplishments:

Lakshika Nanda Kumar Reddy

- Worked on PDS and edited it
- Researched more on flow-volume curves and spirometry for sections of PDS
- Started brainstorming design ideas

Julia Shefchik

- Worked on the PDS and edited it
- Found research standards on operating devices using compressed air

Caroline Blust

- Wrote section of PDS
- Researched further articles on key choke point concepts to inform material decision-making

Eliza Kubicek

- Conducted research to find pressure and compliance values of human airways for the device to mimic as well as to identify and minimize safety concerns
- Reported research findings in LabArchives
- Worked on the PDS and edited based on team feedback

Brady Mayer

- Worked on the PDS and edited with the team to create a cohesive document.
- Researched articles about patient concerns and competing designs.

Jillian Seibert

- Worked on PDS and continued to edit anything that needed changes
- Researched some more articles and topics related to COPD and math for the project
- Added anything necessary to the website that is needed

ACTIVITIES

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Lakshika Nanda Kumar Reddy	9/7/2026	Review previous team's final report	1	2.5	8
	9/7/2026	Brainstorm questions for the client meeting	0.5		
	9/10/2026	Conducted research on flow limitation and took notes	1		
	9/15/2026	Worked on PDS	1	5.5	
	9/15/2026	Researched FV curves, obstructive diseases, and flow limitation for PDS	2		
	9/16/2026	Edited PDS	1.5		
	9/16/2026	Researched materials for design ideas	1		
Julia Shefchik	9/7/2026	Review previous team's deliverables (final report, PDS, final poster)	1	4	8
	9/7/2026	Brainstorm questions for the client meeting	0.5		
	9/9/2026	Annotated and read a review article on Expiratory Flow Limitation	1.5		
	9/9/2026	Researched mechanical properties of the Airway Tree	1		
	9/13/2026	Worked on PDS	1	4	
	9/14/2026	Research standards and	2		

		worked on PDS			
	9/16/2026	Edited PDS	1		
Caroline Blust	9/7/2026	Brainstorm questions and review past project	0.5	1	7
	9/7/2026	Add research entry to LabArchives	0.5		
	9/11/2026	Researched project concepts and summarized client article	1.5	6	
	9/15/2026	Worked on PDS	3		
	9/15/2026	Further research	1		
	9/16/2026	PDS edits	0.5		
Eliza Kubicek	9/5/2026	Read through last semester's final report documentation and took notes on previous work and potential starting points in LabArchives	2	6	10
	9/7/2026	Brainstormed questions for the client meeting	0.5		
	9/7/2026	Conducted research on flow limitation during forced expiration and took notes in LabArchives	2		
	9/9/2026	Conducted research on tube law and physical properties of human airways for future design use and took notes in LabArchives	1.5		
	9/14/2026	Outlined PDS sections	0.5	4	
	9/15/2026	Conducted research for and wrote PDS sections	2.5		
	9/16/2026	Edited PDS based on feedback	0.5		
	9/16/2026	Updated LabArchives with research findings used in writing the PDS	0.5		
Brady Mayer	9/7/2026	Researched background information and brainstormed questions for client meetings. I also further researched	2	4	7

		information about the trachea and bronchi and updated lab archives after previous issues.			
	9/9/2026	I also further researched information about the trachea and bronchi and updated lab archives after previous issues.	2		
	9/15/2026	Worked on PDS and researched info for it.	2	3	
	9/16/2026	Made PDS edits based on team recommendations.	0.5		
	9/17/2026	Worked on progress report and final PDS edits.	0.5		
Jillian Seibert	9/7/2026	Added research entries to LabArchives and contributed to research more background information	1.5	2	7
	9/7/2026	Went through previous teams reports and clients powerpoint	0.5		
	9/11/2026	Researched more on the math and COPD aspect of project	1	5	
	9/13/2026	Researched anything necessary for the PDS	1		
	9/13/2026	Worked on my section of PDS	1.5		
	9/16/2026	Revised the PDS and updated my labarchives to match with my research for the PDS	1.5		

PROJECT TIMELINE

Task	Sept			October					November				Dec	
	11	18	25	2	9	16	23	30	6	13	20	27	4	11
Project R&D														
Preliminary Research	X	X												
Detailed Final Design														
Testing Plan														
Show and Tell														
Fabrication														
Testing														
Deliverables														
Progress Reports	X	X												
PDS		X												
Design Matrix														
Prelim presentation														
Preliminary Deliverables					7th									
Final Poster														
Final Deliverables														9th
Meetings														
Client		X												
Advisor	X	X												
Website														
Update	X	X												

Materials and expenses:

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
									$0.00	
									$0.00	
Category 2										

									$0.00	
									$0.00	
								TOTAL:	**$0.00**	

References

[1] C. Tantucci, “Expiratory Flow Limitation Definition, Mechanisms, Methods, and Significance,” Pulm Med, vol. 2013, p. 749860, 2013, doi: 10.1155/2013/749860.

[2] T. C and G. V, “Flow limitation: an overview,” PubMed, Accessed: Sep. 15, 2026. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/10546481/

[3] Z. Ms, “The physiology of forced expiration,” PubMed, Accessed: Sep. 15, 2026. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/16263442/

[4] “Lung Flow Volume Curve - an overview | ScienceDirect Topics.” Accessed: Sep. 15, 2026. [Online]. Available: https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/lung-flow-volume-curve

[5] “Pulmonary Function Testing - PMC.” Accessed: Sep. 15, 2026. [Online]. Available: https://pmc.ncbi.nlm.nih.gov/articles/PMC7158317/

[6] R. L. Dellacà et al., “Detection of expiratory flow limitation in COPD using the forced oscillation technique,” Feb. 2004, Accessed: Sep. 15, 2026. [Online]. Available: https://publications.ersnet.org/content/erj/23/2/232