Permission Acknowledgement	Yes
Has the work you are presenting been submitted to or published in a peer-review journal?	No
Professional Title	Graduate Research Assistant (4th year PhD)

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001	Akshay Anand, MS	Speaker	aanand@fsu.edu	Florida State University	Submitter
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If you are planning to attend the DFD 2024 meeting in person and would like to volunteer to serve as a session chair, please check this box:	Yes, I would like to serve as a session chair
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Presentation Type:	Oral
Select your Sorting Category:	4. Biological Fluid Dynamics
Select your Sub-Category	4.8.6
Abstract Title:	Integrating Machine Learning and Physics-Based Flow Models for Population-Level Respiratory Disease Simulation
Abstract Body:	This study presents a novel framework for simulating respiratory disease transmission across diverse populations using advanced machine learning and fluid-based reduced-order modeling. Our approach leverages computational efficiency to integrate a wide range of facial shapes, mask sizes, and fluid dynamics, modeling the intricate interactions between facial movement, mask fit, and varying dynamic conditions. We represent the space between the face and mask as interconnected channels with porous boundaries and imposed compatibility conditions to accurately predict airflow leakage patterns. By incorporating facial deformations linked to specific phonemes, we

analyze how different speech scenarios affect mask efficacy, providing a nuanced understanding of how verbal communication impacts leakage. We will then compare these results with our breathing simulations inside a large cohort of subjects, quantifying the differential impact of these two distinct respiratory events on mask leakage patterns. Finally, we discuss how this methodology contributes to the identification of more effective mitigation strategies for respiratory disease transmission.

Funding Acknowledgement:

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Category Type: Computational

Newsworthy Research? Yes, I would like to consider highlighting my abstract in outreach to journalists.

Keyword Label 1: reduced-order model

Keyword Label 2: machine learning

Keyword Label 3: respiratory flows

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