

ATS 2026 Highlights

Respiratory Structure and Function Early Career Professionals

Get to know members of the RSF Assembly



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Is your research clinical, basic science or translational?

Translational.

Tell us about your research?

I develop automated imaging tools for disease detection and characterization using chest CT scans. A primary focus of my work is building an automated end-to-end system for mucus plug detection and quantification, enabling efficient, scalable analysis across large cohorts. By turning a labor-intensive imaging phenotype into a reproducible quantitative biomarker, this platform supports population-level studies linking mucus plug burden to clinical outcomes across patients with diverse airway pathology and disease severity.

Where do you see yourself in 5 years?

In 5 years, I see myself having completed my PhD and established a strong track record of collaborative work with engineers and clinicians that substantially advances medical imaging. I aim to develop and rigorously validate computational tools that make disease detection more reliable and efficient, and to translate them into clinical workflows where they can meaningfully improve patient care.

What do you find is the major benefit of RSF Assembly Membership?

Being in a community of clinicians and scientists who inspire me to produce research that is grounded in clinical and translational necessity.



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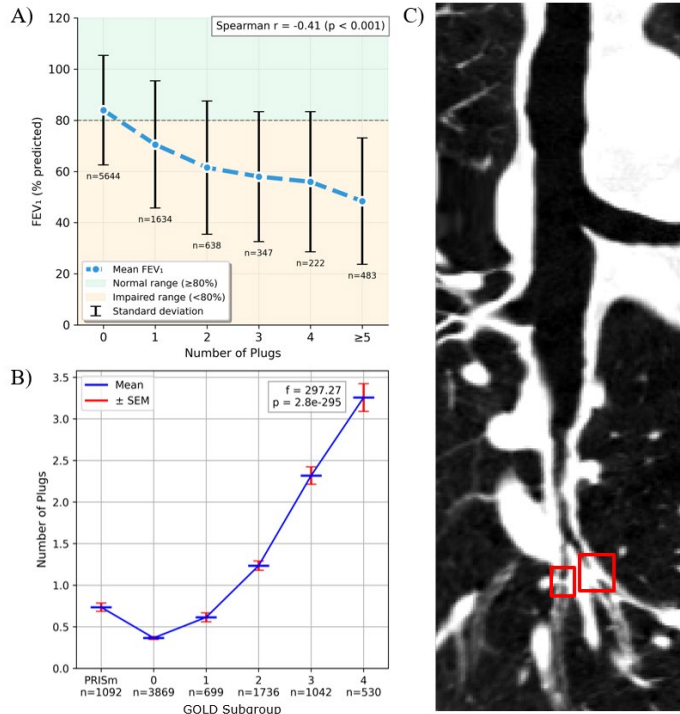
If you or someone you know would like to be featured as an ATS RSF ECP please email Carolyn Wang (carolyn.wang@hli.ubc.ca)

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A) Number of plugs vs post-bronchodilator FEV₁ % predicted. B) Mean number of plugs by GOLD subgroup. C) Multiplanar reconstruction with algorithm-detected mucus plugs highlighted.

AI-based Detection of Airway Mucus Plugs and Imaging Correlates in COPDGene

Objective: Airway abnormalities such as mucus plugging are increasingly recognized as important imaging markers of diagnosis, prognosis, and therapeutic response in COPD. Mucus plugs have been linked to increased mortality, even in mild (GOLD 1) disease, suggesting a role for mucolytic therapy in early intervention. However, visual identification on CT is time-consuming, subjective, and lacks standardization. To address this, we developed an AI-based algorithm for automated mucus plug detection and evaluated its associations with lung function, mortality, and exacerbations in the COPDGene cohort.

Methods: Cross-sectional data from 8,971 participants in Phase 1 of the COPDGene study were analysed, including current and former smokers across GOLD stages 0–4 and those with preserved ratio impaired spirometry (PRISm). Airway structures were segmented from inspiratory CT scans using a 3D nnU-Net model trained on 279 subjects from the Airway Tree Modelling (ATM'22) dataset, enabling detection of visible airways disconnected from the central bronchial tree, representing potential obstructions. A lightweight three-layer convolutional neural network (CNN) encoder was trained to classify regions bridging these disjoint airway endpoints as mucus plug obstructions (Figure 1C). Mucus plug burden was quantified, and associations with clinical outcomes were evaluated using Spearman correlation and negative binomial regression, adjusted for demographic, clinical, and imaging covariates.

Results: Greater mucus plug burden was associated with lower post-bronchodilator FEV₁ % predicted ($\rho = -0.41$, $p < 0.001$; Figure 1A) and increased air trapping defined by low-attenuation areas (LAA < -856 HU) on expiratory CT ($\rho = 0.33$, $p < 0.001$). Plug burden increased with GOLD stage (Figure 1B). Participants with higher plug burden also had worse quality-of-life scores (SGRQ: $\rho = 0.31$, $p < 0.001$) and reduced exercise capacity (6-minute walk distance: $\rho = -0.26$, $p < 0.001$). A representative 2D multiplanar slice reconstruction from a GOLD 4 participant illustrates mucus plugs detected by the algorithm (Figure 1C, red boxes). In multivariable models among GOLD 1–4 participants, mucus plug presence was independently associated with increased mortality risk (hazard ratio = 1.28, $p < 0.005$) and higher exacerbation frequency (incidence rate ratio = 1.32, $p < 0.005$).

Conclusion: We developed an AI-based algorithm for automated mucus plug detection within the airway tree. Detected mucus plug burden was significantly associated with impaired lung function, air trapping, and elevated mortality and exacerbation risk. These findings support the use of AI-based mucus plug quantification as a potential imaging biomarker of disease severity and clinical outcomes in COPD.