Advancing the Precision Approaches for COPD

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Educational background

2002-2004	M.P.H., Harvard School of Public Health
2000-2004	Fellow, Pulmonary and Critical Care Medicine, Harvard Medical School
1997-2000	Resident in Internal Medicine, University of Pennsylvania
1993-1997	M.D., University of Pennsylvania School of Medicine
1989-1993	B.A., Harvard University

Professional experience

2025-Present	Professor of Medicine, Brigham and Women's Hospital, Harvard Medical School
2016-2025	Associate Professor of Medicine, Brigham and Women's Hospital, Harvard Medical School
2008-2016	Assistant Professor of Medicine, Brigham and Women's Hospital, Harvard Medical School
2004-2008	Instructor in Medicine, Brigham and Women's Hospital, Harvard Medical School

The aim of precision medicine is to define subtypes of a heterogeneous disease, which can have implications for diagnosis, prognosis, and/or treatment. This approach has been highly successful in many types of cancer. COPD is a heterogeneous disease and would be an appropriate condition for a precision medicine approach. The idea of COPD heterogeneity has been proposed for decades, with subtypes of emphysema and chronic bronchitis. More modern approaches include the use of chest CT scan imaging and omics biomarkers.

The approach is to start by identifying a clinical question. We then try to understand the epidemiology, specifically looking at clinical phenotypes that can be measured and disease subtypes. We then incorporate genomics biomarkers, with the goal of arriving at an endotype, a subtype with a shared biologic mechanism. Eosinophilic COPD and alpha-1 antitrypsin deficiency-related emphysema are endotypes that already have specific therapies. Subtypes such as patients with frequent exacerbations can be targeted with several treatments, but the underlying biology is likely heterogeneous.

We will highlight this approach, using examples such as airway-predominant COPD, frequent exacerbations, and asthma-COPD overlap. These studies have been conducted in large observational studies, including the multi-center U.S. COPDGene Study. This work has leveraged the wealth of data in COPDGene, including clinical information, pulmonary function tests, chest CT scans, and multi-omics such as genetics, RNA-sequencing and proteomics. Despite these advances, there are many challenges for COPD precision medicine, such as the requirement for large studies with longitudinal outcomes and biospecimens. Clinical trials of targeted therapies will be needed for the application of precision medicine in COPD.