

## SITUATION

The University of Michigan Health System comprises numerous hospitals, health centers, and outpatient clinics serving patients all across the state of Michigan. The Division of Pulmonary and Critical Care Medicine, recently rated as one of the 'Best Hospitals for Pulmonology and Lung Surgery' for 2020-2021 by U.S. News and World Report, has 52 physicians specializing in the treatment of patients with acute or chronic respiratory disease.

The multidisciplinary team at the Taubman Center in Ann Arbor screens, diagnoses, and treats patients with rare lung diseases, lung cancer, chronic obstructive pulmonary disease (COPD), and interstitial lung disease (ILD), including those in need of lung transplant. Developing optimal treatment strategies requires clinicians to have a comprehensive picture of their patient's health.

Dr. MeiLan Han, Pulmonologist and Professor of Medicine in the Division of Pulmonary and Critical Care, and Dr. Craig Galban, a researcher and Professor in the Department of Radiology, are leading research efforts to utilize advanced machine learning techniques for discovering previously unknown or misunderstood COPD phenotypes. Pulmonologists often encounter patients with COPD phenotypes that do not fit into well-defined

disease categories, which results in diagnostic uncertainty. For example, a patient with a history of smoking and respiratory symptoms may have normal pulmonary function test (PFT) results.

### ALGORITHMS

**31,000** analyses  
run per year



Lung Density Analysis Functional (LDAf)



Lung Density Analysis Inspiration (LDAi)

## SOLUTION

The University of Michigan team developed and validated a computed tomography (CT)-based image analysis and registration technique known as Parametric Response Mapping (PRM). The patented PRM technology uses machine learning and image processing techniques to align or register paired inspiratory/expiratory chest CT studies, which in turn allows for classification of lung tissue into multiple COPD-related categories.

Imbio Inc. provides fully-automated artificial intelligence (AI) analysis tools for medical imaging that convert grayscale chest CT scans into rich, color-coded, visual maps with quantitative reports, transforming the way patients are screened, diagnosed, treated and managed for lung and cardiothoracic conditions. Imbio's Functional Lung Density Analysis™ (LDAf) is based on PRM and is the only automated, regulatory-cleared image analysis tool providing a complete mapping of normal lung, air-trapping, and areas of persistent low density in a combined image to help visualize the components of COPD. Imbio's Lung Density Analysis Inspiration (LDAi) algorithm includes proprietary Noise Reduction Technology to aid in quantification and visualization of low dose CT scans. LDAi serves as a component of lung cancer screening programs and includes a patient-centered LungMap™ report to assist with smoking cessation counseling. LDAf and LDAi offer advanced analysis of chronic lung conditions and provide maximum information for personalized care decisions as well as surgical and interventional procedure planning.

# CASE STUDY

## RESULTS

When assessing patient eligibility for a lung valve replacement or lung volume reduction surgery, Dr. Han needs information to determine whether a patient has substantial emphysema to qualify. The LDA analysis tool not only helps guide the targeted interventions that her patients receive, but assists in finding previously undiscovered airway abnormalities and helps in facilitating patient education. Dr. Han explained that, for instance, pulmonary function tests can be inadequate to understand disease progression in patients who have both a native and transplanted lung. Therefore, the ability to quantify abnormality in each lung using medical imaging tools has proven to be very beneficial in those patients. Assessing for and tracking disease over time with these tools produces an exact percentage of change that can be relayed to a patient, which has also been clinically impactful.

Dr. Han has found that her clinical decision-making has increasingly benefited from having access to the Imbio quantitative reports and visual maps. This information has also increased her level of confidence when determining the best course-of-action for advanced endoscopic and surgical treatment planning.

From a patient care perspective, the University of Michigan team finds that Imbio's tools facilitate meaningful conversations with patients. The automated quantitative reports are more helpful than plain grayscale CT images in illustrating the lung disease to patients without medical experience interpreting chest CT images.

Dr. Han states that it is "difficult to run an advanced lung program without this type of technology," especially as a referral center like the University of Michigan where it has become more standard-of-care to have these capabilities when treating patients with severe lung diseases. For the Michigan pulmonary team, that means having LDAi available for emphysema screening while utilizing LDAf for severe cases of obstructive lung diseases for the purposes of diagnosis and treatment. Imbio solutions deliver more than quantitative analysis, they provide clinicians with diagnostic comfort and certainty to the best care pathway forward.



## BENEFITS

Facilitating Patient Communication



Faster Reviews with More Confidence



Tracking Patients in a Quantified Way

## VALUE

**"You didn't know you needed it until you had it. Once you have [this technology] you realize there are all sorts of ways it helps. [Using Imbio] makes my life easier and gives me greater confidence in my diagnostic and prognostic abilities. It facilitates conversations with colleagues and patients. It's become more and more important for advanced procedures planning. I wouldn't want to give up access to the technology."**



*MeiLan Han, MD MS*