**Title:** Logistic and Ordinal Logistic Modeling of Computed Tomography Features Associated with Non-Tuberculous Mycobacteria Lung Disease

**Abstract:** Non-tuberculous mycobacteria lung disease (NTM-LD) is a chronic infection of the lungs caused by the inhalation of microbial organisms called non-tuberculous mycobacteria. NTM-LD is associated with radiologic features that can be observed through CT scans, including atelectasis, bronchiectasis, consolidation, ground-glass opacities, tree-in-bud opacities, centrilobular nodules, and cavities. Prior studies have reported that NTM-LD is more severe and its associated features, especially bronchiectasis, are observed more frequently in certain regions of the lung, particularly the right middle lobe and lingula. However, these findings have largely been based on small cohorts, and a systematic, quantitative analysis comparing radiologic feature severity across lung regions in a larger population has not been conducted.

This analysis addresses that gap by evaluating CT scans from 166 subjects to quantify and compare the severity of NTM-LD features across six lung regions: the right upper lobe (RUL), right middle lobe (RML), right lower lobe (RLL), left upper segment (LUS), left lingular segment (LLS), and the left lower lobe (LLL). Nodule and cavity severity were scored on a binary scale (“0” for absence of the feature and “1” for presence), and the remaining five features were scored on an ordinal four-point scale (“0” for absence, “1” for 0-25% involvement, “2” for 25-50%, and “3” for >50%). To account for the complex correlation structure from repeated ratings across multiple lobes and two raters per subject, we fit mixed-effects regression models, logistic for binary outcomes and ordinal logistic for ordinal outcomes, with random intercepts for subject and a nested random effect for rater.

Results indicate that atelectasis and bronchiectasis were most severe in the RML and LLS; consolidation in the RML and RUL; ground-glass opacities and nodules in the RLL, RUL, and LLL; thick wall cavities in the RUL and RLL; tree-in-bud opacities in the RLL and LLL; while thin wall cavities had no significant differences in lobar severity. These results confirm preferential involvement of lung regions with NTM-LD which can focus surveillance on the most affected regions and inform treatment recommendations.