

Imbio Lung Density Analysis™

(with PRM technology exclusively licensed from the University of Michigan)

Bibliography of Peer-Reviewed Scientific Literature

Regulatory Clearance Notice: Lung Density Analysis (LDA) is FDA Cleared, CE Mark certified and Health Canada Approved. LDA is available for research use only in other regions without regulatory clearance for clinical use.

Indications for Use: The Imbio CT Lung Density Analysis Software provides reproducible CT values for pulmonary tissue, which is essential for providing quantitative support for diagnosis and follow up examinations. The Imbio CT Lung Density Analysis software can be used to support the physician in the diagnosis and documentation of pulmonary tissue images (e.g. abnormalities) from CT thoracic datasets. Three-D segmentation and isolation of sub-compartments, volumetric analysis, density evaluations and reporting tools are provided.

Below is a representative sampling of published scientific peer-reviewed articles that relate to general CT Lung Densitometry, as well as Imbio Lung Density Analysis - including core embedded technology known as "PRM" (Parametric Response Mapping) - used for classification of pulmonary tissue. This bibliography is being provided by way of illustration of the scientific discourse on the subject.

Clinical Value of LAA%

Association between emphysema-like lung on cardiac CT and mortality in persons without airflow obstruction: A cohort study.

Oelsner EC, Hoffman EA, et al. *Ann Intern Med.* 2014;161:863-873.

Quantitative computed tomography in chronic obstructive pulmonary disease.

Lynch DA, Al-Qaisi MA. *J Thorac Imaging.* 2013 Sep;28(5):284-90. doi: 10.1097/RTI.0b013e318298733c.

Optimal threshold in CT quantification of emphysema.

Wang Z, et al. *Eur Radiol.* 2013 Apr;23(4):975-84. doi: 10.1007/s00330-012-2683-z.

Emphysema scores predict death from COPD and lung cancer.

Zulueta JJ, Wisnivesky JP, et al. *Chest* 2012;141(5):1216-1223.

Effect of emphysema on lung cancer risk in smokers: A CT-based assessment.

Li Y, Swensen SJ, et al. *Cancer Prev Res.* 2011;4(1):43-50.

Clinical significance of radiologic characterizations in COPD.

Han MK, Bartholmai B, et al. *J COPD.* 2009;6(6):459-467.

Association of radiographic emphysema and airflow obstruction with lung cancer.

Wilson DO, Weissfeld JL, et al. Am J Respir Crit Care Med. 2008;178:738-744.

Air Trapping on Expiration**Association Between Functional Small Airway Disease and FEV1 decline in COPD**

Bhatt SP and COPDGene Investigators. Am J Respir Crit Care Med. 2016 Jul 15;194(2):178-84. doi: 10.1164/rccm.201511-2219OC.

Quantitative CT in COPD: Inspiratory and expiratory assessment.

Akira M, Toyokawa K, Inoue Y, Arai T. AJR. 2009; 192:267-272.

Air trapping on expiratory high-resolution CT scans in the absence of inspiratory scan abnormalities: correlation with pulmonary function tests and differential diagnosis.

Arakawa H, Webb RW. AJR. 1998; 170: 1349-1353.

Inter-reader Variability in Assessing COPD**Pulmonary emphysema: subjective visual grading versus objective quantification with macroscopic morphometry and thin-section CT densitometry.**

Bankier AA, De Maertelaer V, Keyzer C, Gevenois PA. Radiology. 1999; 211: 851-858.

A combined pulmonary- radiology workshop for visual evaluation of COPD: study design, chest CT findings and concordance with quantitative evaluation.

Barr G, Berkowitz E, et al. COPD. 2012; 9: 151-159.

Technical Methods and Limitations**CT lung densitometry: Dependence of CT number histograms on sample volume and consequences for scan protocol comparability.**

Kemerink GJ, Kruize HH, Lamers RJ, van Engelshoven JMA. J Comp Assist Tomog. 1997; 21(6):948-954.

Repeatability of quantitative CT indexes of emphysema in patients evaluated for lung volume reduction surgery.

Gierada DS, Yusen RD, et al. Radiology. 2001; 220:448-454.

Reference standard and statistical model for intersite and temporal comparisons of CT attenuation in a multicenter quantitative lung study.

Sieren JP, Newell JD, et al. Med Phys 2012; 39(9):5757-5767.

Effects of CT section thickness and reconstruction kernel on emphysema quantification: relationship to the magnitude of the CT emphysema index.

Gierada DS, Bierhals AJ, et al. Acad Radiol. 2010; 17(2):146.