

Online Supplement

Original Research

An Interpretable Multidimensional Acoustic Physiology Map for COPD Using Digital Lung Sounds

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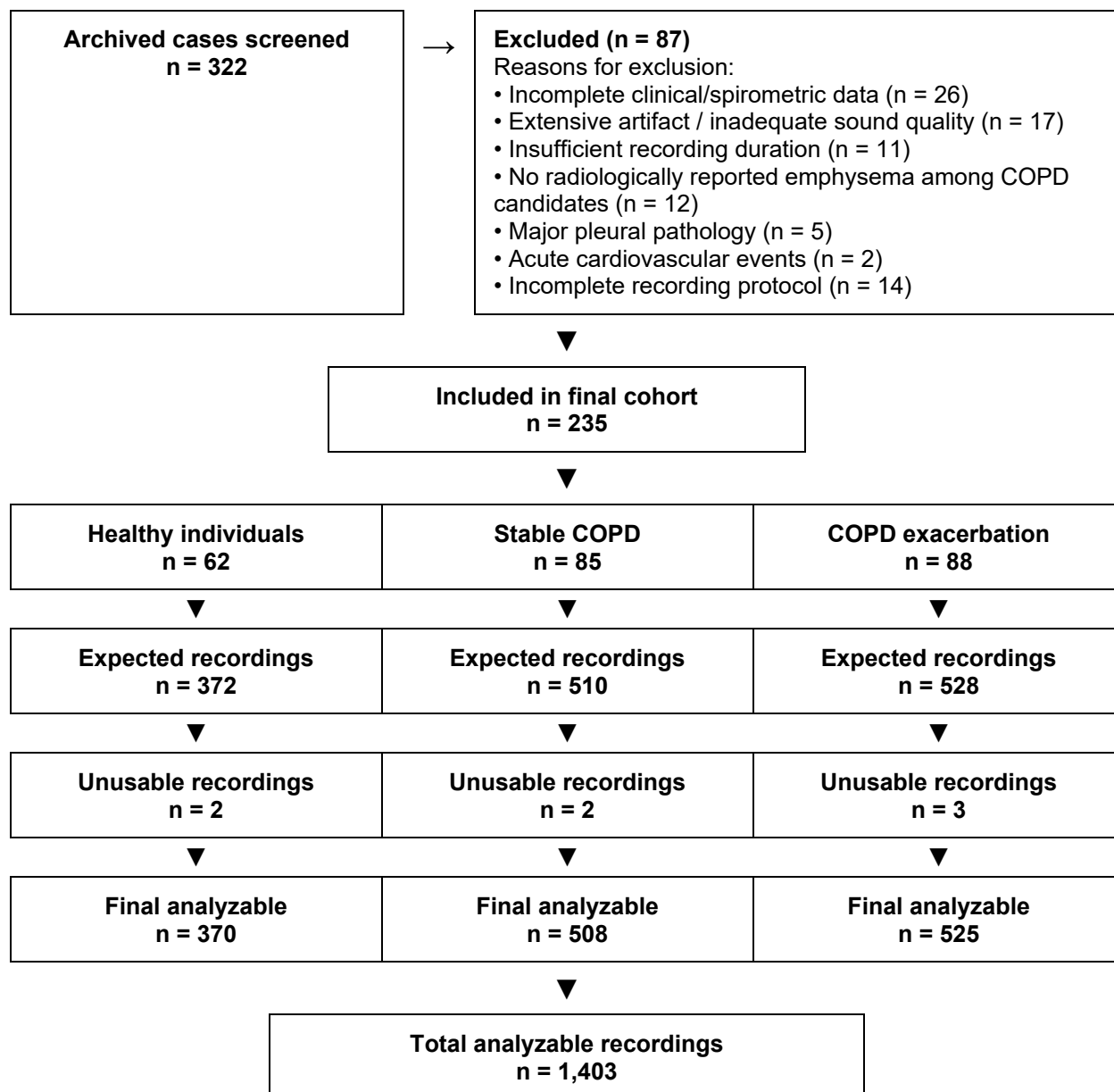
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Supplementary Table 1. Quantitative emphysema assessment on inspiratory chest CT.

	Stable COPD (n = 85)	COPD Exacerbation (n = 88)	P-value
LAA-950, % (whole lung)			
Median (IQR)	15.27 (4.81–32.99)	27.61 (14.18–35.39)	0.002
Mean ± SD	19.59 ± 16.21	27.33 ± 15.35	
Distribution by LAA-950 threshold, n (%)			
< 5 %	22 (25.9)	2 (2.3)	< 0.001
5 to < 25 %	32 (37.6)	36 (40.9)	
25 to < 50 %	26 (30.6)	44 (50.0)	
≥ 50 %	5 (5.9)	6 (6.8)	

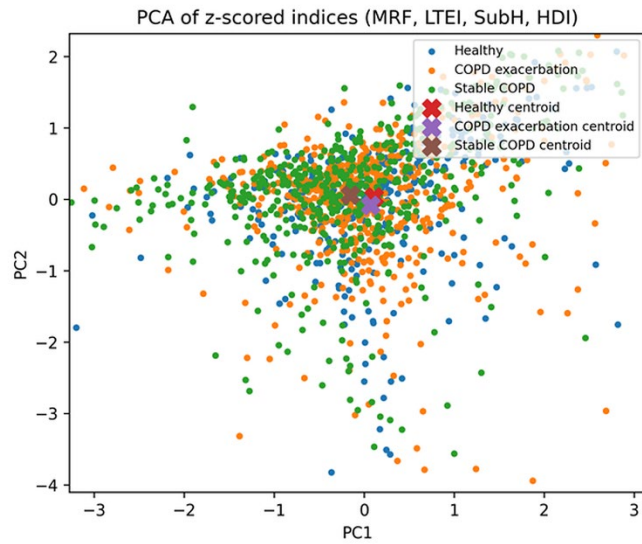
Note: LAA-950, percentage of lung voxels with attenuation < -950 Hounsfield units; COPD, chronic obstructive pulmonary disease; IQR, interquartile range; SD, standard deviation. P-values calculated with the Mann-Whitney U test for continuous variables and Fisher's exact test for the categorical distribution.

Supplementary Figure 1. Study flow diagram.



Note: A total of 322 archived cases were screened. Eighty-seven were excluded because of incomplete clinical/spirometric data (n = 26), extensive artifact or inadequate sound quality (n = 17), insufficient recording duration (n = 11), absence of radiologically reported emphysema among COPD candidates (n = 12), major pleural pathology (n = 5), acute cardiovascular events (n = 2), or incomplete recording protocol (n = 14). The final cohort included 235 participants: 62 healthy individuals, 85 patients with stable COPD, and 88 patients with COPD exacerbation. Based on the six-site posterior thoracic recording protocol, expected recordings were 372, 510, and 528, respectively. After quality control, final analyzable recordings were 370, 508, and 525, respectively, for a total of 1,403 recordings. COPD, chronic obstructive pulmonary disease.

Figure S1. PCA visualization of the four-index acoustic space.



PC1-PC2 projection of z-scored MRF, LTEI, SubH, and HDI recordings, colored by clinical group; X markers indicate group centroids. Plot limits were set to improve visualization of the main cluster; 20 recordings fall outside the displayed range but are included in the PCA and all downstream analyses.