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**Title:** MRI equilibrium signal mapping is a quantitative and reproducible alternative to CT for the estimation of lung density in COPD

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**Body:** In MRI, the equilibrium tissue magnetisation is proportional to tissue water density. This study aimed to explore the feasibility and reproducibility of mapping the signal ( $S_0$ ) associated with the equilibrium magnetisation in the assessment of structural abnormalities in COPD. MR images were acquired in 12 COPD subjects twice within 1 week for  $T_1$  and  $S_0$  mapping. Lung  $S_0$  was normalized by dividing by muscle  $S_0$  to obtain a quantitative  $S_0$  ( $qS_0$ ). Matched CT slices were selected to calculate  $PD_{15}$  and  $RA_{950}$ . Lung  $qS_0$  maps were reproducible with reduced values seen in regions comparable to CT detected emphysema regions. The mean and 15<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> percentile  $qS_0$  showed strong correlations with  $PD_{15}$  and  $RA_{950}$ . Equilibrium signal maps of MRI correlate strongly with CT density estimates, indicating that  $qS_0$  may be a reproducible, non-invasive/-ionising measure for quantifying lung density changes in COPD.

Table 1. Pearson correlation coefficient between lung  $qS_0$  values and quantitative CT parameters

	Mean $qS_0$	15 <sup>th</sup> centile $qS_0$	50 <sup>th</sup> centile $qS_0$	75 <sup>th</sup> centile $qS_0$
$PD_{15}$	0.930*	0.847*	0.938*	0.911*

RA <sub>.950</sub>	-0.907*	-0.830*	-0.900*	-0.892*
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\* p value < 0.01