Reply to Verbanck and Paiva

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TO THE EDITOR: We welcome this interest in our method (2) for regionally mapping ventilation with multiple breath washout imaging (MBW-imaging), we agree that quantitative maps of fractional ventilation (r maps) from 3He MRI can add to the regional understanding of ventilation heterogeneity as measured with MBW. Compartmental models of the lungs that link specific (or fractional) ventilation to MBW signal have been proposed before (1). With respect to the choice of 10 compartments in Verbanck and Paiva’s (4) implementation of such a model, the process of binning the histograms of r values from all voxels into further compartments could sacrifice some of the inherent regional sensitivity and strength of the imaging method, whereby each voxel represents a regionally discrete physiological measurement.

The use of these MBW-imaging ventilation maps to model global lung MBW measures is a logical application of our method, and, as Dr. Verbanck is aware from personal communications, we developed our own models of whole lung MBW by integration of the signal from all lung voxels. In work to be presented at the forthcoming ATS (3), we introduce these image-based MBW models with comparisons to actual whole lung MBW measurements from the subjects imaged.

With respect to the observations made by Verbanck and Paiva, indeed it is not surprising that the fractional ventilation maps from subject 3, showing low ventilation heterogeneity with a narrow range of r values, shows a more monoeponential behavior in the global MBW model because all lung units have similar time constants. What may have been missed in the simulations by Verbanck and Paiva, but was addressed in our paper (2), is the nonequilibrium starting gas concentration after a single breath of the 3He gas prior to washout. This starting concentration should be considered as a voxel-specific parameter (as well as the voxel’s r value) when simulating the MBW signal decay. Given this, and without full details of their compartmental simulations, we are somewhat hesitant to agree with the quantitative numbers that are drawn from our published data. In summary, we are very pleased these two experts in the field of quantitative lung physiology are interested in our work, and we look forward to additional scientific discussions on the details of how best to interpret the results.

DISCLOSURES
No conflicts of interest, financial or otherwise, are declared by the author(s).

AUTHOR CONTRIBUTIONS
Author contributions: J.M.W. and F.C.H. conception and design of research; J.M.W. and F.C.H. interpreted results of experiments; J.M.W. and F.C.H. drafted manuscript; J.M.W. and F.C.H. edited and revised manuscript; J.M.W. and F.C.H. approved final version of manuscript.

REFERENCES

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