Reply: The new ERS/ATS standards on lung function test interpretation: some extant limitations

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Reply to J.A. Neder:

We would like to thank J.A. Neder for his thoughtful correspondence and critical review of the updated ERS/ATS technical statement on pulmonary function test interpretation [1]. As the updated technical document focuses on physiological interpretation of pulmonary function tests, we welcome the discussion on how to incorporate these updated standards into clinical practice.

We certainly agree with J.A Neder that the interpretation of pulmonary function tests should always be done in the clinical context considering a clinician's prior knowledge of the patient and the established likelihood of disease. In practice, the interpretation of pulmonary function tests is often done without all the relevant clinical information and consequently this is one of the reasons we focused on the physiological interpretation, as opposed to the specific clinical context. As highlighted by J.A. Neder, there are many instances when a dogmatic approach is used to define disease based on arbitrary cut-points and this will inevitably lead to misclassification of impairment and in some cases missed opportunities for intervention. We recognise that the relative merits of using the lower limit of normal (LLN) compared with the fixed ratio (0.7) for the ratio of forced expiratory volume in 1 s (FEV_1) to forced vital capacity (FVC) to identify airflow obstruction have been debated widely in the literature, and in practice. As neither of these two approaches are anchored to clinically relevant endpoints, there is an urgent need to re-evaluate how we use pulmonary function tests to inform clinical decisions. J.A. Neder refers to data showing increased dyspnoea in the "discordant" subjects with FEV_1/FVC <0.7 but >LLN [2]. He notes, as others have found, that these subjects were older male subjects. However, cardiovascular disease is higher in these "discordant" subjects [3, 4] and may be the cause for the dyspnoea rather than "early COPD". A transition away from dichotomising decisions based on an arbitrary threshold to incorporate pulmonary function test results with imaging results and symptomology is an essential step towards patient-centred care.

Many of the recommendations made within the recent technical statement are based on evidence available from large population studies, and J.A. Neder raises a second important issue in that in much of medicine we rely on evidence from large population-based studies to inform decisions for an individual patient. This further emphasises that individual results need to be put in context of the patients' specific circumstances. This is particularly relevant to the point about mid-range expiratory flows. There may be individual circumstances where mid-expiratory flows help to confirm a clinical picture; however, based on the body of evidence it is important to recognise the limits of using mid-expiratory flows on their own as a tool for early airflow obstruction, because of the wide range of values found in healthy individuals. There have been considerable advances in imaging technologies and novel pulmonary function tests (*e.g.* the forced oscillation technique) that are more sensitive and robust at detecting small airway obstruction, and would be preferrable to the use of mid-expiratory flows.

In addition to J.A. Neder's correspondence, we have received several questions regarding the need to measure lung volumes to confirm a restrictive pattern. Our intention was not to increase the need for unnecessary testing, but rather to avoid the misuse or over-reliance on FVC alone to define a restrictive pattern. Perhaps what is not explicit in the ERS/ATS updated technical standard is that an *a priori* reason to suspect restrictive pattern should be considered when determining which tests to use. Indeed, in the context of COPD, FVC can be reduced from concomitant obstruction or suboptimal effort. To differentiate

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The updated technical statement on pulmonary function test interpretation focuses on physiological interpretation. There are important considerations regarding how these updated standards can be incorporated into clinical practice. https://bit.ly/3xDZGOJ

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restrictive pattern from gas trapping would require measures of lung volumes to rule out the former. Furthermore, if FVC and FEV_1/FVC are low, lung volumes may be informative to assess mixed obstructive/restrictive pattern. J.A. Neder's point about the differences between slow vital capacity and FVC are reasonable and important to consider. His suggestions further highlight that interpretation of pulmonary function tests requires wholistic consideration of the patient, and all clinical findings, as opposed to dichotomous interpretation (normal/abnormal) based on specific thresholds. The updated ERS/ATS technical statement suggests thresholds for interpretative strategies to inform practice. Importantly, the central message of document is that we must start accepting and incorporating the uncertainty of measurements into how we interpret pulmonary function test results.

With respect to the comment about alveolar volume (V_A) and transfer coefficient of the lung for carbon monoxide (K_{CO}), we were perhaps ambiguous, and we thank J.A. Neder for pointing out that figure 11 in the report needs to be considered in context of the text. We emphasise that there are no strict cut-offs to determine when K_{CO} seems normal or too high when V_A is low.

We welcome the discussion about definitions of severity and FEV_1Q. We found that the evidence to support the current approach to the interpretation of pulmonary function tests is limited, and the lack of evidence leads to wide disparities in how pulmonary function tests are used. We appreciate that the anchor points to support the cut-offs are linked to mortality and this distal outcome does not necessarily help with defining current functional impairment; however, defining relevant grades of functional impairment, from which to anchor lung function grading, is a much more complex construct than using mortality. The previously recommended cut-points were arbitrary and furthermore were age and sex biased. This discussion highlights the urgent need for large prospective studies to determine how to use pulmonary function tests to identify clinically relevant and patient-centred endpoints.

We anticipate that the approaches proposed in the updated ERS/ATS technical statement on pulmonary function test interpretation document will be considered in the context of disease specific endpoints, and that more customised approaches will be developed considering the challenges that exist with how pulmonary function tests are currently used.

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References

1 Stanojevic S, Kaminsky DA, Miller MR, *et al.* ERS/ATS technical standard on interpretive strategies for routine lung function tests. *Eur Respir J* 2022; 60: 2101499.
2 Neder JA, Milne KM, Berton DC, *et al.* Exercise tolerance according to the definition of airflow obstruction in smokers. *Am J Respir Crit Care Med* 2020; 202: 760–762.
3 Van Dijk W, Tan W, Li P, *et al.* Clinical relevance of fixed ratio vs lower limit of normal of FEV1/FVC in COPD: patient-reported outcomes from the CanCOLD cohort. *Ann Fam Med* 2015; 13: 41–48.
4 Lamprecht B, Schirnhofer L, Kaiser B, *et al.* Subjects with discordant airways obstruction: lost between spirometric definitions of COPD. *Pulm Med* 2011; 2011: 780215.