

Online appendix 1: Quality assessment criteria for spirometry

According to American Thoracic Society (ATS) 2005 guidelines on the standardization of spirometry,¹ "acceptable" quality blows may not have any of the following:

1. A cough in the first second of the maneuver
2. Glottis closure or early termination of the blow (i.e., the blow should last ≥ 6 seconds, or the volume-time curve should reach a plateau)
3. Obstruction of mouthpiece
4. Sub-maximal blowing effort
5. Leak around mouthpiece
6. Slow start of exhalation (defined as extrapolated volume $\geq 5\%$ of FVC or ≥ 150 ml, whichever is greater).
7. Extra inhalation during the maneuver.

According to the ATS, an adequate test must have at least three acceptable maneuvers. In addition, the difference between the largest and the second-largest values of both FEV₁ and FVC must be ≤ 150 ml (≤ 100 ml if the largest FVC is ≤ 1.00 liter).¹ To maximize the amount of data available for our analyses, our quality criteria were less strict. We called a test adequate if it contained at least two (rather than three) acceptable maneuvers, and reproducibility was deemed adequate as long as the difference in best and second-best FEV₁ and FVC was ≤ 250 ml. In a sensitivity analysis, we applied the stricter ATS criteria for reproducibility.

When calculating summary measures from spirometry, we considered a blow "usable", as long as it did not have problems 1 or 6 listed above. Furthermore, blows were not usable for FEV₁ if there was an extra inhalation in the first second, and they were not usable for FVC if there was any extra inhalation during the maneuver. The criteria are summarized in the table below:

	Disqualifies blow from being...		
	Acceptable	Usable for FEV ₁	Usable for FVC
Cough in first second	x	x	x
Plateau not reached	x		
Obstruction of mouthpiece	x		
Sub-maximal blowing effort	x		
Leak around mouthpiece	x		
Slow start of exhalation (subjectively judged from volume-time curve)	x	x	x
Extra inhalation before 1 second	x	x	
Extra inhalation after 1 second	x		x

The PEF was defined as the highest PEF in a blow that was also usable for FEV₁. FEF₂₅, FEF₅₀, FEF₇₅ and FEF₂₅₋₇₅ were recorded from the blow that had the highest sum of FEV₁ + FVC.

References for this appendix

- 1 Miller MR, Hankinson J, Brusasco V et al. Standardisation of spirometry. *European Respiratory Journal* 2005;26:319-338. <https://dx.doi.org/10.1183/09031936.05.00034805>