ATS/ERS PULMONARY FUNCTION ACCEPTABILITY & REPEATABILITY GUIDELINES

Quick Reference Guide

FVC

ACCEPTABILITY

1. Back extrapolated volume must be ≤5% of the FVC or 0.100 L, whichever is greater.
2. The subject must achieve one of the following three End of Forced Expiration (EOFE) indicators:
   - The volume/time curve shows less than 25 mL change in volume for at least 1 second (subject has a plateau).
   - The subject has tried to exhale for ≥15 seconds.
   - The measured FVC is within the repeatability tolerance (in case the subject cannot expire long enough to achieve a plateau).
3. There should be no cough detected in the first second of exhalation which could affect FEV1.
4. There should be no glottic closure detected in the first second of exhalation which could affect FEV1 or FVC and there should be no glottic closure detected after the first second of exhalation which could affect the FVC.
5. There should be no evidence of a faulty zero-flow setting, leaks or obstruction of the mouthpiece.
6. The difference between FIVC minus FVC must be <5% of the FVC or ≤0.100 L, whichever is greater.
7. An adequate test requires a minimum of three acceptable FVC maneuvers with two of them meeting repeatability criteria.

ACCEPTABILITY PRESCHOOL CHILDREN (≤ 6 YEARS OLD)

1. All of the above applies for preschool children as well, except for a cough and glottic closure in the first second.
2. For children aged 6 years or younger, there should be no cough or glottic closure detected in the first 0.75 seconds of the exhalation for an acceptable measurement of FEV0.75.

REPEATABILITY

1. The difference between the largest and next largest FVC is ≤0.150 L
2. The difference between the largest and next largest FEV1 is ≤0.150 L
3. The largest values for FVC, FEV1 and Peak Flow, from three acceptable maneuvers are reported.

REPEATABILITY PRESCHOOL CHILDREN (≤ 6 YEARS OLD)

1. The difference between the largest and next largest FVC is ≤0.1 L or 10% of the highest value, whichever is greater.
2. The difference between the largest and next largest FEV1 is ≤0.1 L or 10% of the highest value, whichever is greater.

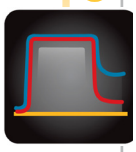
BRONCHODILATOR RESPONSE

A change in FEV1 or FVC >10% relative to the predicted value is considered a significant BDR response.

$$\text{Bronchodilator Response} = \frac{(\text{Post-bronchodilator value} - \text{Pre-bronchodilator value}) * 100}{\text{Predicted value}}$$

NOTE: The recorded FIVC is the largest inspiratory volume immediately after a forced expiration.

Diffusing Capacity



ACCEPTABILITY

1. Inspired volume should be ≥ 90% of largest Vital Capacity*.
2. 85% of test gas inhaled in < 4 seconds.
3. Breath Hold Time should be between 8-12 seconds.
4. Sample collection should be completed within 4 seconds of the start of exhalation. For RGA systems, virtual sample collection should be initiated after dead-space washout is complete.
5. No evidence of leaks, or Valsalva or Mueller maneuvers during lockout.
6. At least 4 minutes between tests to allow an adequate elimination of test gas from the lungs for classical systems. For RGA systems, tracer gas level at end-exhalation must be ≤ 2 % of the tracer gas concentration in the test gas.

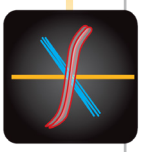
REPEATABILITY

1. DLco values should be within 2 mL/min/mmHg (0.67 mmol/min/kPa) of each other.
2. The average of at least two acceptable tests that meet repeatability should be reported.

NOTE: Adjustments of DLco for Hb, COHB and altitude should be considered.

*A maneuver with an inspired volume of ≥ 85% of largest vital capacity may be deemed acceptable if the VA is within 200mL or 5% (whichever is greater) of the largest VA from other acceptable maneuvers.

TGV FRCpleth



ACCEPTABILITY

1. Patient's cheeks are to be supported by both hands and the subject should breathe quietly until a stable end-expiratory level is achieved (usually 3-10 breaths) before closing the shutter.
2. Closed shutter panting frequency between 0.5 and 1.0 Hz (30-60/min) OR panting frequency up to 1.5 Hz (90/min) with no or minimal obstruction on spirometry.
3. When the shutter opens, the subject performs a linked IC maneuver followed by an expiratory VC.

REPEATABILITY

1. At least three acceptable TGV (FRCpleth) values that agree within 5% (the difference between the highest and lowest value divided by the mean).
2. The average value should be reported.

NOTE: Measurement of airway resistance must not be used during the same maneuver performed to measure lung volumes because the optimal panting frequencies are different.

Nitrogen Washout

ACCEPTABILITY

1. N_2 concentration should be 1/40th of starting N2% (~2% N_2) for at least three consecutive tidal breaths before ending test.
2. Sudden large increases in expiratory N_2 concentration may indicate a leak.
3. The subject should perform a linked IC maneuver followed by an expiratory VC

REPEATABILITY

1. Operator should strive to obtain at least two technically acceptable trials.
2. If more than one measurement is made, the reported FRC should be within 10% of the mean of all acceptable or useable trials.

NOTE: A waiting period of at least twice the washout time is recommended between maneuvers. Longer waiting periods may be required in patients with severe obstruction.

FOR ADDITIONAL INFORMATION ON PULMONARY DIAGNOSTICS, PLEASE CONSULT THE ATS/ERS GUIDELINES:

www.thoracic.org ||| www.ers-education.org

References:

ATS/ERS Technical Statement: Standardization of the Measurement of Lung Volumes, 2023 Update, Eur Respir J 2023; 62: 2201519

ATS/ERS Task Force: Standardization of Spirometry 2019 Update, Am J Respir Crit Care Med; Vol 200: e70–e88, Oct 15, 2019

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