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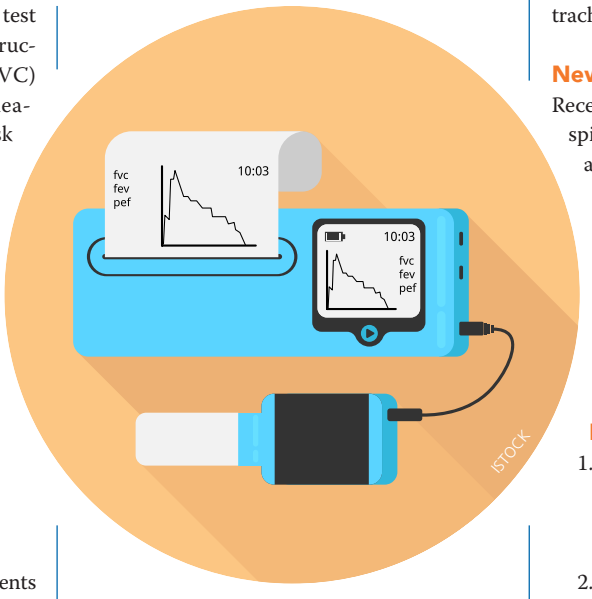
Steps To Successful Spirometry

Closed- versus Open-Circuit Spirometry Tests

Spirometry is a pulmonary function test (PFT) used to diagnose airway obstructions with forced vital capacity (FVC) and forced expiratory volume (FEV-1) measurements. It's also used to determine risk factors for certain pulmonary diseases, the severity and prognosis of lung function, detect early lung disease, and monitor lung growth or functional decline.1 Two types of spirometry procedures exist: closed-circuit and open-circuit testing, both can be conducted either sitting or standing. Clinicians should take note of how the baseline test was conducted as all future spirometry tests need to be performed in the same position.



Closed- versus Open-circuit Spirometry Tests

A closed-circuit spirometry test requires patients to breathe air from the spirometer and then exhale into it, whereas an open-circuit test requires the patient to inhale room air and then exhale into the spirometer. To conduct either spirometry test, clinicians should:

- calibrate the spirometer
- ask the patient about smoking, recent illnesses, and current medications
- explain the test and demonstrate instructions
  - correct posture, head slightly elevated
  - inhale rapidly and completely
  - exhale as forcefully as possible

For closed-circuit testing, have the patient take no more than five normal breaths with their mouth on the spirometer (with the nose clip in place) before completing the following:

- inhale completely and rapidly with a pause of 1 second at total lung capacity (TLC)
- exhale forcefully until no more air can be released
- repeat instructions as necessary—at least three times, but no more than eight
- check test repeatability and perform again as necessary

The **open-circuit test** is nearly identical, except that only the nose clip is placed, and then the patient must inhale completely and rapidly with a pause of 1 second at TLC. Once their lungs are full, the mouthpiece is inserted and the patient must exhale forcefully—the remaining steps are the same.

Interpreting the Data

Lung function is considered normal if the FEV-1/FVC is ≥ 80%. If the percentage is lower than 80, severity of an obstruction, based on FEV1 percent predicted, is as follows:

- 65% to 80%: mild obstructive defect
- 50% to 65%: moderate obstructive defect
- < 50%: severe obstructive defect

After examining the numerical values, clinicians should assess the spirogram, a graph of the respiratory movements collected from the spirometer, for a pattern. Often, if an obstruction exists, there will be a scooped pattern in the flow-volume loop. Other patterns may include flattening of the inspiratory or expiratory portion of the test. The former may indicate a variable extrathoracic obstructive defect, such as vocal cord dyskinesia or tracheomalacia while the latter may indicate a variable intrathoracic defect, such as bronchiectasis. If both portions look flattened, there may be a static defect, such as a lung tumor or tracheal stenosis.[2]

New and Notable

Recent research has revealed new international spirometry reference equations for patients aged 3 to 95 years from different ethnic groups for calculating ranges of FEV-1, FVC, and FEV-1/FVC values. Researchers found significant differences in lung function between ethnic groups, which may be related to lung size based on certain demographic variables, such as body type and geographic location.[1,3] ■

References:

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2. Baptist A, et al. Pulmonary function tests. The University of Michigan Division of Allergy and Immunology. 2005. https://www.med.umich.edu/intmed/allergy/edu/syllabus/TOPICS/PFTs/pft.htm.
3. Redlich CA, et al. Official American Thoracic Society technical standards: spirometry in the occupational setting. Am J Respir Crit Care Med. 2014;189(8):984-994.

Resources:

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