Controversies in Office Spirometry

W.G. Petersen, M.D., F.C.C.P.
Director Pulmonary Functions Laboratory
Scott & White – Temple
(254) 724-0039
wpetersen@swmail.sw.org

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**Spirometry:** Measurement of expiratory flows and/or volumes performed with maximal effort from Total Lung Capacity (TLC) to Residual Volume. (RV)

- Routinely reported standardized values of
  - **FVC:** Forced Vital Capacity – total volume exhaled
  - **FEV1:** Exhaled Volume in the first second
  - **FEF 25-75%:** The geometric mean of all instantaneous flows measured over the middle of the exhaled volume. Previously known as the Mean Mid Expiratory Flow (MMEF)
  - **FET 100%** The time required to exhale the FVC.

**Graphic Displays of Data**
- Volume-time Curve: For judging quality of trial – expiratory data only
- Flow-Volume Loop: Both Quality and Pattern Recognition as well as inspiratory flows

**Quality Indicators - Is this trial acceptable?**

- FET 100% > 6 seconds. Difficult in children, many adults with COPD exceed 12 seconds
- End of Test Plateau: The change in volume < 30 cc per second AFTER the first 6 seconds
- Extrapolated Volumes: Less than the greater of: 5% of VC or 150 cc.

**Quality Indicators - Is this study acceptable?**

- Reproducibility: Both the FEV1 and FVC should vary less than 5% or 100 cc for the two best trials. (200 cc for large volumes).
- Data retained for the three best trials but only data from single best is reported

**Office Spirometry:** Spirometry performed by someone (physician, RT, nurse or aide) whose major work effort is not solely spirometry and in a location not dedicated to pulmonary function testing.
Normal Spirometry: A statistical statement that there is a 95% chance that the values measured will occur in a population without disease.

This is not a statement of the absence or presence of disease.

The range of normals is quite wide
- FVC and FEV1 +/- 20%
- FEF 25-75% +/- 35%

However the inter-test variation should be less than 5%. (Abnormal degree of variability but values remain within range of normals.)

Predicted normal values are adjusted for age, height, and gender and are proprietary (NHANES-3) Adjustment required for African-American

Statistical weakness at extremes of age:
- 5 yrs and under,
- Over 75 years
- Adolescents

Diagnostic Spirometry: Measure ventilatory physiology in order to diagnose or manage disease. Seeking a basis of symptoms

Screening Spirometry: Detect the presence of lung disease at the asymptomatic stage in the apparently healthy individual.

- Prevalence: 30% adults smoke - only 1/3 will develop significant COPD
- Efficient screening implies sensitivity, specificity and economy
- Intervention: Effective methods to alter progression of COPD

The Unintended Consequences of Screening Spirometry

False reassurance: Undetected lung injury continues because of “normal” results
Data Storage: Suggested 2 years for medical purposes but NIOSH suggest over 20 years past end of work exposure. Paper (retrieval) vs Electronic (upgrade compatibility and proprietary software)
Liability: “Failure to diagnose in timely fashion” Quality issues or unsuspected disease
Safety: Need for negative airflow rooms, Yearly PPD for employees, Documentation to allow for contact investigation if ever needed.
Quality Assurance: Daily functioning, calibration logs, bio-norms, Competency logs
Bronchodilators: Constitutes administration of a medication.
- Physician oversight, (ordering or supervising), Medication log books
Certified Pulmonary Function Technologist: Not offered in formal institutions
- GED, on the job training under a physician and a CPFT for TWO years, followed by successful completion of the exam
- BS degree, 6 month OTJ, and successful completion of the exam
- Certified RT (licensed) and successful completion of the exam
- CPFT Registry (advanced exam) required for more complex testing

NIOSH Training:
Centers, accredited by the federal government, offer a course, usually two days, which bestows a certificate (but not a CPFT). ($300)

Suggested but not yet mandatory for those doing occupational testing.

Buying Equipments  Fixed spirometer vs Hand held devices

Costs  $7000 to $10,000 vs $1400 to $2100
Variety of sensors with variety of problems
  1. Heated wires: prone to age, $500
  2. Pneumotach: clogged screens, zero bias
  3. Turbinometers: Moving parts, zero bias

Calibration features and costs
Filters: Hidden costs, protection of patient or equipment

Primer on Interpretation:

No Standards on quantifying obstruction
Simple Approach (Adults Only)
FEV1 (volume in one second) = flow
FVC Total volume exhaled

The FEV1/FVC ratio thus expresses the relationship of expiratory flows to lung volume.

Ratio invariably decreases with airflow obstruction (asthma, COPD)
In restrictive proves the ratio may be increased or normal.
Lower limits of normal adults over 30: 70%

Remember - Spirometry is primarily a measure of airflow, not lung volumes.