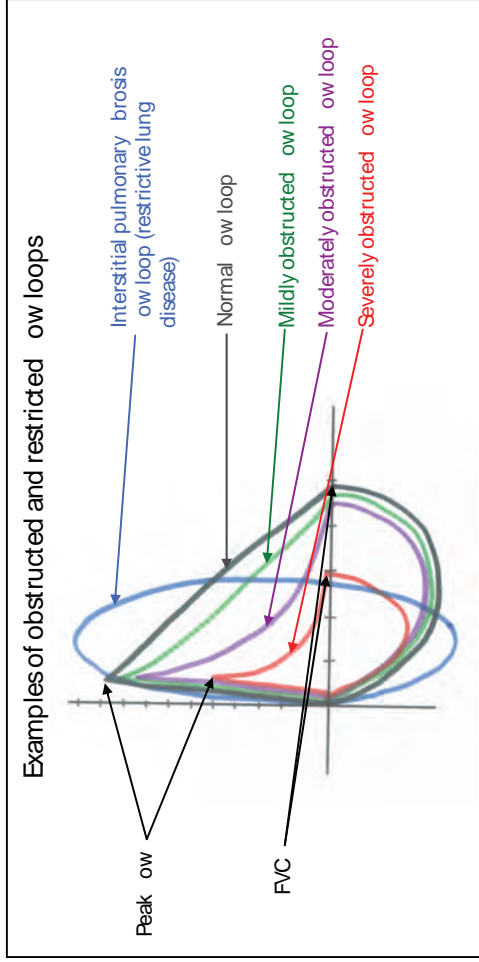


# QUICK GLANCE GUIDE TO SPIROMETRY

## Spirometry: a measure of airflow (how fast) and volume (how much)

### Definitions:

- Forced Vital Capacity (FVC):** the volume delivered during an expiration made as forcefully and completely as possible starting from full inspiration
- Forced Expiratory Volume in the first second (FEV<sub>1</sub>):** the volume delivered in the first second of an FVC maneuver
- Obstruction:** airway limitation is observed during spirometry. If the observed FEV<sub>1</sub>/FVC ratio is down 10 or more from the predicted, obstruction is present.
- Restriction:** Spirometry with low FVC (< 80%) can only suggest restriction. Further testing is needed to confirm.



Spirometry must establish a solid baseline meeting all criteria for acceptability and repeatability. For patients 8-80 years old, use NHANES III. For children under the age of 5-8 years, use Wang. Testing children < age 5 is likely to be unsuccessful. Always have your patient sit when performing spirometry. Follow all OSHA and JCAHO standards for infection control.

### Contraindications:

- Recent surgery
- Within one month of myocardial infarction
- Recent pneumothorax
- Unable to understand directions or inability to seal mouthpiece

### CPT codes for spirometry:

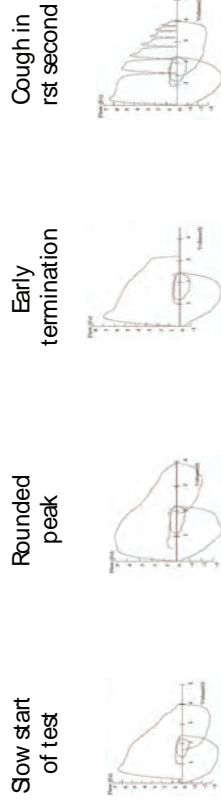
94010 spirometry 94060 spirometry with bronchodilator (pre- and post-test)  
When using these CPT codes, better reimbursement happens when current symptoms are associated with the appropriate ICD9 code for asthma or COPD.

### Refer to a specialist:

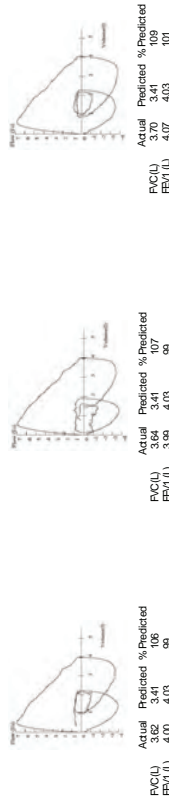
- If patient has **severe obstruction**
- If patient has a **restrictive pattern**
- If patient **does not respond to medications**

**Acceptability criteria from the American Thoracic Society:** Global Lung Function Initiative (GLI)-2012 multi-ethnic reference ranges are recommended. NHANES III reference values remain appropriate where maintaining continuity is important. Following a grading system range of A-F, spirometry tests with grades of A-C are clinically useful.

### Examples of unacceptable tests



**Repeatability criteria for the American Thoracic Society:** Recommended repeatability criteria of 150 ml.



### Coaching patients through spirometry:

Instruct patient to breathe normally. When patient is ready, have him/her take his/her deepest breath and blow as hard as he/she can as long as he/she can. There is a learning curve for spirometry. Use positive reinforcement to build on the patient's successes. (For example, "That was really good; this time take an even deeper breath.") Always demonstrate the spirometry maneuver, especially if language is a barrier or communication issues arise.

### Appropriate bronchodilator use:

If testing for reversibility, give patient 4 puffs of bronchodilator with a spacer or a standard nebulized dose. Wait 15 minutes after last dose to perform post-bronchodilator maneuver. If a patient cannot perform acceptable baseline maneuvers according to American Thoracic Society criteria or there is no evidence of airflow obstruction, do NOT give a bronchodilator.

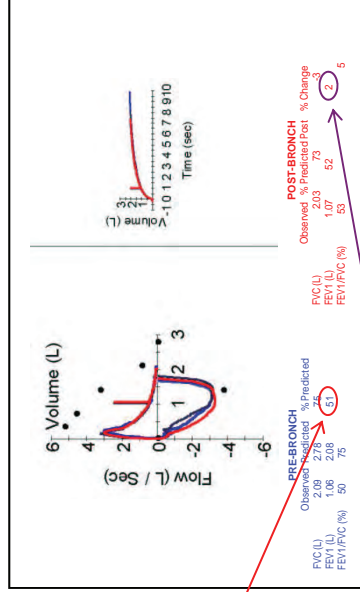
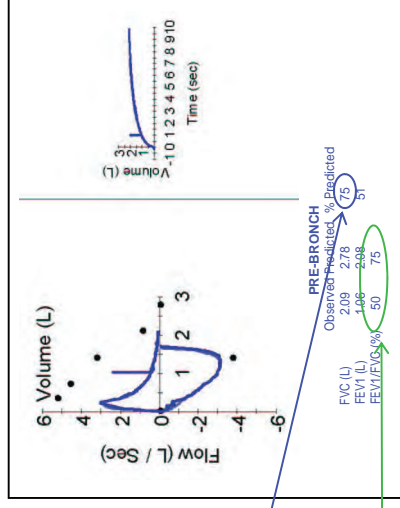
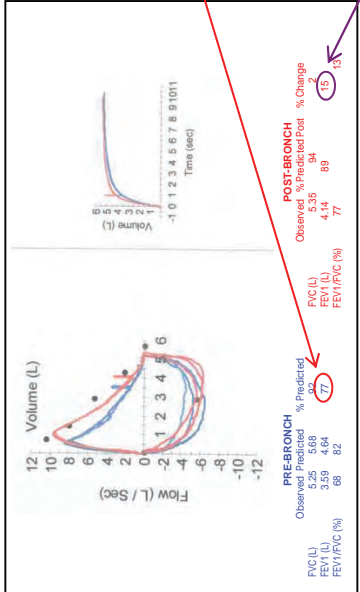
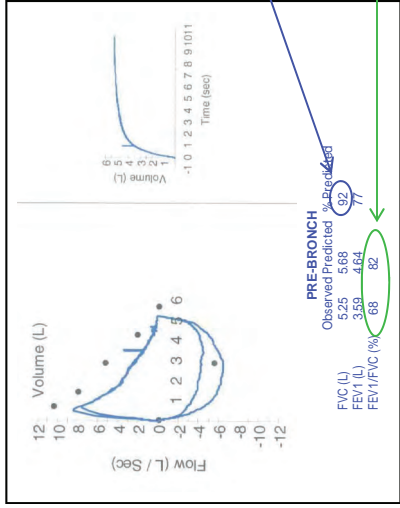
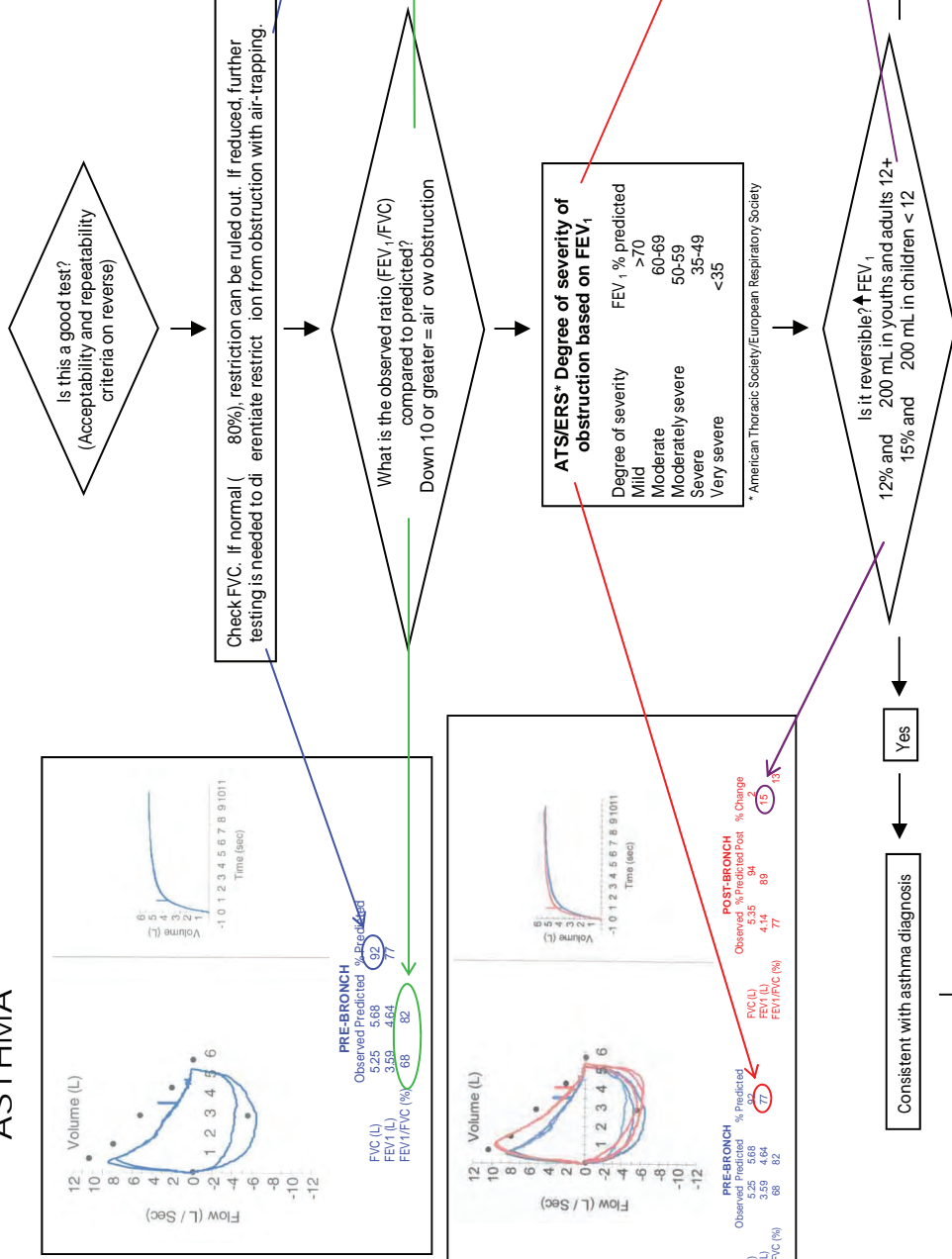
### References:

1. Repeatability criteria for the American Thoracic Society: Three (3) acceptable tests must be performed with two (2) tests having FEV<sub>1</sub> and FVC within ±15L or 150mL of each other.
2. Miller M, Hankinson J, Brusasco V, et al. Standardisation of spirometry. *European Respiratory Journal*. 2005;26:319-338.
3. Pellegrino R, Viegi G, Brusasco V, et al. Interpretative strategies for lung function tests. *European Respiratory Journal*. 2005;26:948-968.
4. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease. Updated 2007. Available at <http://www.goldcopd.com>.
5. National Heart, Lung and Blood Institute National Asthma Education and Prevention Program. *Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma*. 2007. Available at <http://www.nhlbi.nih.gov>.

# SPIROMETRY INTERPRETATION

## ASTHMA

## COPD



	Asthma Severity		
	Intermittent	Mild	Moderate to Severe
5-11 years	Normal FEV <sub>1</sub> between exacerbations FEV <sub>1</sub> > 80% predicted FEV <sub>1</sub> /FVC > 85%	FEV <sub>1</sub> > 80% predicted FEV <sub>1</sub> /FVC > 80%	FEV <sub>1</sub> = 60-80% predicted FEV <sub>1</sub> /FVC = 75-80%
12+ years	Normal FEV <sub>1</sub> /FVC: 8-19 yr 85% 20-39 yr 80% 40-59 yr 75% 60-80 yr 70%	FEV <sub>1</sub> > 80% predicted FEV <sub>1</sub> /FVC normal	FEV <sub>1</sub> < 60% predicted FEV <sub>1</sub> /FVC reduced > 5%

**Sample written asthma interpretation:**  
 The FEV<sub>1</sub>/FVC ratio being down more than 10% from predicted is consistent with air flow obstruction. The FEV<sub>1</sub> being 77% of predicted suggests a mild air flow obstruction (based on the 2005 ATS/ERS guide for severity of obstruction). The post bronchodilator study reveals a significant response to albuterol with the FEV<sub>1</sub> increasing 15% or 550cc. This finding is consistent with diagnosis of asthma although clinical correlation is needed to confirm. (Based on the 2007 NAEPP guidelines for asthma severity), this 28 year old male with a baseline FEV<sub>1</sub> of 77% has moderate persistent asthma.

	COPD Severity		
	Stage I: mild	Stage II: moderate	Stage III: severe to Stage IV: very severe
	FEV <sub>1</sub> /FVC < 70% FEV <sub>1</sub> 80% predicted	FEV <sub>1</sub> /FVC < 70% FEV <sub>1</sub> 50-80% predicted	FEV <sub>1</sub> /FVC < 70% FEV <sub>1</sub> < 30% predicted or FEV <sub>1</sub> < 50% predicted plus chronic respiratory failure

**Sample written COPD interpretation:**  
 The FEV<sub>1</sub>/FVC ratio being down more than 10% from predicted is consistent with air flow obstruction. The FEV<sub>1</sub> being 51% of predicted suggests a moderately-severe air flow obstruction (based on the 2005 ATS/ERS guidelines for severity of obstruction). No significant response to albuterol was revealed as the FEV<sub>1</sub> only increased 2%. Further testing revealed a diminished capacity of 50% of predicted. The lateral chest film showed signs of hyperinflation and attenuated diaphragm and the chest CT had classic changes seen in emphysema. (Based on the 2007 GOLD guidelines for COPD severity), this 74 year old female with a baseline FEV<sub>1</sub> of 51% has Stage II moderate COPD.