

# SPIROMETRY

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# SPIROMETRY

Is the measurement of the air moving in and out of the lungs during various respiratory maneuvers. It allows one to determine how much air can be inhaled and exhaled, and how fast.

It is the most commonly used pulmonary function test.

Effective diagnostic test that can easily be done in a physician's office



**Vitalograph alpha**  
CHRONO-VOL SYSTEM  
SERVOLOGIC 1100

ID: 12345  
 SEX: M  
 REF. POP.: EUROPEAN  
 TEST TYPE: 2-BUNGOM  
 SYSTEM: 1  
 AGE: 20 Yrs  
 HEIGHT: 180cm  
 WEIGHT: 80 Kg  
 DATE: 2000/01/01  
 TIME: 11:30  
 TEST TIME: 11:35

PREV. REPROD.: L  
 CALIBRATION: 870020000

SERIAL NO.: 12345  
 CALIBRATION: 870020000  
 PREV. REPROD.: L

Index	Mean	Pre	AccURACY CHECK: 860020000
VC	Post	Best	SERVICE DATE: 860020000
VC	4.20	4.00	
FEV1	2.20	2.00	
FEV1%	52.4	50.0	
PEF	4.20	4.00	
PIV1	10.00	9.50	
PIVC	2.00	1.80	
	3.00	2.80	
	4.70	4.50	
		9.0	
		8.4	
		9.4	
		9.0	
		8.70	

\* BELOW LOWER LIMIT OF NORMALITY (LLN)

FLOW-VOLUME

VOLUME/TIME



**Vitalograph**

# DYNAMIC LUNG VOLUMES & CAPACITIES MEASURED BY THE SPIROMETER

**Forced vital capacity (FVC)**: is the volume of air that can be exhaled as forcefully and rapidly as possible after a maximal inspiration

**Forced expiratory volume in 1 second (FEV1)**: the volume of air that can be forcefully expired out in the first second, after a maximal inspiration.

**FEV1/FVC ratio** : ~ 80%

**Peak expiratory flow (PEF)**: the maximum speed of air during forced expiration following a maximal inspiration

**Forced expiratory flow (FEF)**: speed of air during forced expiration following a maximal inspiration.

✓ Usually given at discrete times, generally defined by the expired fraction of the FVC. The usual intervals are 25%, 50% and 75% (FEF 25, FEF 50 and FEF 75)

**FEF 25–75%**: Forced expiratory flow over the middle one half of the FVC; the average flow from the point at which 25% of the FVC has been exhaled to the point at which 75% of the FVC has been exhaled.



# BEFORE STARTING THE TEST

- Record the patients name, age, gender , ethnicity, smoking history, weight and height
- Make sure the patient is sitting upright, feet flat on the floor(legs not crossed), wearing loose clothes & no heavy meals before the test
- Give clear instructions about the test procedure
- Teach the patient how to make a good seal with the mouth piece
- Apply a nose clip



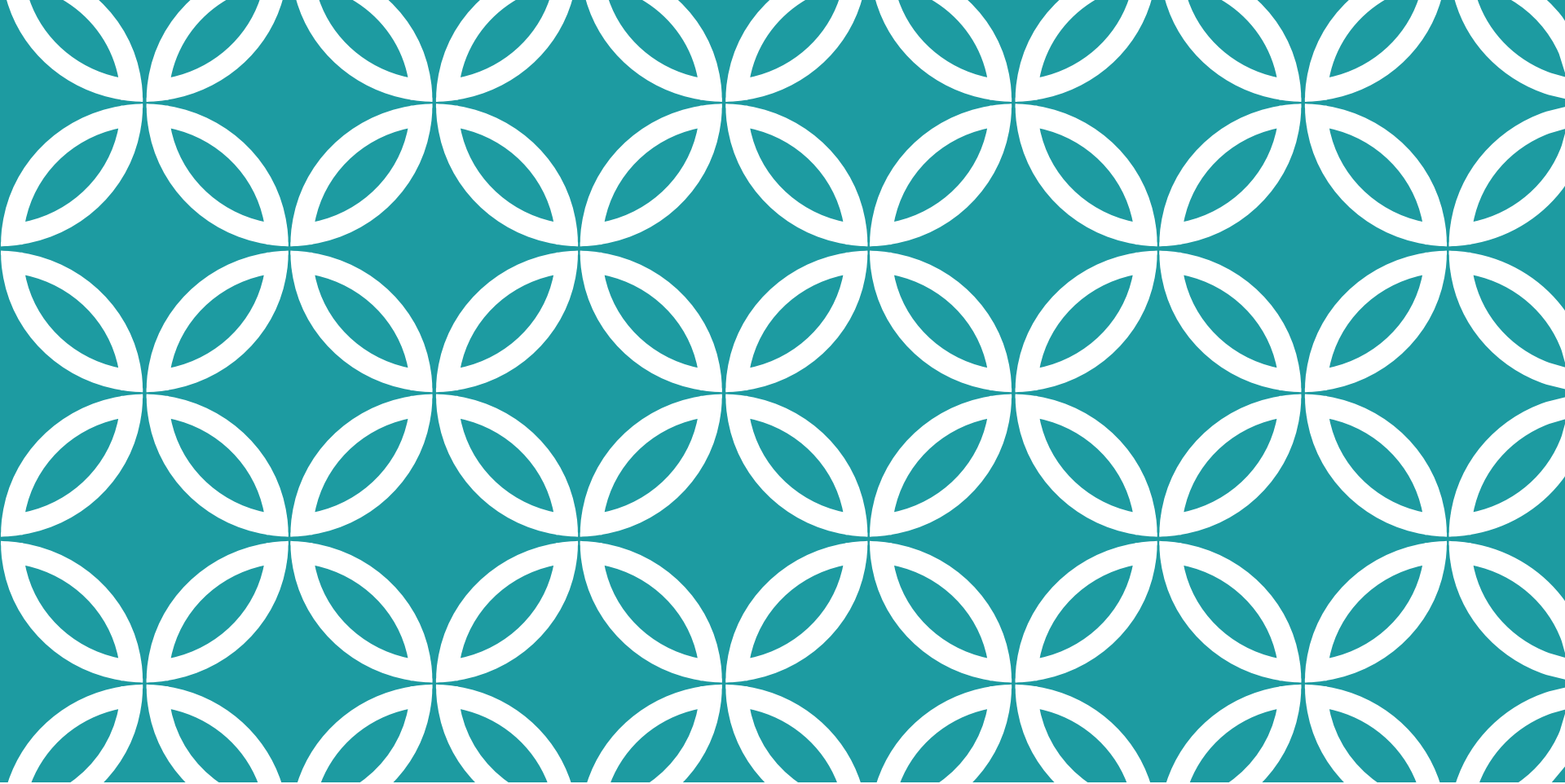


# PERFORMING THE TEST

- Give the patient the following instructions:
  1. Take a few normal breaths
  2. Take the deepest breath you can take
  3. Exhale the air as strong & as fast as possible (continue for approximately 6 seconds)
  4. Then take a deep breath back in
- Repeat the process three times (Give the patient a chance to rest between blows)
- The highest value among three close test results is used as the final result.



[Performing spirometry in primary care – YouTube](#)



## THE RESULTS



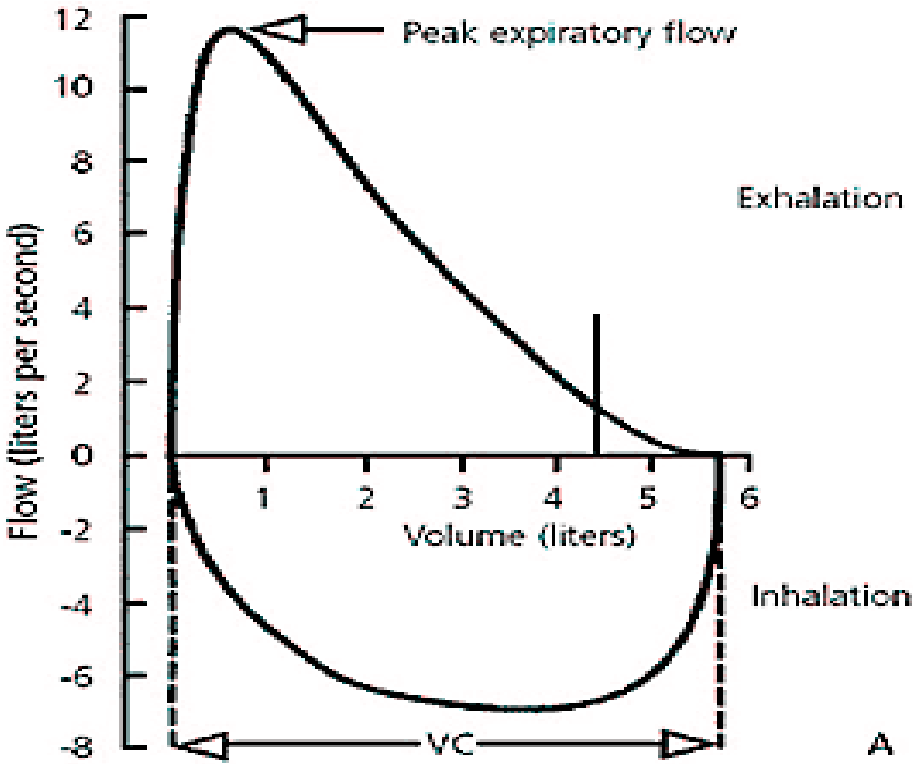




	FEV1	FVC	FEV1/FVC
Normal	80%-120% of the predicted value	80%-120% of the predicted value	>70%
Obstructive lung disease	Decreased	Normal or <b>decreased</b>	<b><u>Decreased</u></b>
Restrictive lung disease	Decreased	<b><u>Decreased</u></b>	Normal or increased

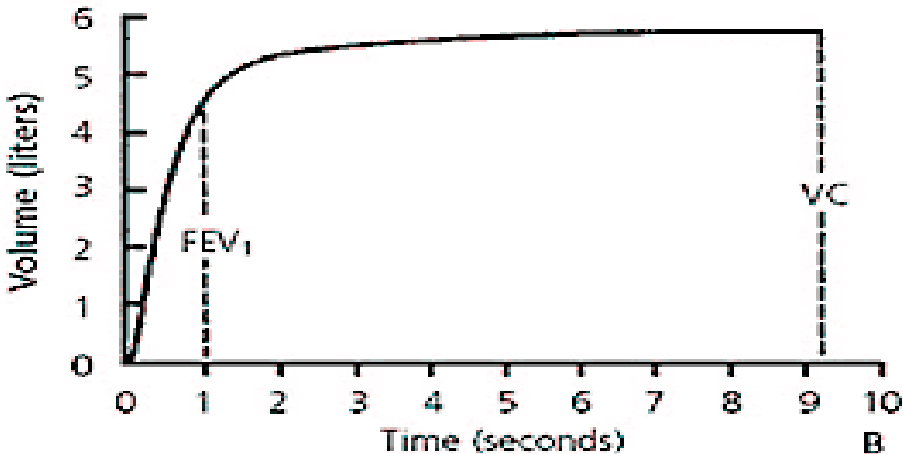
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# THE GRAPHS



## Flow-volume curve

- PEF
- FVC
- Expiratory effort



## Volume-time curve


- FEV<sub>1</sub>
- FVC
- Duration of Expiration

# IMPORTANT TERMS

Confirm that the test result is acceptable and reproducible

- ❖ Acceptable test: we check from the graphs if the patient made a good effort.
  - Rapid increase in airflow at the start of exhalation
  - Exhalation continued for ~6 seconds
- ❖ Reproducible test: the difference between the two largest FVC measurements and between the two largest FEV1 measurements is within 200 ml



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- If an obstructive defect is present, the physician should determine if the disease is reversible based on the increase in FEV<sub>1</sub> after bronchodilator treatment
  - The test is repeated 15 minutes after giving a bronchodilator (4 puffs of salbutamol inhaler) to check for FEV<sub>1</sub> reversibility. (i.e., increase of more than 12% and more than 200 mL )
  - If a restrictive pattern is present, full pulmonary function tests should be ordered to confirm restrictive lung disease and form a differential diagnosis.

**Check FEV1/FVC**

Decreased

Normal or increased

Obstructive disease

Restrictive or normal pattern

Check FEV1 to determine stage

Check FVC

Perform reversibility test

Normal FVC

Low FVC

>12% improvement in FEV1

<12% improvement in FEV1

Normal test

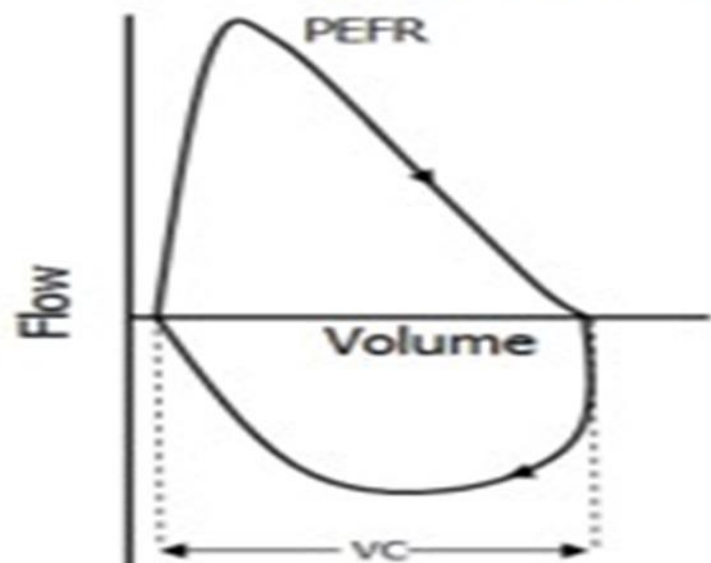
Restrictive disease??

Asthma

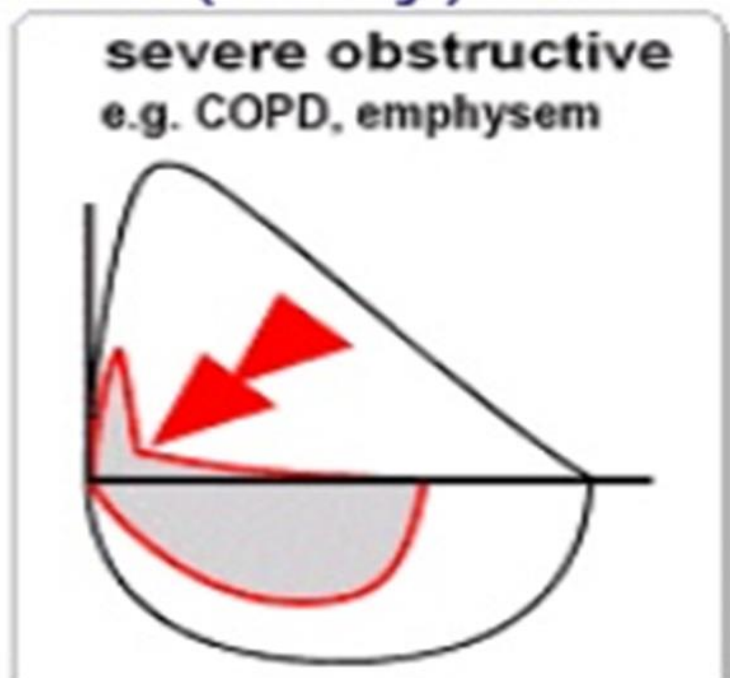
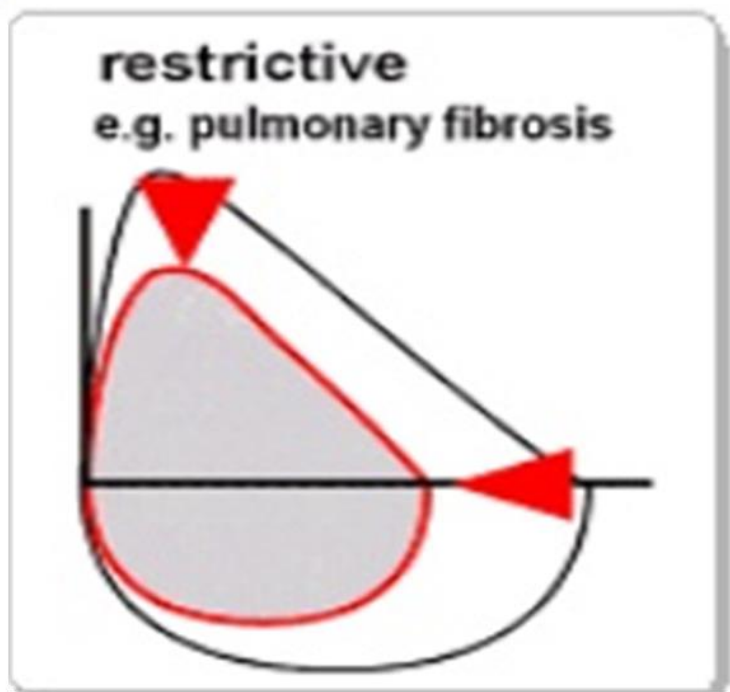
COPD

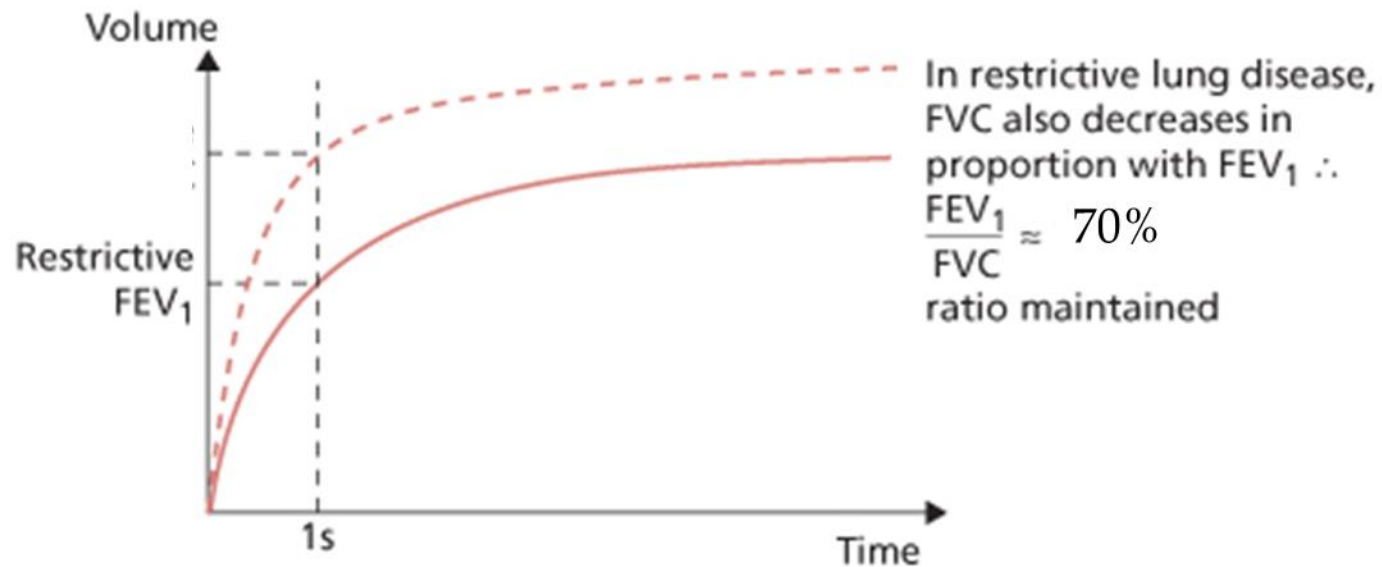
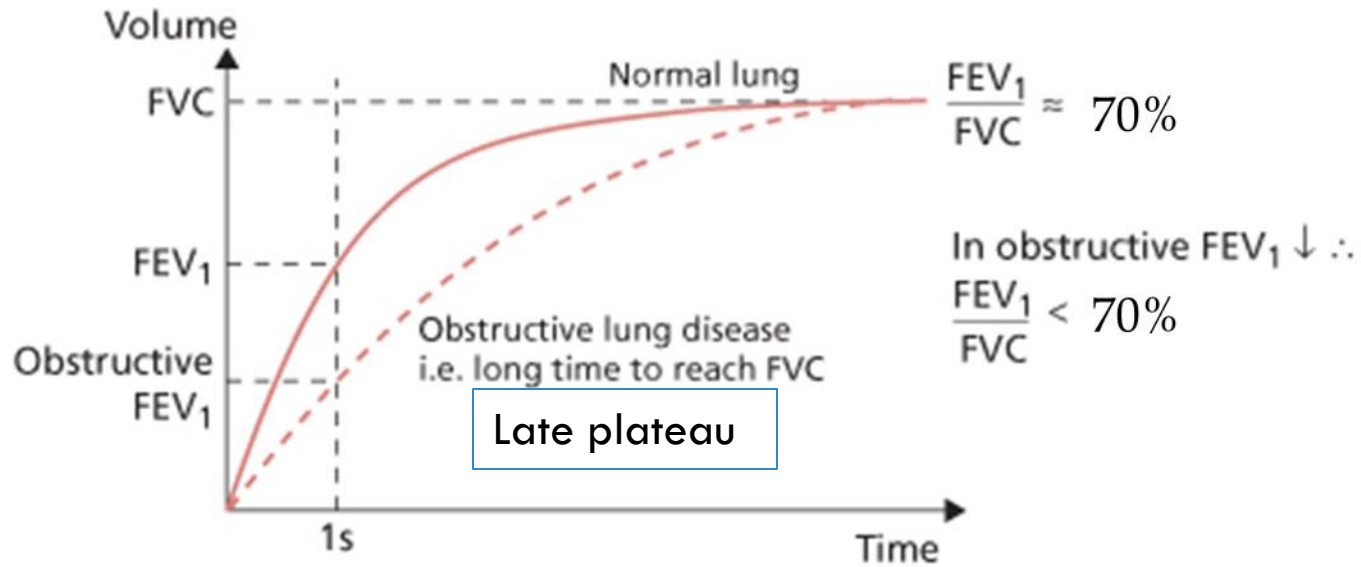
Perform a complete PFT

If the TLC is decreased a restrictive pattern is confirmed



Normal





# METHCHOLINE CHALLENGE TEST

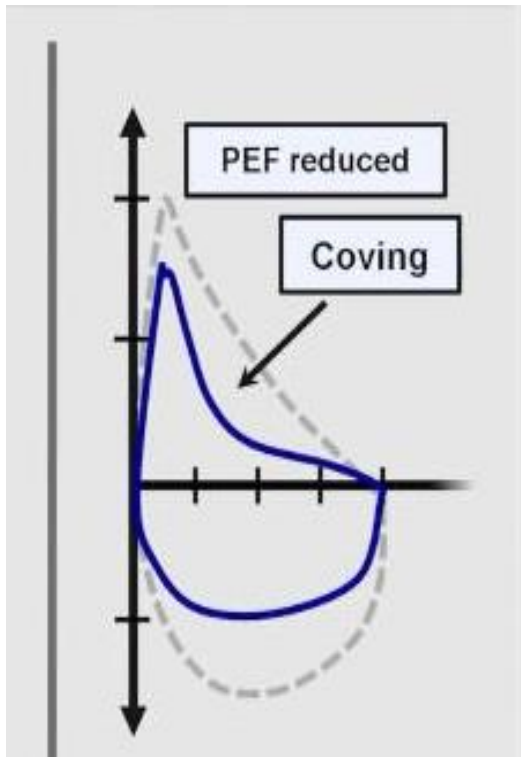
- When the test results are normal but the history strongly suggests the presence of asthma the next step is bronchoprovocation, such as a methacholine challenge.
- Methcholine causes bronchoconstriction, dose used between 4 and 16 mg per mL.
- During the test progressively larger doses of inhaled methacholine are given by a nebulizer. The test stops once the FEV1 drops by 20% or more from baseline or the maximum dose of methacholine is reached with no change in FEV1.

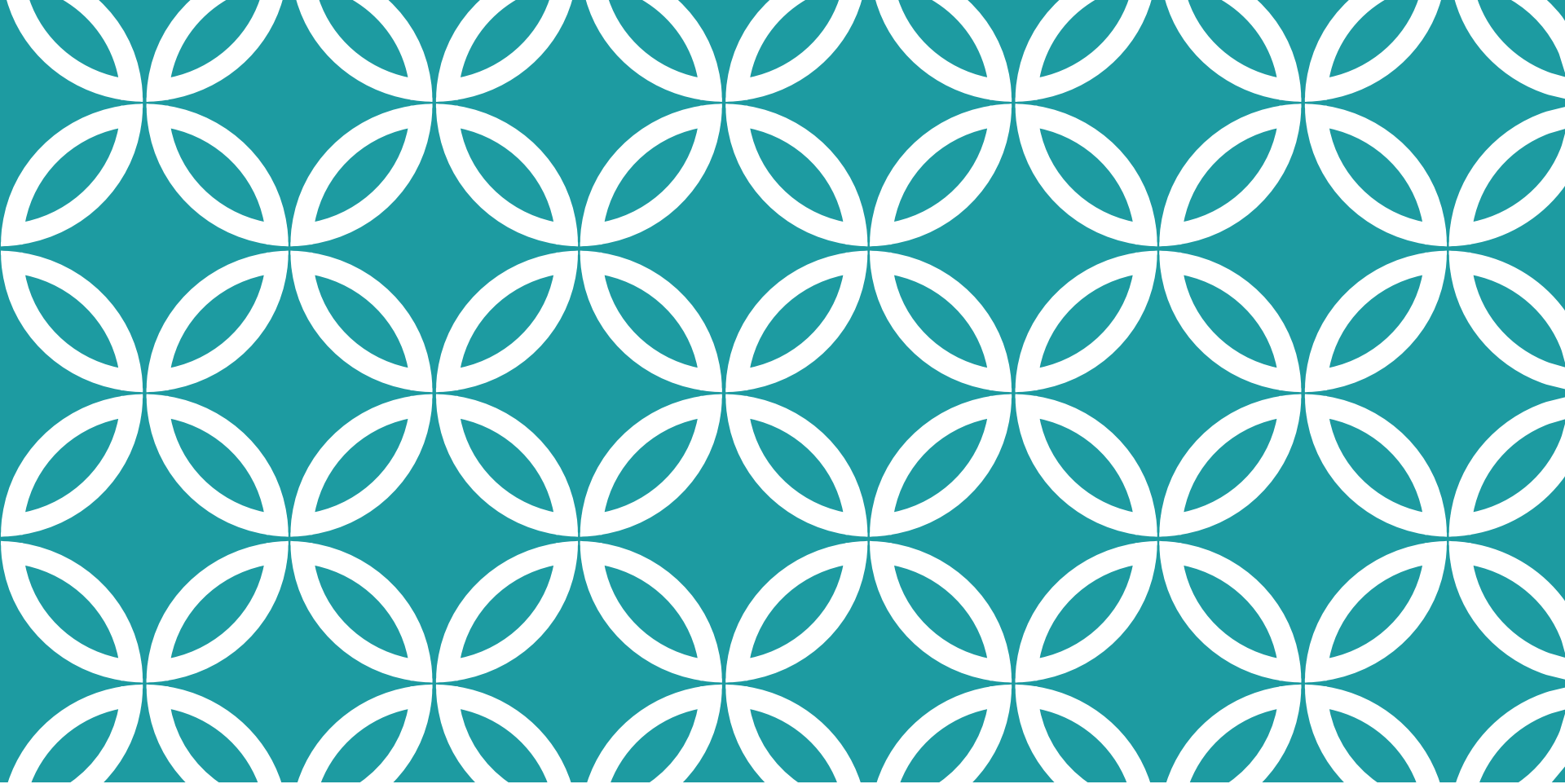
# SPIROMETRY INDICATIONS

- Evaluate the signs and symptoms of lung disease
- Classify asthma and COPD
- Assess the progression of lung disease
- Monitor the effectiveness of therapy
- Evaluate preoperative patients in selected situations

A 51 year old woman presents with shortness of breath, coughing and wheezing for the past 3 months. Her spirometry results are shown in the table below. What is your diagnosis?

	Predicted	Actual	% of predicted	Post bronchodilator	% change
FVC (L)	2.91	2.42	83%	2.72	12%
FEV1 (L)	2.41	1.52	63%	2.05	34%
FEV1/FVC	82.8%	58.2%		75.4%	





**THANK YOU** |