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 the physician 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 at a physician's office

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

PREPARING PATIENTS FOR SPIROMETRY

- No smoking within 2 hours of the test

- No vigorous exercising

- Do not eat a heavy meal before the test

- Do not take a short-acting bronchodilator within 4 to 6 hours

- Do not take a long-acting inhaled bronchodilator within 12 hours

- Do not wear restrictive clothing during the test

BEFORE STARTING THE TEST

- Record the patients name, age, gender , ethnicity, smoking history, weight and height on the spirometer

- Make sure the patient is sitting upright, feet flat on the floor (legs not crossed

- 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 Trials)

- The highest value among three close test results is used as the final result.

DYNAMIC LUNG VOLUMES & CAPACITIES MEASURED BY THE SPIROMETER

Lung volumes that depend upon the rate at which air flows out of the lungs are termed dynamic lung volumes.

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.
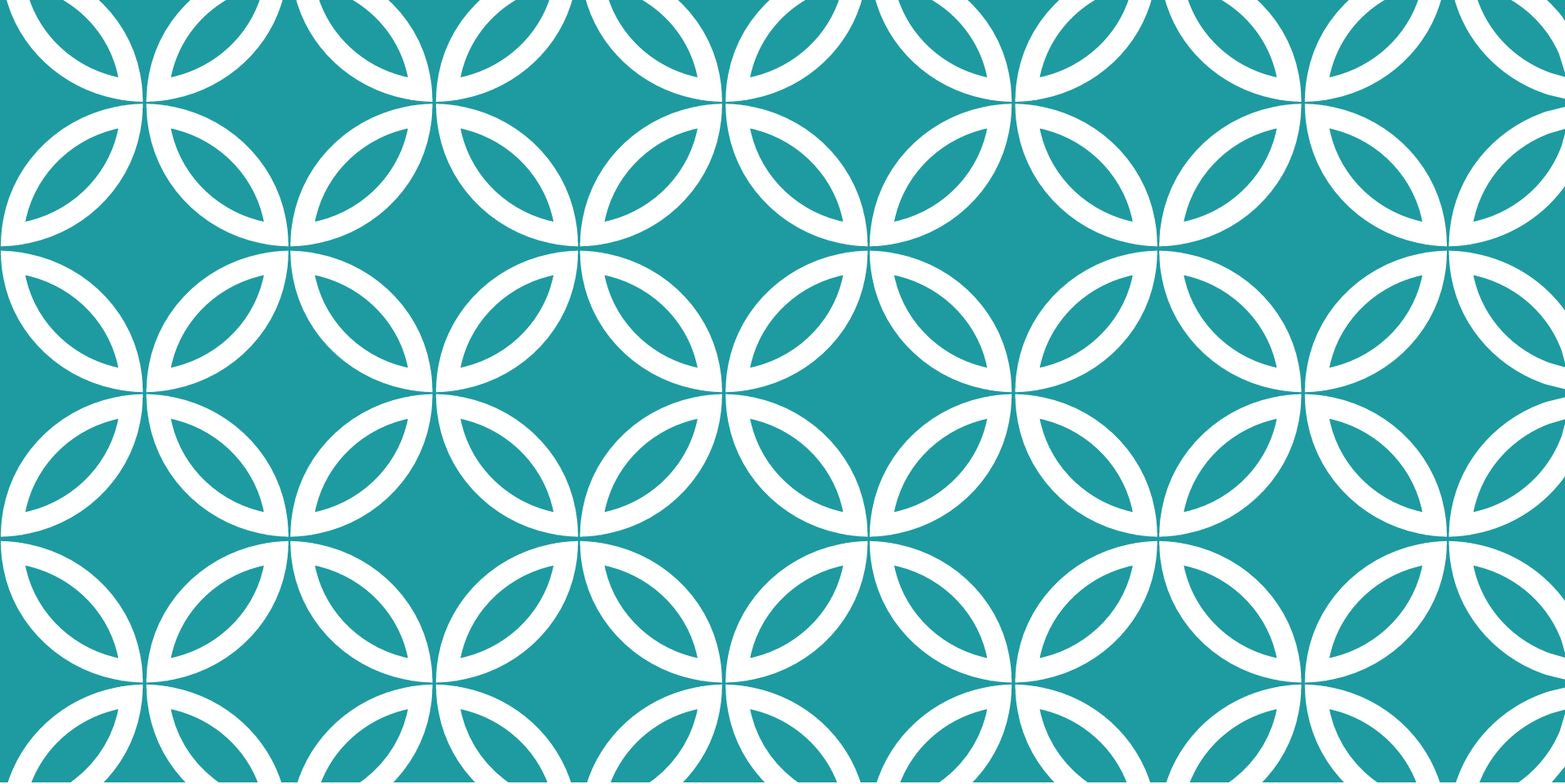
FEV1/FVC ratio : ~ 80%

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.
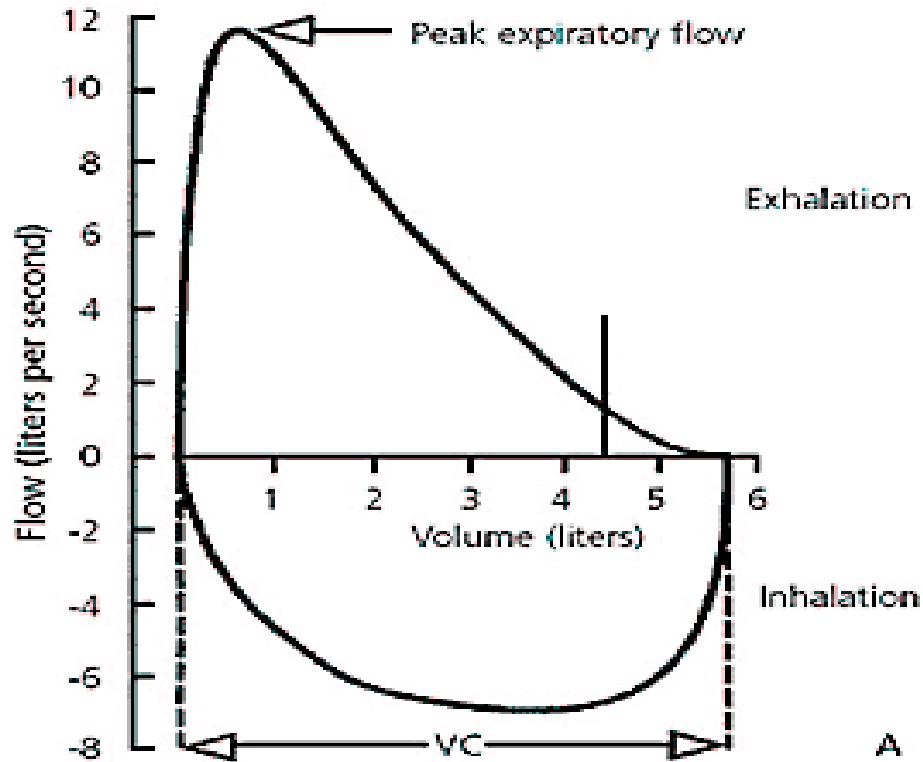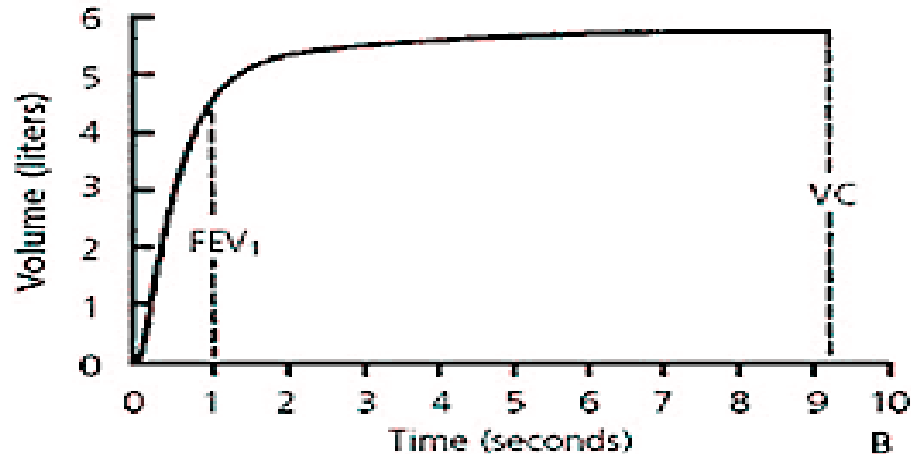
THE RESULTS

NAME _____

Index		Norm Pred	Meas BEST	%Pred
FVC	L	3.53	3.07	87
FEV1	L	2.81	2.42	86
FEV1R		0.80	0.79	99
FEV6	L	3.44	3.07	89
PEF	L/min	404	354	88
FEF25-75	L/s	2.79	2.20	79
FEF25	L/s	5.59	5.02	90
FEF50	L/s	3.90	3.37	86
FEF75	L/s	1.59	0.74	47
PIF	L/s	8.10	3.92*	48
MVVInd	L/min	105	91	86

* BELOW LOWER LIMIT OF NORMALITY (LLN)

FLOW/VOLUME

VOLUME/TIME

vitalograph® alpha
Spirometry Report
08/DEC/2019, 11:35 AM

NAME _____

ID :	1	AGE :	49 YRS
HEIGHT :	162 CM	SEX :	FEMALE
SMOKER :	NON SMOKER	NORMAL VALUES	NHANES_C

TEST DATE :	08/DEC/2019	TEST TIME :	11:35 AM
No ATTEMPTS :4		VALUES AT BTPS	

FVC WITHIN : 0.07 L		FEV1 WITHIN : 0.01 L
TEST QUALITY:GRADE B		

SERIAL # :	28632	ACC. CHECK : 09/DEC/2013
CALIBRATION :05/DEC/2013		

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Each patient's predicted values depend on the _age, gender,_ height, weight and ethnicity. THE MOST IMPORTANT FACTORS ARE AGE & GENDER.

THE GRAPHS
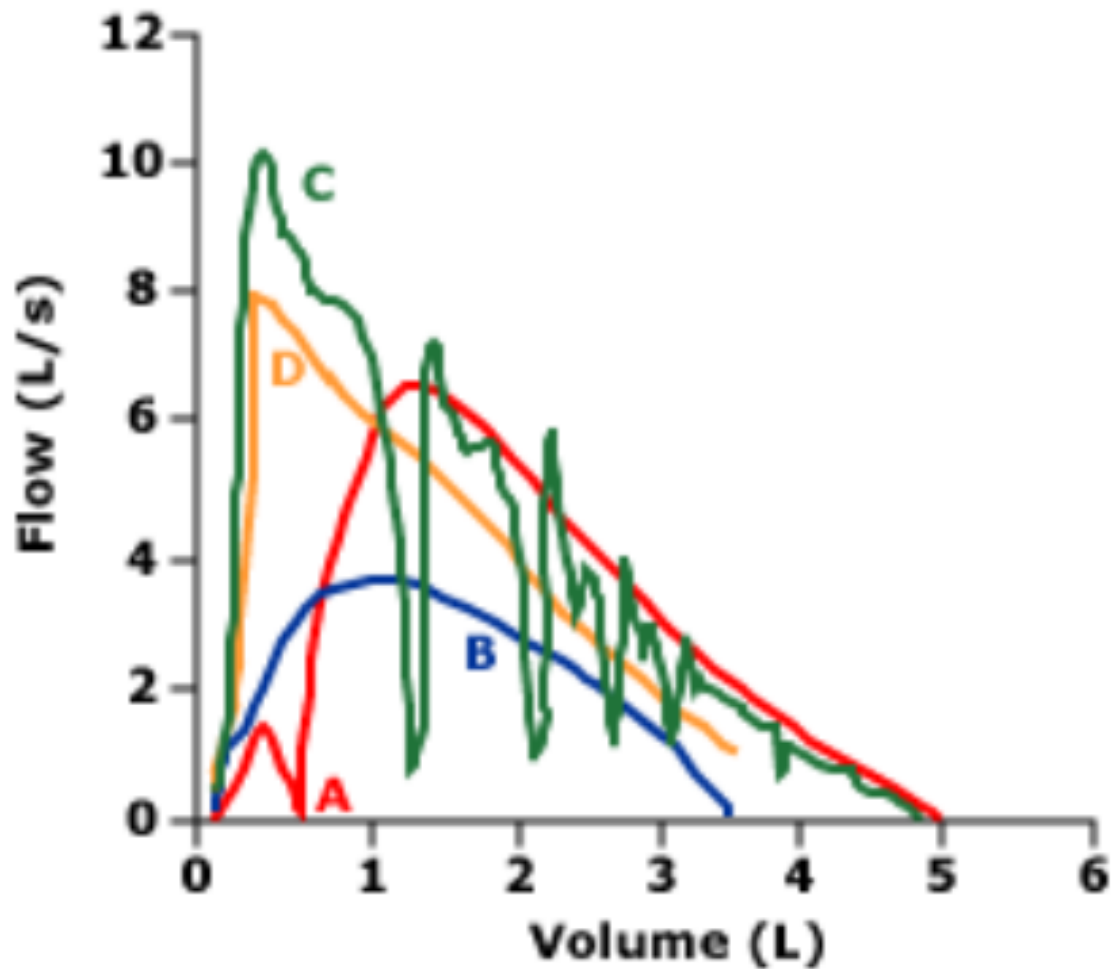
Flow-volume curve

- PEF
- FVC
- Expiratory effort

Volume-time curve

- FEV1
- 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 (Flow-volume curve)

- Exhalation continued for ~6 seconds (Volume-time curve)

❖ Reproducible test: the difference between the two largest FVC measurements and between the two largest FEV1 measurements is within 200 ml

Flow-volume curve patterns from unacceptable forced vital capacity maneuvers. Curve A (red) hesitating start; curve B (blue) submaximal blast (poor peak flow effort); curve C (green) excessive coughing at the beginning of the maneuver; curve D (orange) premature termination of effort.

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

- A reduction in FEF25-75% of less than 60% of that predicted confirms airway obstruction

- PEF decreases with obstructive diseases and shows great diurnal variation

Check FEV1/FVC

Decreased

Obstructive disease
Check FEV1 to determine stage

Perform reversibility test

>12% improvement in FEV1

<12% improvement in FEV1

Reversible airway obstruction

Irreversible airway obstruction

Normal or increased

Restrictive or normal pattern

Check FVC

Normal FVC

Low FVC

Normal test

Restrictive disease??

Perform a complete PFT

If the TLC is decreased a restrictive pattern is confirmed

OBSTRUCTIVE DISEASES

Late plateau
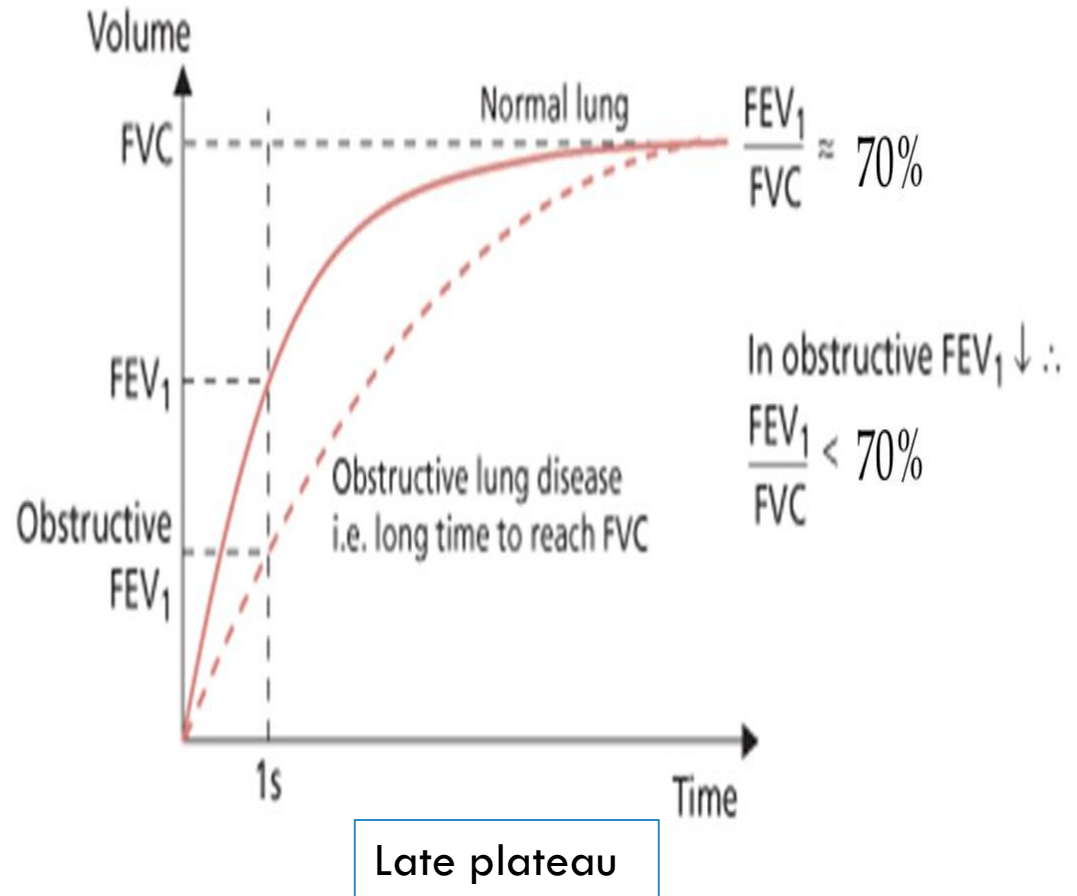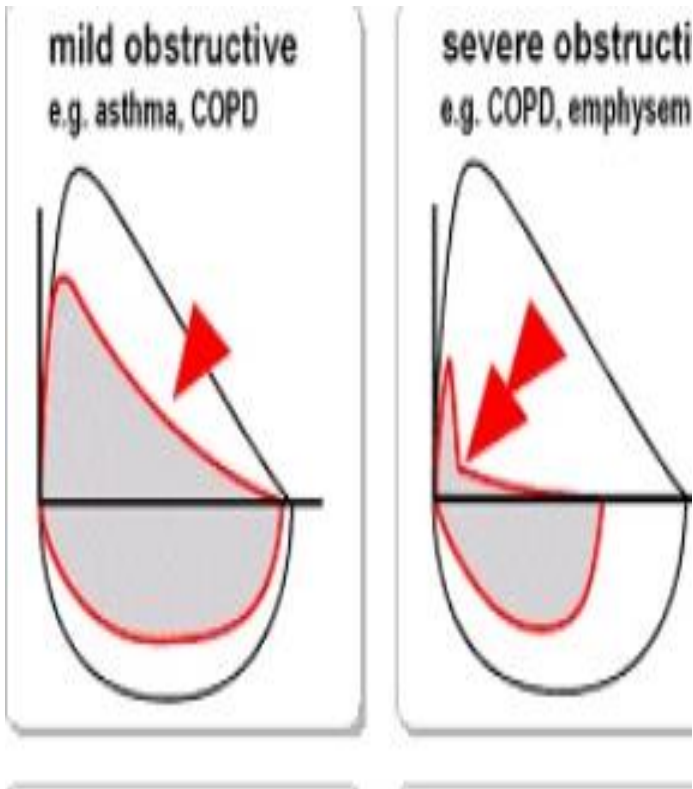
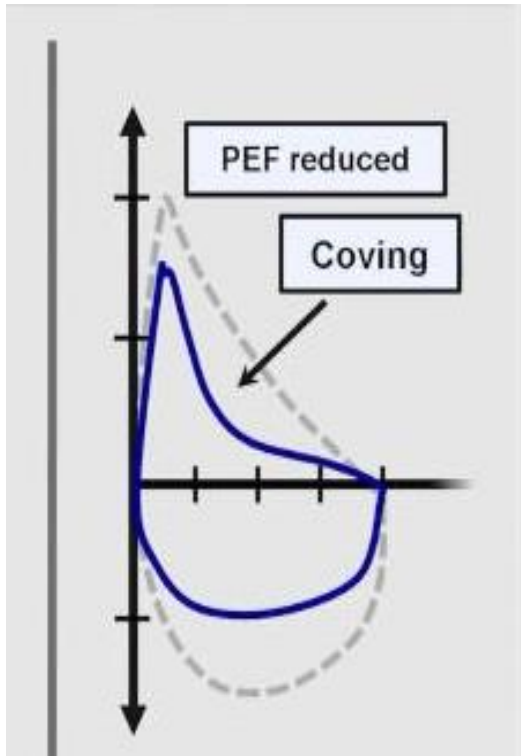# RESTRICTIVE DISEASES
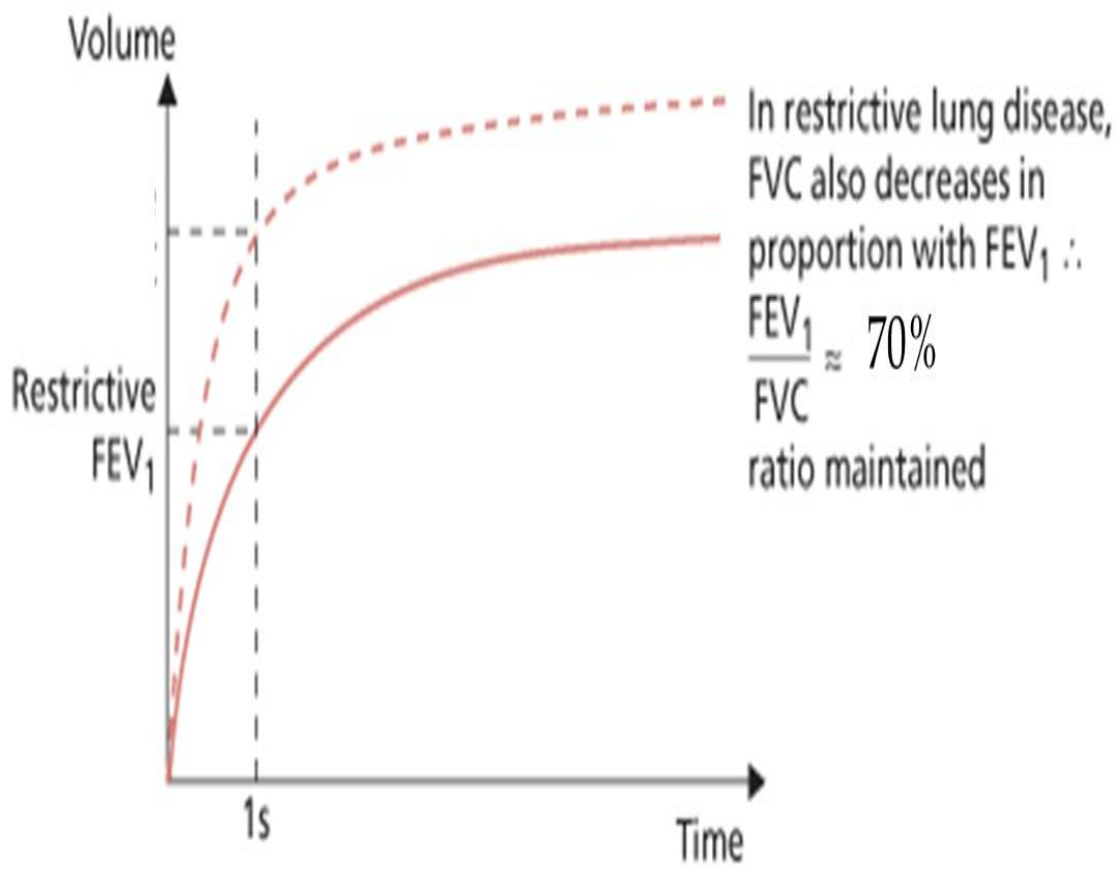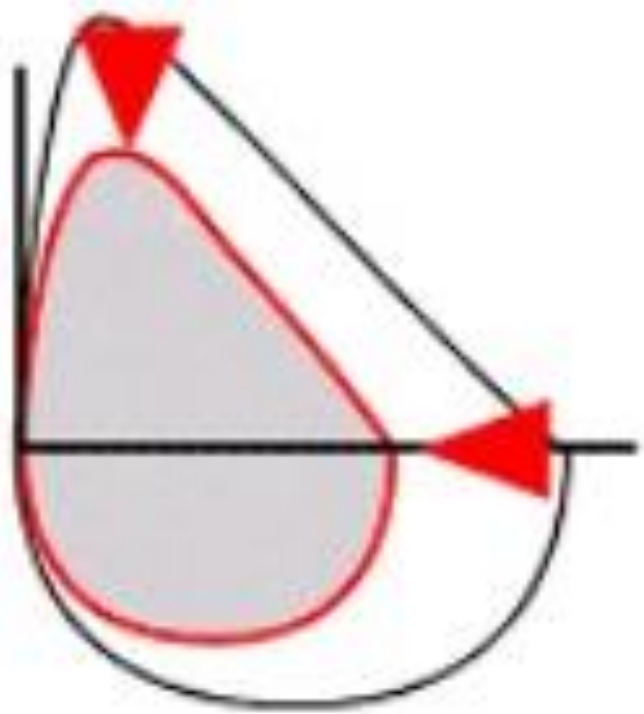
REVERSIBLE AIRWAY OBSTRUCTION

- If an obstructive defect is present, the physician should determine if the disease is reversible based on the increase in FEV_1 after bronchodilator treatment

- The test is repeated 15 minutes after giving a bronchodilator (4 puffs of salbutamol inhaler) to check for FEV1 reversibility. (i.e., increase of more than 12%)

- If a restrictive pattern is present, full pulmonary function tests should be ordered to confirm restrictive lung disease and form a differential diagnosis.
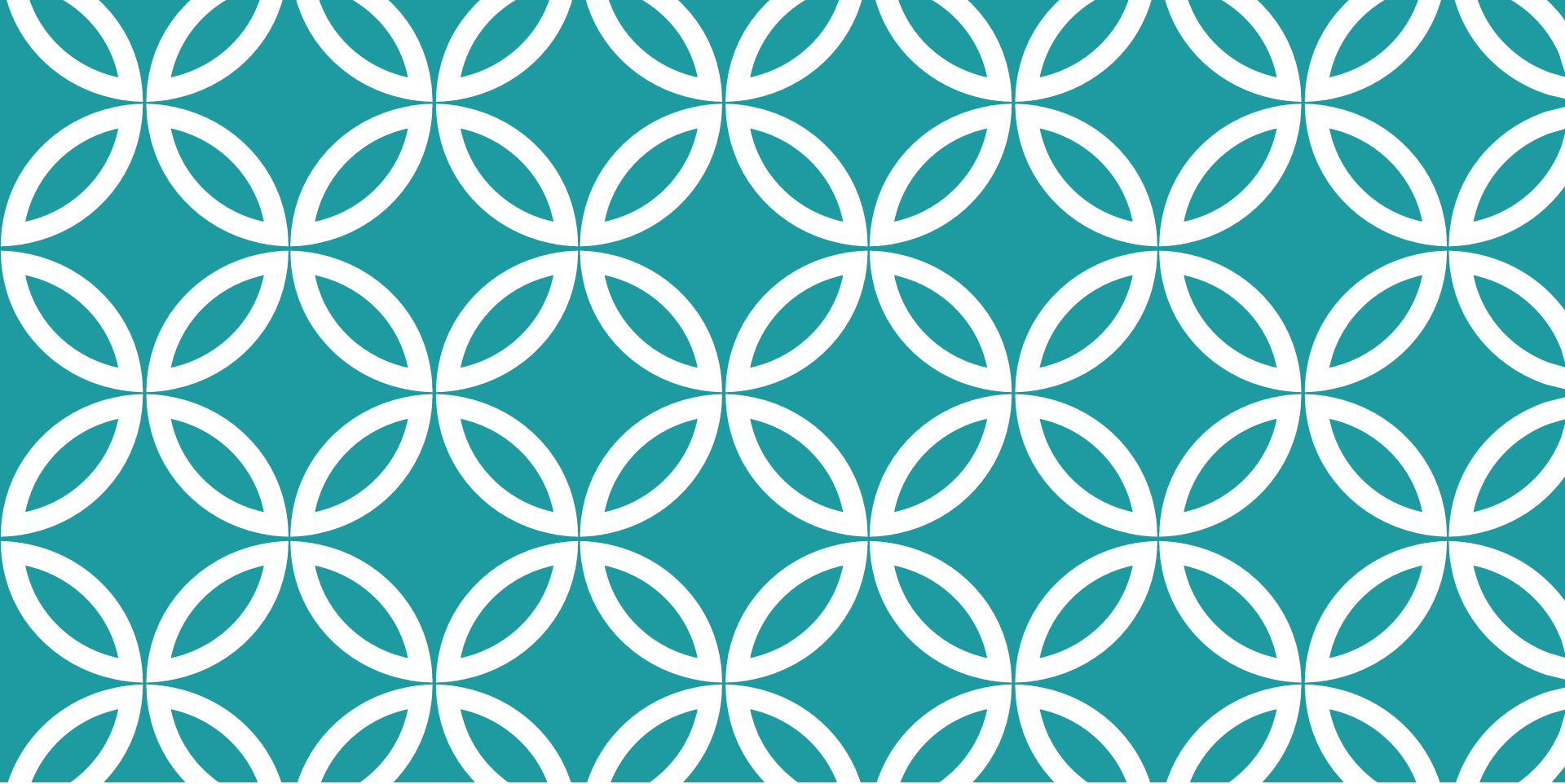
METHCHOLINE CHALLENGE TEST

- Methcholine: a direct stimulant that acts directly on acetylcholine receptors on smooth muscle, causing contraction and airway narrowing

- This test might be performed when the test results are normal but the history strongly suggests the presence of asthma .

- 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.

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