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. Dynamic lung volume

It is the most commonly used pulmonary function test.

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


Mouth piece: the part that the pateint insert into his mouth and then start to inhale and exhale and all air movment will be recorded
Screen
vitalograph alpha
FVC test
ready to do test
ENT key to retain
vitalograph

DYNAMIC LUNG VOLUMES & CAPACITIES MEASURED BY THE SPIROMETER

We ask the pateint to take the deepest breath he can (maximum inhalation) and then to expire as forcefully and rapidly as he can and to continue expiration for 6 sec

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.

The most important values

FEV1/FVC ratio : ~ 80%

80% of air exhale at the first sec

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.

disposable mouth piece to reduce the infections as we can

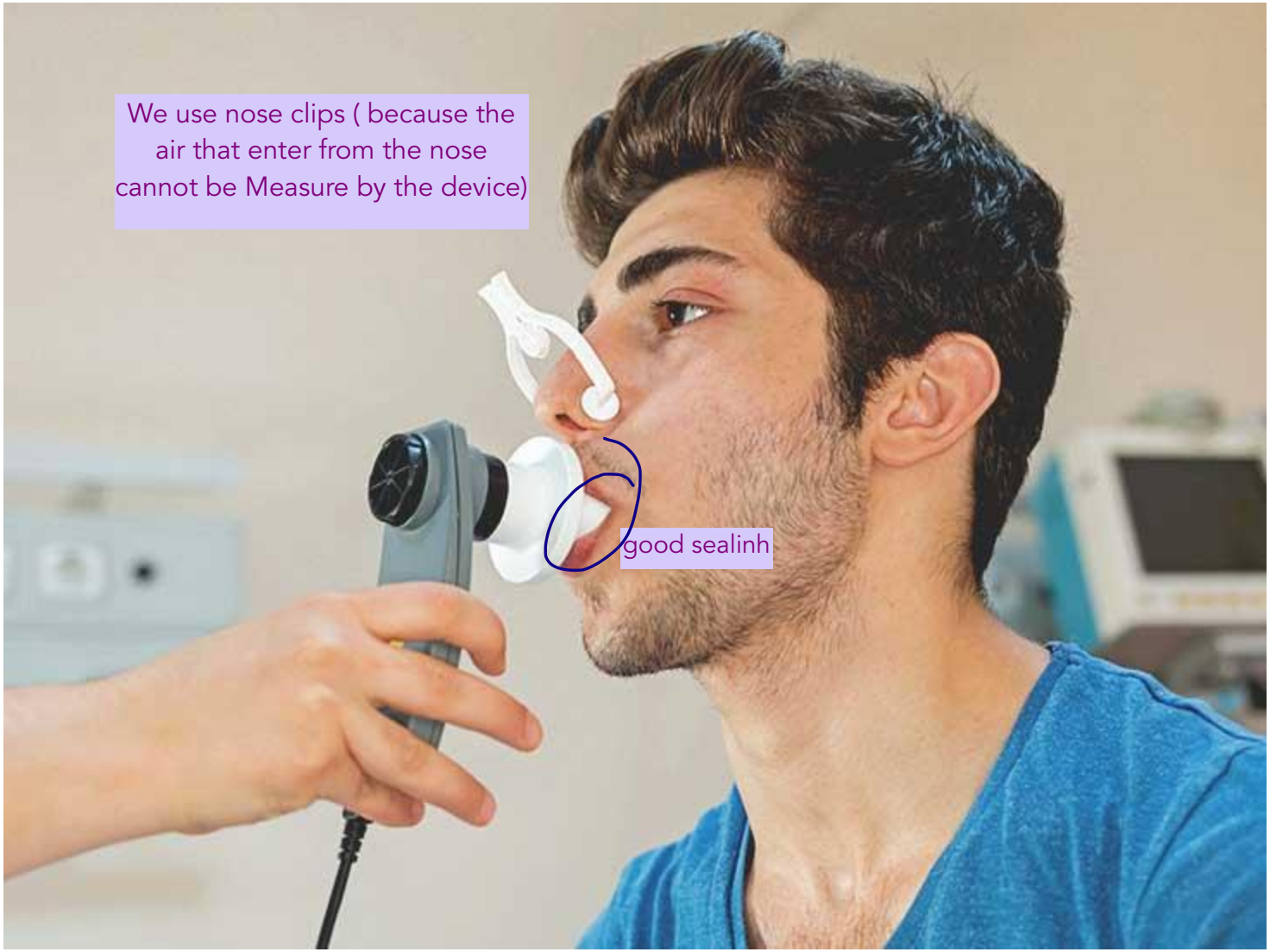
BEFORE STARTING THE TEST

The most imp factors

- 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

And setting in supportive chair (because some people feel dizzy during 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


We use nose clips (because the air that enter from the nose cannot be Measure by the device)
good sealinh

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

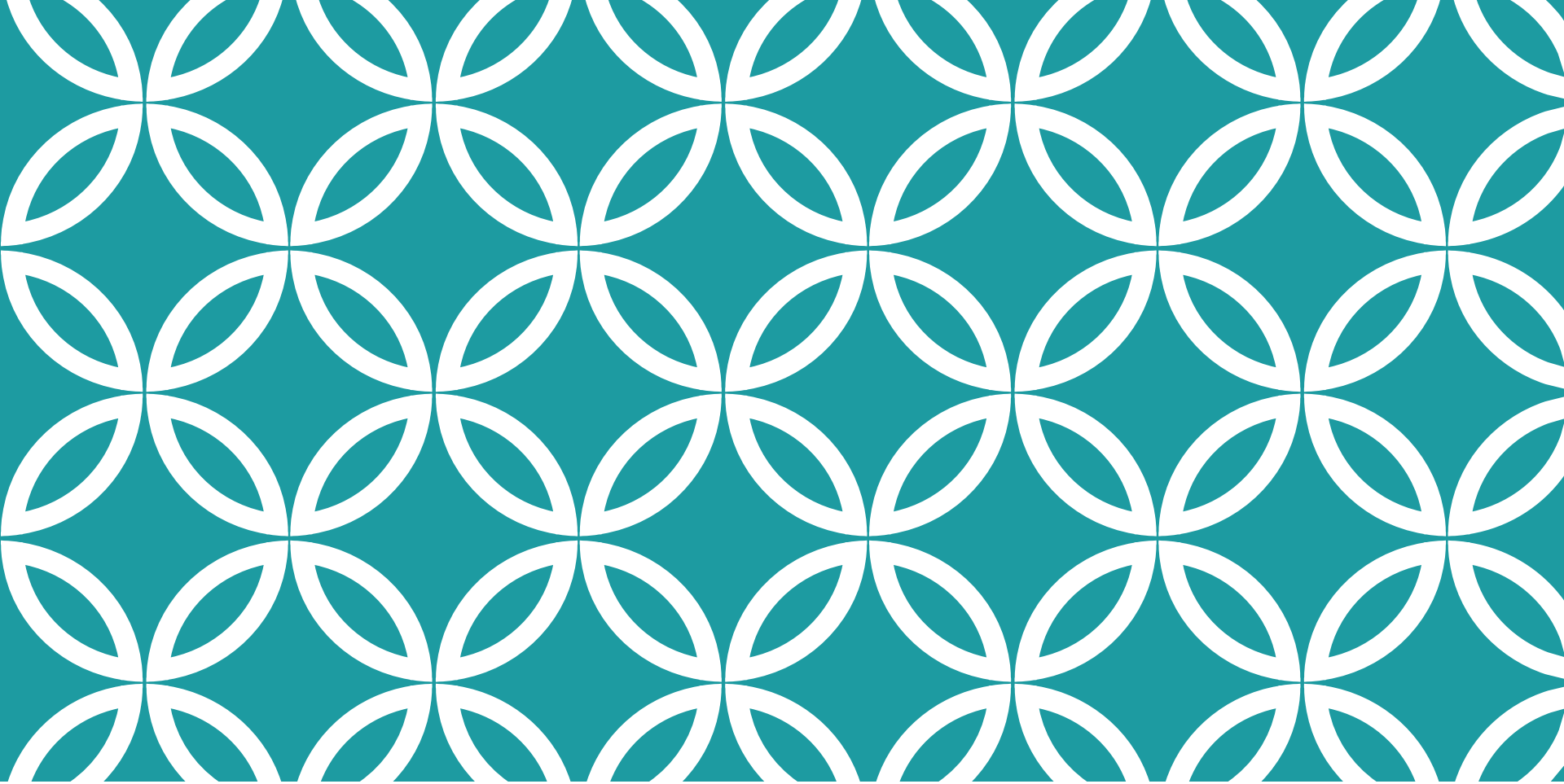
Or more (depending on the patient state)

- Repeat the process three times (Give the patient a chance to rest between blows)

To make sure that the test is repeatable and acceptable

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

Performing spirometry in primary care – YouTube



THE RESULTS

pateint data

Variation

Normal Variation ≤ 200mL

0.2L

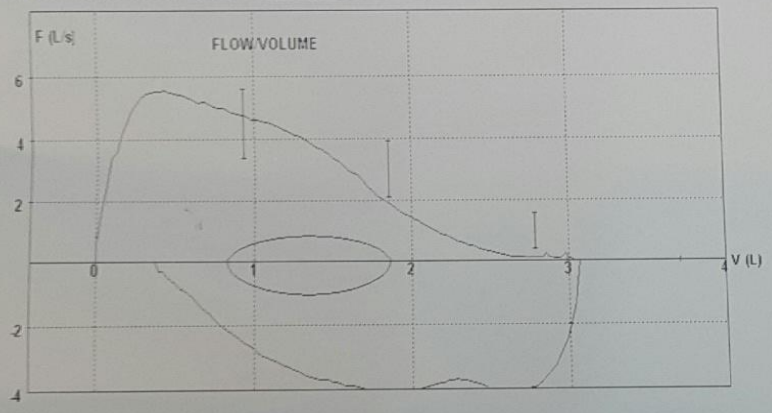
NAME _____

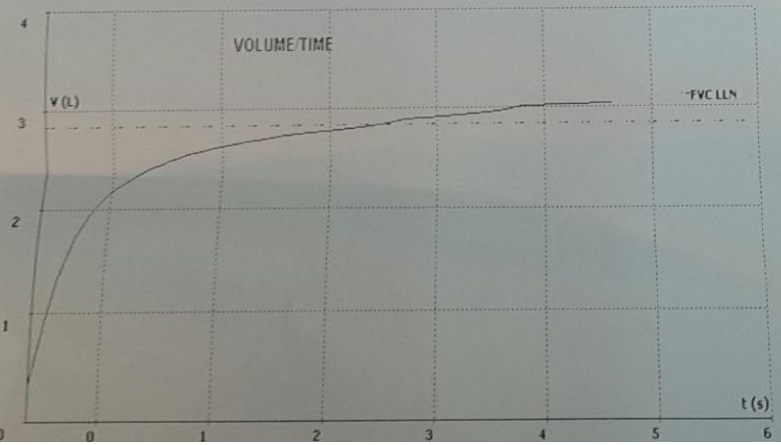
ID :	1	AGE :	49 YRS
HEIGHT :	162 CM	SEX :	FEMALE
SMOKER :	NON SMOKER	NORMAL VALUES	NHANES_C

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		

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)





Analogmatic 50th ANNIVERSARY 1963-2013 CAT#61149

Vitalograph alpha

Spirometry Report

08/DEC/2019, 11:35 AM

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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.

Vitalograph 50th ANNIVERSARY 1963-2013 CAT#66149

	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** ⬇	**Decreased**
Restrictive lung disease	Decreased	**Decreased**	Normal or increased

If we predicted that the pateint has RLD , we should do further test to confirm that

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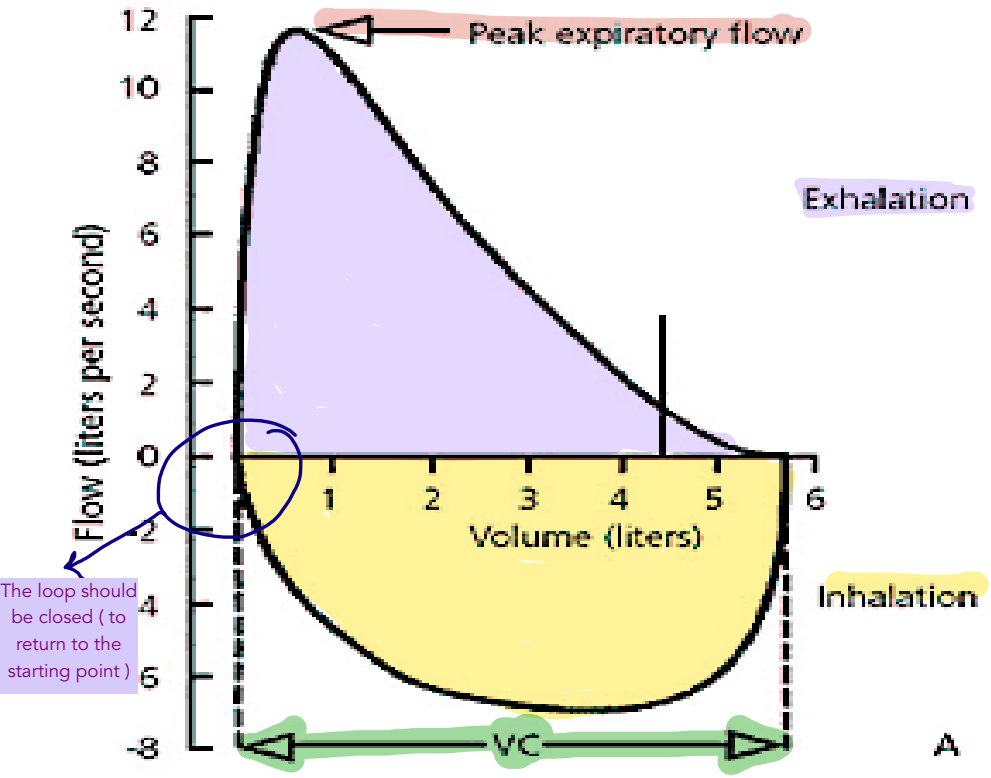
TLC , RV can't be measure by spirometer

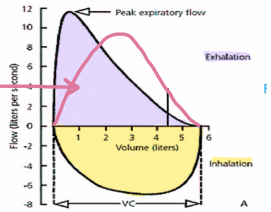
THE GRAPHS

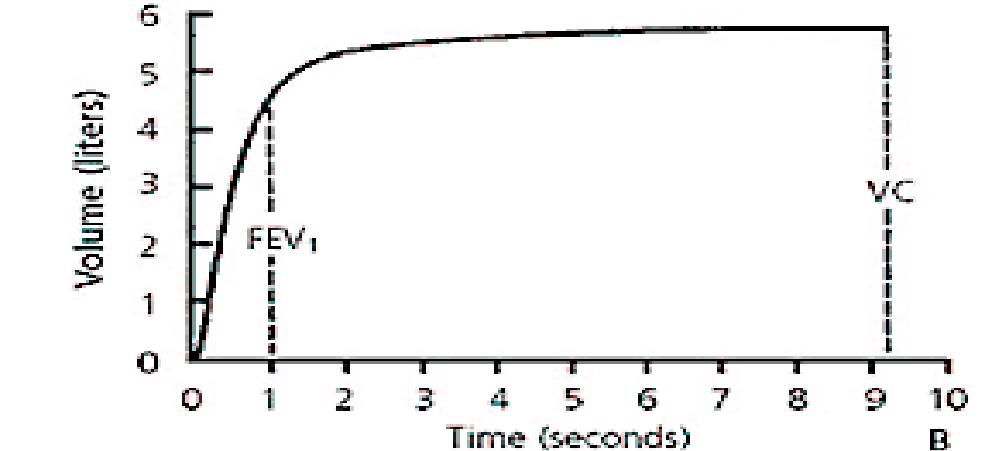


Flow-volume curve

- PEF
- FVC
- Expiratory effort

The curve will be like this if the pateint isnot exhaling as forcefully as he can





Volume-time curve

- FEV1
- FVC
- Duration of Expiration

Normally ~6 sec

In this curve :
- FEV1 = 4.5 L
- FVC = 5.5 L
- Duration of Expiration ~ 9 sec

IMPORTANT TERMS

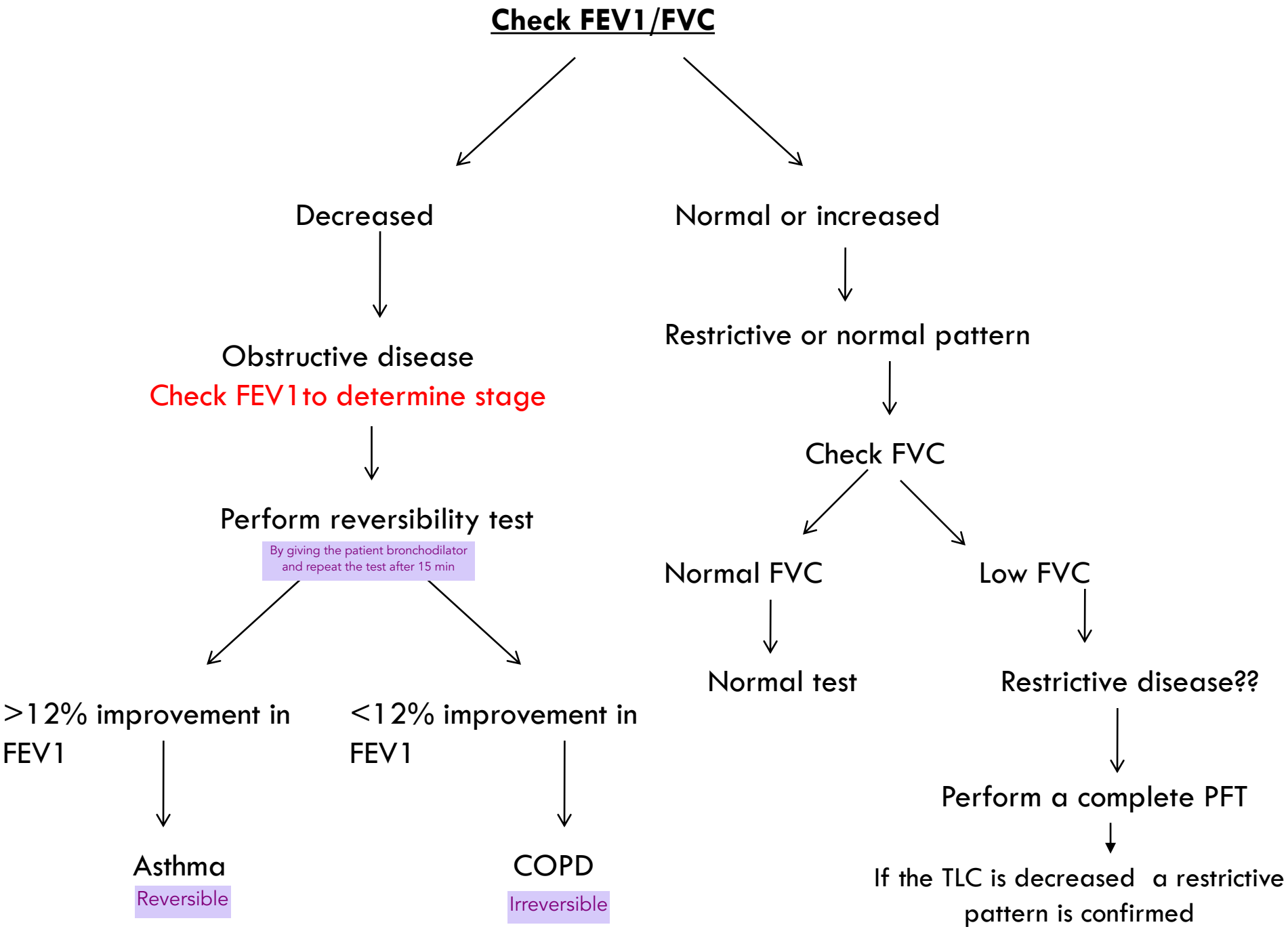
Confirm that the test result is acceptable and reproducible

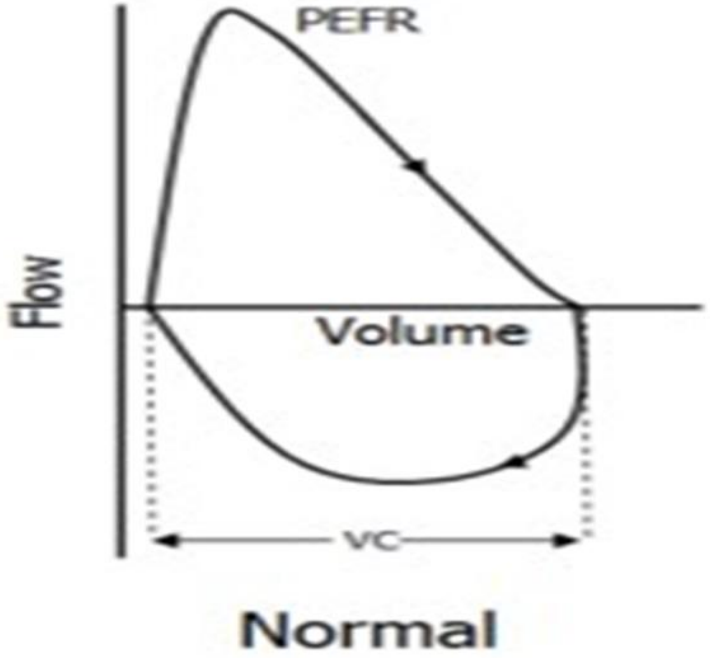
- Acceptable test: we check from the graphs if the patient made a good effort.
  - Rapid increase in airflow at the start of exhalation
  - Exhalation continued for ~6 seconds
- Reproducible test: the difference between the two largest FVC measurements and between the two largest FEV1 measurements is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

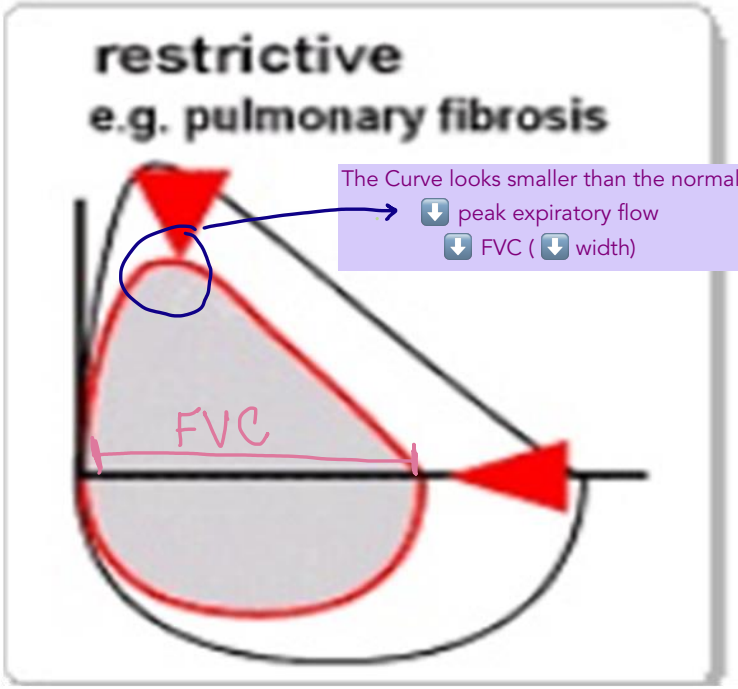
لازم القراءة اللي بعطيها المريض ، يكون قادر يعطيها على اكتر من مرة (مش مرة وحدة قدر يعطيها بس)

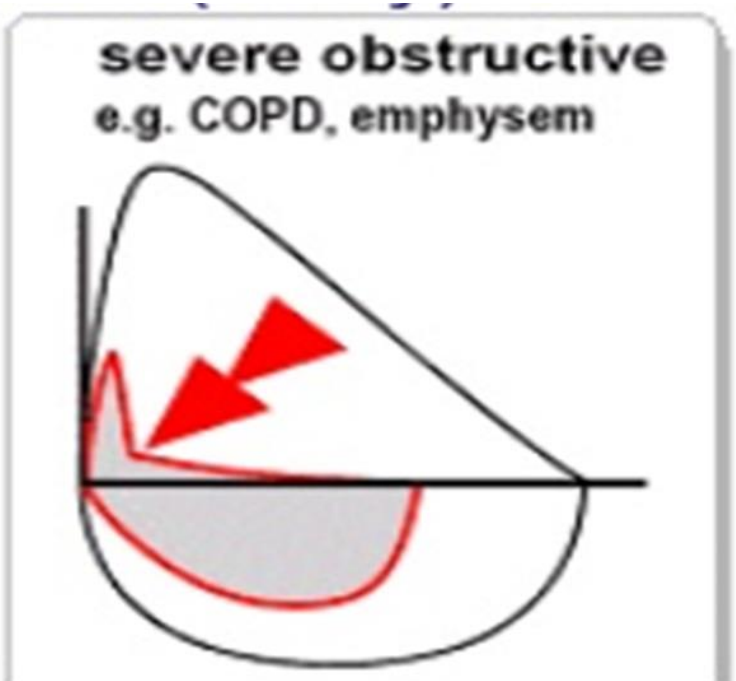
- If an obstructive defect is present, the physician should determine if the disease is reversible based on the increase in FEV_1 after bronchodilator treatment
- The test is repeated 15 minutes after giving a bronchodilator (4 puffs of salbutamol inhaler) to check for FEV1 reversibility. (i.e., increase of more than 12% and more than 200 mL)

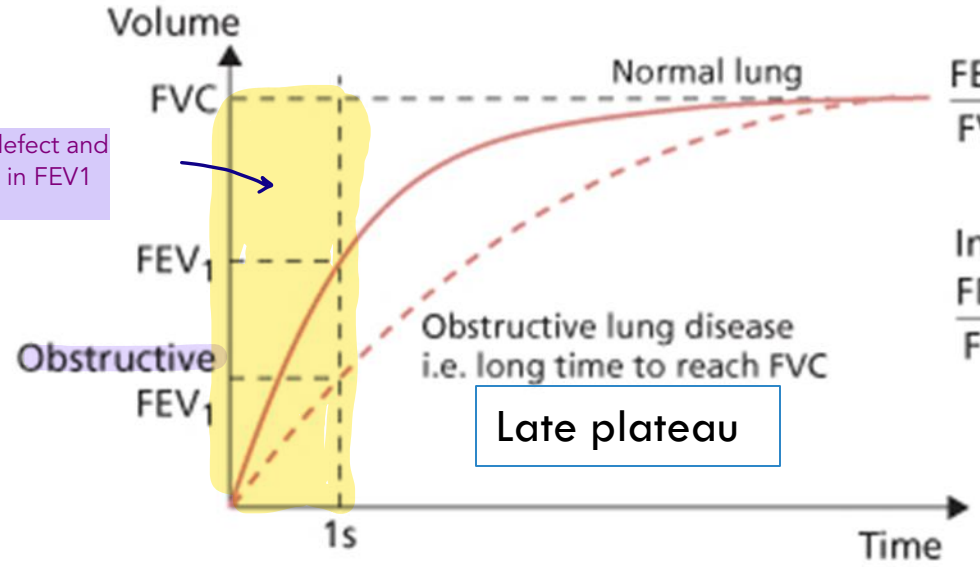
- If a restrictive pattern is present, full pulmonary function tests should be ordered to confirm restrictive lung disease and form a differential diagnosis.


Check FEV1/FVC
Decreased
Normal or increased
Obstructive disease
Check FEV1to determine stage
Restrictive or normal pattern
Perform reversibility test
By giving the patient bronchodilator and repeat the test after 15 min
Check FVC
Normal FVC
Low FVC
>12% improvement in FEV1
<12% improvement in FEV1
Normal test
Restrictive disease??
Perform a complete PFT
Asthma
Reversible
COPD
Irreversible
If the TLC is decreased a restrictive pattern is confirmed


PEFR
Flow
Volume
VC
Normal


restrictive
e.g. pulmonary fibrosis
The Curve looks smaller than the normal
⬇ peak expiratory flow
⬇ FVC (⬇ width)
FVC


severe obstructive
e.g. COPD, emphysem

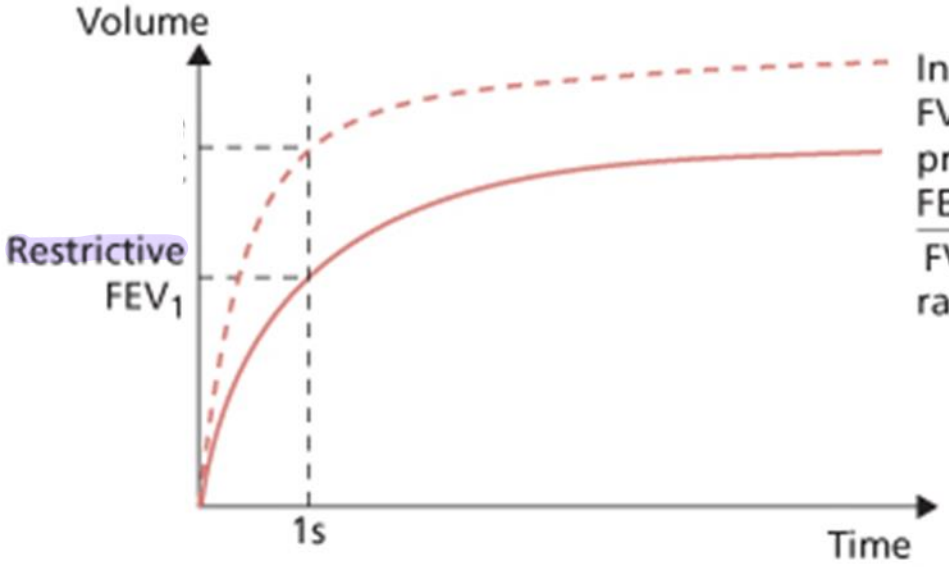


The main defect and change is in FEV1

$\frac{FEV_1}{FVC} \approx 70\%$

In obstructive $FEV_1 \downarrow \therefore$

$\frac{FEV_1}{FVC} < 70\%$



In restrictive lung disease, FVC also decreases in proportion with $FEV_1 \therefore$

$\frac{FEV_1}{FVC} \approx 70\%$

ratio maintained

The shape of the curve is normal but (all the curve is pushed down)

METHCHOLINE CHALLENGE TEST

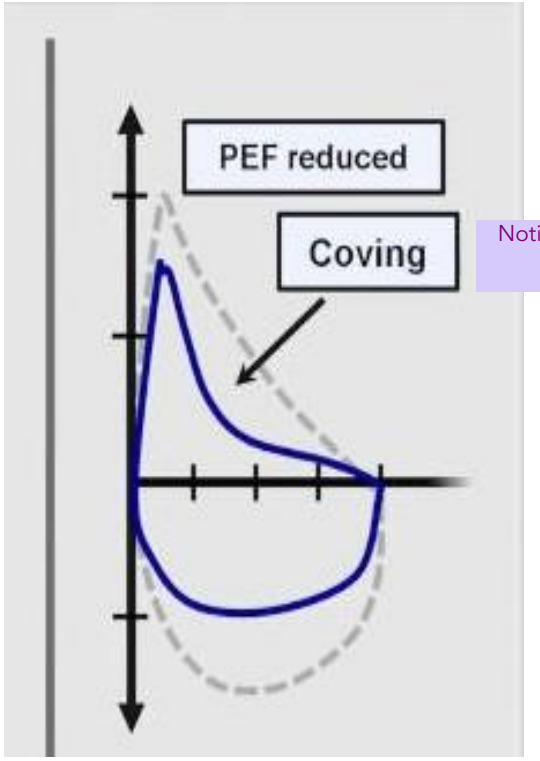
- When the test results are normal but the history strongly suggests the presence of asthma the next step is bronchoprovocation, such as a methacholine challenge.
- Methcholine causes bronchoconstriction, dose used between 4 and 16 mg per mL.
- During the test progressively larger doses of inhaled methacholine 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

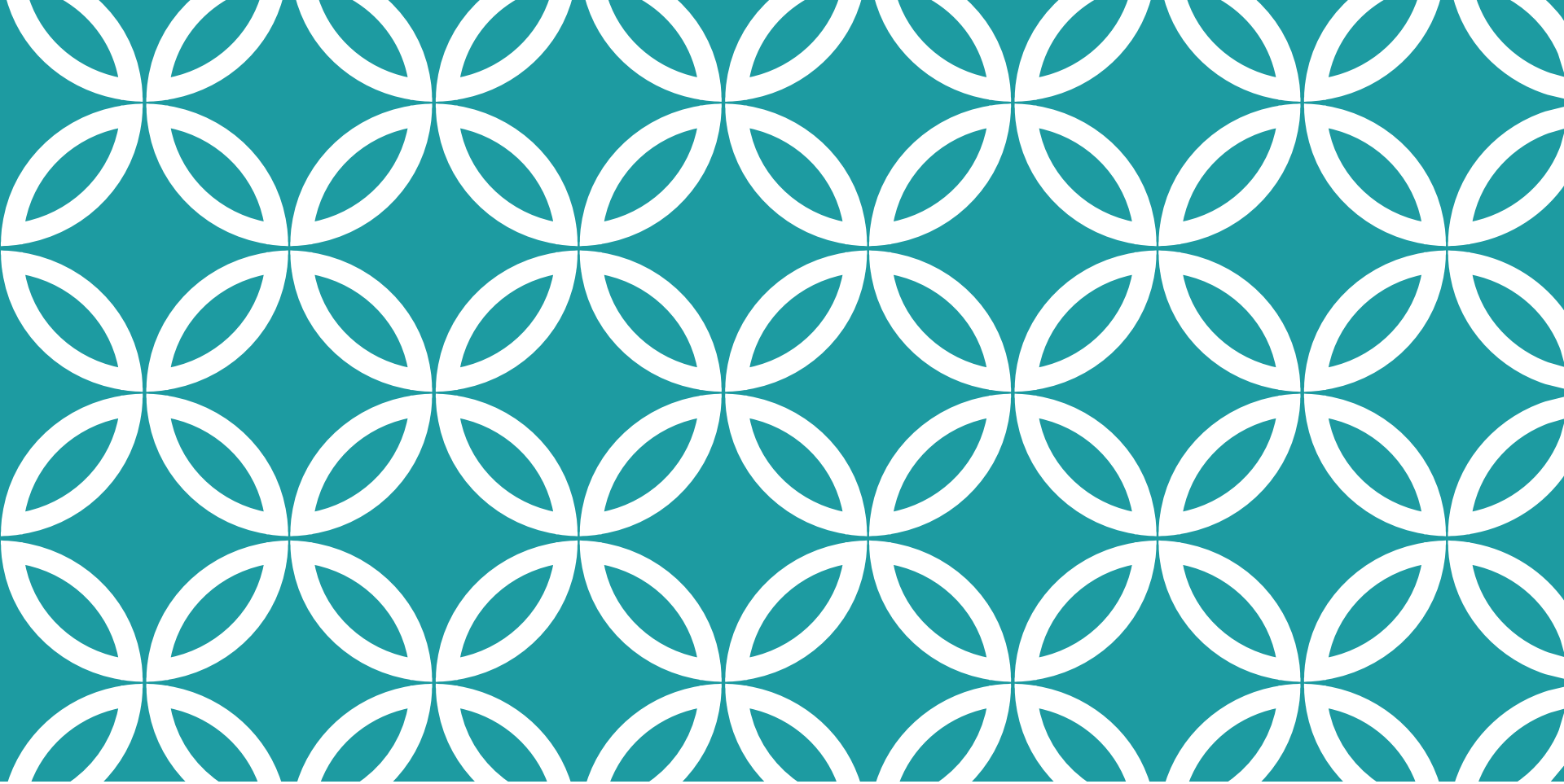
- Evaluate the signs and symptoms of lung disease Dyspnea, shortness of breath
- Classify asthma and COPD Mild , moderate , severe
- Assess the progression of lung disease To make sure that the medication is effective or not
- Monitor the effectiveness of therapy
- Evaluate preoperative patients in selected 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% Normal	2.72	12%
FEV1(L)	2.41	1.52	63%	2.05	34% Improvement >12% , reversible
FEV1/FVC	82.8%	58.2% ⬇		75.4%	



Notice the coving which indicates OLD



THANK YOU