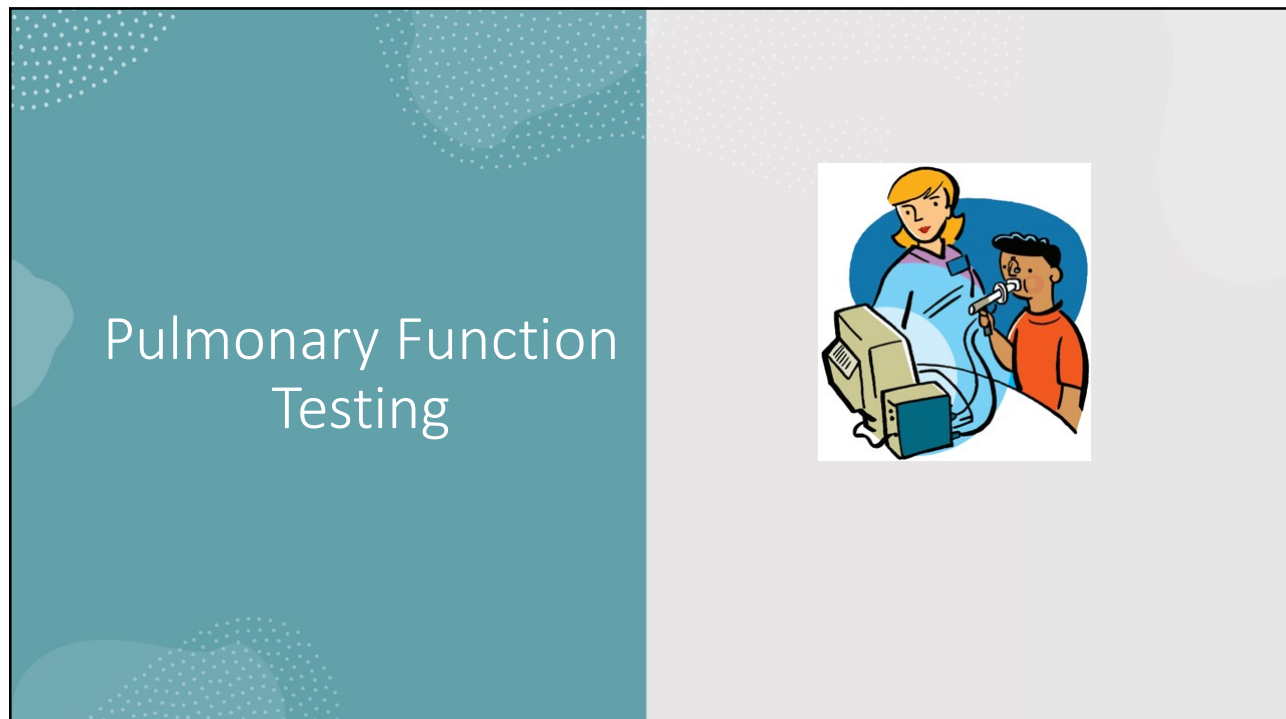



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1



Pulmonary Function Testing



The slide features a teal background on the left with white text and a light gray background on the right. An illustration shows a healthcare professional in a blue coat using a spirometer on a patient in an orange shirt. The spirometer is connected to a computer monitor and a printer.

2

What is Pulmonary Function Testing



Tests that help determine how well your lungs are working



Spirometry

4 steps to complete the test

- normal tidal breathing
- Deep maximal inhalation
- Maximal exhalation to plateau
- Maximal inhalation to close the loop

3

What do I need to complete testing?

Spirometer

Mouthpiece and nose clip

Syringe for calibration

Cooperative patient

4

Spirometry Goals

3 acceptable maneuvers

Goal is to reach exhalation plateau of 1 second

- If unable to reach plateau, acceptability is based on repeatability of FVC and FEV1 within 0.15L. If patient is less than 6 years old, 0.10L.

5

Basic Spirometry

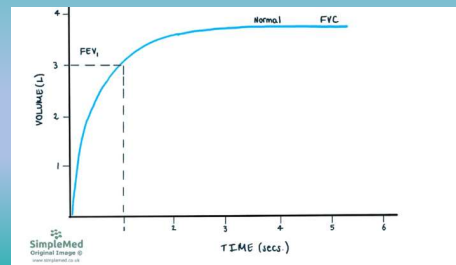
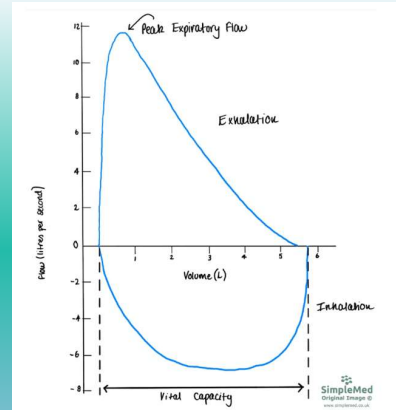
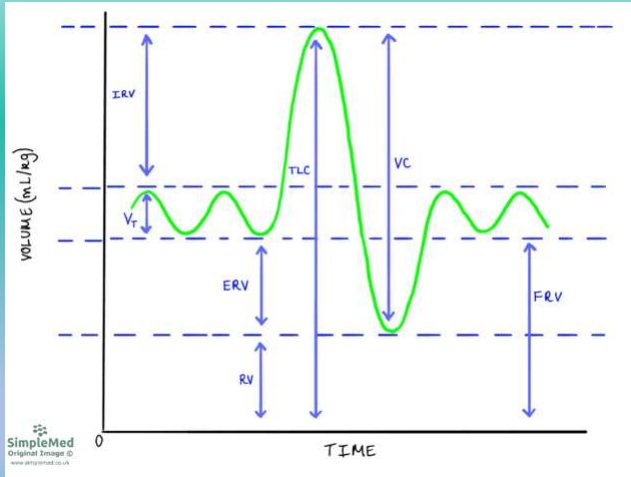
- Two main visual graphs
 - Volume-time
 - Flow-Volume
- Values
 - FVC
 - FEV1
 - Z-scores
 - If pre Z is more than -1.67, shows deficits in breathing

The "Predicted" PFT Value

		Pred	Pre	PrePred	PreZ
FVC	L	2.72	2.57	94	-0.47
FEV1	L	2.37	1.69	71	-2.15
FEV1/FVC	%	87	66	75	-2.97
FEF25-75%	L/s	2.79	0.98	35	-3.10
PEF	L/min	342	277	81	-1.34
FENO ppb		66	<u>Tech Comments</u>		

6

What Am I Looking At?

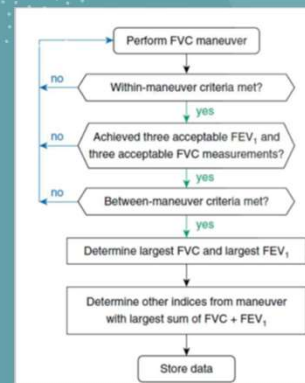


7

What is Acceptable?

- ATS guidelines:

Acceptability and Usability Criterion	Required for Acceptability		Required for Usability	
	FEV ₁	FVC	FEV ₁	FVC
Must have BEV \leq 5% of FVC or 0.100 L, whichever is greater	Yes	Yes	Yes	Yes
Must have no evidence of a faulty zero-flow setting	Yes	Yes	Yes	Yes
Must have no cough in the first second of expiration*	Yes	No	Yes	No
Must have no glottic closure in the first second of expiration*	Yes	Yes	Yes	Yes
Must have no glottic closure after 1 s of expiration	No	Yes	No	No
Must achieve one of these three EOFE indicators:	No	Yes	No	No
1. Expiratory plateau (\approx 0.025 L in the last 1 s of expiration)				
2. Expiratory time \geq 15 s				
3. FVC is within the repeatability tolerance of or is greater than the largest prior observed FVC [†]				
Must have no evidence of obstructed mouthpiece or spirometer	Yes	Yes	No	No
Must have no evidence of a leak	Yes	Yes	No	No
If the maximal inspiration after EOFE is greater than FVC, then FVC - FVC must be \leq 0.100 L or 5% of FVC, whichever is greater [†]	Yes	Yes	No	No



Grade	Number of Measurements	Repeatability: Age >6 yr	Repeatability: Age \leq 6 yr*
A	\geq 3 acceptable	Within 0.150 L	Within 0.100 L*
B	2 acceptable	Within 0.150 L	Within 0.100 L*
C	\geq 2 acceptable	Within 0.200 L	Within 0.150 L*
D	\geq 2 acceptable	Within 0.250 L	Within 0.200 L*
E	\geq 2 acceptable	$>$ 0.250 L	$>$ 0.200 L*
U	0 acceptable AND \geq 1 usable	N/A	N/A
F	0 acceptable and 0 usable	N/A	N/A

8

What is my role as the tester for the pediatric patient?

- 1**
 - Coach, Coach, Coach
- 2**
 - Don't be afraid to be overzealous
 - Overexaggerate what you are asking of your patients
- 3**
 - Sync your breathing with patient
- 4**
 - Praise them when they get it even partially right
- 5**
 - Make it fun!
 - Use different animations

9

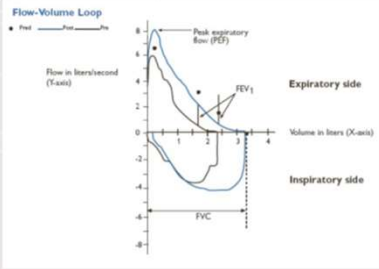


10

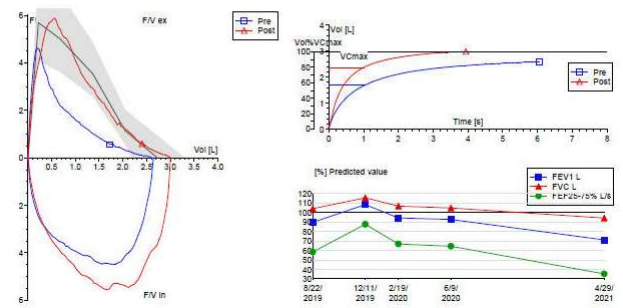
How Can I Tell If They Get Better?

- Post Bronchodilator Testing
 - Performed after completion of baseline testing
 - Bronchodilator treatment given
 - Unit dose Albuterol nebulizer or 4 puffs Albuterol MDI with valved-holding chamber
 - Repeat PFTs are performed after 10-15 minutes
 - Shows percent change from baseline to post
 - Recent change within last few years for percent change
 - More than 10% is significant
 - Previous was post-pre/pre x 100
 - Now Post-Pre/Pred x100
 - This example it would change the data as follows

	Pred	Pre	Prepred	Post	PostPred
FVC	2.72	2.57	94	2.98	15%
FEV1	2.37	1.69	71	2.37	27%

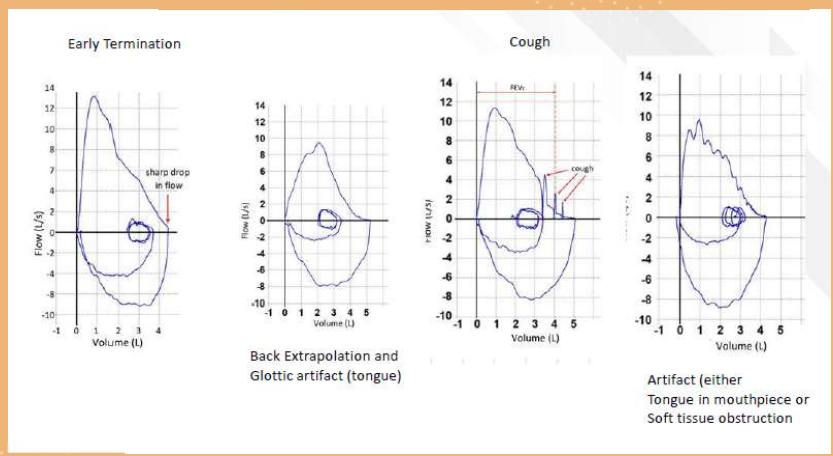


		Pred	Pre	PrePred	PreZ	Post	PostPred	PostZ	Change
FVC	L	2.72	2.57	94	-0.47	2.98	110	0.76	18
FEV1	L	2.37	1.69	71	-2.15	2.37	100	0.00	40
FEV1/FVC	%	87	66	75	-2.97	79	91	-1.24	21
FEF25-75%	L/s	2.79	0.98	35	-3.10	2.13	76	-0.96	116
PEF	L/min	342	277	81	-1.34	353	103	0.18	27
FENO ppb		66							



11

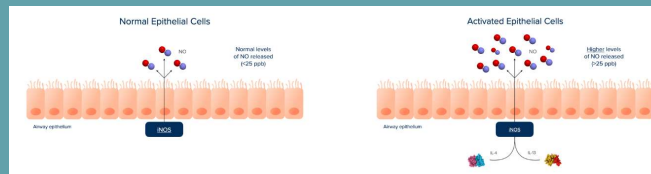
What's Wrong With My Spirometry?



12

What Else Can I Perform Quickly in Clinic?

- Exhaled Nitric Oxide
 - Can help to measure possible inflammation associated with allergic asthma
 - Quick 10 second inhalation into device



FeNO levels and assessment of airway inflammation, from the ATS guidelines ¹			
FeNO (ppb)	LOW	INTERMEDIATE	HIGH
Adults	< 25	25-50	> 50
Children	< 20	20-35	> 35
Type 2 Inflammation	Unlikely	Possible	Likely

13

What Other Options Are Out There?

- Referral to Pulmonary Specialist
- Impulse Oscillometry
- Body Box
 - Lung volume
 - Diffusing Capacity
- Exercise Challenges
 - With or without Metabolic
- Methacholine Challenge
 - Provocation testing
 - Increasing doses of methacholine given to attempt to cause bronchospasm
 - Some branches of military require passing for admission to military



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