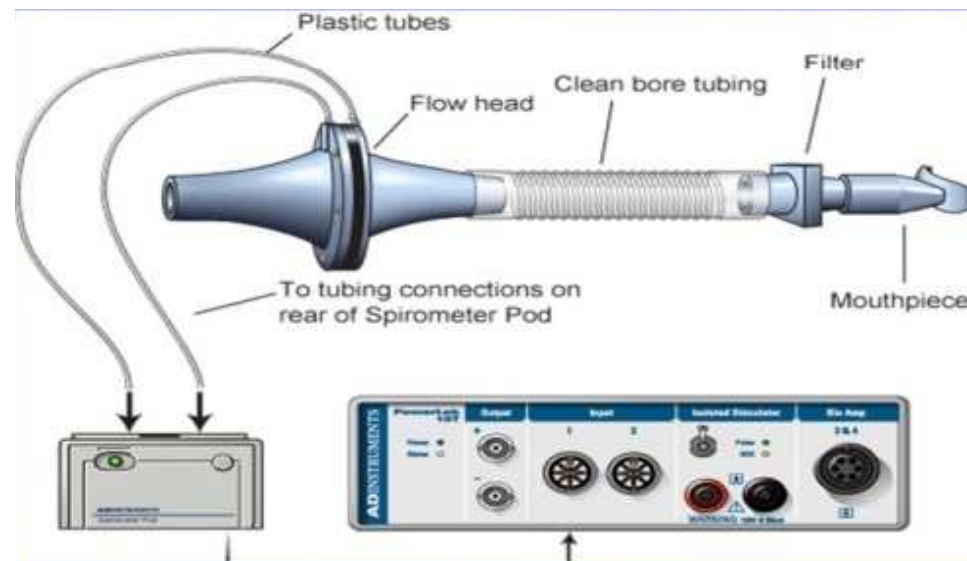


**M U N I
M E D**

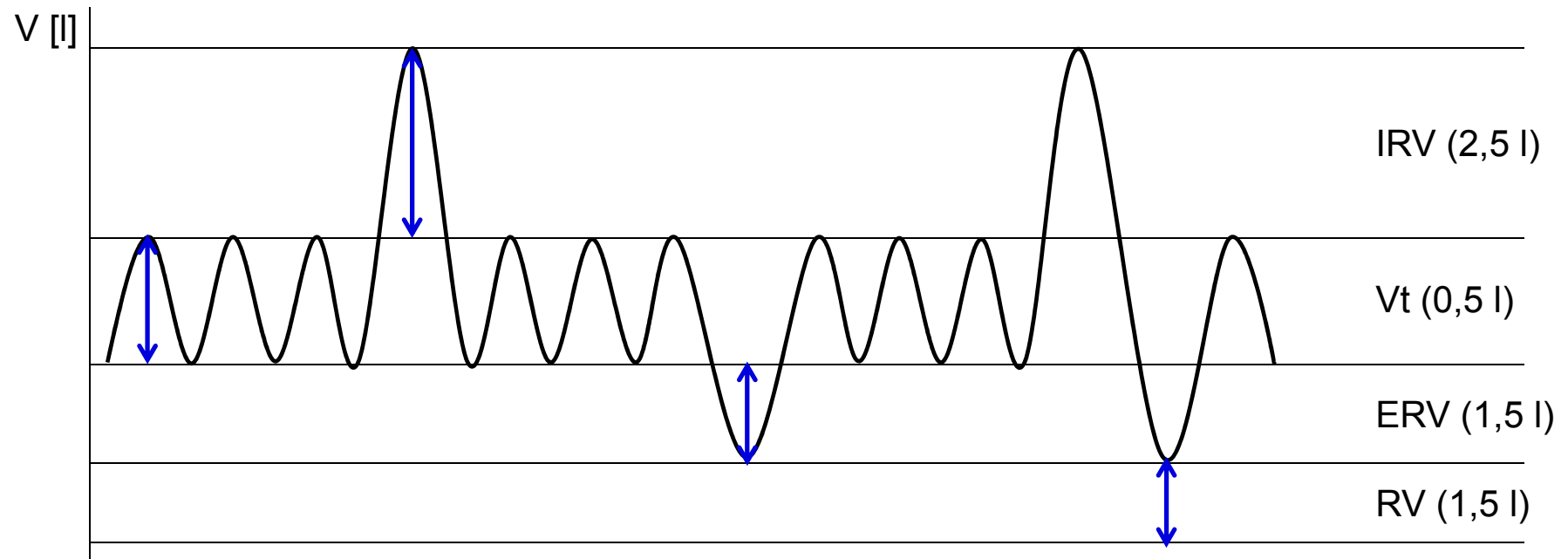
Respiratory system.

Lung ventilation, volumes, measurement

Principle: determination the air flow velocity from the measured pressure differences between the inner and outer spirometer membranes, the volumes being calculated (PowerLab spirometry)

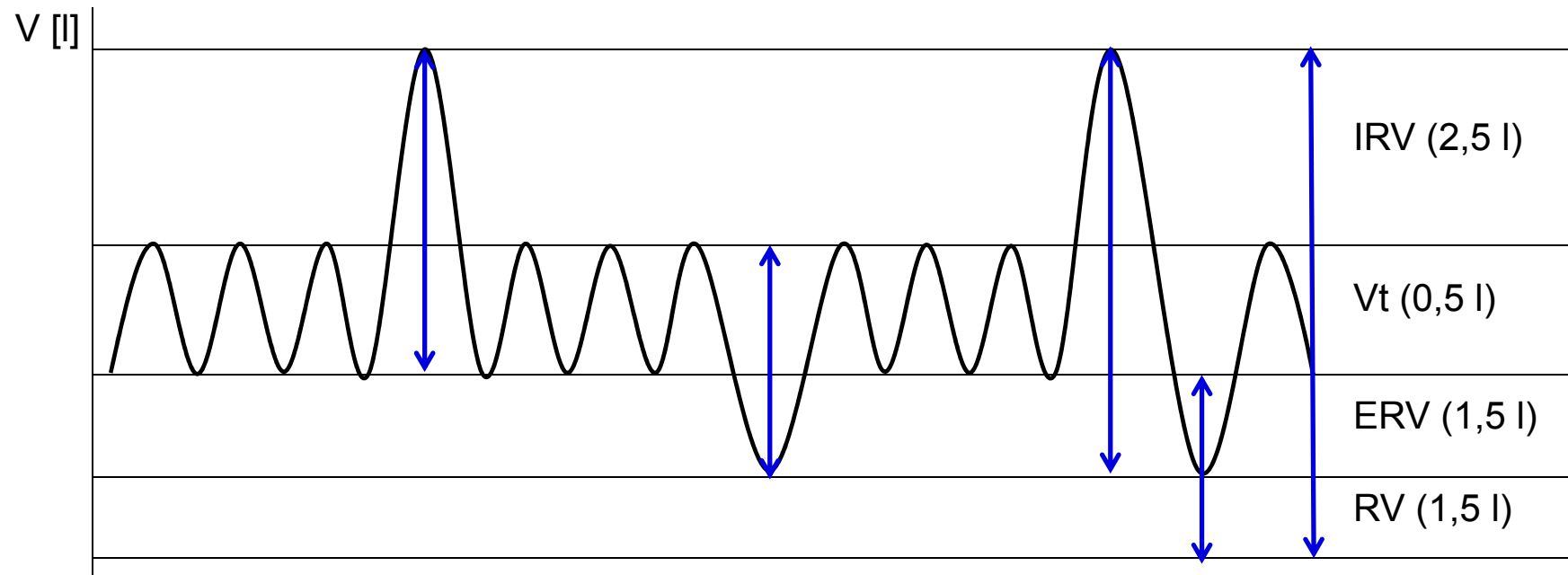


Lung ventilation, volumes, measurement



- **Tidal volume (TV)** – the volume of air that enters the lungs during each inspiration (or the volume that is exhaled during every expiration).
- **Inspiratory reserve volume (IRV)** – the maximal amount of additional air that can be drawn into the lungs by determined effort after a normal inspiration at rest.
- **Expiratory reserve volume (ERV)** – the additional amount of air that can be exhaled from the lungs by determined effort after a normal expiration.
- **Residual volume (RV)** – the volume of air still remaining in the lungs after the most forcible expiration possible.

Lung ventilation, volumes, measurement



Lung capacity:

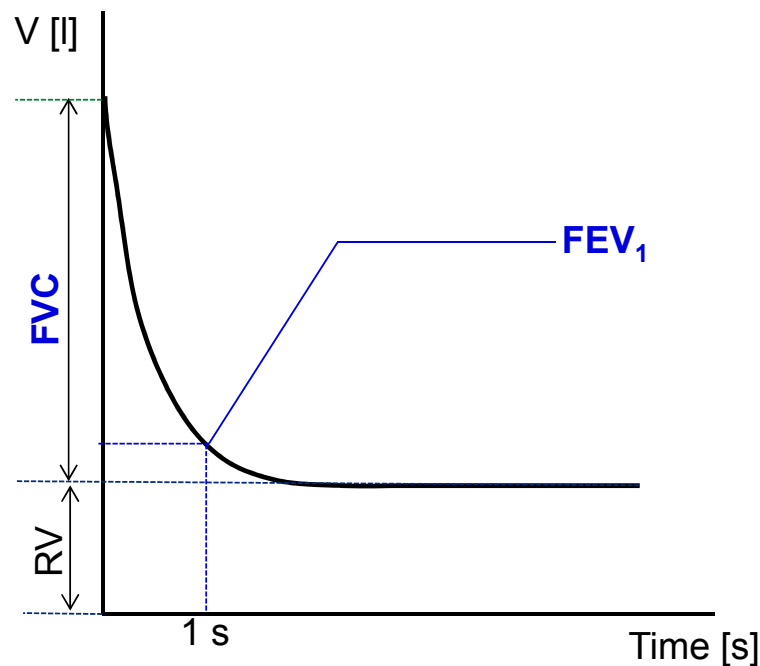
- $VC = VT + IRV + ERV$
- $TLC = VC + RV$
- $FRC = ERV + RV$
- $IC = IRV + VT$
- $EC = ERV + VT$

Dynamic lung volumes:

- VE
- MMV

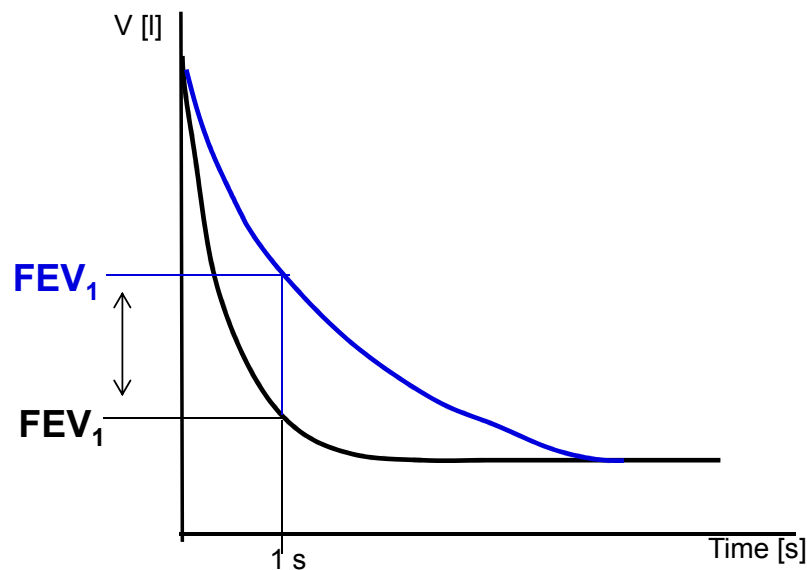
Lung ventilation, volumes, measurement

Dynamic lung volumes



- **FVC** – the maximum volume of air that can be exhaled after maximum inhale
- **FEV₁** – the volume of air exhaled with the greatest effort in 1 second after maximum inhale
- **FEV₁/FVC (%)** – Tiffeneau index – around 0,8 (80 %)

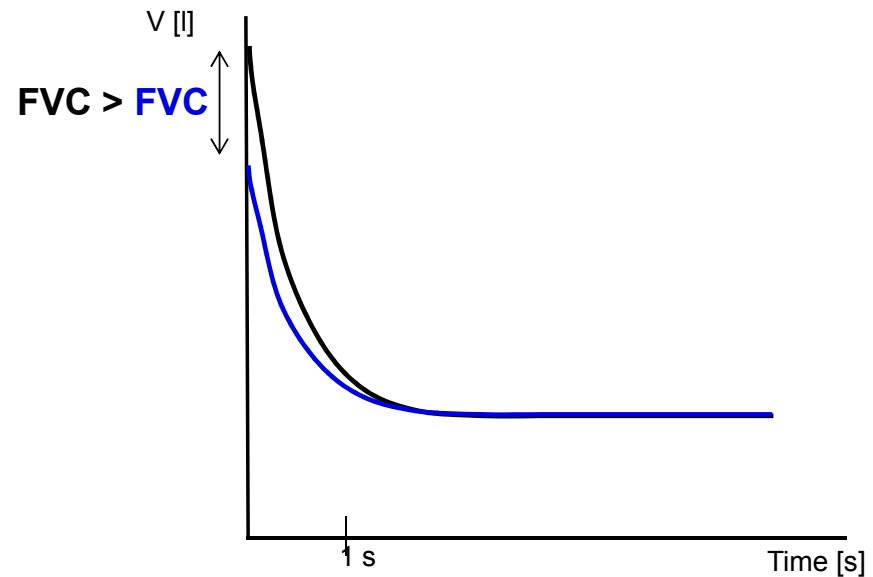
Lung ventilation, volumes, measurement



Obstructive lung disease

($FVC=N$; $FEV_1=\downarrow$)

- tracheal stenosis
- astma bronchiale
- CHOPN
- tumor



Restrictive lung disease

($FVC=\downarrow$; $FEV_1=N$)

- ### Pulmonary etiology
- pulmonary fibrosis
 - lung resection
 - pulmonary edema
 - pneumonia

Extrapulmonary etiology

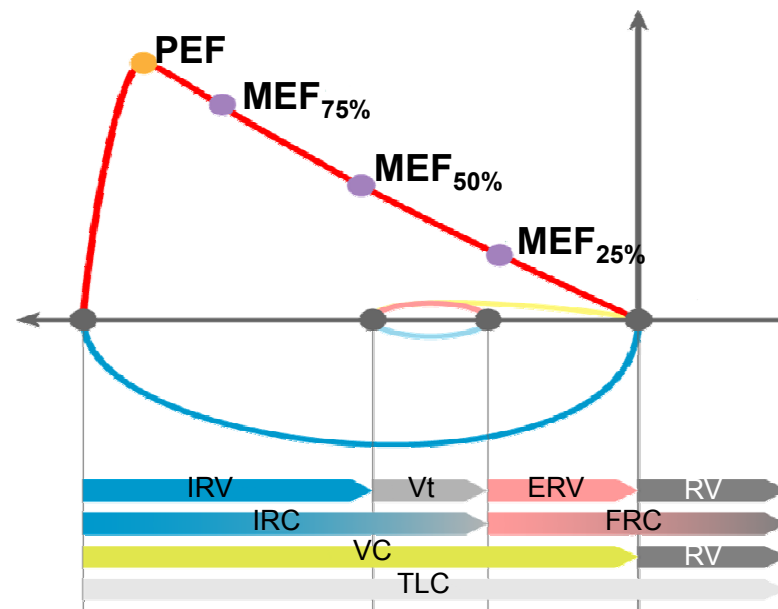
- ascites
- kyphoscoliosis
- burns
- high diaphragm condition

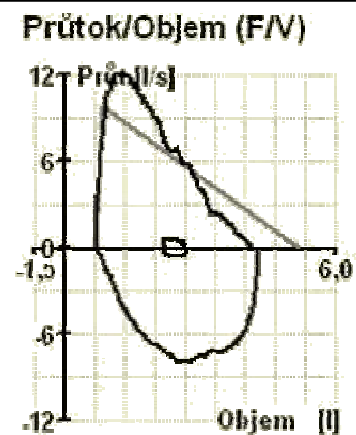
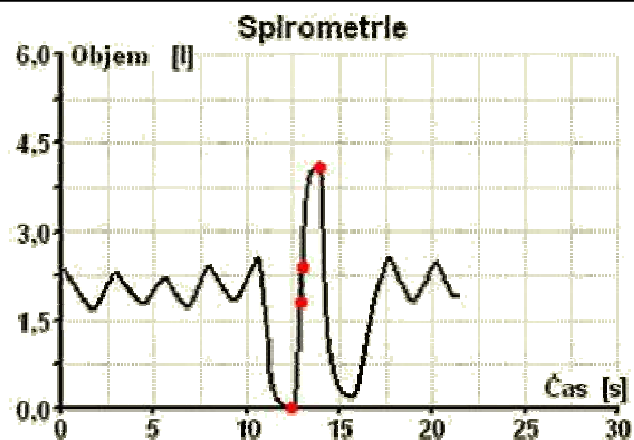
Maximal respiratory flow - volume curve (spirogram)

Principle: the measurement of the air flow velocity according to the speed of the turbine and the volumes are calculated (Cosmed).



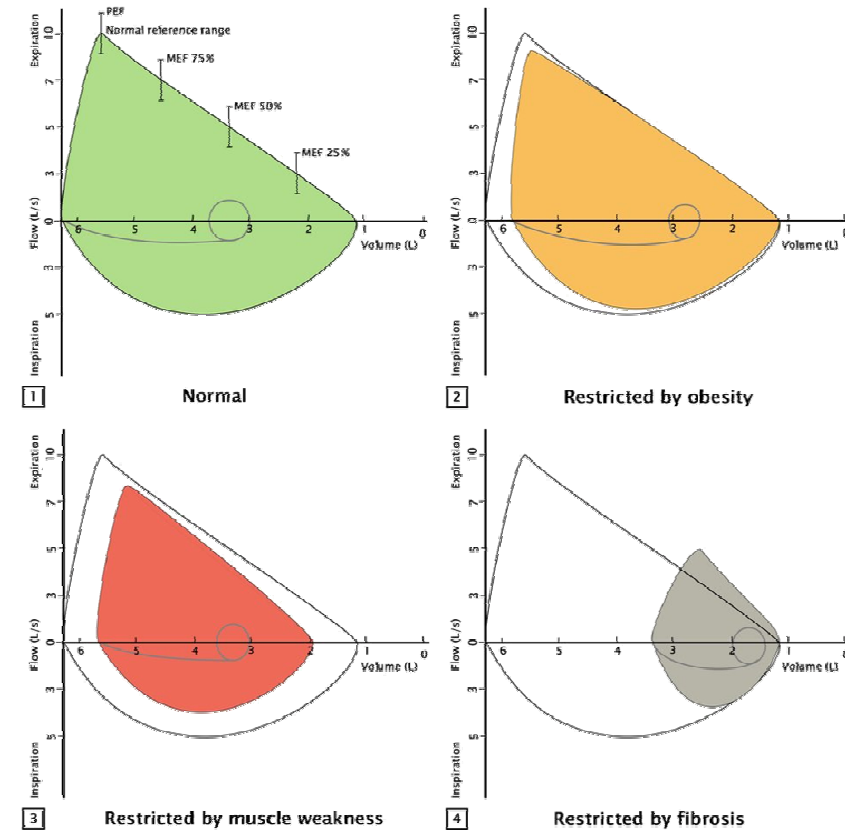
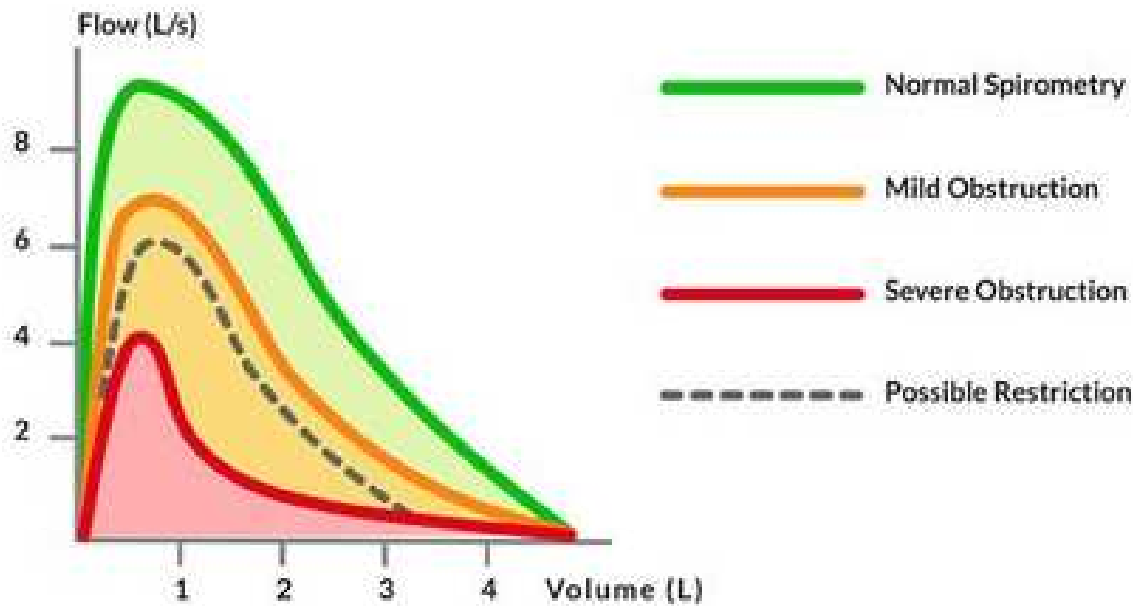
- **PEF** – peak expiratory flow; the highest speed of air flow at peak of exhale
- **MEF** – maximum expiratory flow rates at different FVC levels, which is still to be exhaled (75 %, 50 % and 25 % of FVC)





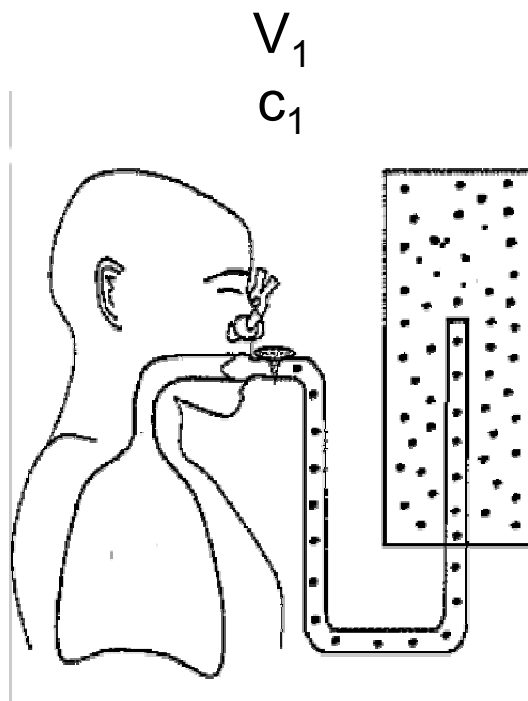
	Ref.	Měř	Měř/Ref.
Spirometrie			
IVC	5,30	4,09	77%
IRV	-	1,67	-
ERV	-	1,81	-
VT	-	0,61	-
Průtok/Objem (F/V)			
FVCex	5,05	3,89	77%
FEV1	4,28	3,73	87%
FEV1/IVC	83	91	110%
MEF25	2,55	2,44	96%
MEF50	5,48	6,63	121%
MEF75	8,33	11,40	137%
MEF25-75	4,98	6,02	121%
PEF	9,79	12,03	123%
PIF	-	7,99	-
AREAex	19,42	24,66	127%

Maximal respiratory flow - volume curve (spirogram)



Lung ventilation, volumes, measurement

Helium dilution method – residual volume



$$C = \frac{n}{V}$$

$$V_1 \times C_1 = (RV + V_1) \times C_2$$

$$RV = \frac{V_1 \times C_1}{C_2} - V_1$$

$$V_2 = RV + V_1$$

C_2

