

MODULE 7 L08

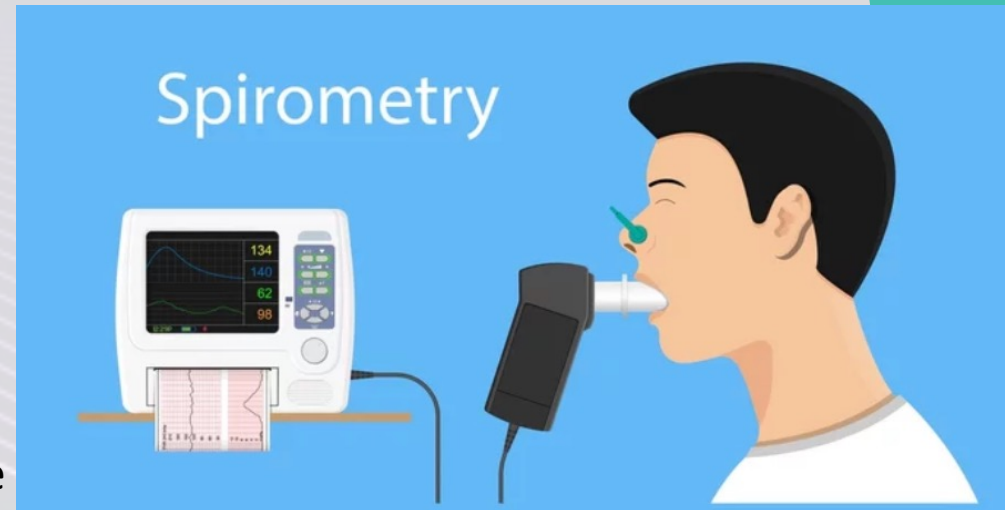
Respiratory System: Lung Volumes and Capacities

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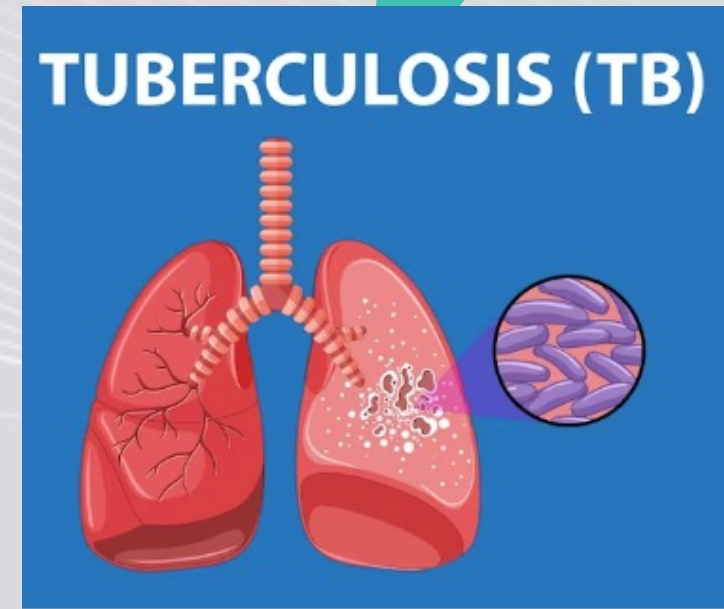
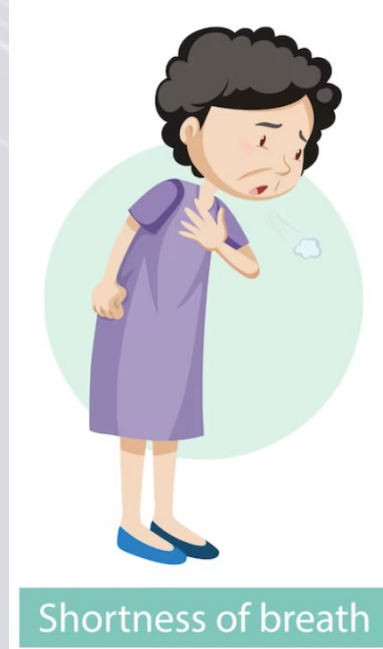
3. Lung Volume and Capacities

- A way to assess pulmonary function
 - ❖ Lung volume - volume of gas in lungs at a given time during respiratory cycle
 - ❖ Lung capacities - derived from a summation of different lung volumes
- Spirogram
 - ❖ Record of lung volumes and lung capacities
 - ❖ Device
 - Spirometer
 - ❖ Breathing test
 - Spirometry
 - ❖ Detecting following diseases:
 - Asthma
 - Chronic obstructive pulmonary disease
 - Cystic fibrosis
 - Pulmonary fibrosis



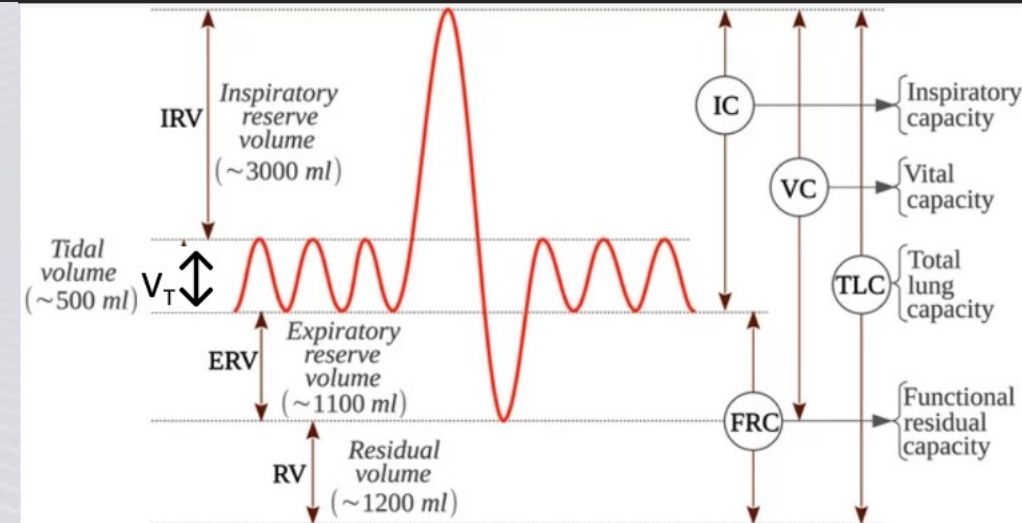
Other Lung Diseases

- Eupnea – normal, good, healthy and unlabored breathing
- Apnea – low oxygen levels when breathing stops
- Dyspnea – shortness of breath
- Tuberculosis – caused by *Mycobacterium tuberculosis*



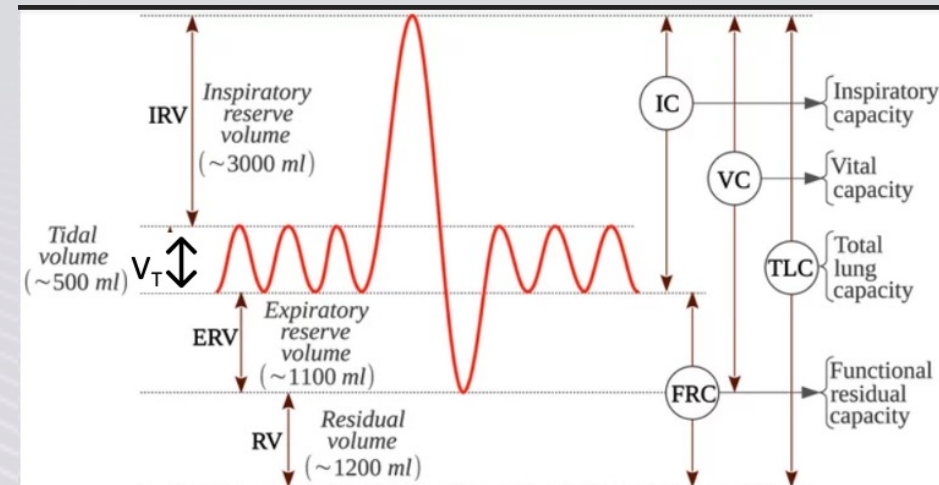
Lung Volumes

- Larger
 - ❖ Males
 - ❖ Taller individuals
 - ❖ Younger adults
- Smaller
 - ❖ Females
 - ❖ Shorter individuals
 - ❖ Elderly
- Lung volumes:
 - ❖ Tidal volume (V_T)
 - volume of air inspired or expired during a single breathing cycle under resting conditions
 - = 500 ML in an average adult male or female
 - ❖ Inspiratory reserve volume (IRV)
 - maximum volume of air that can be inspired after a normal inspiration.
 - ~ 3000 mL in average adult male and 1900 mL in an average adult female
 - ❖ Expiratory reserve volume (ERV)
 - maximum volume of air that can be expired after a normal expiration
 - averages 1100 mL in adult male and 700 mL in an adult female
 - ❖ Residual volume (RV)
 - volume of air that remains in lungs after a maximum expiration
 - ~ 1200mL in males and 1100 mL in females



Lung Capacities

- Calculated by adding two or more specific lung volumes
 - ❖ Functional residual capacity (FRC)
 - volume of air in the lungs at the end of a normal expiration under resting conditions
 - $RV + ERV$
 - Males - $1200 \text{ mL} + 1100 \text{ mL} = 2300 \text{ mL}$
 - Females - $1100 \text{ mL} + 700 \text{ mL} = 1800 \text{ mL}$
 - Inspiratory capacity (IC)
 - maximum volume of air that can be inspired after a normal expiration
 - $V_T + IRV$
 - Males - $500 \text{ mL} + 3000 \text{ mL} = 3500 \text{ mL}$
 - Females - $500 \text{ mL} + 1900 \text{ mL} = 2400 \text{ mL}$
 - ❖ Vital capacity (VC)
 - maximum volume of air that can be expired after a maximum inspiration
 - $IRV + \text{tidal volume} + ERV$
 - Males - 4600 mL
 - Females - 3100 mL
 - Forced expiratory volume (FEV_1), - volume of air that can be exhaled from lungs in 1 second with maximal effort following a maximal inspiration
 - 80% of VC
 - ❖ Total lung capacity (TLC)
 - total volume of air in the lungs after a maximum inspiration
 - $VC + RV$
 - Males - $4600 \text{ mL} + 1200 \text{ mL} = 5800 \text{ mL}$
 - Females - $3100 \text{ mL} + 1100 \text{ mL} = 4200 \text{ mL}$



Anatomic Dead Space

- 70% V_T – 350 mL
 - ❖ Reaches respiratory zone
 - ❖ Participates in gas exchange
- 30% V_T - 150 mL
 - ❖ Remains in conducting zone
 - ❖ Anatomic dead space
 - Contains air that does not undergo gas exchange
- Alveolar ventilation (V_A)
 - ❖ Volume of air/minute – reaches respiratory zone
 - ❖ 4200 mL/min

Respiratory bronchioles



Alveolar ducts



Alveolar sacs