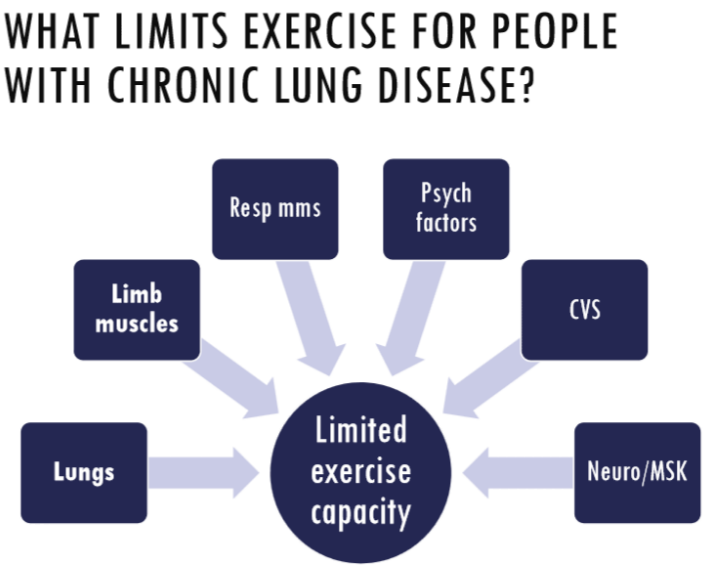
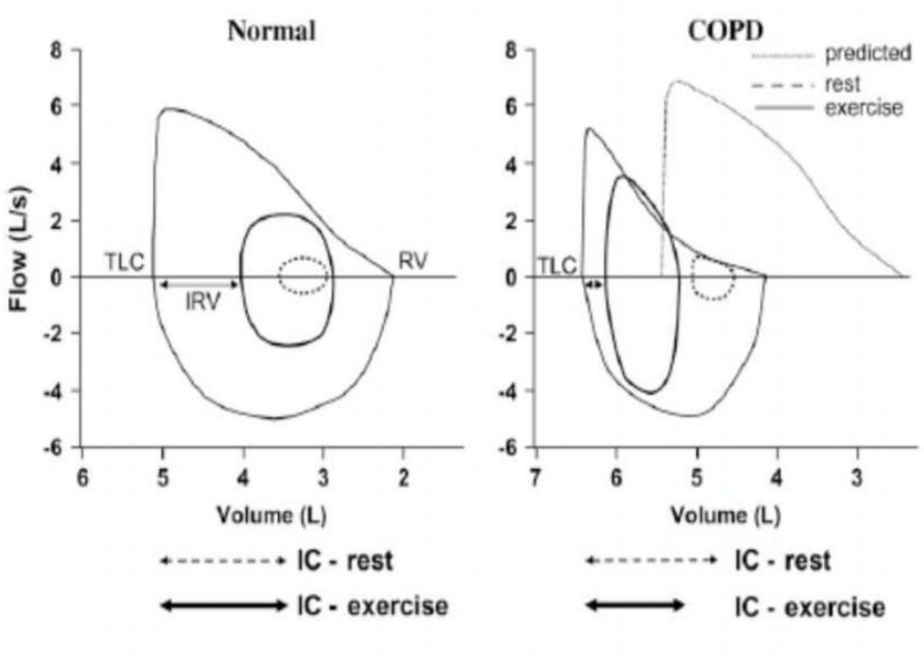
- **Describe in detail the factors which may limit the exercise capacity of patients with cardiovascular and pulmonary dysfunction.**



  - Complex interaction of factors.
  - Variable exercise capacities – disease process, type of exercise.
  - Limitation in exercise capacity not directly related to lung function as measured by FEV1 Major Symptoms causing exercise intolerance for people with COPD.
  - SOB (mod-severe), leg fatigue (mild).
  - Ventilatory limitations;
    - Alterations in gas exchange
      - Destruction of parenchyma and capillary network.
      - Increased diffusion distance -less time for diffusion
    - Alterations in pulmonary ventilation
      - Airflow limitation
      - Alterations in resp mechanics – hyperinflation.
    - Dynamic hyperinflation
      - Shortening of expiratory time leads to gas trapping.
      - Increase in end expiratory lung volume → dynamic hyperinflation.
      - Initially allows the patient to increase expiratory flow (higher volume → higher exp flow).
      - Further worsens respiratory mm mechanics and increases WOB → flow limitations.
      - Flow limitation- The hallmark of exercise intolerance in COPD.
      - People with COPD may have close to maximal expiratory flow rates at rest.
      - During exercise;
        - Tidal volume is increased, further hyperinflation.
        - Expiratory flow reaches the maximum available (limits further increases in ventilation).



- <u>Peripheral muscle limitations</u>
  - Limb muscle dysfunction highly prevalent in people with COPD.
  - Predictor of mortality (independent of lung function).
  - Reduced ability to perform physical activity.
  - Exercise intolerance.
  - Reduced function - ADLs
  - Higher healthcare utilisation
  - Poor QOL
  - Premature mortality.
  - LL most affected (quads).
  - Mm atrophy – reduced mm mass (FFM).
  - Fibre shift – from Type 1 (slow twitch) to Type IIx (fast twitch fatigable).
  - Reduced oxidative capacity – mitochondrial function, capillary density.
  - Early lactic acid production – further drives ventilation.
  - Reduced strength
  - Reduced endurance
  - Worsened during AECOPD
  - Aetiology;
    - Deconditioning/disuse
    - Inflammation
    - Oxidative stress
    - Nutritional imbalances
    - Alterations in blood gases (hypoxia, hypercapnia)
    - Corticosteriods (skin integrity, muscle atrophy, weight gain, immune suppression).
    - Changes in anabolic hormone levels (e.g. testosterone).
  - Management- Multifactorial.
  - Exercise training (Including after AECOPD).
  - Nutritional supplementation.
  - Oxygen therapy