



UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE  
“NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

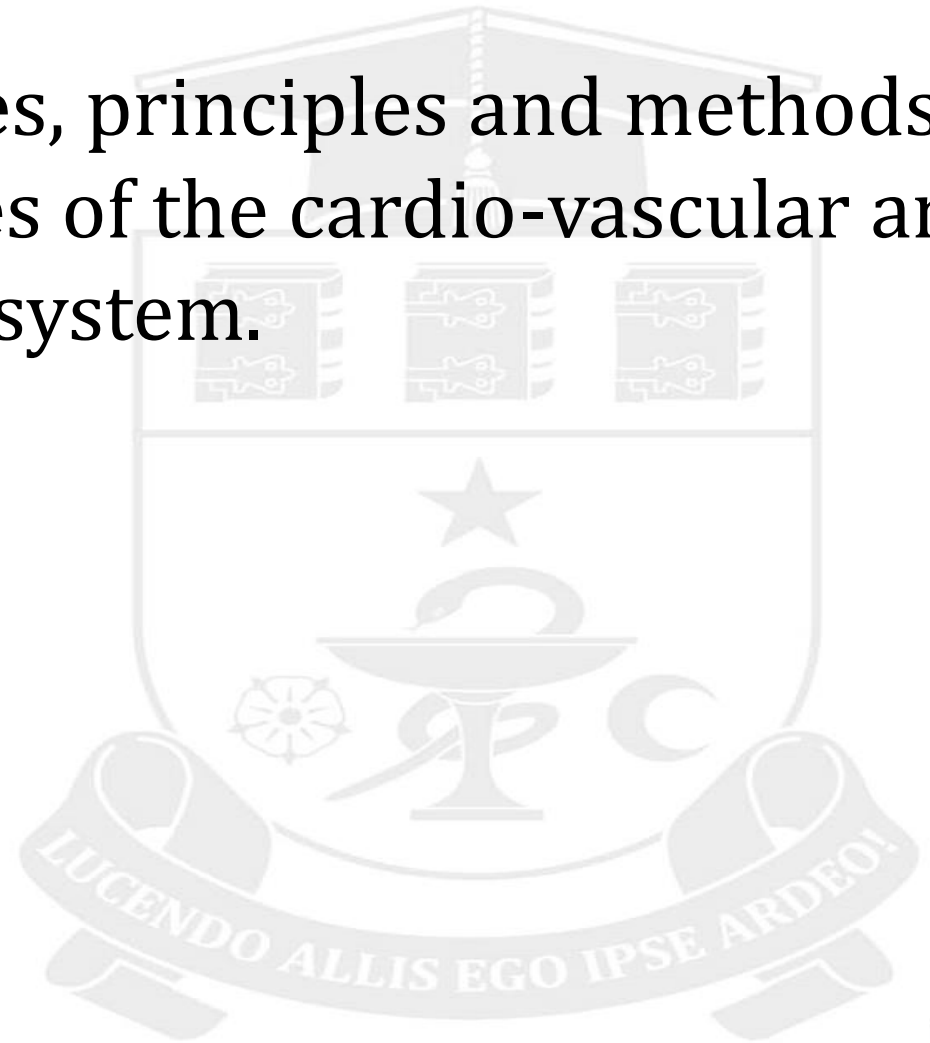
# Cardiovascular and pulmonary Rehabilitation

Department of Medical Rehabilitation, Physical  
Medicine and Manual Therapy



# Lesson's goal

Assessment techniques, objectives, principles and methods of medical rehabilitation in diseases of the cardio-vascular and pulmonary system.





# Lesson's Objectives

- Knowledge of global and specific functional assessment techniques of the cardiovascular and respiratory system.
- Knowing the stages of rehabilitation of patients with cardiovascular diseases and the rehabilitation principles applied at each stage.
- Knowing the application principles of recovery methods and techniques in respiratory system disorders depending on current respiratory functional syndrome.
- Knowing the application goals of specific respiratory kinetic techniques (posture, respiratory reeducation, re-education of cough, etc.).



# Cardiac Rehabilitation

- The term cardiac rehabilitation refers to coordinated, multifaceted interventions designed to optimize a cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing, or even reversing the progression of the underlying atherosclerotic processes, thereby reducing morbidity and mortality.





# Epidemiology

- Cardiac pathology is the leading cause of morbidity and mortality worldwide.
- According to some studies, it is estimated that heart disease is the cause of ~ 20% of the conditions that generate disabilities.
- Due to progress in cardiac surgery / cardiac transplantation, the number of individuals who can benefit from cardiac rehabilitation increases significantly.
- CR determines a definite improvement in exercise tolerance of patients with ischemic cardiopathy (post MI).



# Cardiac Risk Factors

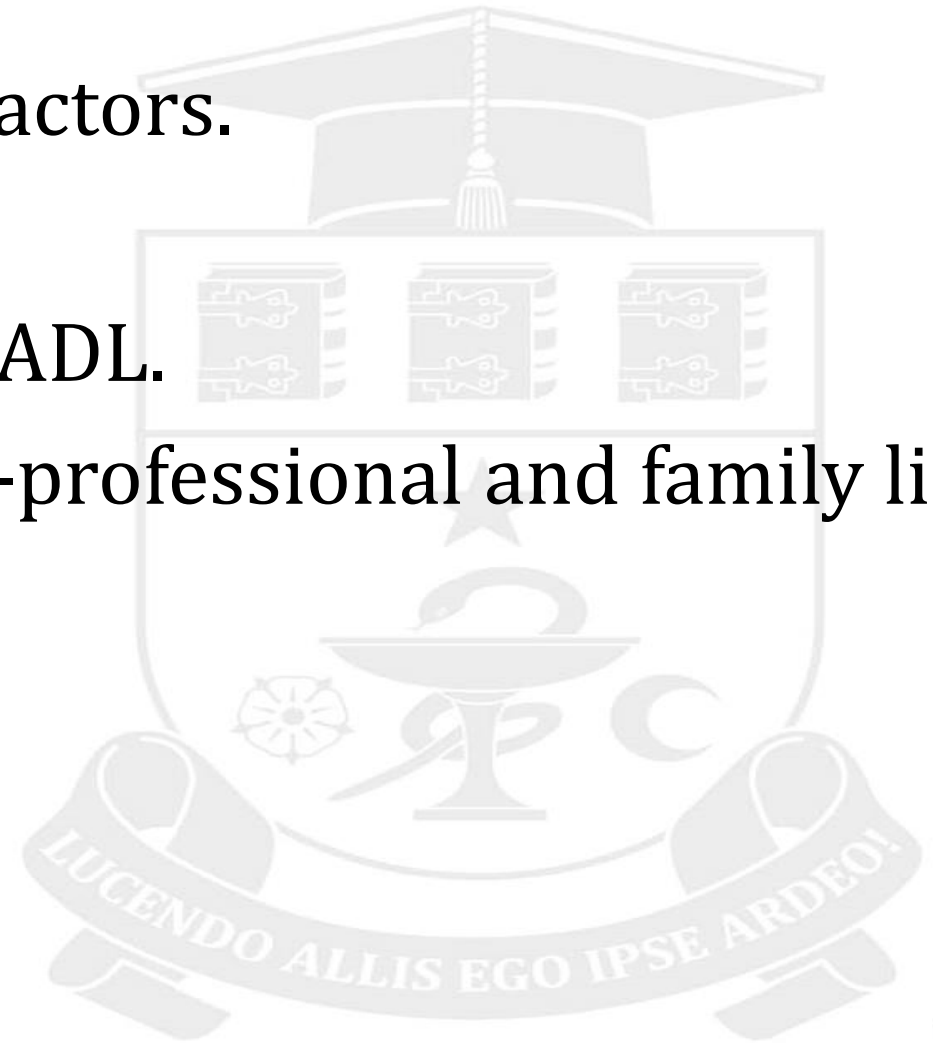
- Obesity and dyslipidaemia
- High blood pressure
- Smoking
- Stress
- Diabetes
- Age
- Cardiac history
- Inactivity





# CR Objectives

- To combat cardiovascular risk factors.
- To increase effort tolerance.
- Encourage the patient towards ADL.
- Patient reintegration into socio-professional and family life.





# Indications

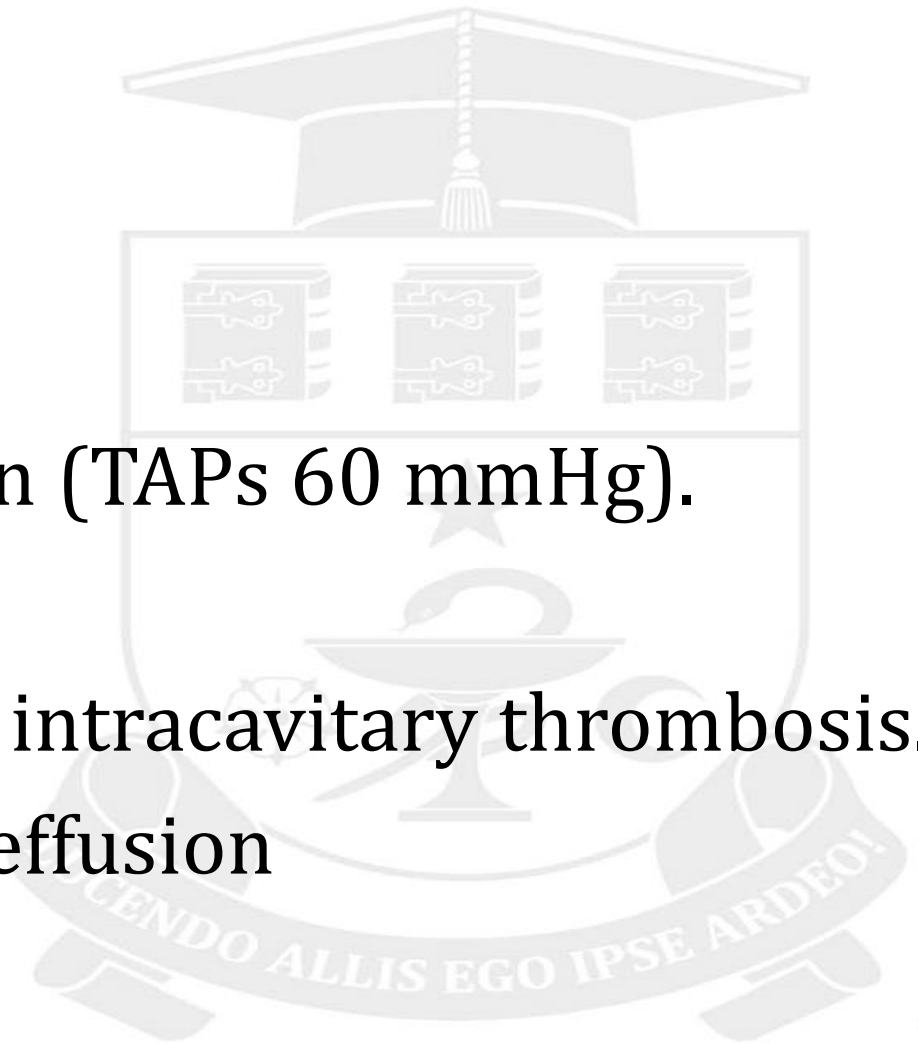
- Acute myocardial infarction.
- High blood pressure.
- Heart surgeries: coronary angioplasty, by-pass, valve correction, transplant, etc.
- Ischemic, valvular cardiomyopathies, chronic heart failure.
- Peripheral vascular pathologies.
- Specific cases (comorbidities: diabetes, metabolic syndrome, history of transient stroke, etc.)





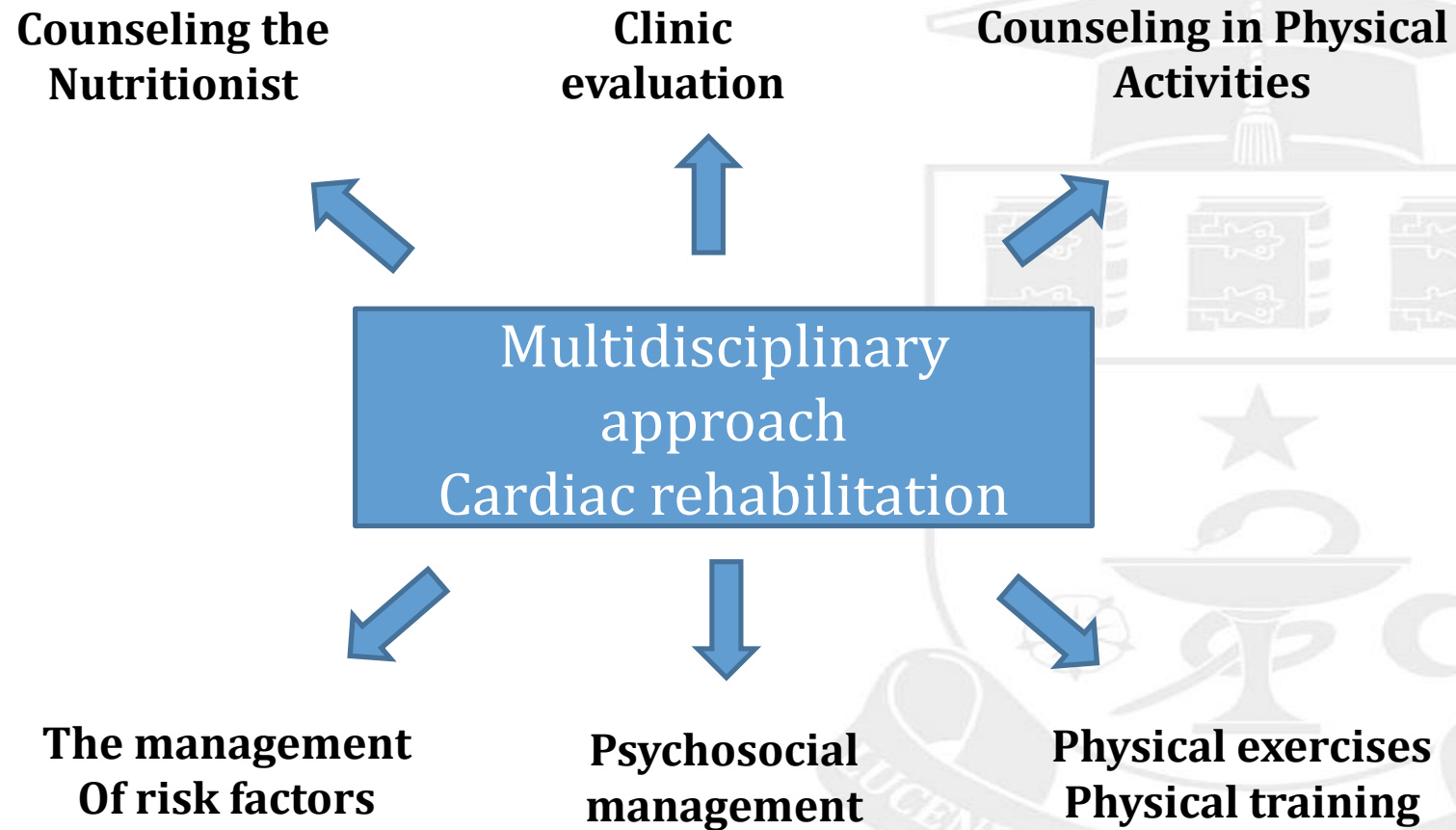
# Contraindications

- Heart failure with high severity.
- Unstable chest pain.
- Severe ventricular arrhythmias.
- Pulmonary arterial hypertension (TAPs 60 mmHg).
- Severe hypertension.
- Intravenous or pedicled cardiac intracavitary thrombosis.
- Moderate or severe pericardial effusion





# CR Components



Piepoli MF et al. Eur J Cardiovasc Rehabil. 2010; 17: 1-17  
Balady GJ et al. Circulation 2007 115: 2675-2683



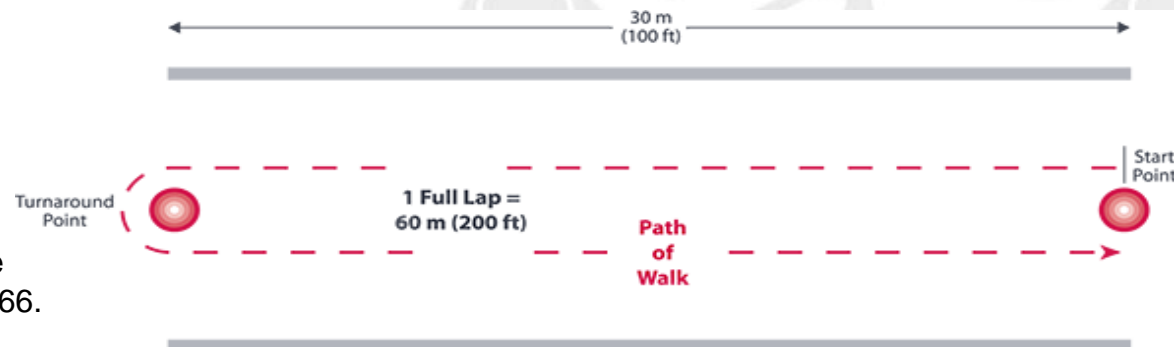
# Evaluation

- Clinically (exercise intolerance, tiredness, dyspnoea)
- Functional (EKG, eco-cardio)
- Biochemistry (lipids, glucose, cardiac proteins, coagulations, etc.)
- Highlighted
- cardiac risk factors (modifiable / non-modifiable)
- Specific scaling tests: Borg, stress test with determination of oxygen consumption, depression / anxiety questionnaires, quality of life etc.



# 6 min. Walking test

- Objective, simple, reproducible, low cost, well-tolerated, adaptable to comorbidities.
- Reflects the functional capacity for sub-maximal efforts in everyday life.
- The longest distance traveled in 6 minutes.
- After a rehabilitation program, an average improvement of 15-25% of the distance traveled is achieved.

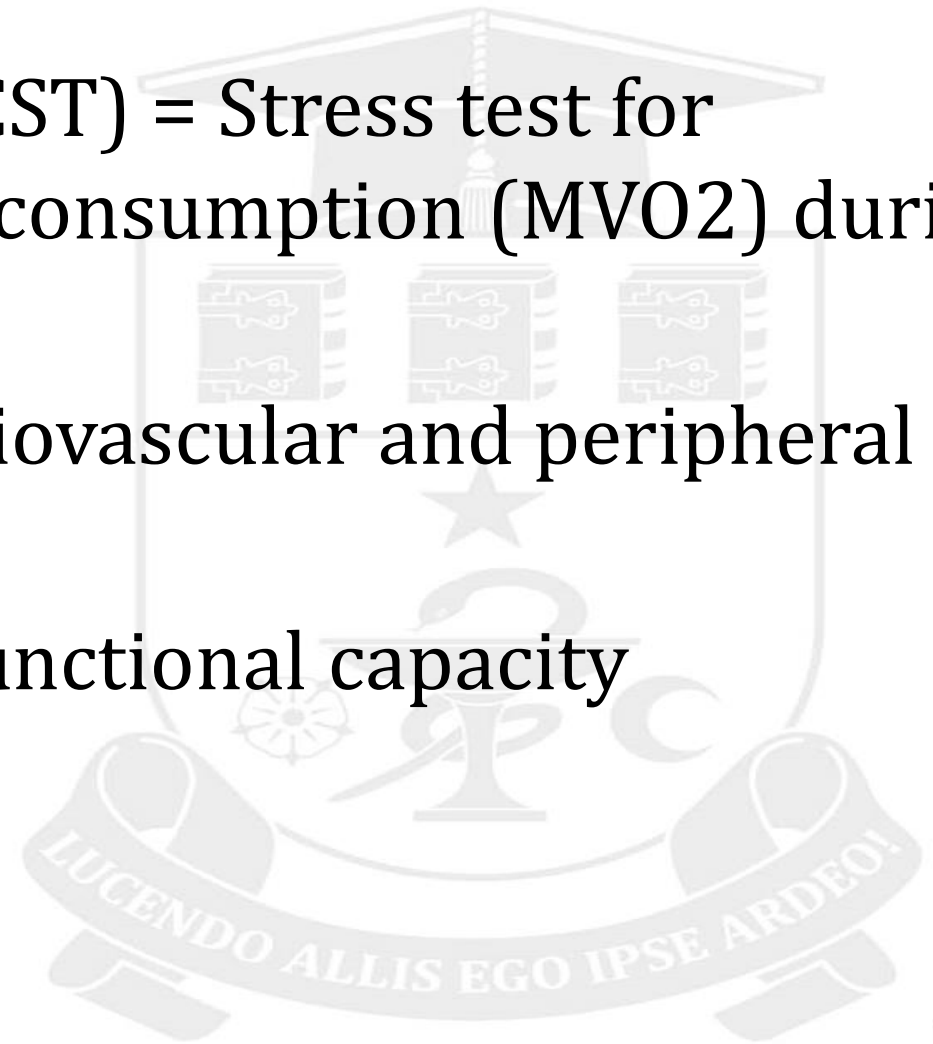


"ATS statement: guidelines for the six-minute walk test". *Am J Respir Crit Care Med.* vol. 166. 2002. pp. 111-7.



# Cardiopulmonary testing

- Cardiopulmonary Stress Test (CST) = Stress test for determining maximum oxygen consumption ( $\text{MV}\text{O}_2$ ) during physical exertion.
- exploration of respiratory, cardiovascular and peripheral muscle function.
- gold standard examination in functional capacity assessment





# Indications for Early Exercise Canceling

- Chest discomfort (angina pain).
- Dizziness.
- Tiredness.
- Severe dyspnoea.
- Depression (subdivision) ST exceeding 0.2 mV (2mm).
- TAS decrease by more than 10 mmHg.
- Ventricular tachyarrhythmia.
- The patient's desire.



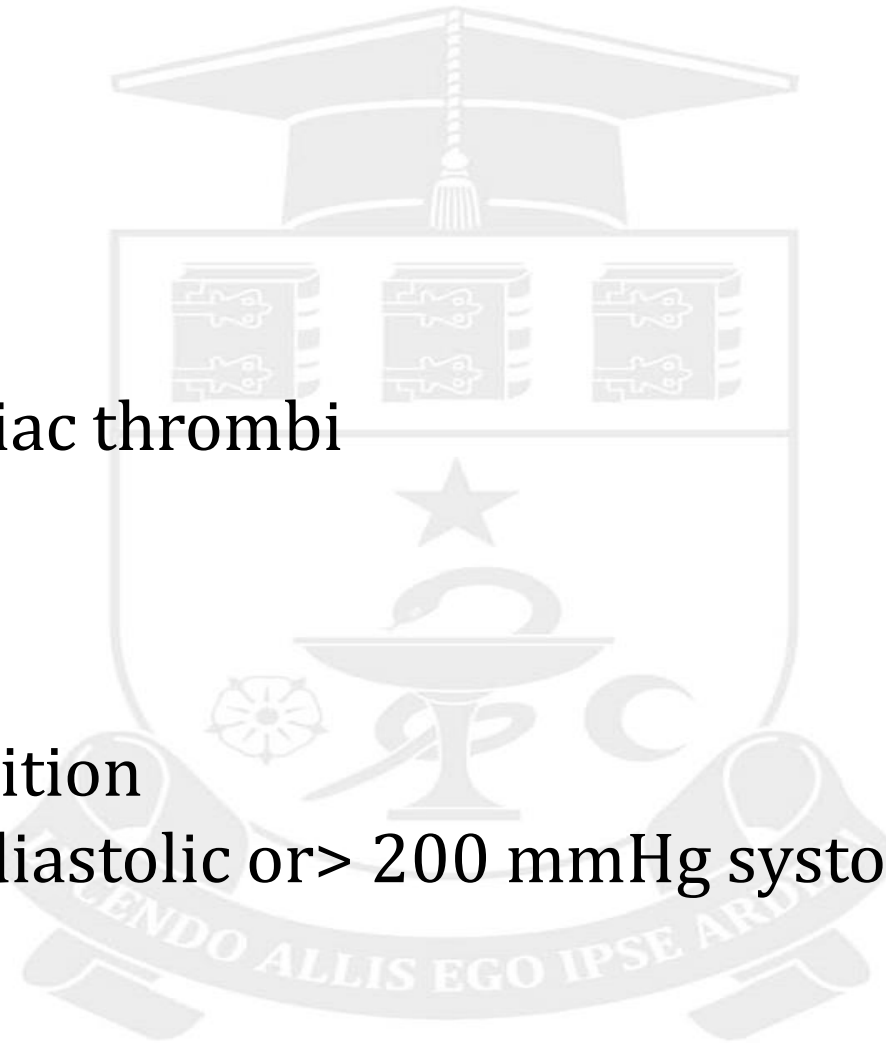
# Properly physical effort

- does not cause precordial pain;
- does not cause dyspnea;
- post-exercise heart rate does not exceed an increase of 30 beats/min. over resting rate or up to a maximum of 120 (within the first 6-8 weeks of infarction);
- systolic blood pressure does not increase by more than 20 mmHg; and diastole with more than 5mmHg; post effort.
- does not cause rhythm disturbances.
- FCC max. admissible =  $220 - \text{person's age}$ .



# Contraindications to the effort test

- Acute myocardial infarction
- Unstable chest pain
- Uncontrolled congestive heart failure
- Active pericarditis or myocarditis
- Known thrombophlebitis or intracardiac thrombi
- Moderate or severe aortic stenosis
- Uncontrolled dysrhythmias
- Major ventricular aneurysm
- Acute systemic disease or febrile condition
- Resting blood pressure: > 120 mmHg diastolic or > 200 mmHg systolic.







# Phases CR

- Phase I represents the hospitalization period of the patient.
- Phase II follows the discharge from the cardiology department lasting 12 weeks. This phase can be divided into 2 sub-phases: the first (4-6 weeks) is carried out in a cardiac recovery medical institution, and the second sub-phase at the patient's home under supervision.
- Phase III continues for up to 1 year at home. Control of risk factors, management of psycho-social and family factors and re-training for effort.



# Phase I CR

- In hospital conditions, after the stabilization of the acute episode (IMA, surgery)
- Lifelong monitoring, avoiding complications
- Purpose: to ensure self-care capacity and independence of movement.
- Simple short-term interventions: KT respiratory, salon T0, sitting, orostatism, movement, ADL
- Physiotherapy is avoided



# Phase II CR

- The aim is to obtain the maximum effort capacity
- Temporary hospitalization, outpatient in profile
- Physical methods can be associated (with relaxation effect, improvement of peripheral circulation, muscular stimulation)
- Periodic check every month at the recovery services and the family doctor





# Phase III CR

- maintaining / improving the effort capacity of phase II
- change of lifestyle, elimination of risk factors
- is performed periodically in various forms (eg coronary groups, recovery hospitals)
- spa treatments are indicated in profile resorts





# Physical therapy

- It is very important in the recovery treatment
- Physical exercise, carefully monitored by physical therapist, has the role of increasing cardiovascular functional capacity and lowering myocardial oxygen requirements
- Exercise can correct cholesterol, diabetes and obesity.
- Aerobic exercises have a blood pressure lowering effect of about 8-10 mm Hg.



# Physical therapy

- ***Clinical mechanisms of action of the kinetotherapeutic methods:***
- General toning action (psycho-emotional state)
- Trophic action (capillaries, collaterals)
- Compensatory action (extracardiac factors)
- Normalization of cardiac function (beat rate increases, vascular reaction to physical exertion).

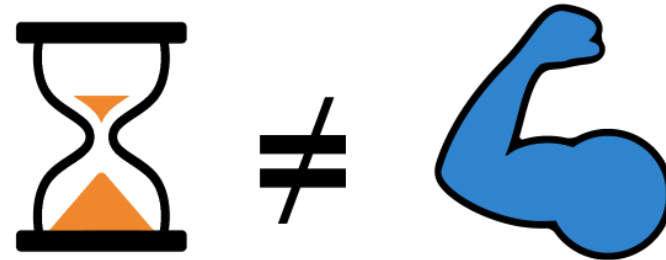
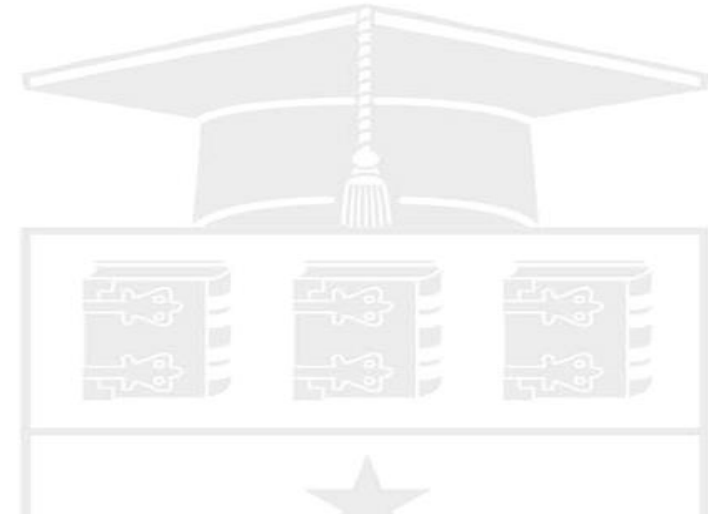




# The amount of effort

It will depend on:

- the type of exercise
- intensity of exercise
- duration of exercise



Effort vs. Duration



# Physical therapy session

- It is carried out in 3 phases
- Warming up for at least 5 minutes
- 5-30 minutes at standard cycloergometer, cycloergometer for arms, walking (combinations)
- Return and relax for at least 5 minutes.
- Recommended frequency - at least 5 sessions per week.
- The social, logistic characteristics and preferences of the patient will be taken into account (pleasant activity for good compliance)







# Hypertension management

- Measurement of resting BP on two or more visits.
- Assess current treatment and compliance.
- Optimal BP is  $< 120/80$  mmHg
- For patients with systolic BP  $> 130$  mmHg or diastolic BP  $> 85$  mmHg initiate lifestyle modification (including exercise, weight management, moderate sodium restriction, alcohol moderation and smoking cessation). Add drug therapy for patients with diabetes, heart failure, or renal failure.
- For patients with sysBP  $> 140$  mmHg or dia BP  $> 90$  mmHg initiate lifestyle modification and drug therapy.



# Weight management

- Measure weight, height, and waist circumference. Calculate body mass index (BMI).
- BMI 21-25 kg/m<sup>2</sup>, waist < 35 inches in men and < 31 inches in women.
- For patients who do not meet the goal criteria, advice a reduction in total caloric intake, and increase in energy expenditure through a combined program of diet, and exercise.
- The initial goal of weight loss therapy should be to reduce body weight by approximately 10% from baseline. With success, further weight loss can be attempted , if indicated.

J Cardiopulm Rehabil Prev. 2010 Sep–Oct; 30(5): 289–298.

The Treatment of Obesity in Cardiac Rehabilitation

Philip A. Ades, MD, Patrick D. Savage, MS, and Jean Harvey-Berino, PhD





# Psychosocial management

- Identify patients with clinically significant depression, anxiety, anger, and substance abuse.
- To minimize the patient's psychosocial distress.
- Stress management and individual or group education to help the patient adjust to his/her disease.
- When needed, refer the patient to appropriate mental health specialists for further treatment.

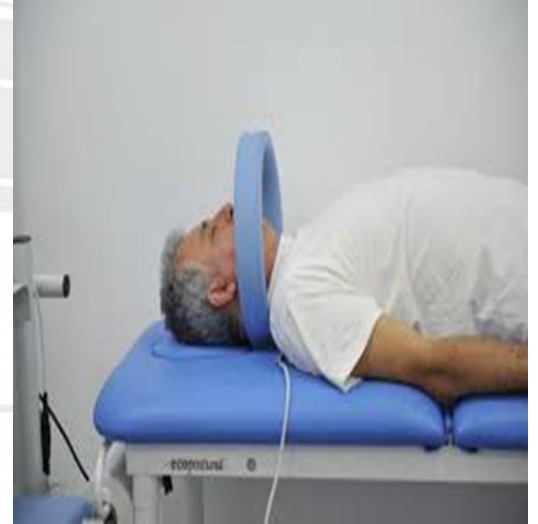


J Psychosom Res. 2000 Apr-May;48(4-5):443-54.  
Psychological treatments in cardiac rehabilitation: review of  
rationales and outcomes. Linden W.



# Electrotherapy

- Simple galvanizing or galvanic baths - reflex mechanisms vasodilatation, redistribution of circulation.
- Pulsed Electrotherapy Low Frequency / TENS - Muscle Stimulation / Amyotrophy / Exercise Reconstruction.
- Thermotherapy - peripheral circulation, venous elasticity.
- Magnetic field - sedative regimen, vegetative regulation, BP decrease.





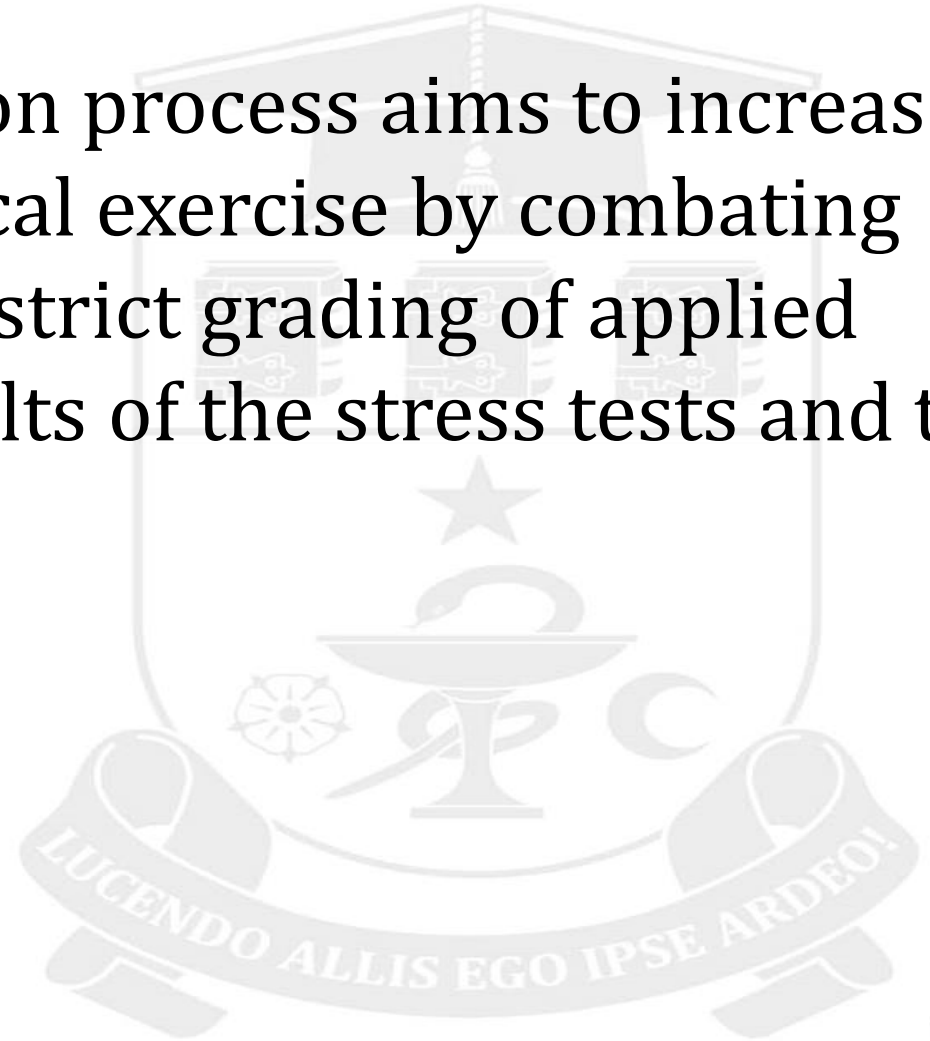
# Balneotherapy

- Carbonated waters - lowering of blood pressure (secondary to vasodilation of the skin); decrease of heart rate; increased blood flow, with improvement in coronary perfusion.
- Sulfur waters (Cahul Nufarul Alb Resort) with peripheral vasodilator effect.
- Partial peripheral baths (Haufe, Schweninger) - thermoregulation, relaxation, vegetative regulation.



# Conclusion

- The cardiovascular rehabilitation process aims to increase the patient's tolerance to physical exercise by combating cardiovascular risk factors and strict grading of applied exercise, depending on the results of the stress tests and the recovery phase.





# Pulmonary Rehabilitation







# Pulmonary Rehabilitation

- The respiratory system is, after the locomotor system, the second locus of human suffering;
- The lung is after cardiovascular disease, the second cause of illness retirement under 50 years of age;
- It is the fourth cause of mortality, ca. 40% of heart failure are based on lung pathology;





# Pulmonary Rehab

- American Thoracic Society (ATS) and the European Respiratory Society (ERS) have adopted the following new definition  
*“Pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors.”*



ERS

every breath counts

EUROPEAN  
RESPIRATORY  
SOCIETY



# PULMONARY REHABILITATION

- Pulmonary rehabilitation is recognized as a core component of the management of individuals with chronic respiratory disease.
- Pulmonary rehabilitation has been clearly demonstrated to reduce dyspnea, increase exercise capacity, and improve quality of life in individuals with chronic obstructive pulmonary disease.
- Following pulmonary rehabilitation, most people report that they are able to do more in their daily activities and are less out of breath during the tasks.



# Causes of respiratory failure

## Obstructive

- Emphysema
- Bronchitis
- Bronchiectasis
- Asthma

## Restrictive

- Duchene muscular dystrophy, lateral sclerosis, myasthenia
- Cystic fibrosis, Ankylosing spondylitis, thoracotomy
- S. Gullian-Barre, traumatic quadriplegia



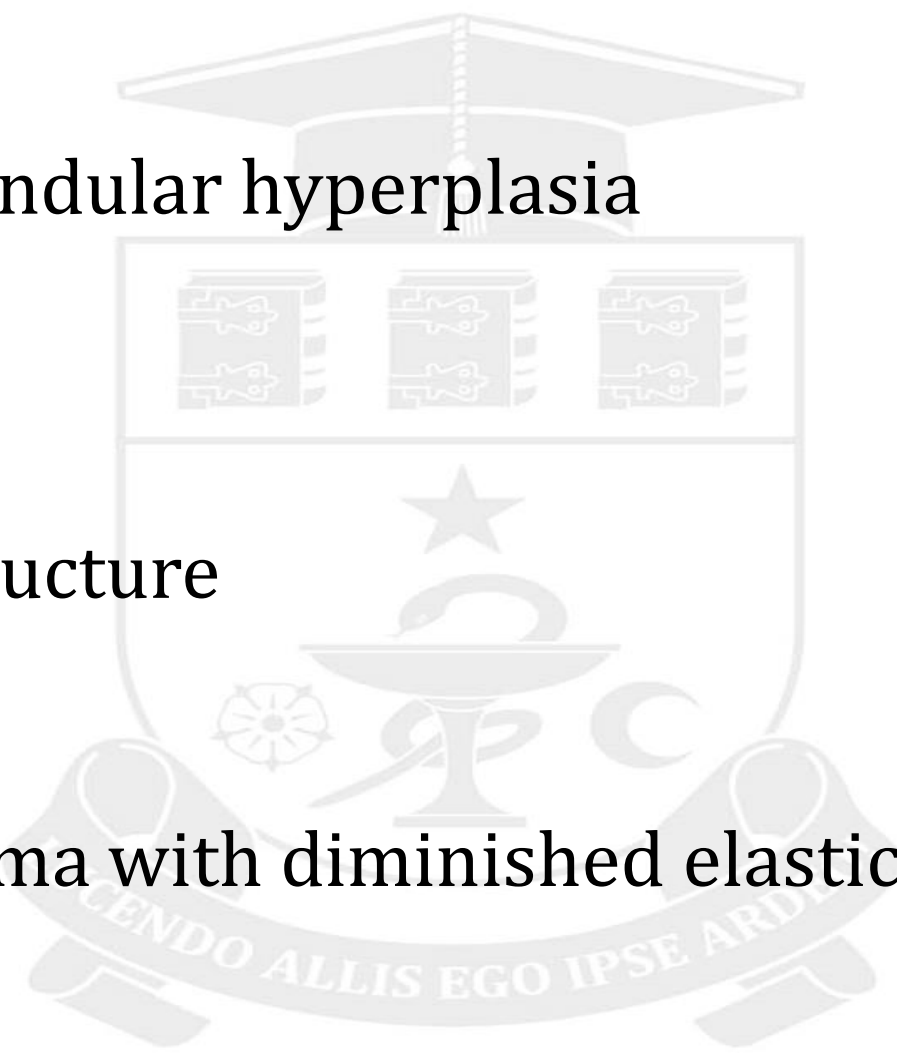
# Restrictive respiratory failure

- limiting chest expansion for any cause, pulmonary or extrapulmonary,
- may occur in the normal lung or the pathological lung,
- leads to alveolar hypoventilation inferior to metabolic requirements, caused by insufficient oxygen supply,
- leads to the installation of hypercapnia and hypoxemia and to the rapid exhaustion of the compensatory mechanisms.



# Obstructive respiratory failure

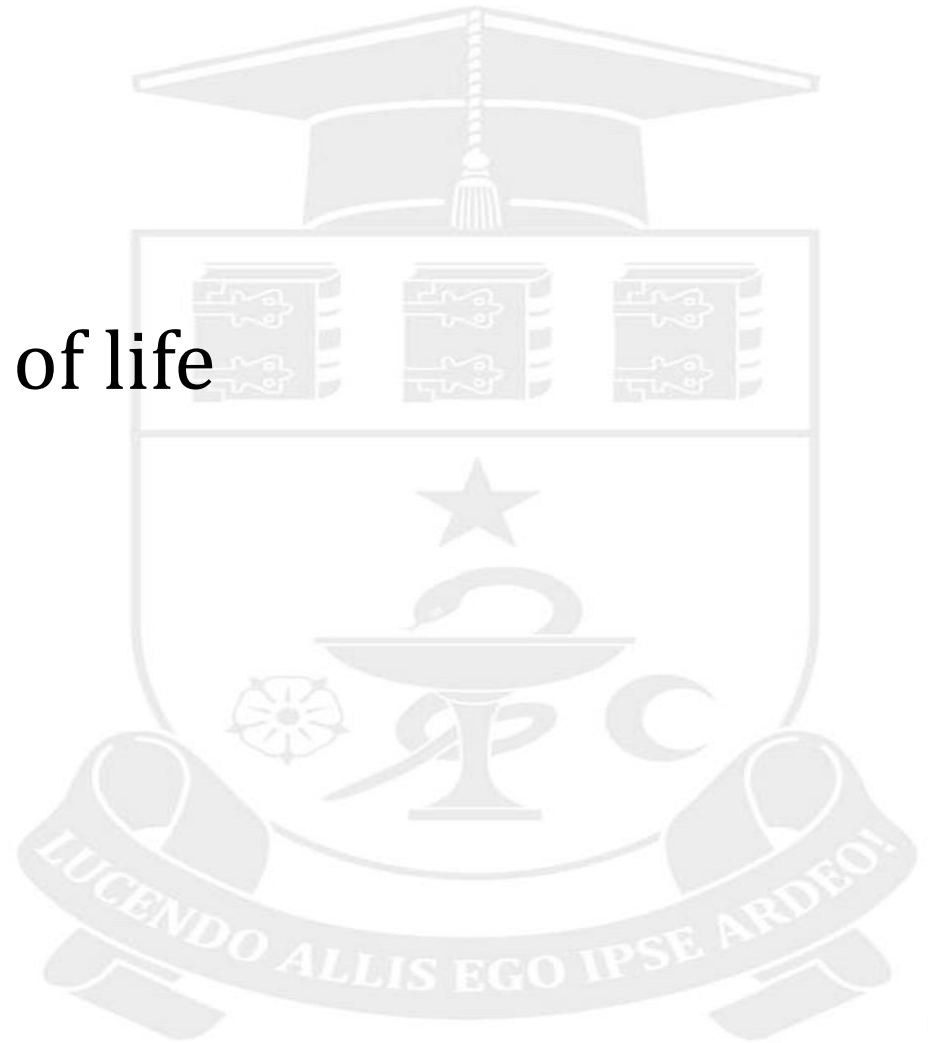
- parietal factors
  - wall thickening by cellular and glandular hyperplasia
  - atrophy of bronchial walls
  - spasm of bronchial muscles
- intraluminal factors
  - secretion disorders and mucus structure
  - mucosal oedema
- parenchymal factors
  - alteration of pulmonary parenchyma with diminished elastic retraction





# RR Objectives

1. Relief respiratory symptoms
2. Increase effort tolerance
3. Improve health related quality of life
4. Decrease health care costs
5. Relief anxiety and depression
6. Reducing aggravation cases
7. Resume professional activities





# Indications

- Obstructive airway diseases: COBP, asthma, bronchiectasis, cystic fibrosis, etc.
- Interstitial lung diseases: pulmonary fibrosis, occupational pulmonary disease, sarcoidosis, scleroderma.
- Thoracic wall deformities: Cicloscolysis, Ankylopoetic Spondylitis.
- Neuromuscular diseases with respiratory dysfunction.







# Indications

- Lung cancer
- Pre- / post thoracic and abdominal surgery, pre- / post-pulmonary transplantation
- Fan dependence
- Autoimmune diseases with pulmonary involvement







# Contraindications

- Acute, decompensated patients - intensive care;
- Severe exacerbation episodes;
- Lung emphysema;
- Haemorrhage, haemoptysis;
- Bronchopulmonary fistula;
- Coastal fractures;
- Associated severe conditions - cardio instability, dementia, drugs abuse, etc.



# Rehabilitation program

1. Assessing the functional status of the respiratory patient;
2. Exercise training and other therapeutic physical exercises (aerobic exercise);
3. Re-breathing;
4. Techniques of bronchial drainage;
5. Prevention and management of exacerbations and respiratory infections.





# Rehabilitation program

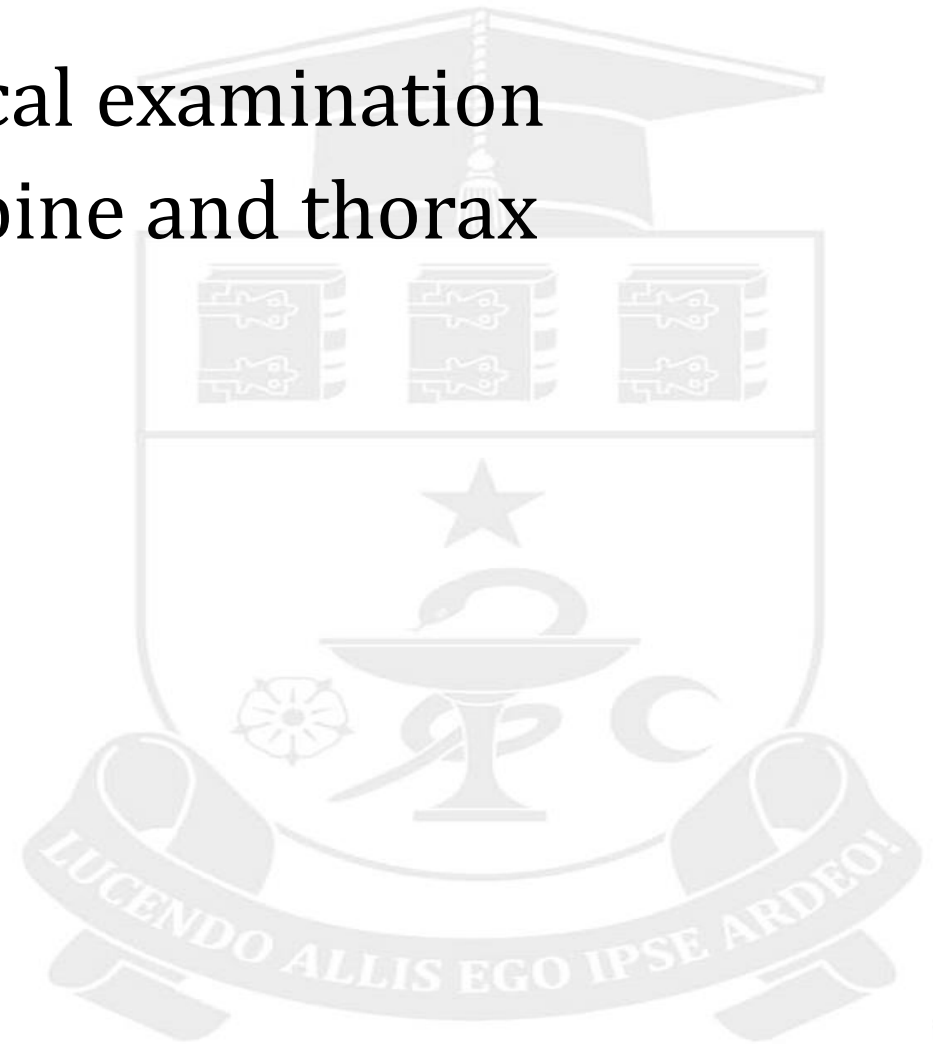
6. Control of allergenic and irritant factors;
7. Proper and safe use of oxygen therapy systems;
8. Nutritional evaluation and specific interventions;
9. Psychosocial evaluation and support;
10. Quitting smoking;
11. Medication;
12. Controlled home treatment programs.





# Assessment

- Anamnesis and objective physical examination
- Morphological balance of the spine and thorax
- Diagnostic tests
- Specific clinical tests
- Assessment of effort capacity
- ADL assessment
- Evaluation of nutritional status
- Psychosocial evaluation





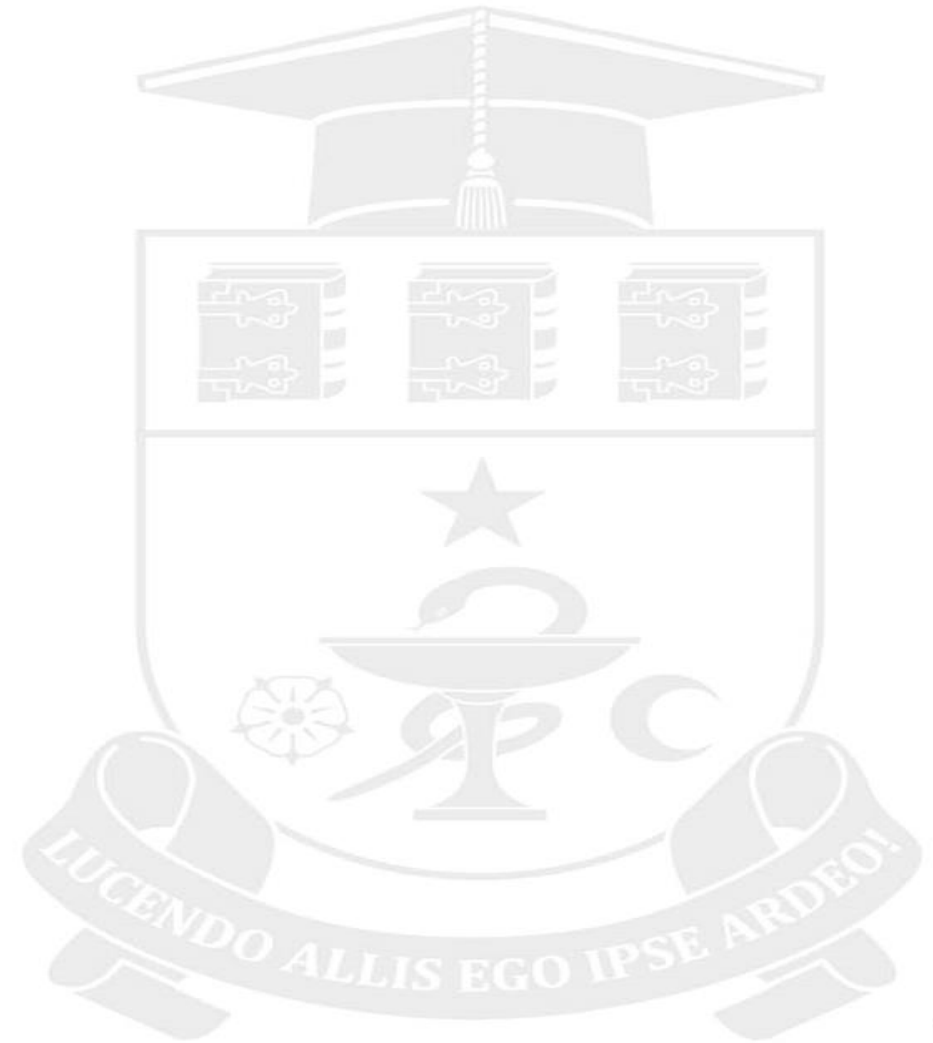
# Appreciation of the degree of dyspnea

- Grade 1: dyspnea occurs on uphill slopes and stairs (after 15-20 steps);
- Grade 2: dyspnea also occurs when walking on a flat ground at the pace imposed by a healthy person;
- Grade 3: dyspnea also occurs when walking on flat terrain at its own pace;
- Grade 4: dyspnea also occurs in common activities: dressed, washed, spoken, etc;
- Grade 5: dyspnea is present at rest.



# Clinical respiratory tests

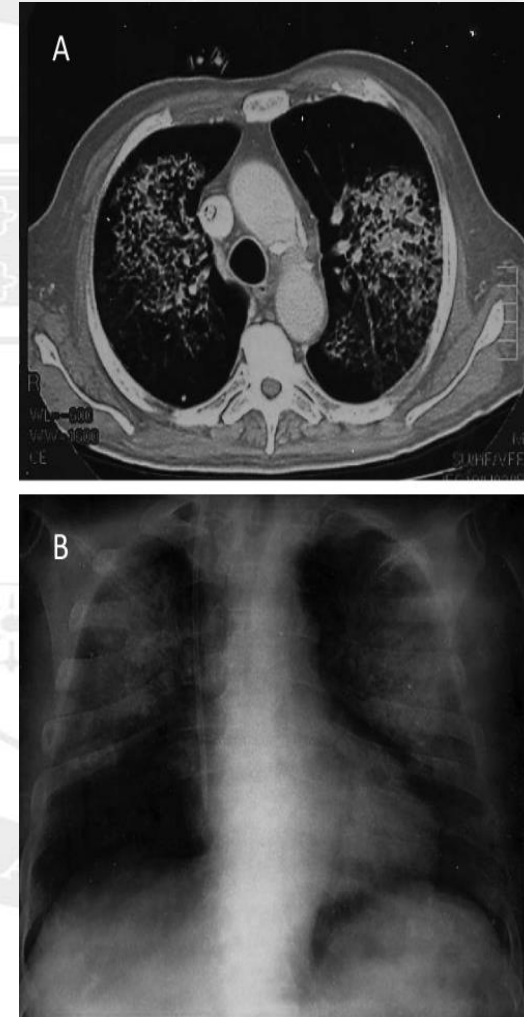
- Conversation and reading test
- The TV test
- Match Test (Snider)
- Candle test
- Apnea test
- Bubble test in water





# Paraclinical respiratory tests

- spirometry
- pneumotachography
- gas dilution method
- plethysmography
- radiography, CT, MRI







# Respiratory physiotherapy

This general notion includes:

- Corrective gymnastics
- Respiratory re-education
- Relaxation
- Posture
- Effortless exercise training
- Cough education
- Speaking education
- Occupational therapy





# Physiotherapy

- Inhalations, nebuliser - cough improvement - warm, wet flow - (Iodine, NaCl, Bicarbonate solutions)
- Aerosols - antibiotics (penicillin, tetracyclines), bronchodilators (Beta2 - blockers, theophylline), corticosteroids
- Fans, positive pressure devices
- Ultraviolet rays in erythema doses, infrared rays - regression phases, interstitial processes

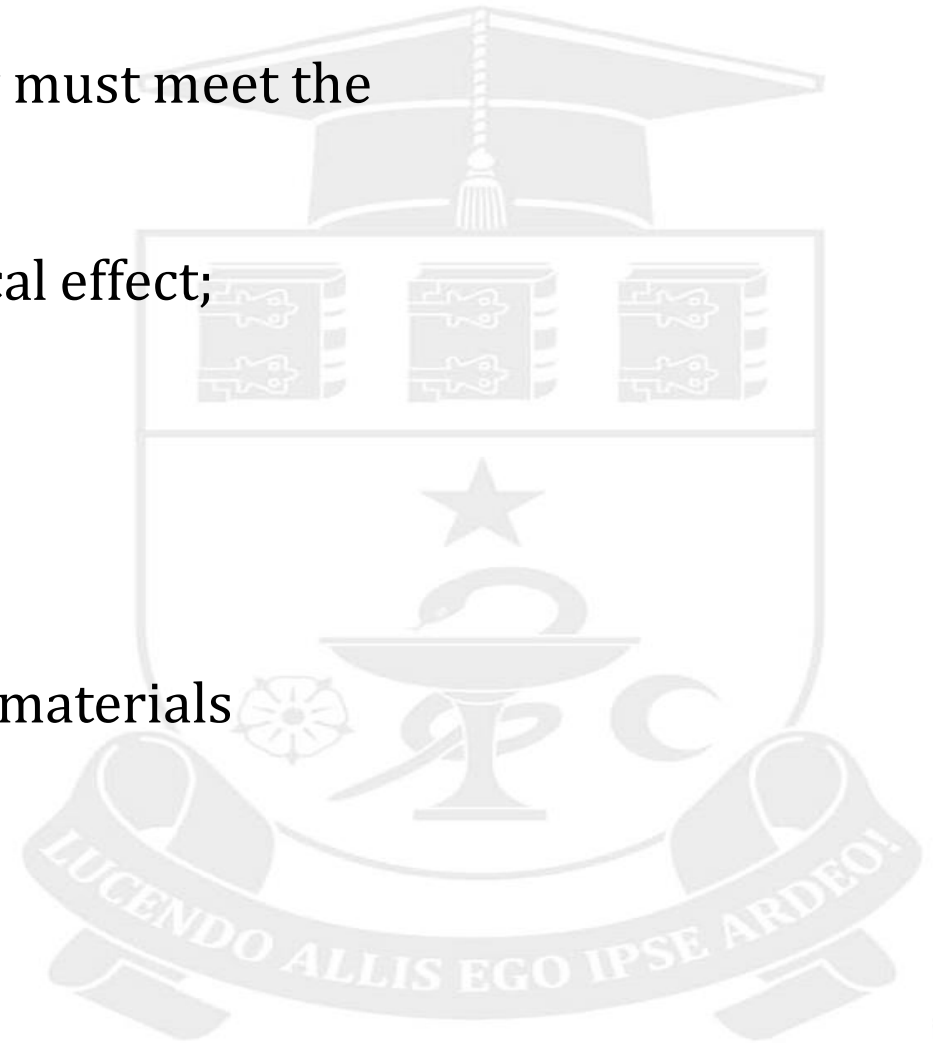




# Physiotherapy

The active substances used in inhalation therapy must meet the following conditions:

- have a well-defined tropical and pharmacological effect;
- be non-toxic and non-irritating;
- be water soluble;
- have a neutral ph;
- they can be sprayed;
- not to degrade rapidly in contact with the air;
- not to get into chemical reaction with ordinary materials from which aerosol apparatus is made;
- have a weaker resorption;
- have minor side effects on others apparatus and systems.





# Oxygen Therapy

- Oxygen therapy is one of the treatments for hypoxia caused by respiratory failure.
- Temporarily used in acute conditions (infection, edema), prolonged, daily, in chronic conditions, it immediately improves the condition and quality of the subject's life, in the long term.





# Mechanical Ventilation

- Assisted ventilation - the patient sets his own ventilator rhythm, his respiratory muscles exert a certain labor,
- Controlled ventilation - the device imparts a breath to the patient that does not participate.





# Conclusion

- The rehabilitation of patients with respiratory diseases depends on the nature of the disease and includes physical methods and specific physical therapy techniques for respiratory rehabilitation, posture, corrective gymnastics and fortification, applied for the purpose of symptomatic relief, increase of resistance to effort and increase the quality of life of the patient.





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3. Randall L. Braddom. Physical Medicine and Rehabilitation. Publisher: Saunders; 4 edition (2010).
4. Codrina Ancuța. Esențialul în medicină fizică și recuperare medicală. Editura Gr. Popa. Iași. 2010.
5. BTS Guideline on Pulmonary Rehabilitation in Adults. September 2013 Volume 68 Supplement 2. [thorax.bmj.com](http://thorax.bmj.com)





# Questions?

