Chronic
Obstructive
Pulmonary
Disease

Teaching form: Lecture
Auditorium: General medicine students ELP
Lecturer: Robert Vyšehradský
Clinic of Pneumology and Phthisiology
Updated: Nov 17th 2025

Most famous killers

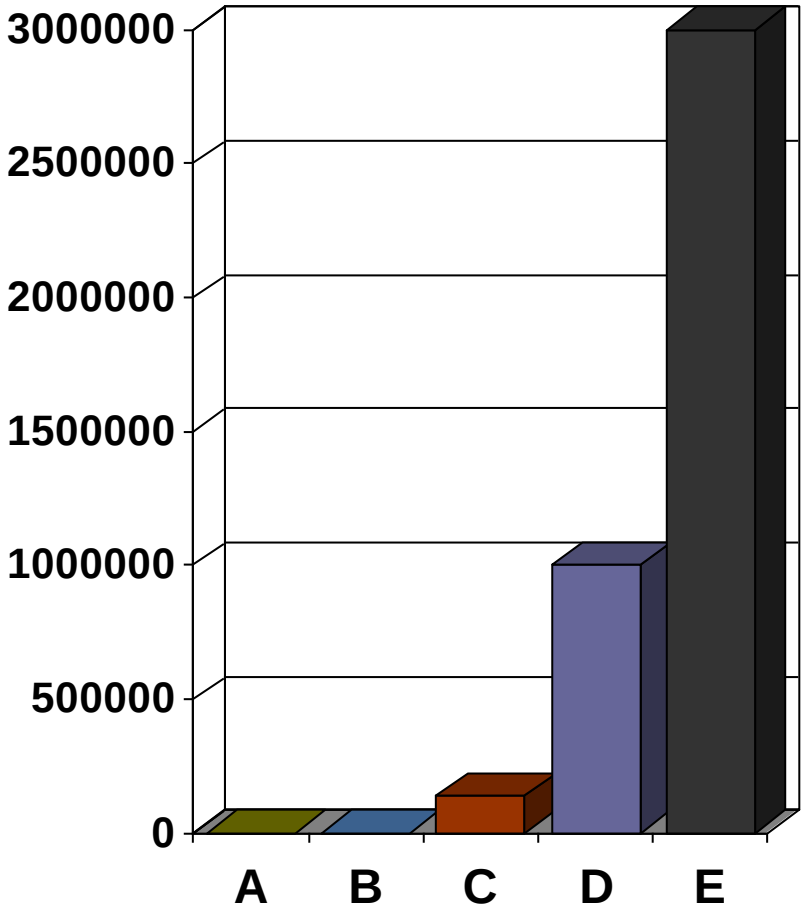
A Jack the Ripper 11?

B Titanic 1514

C Hiroshima ≈ 140000

D Road acc. > 1 mil./1 yr.

E COPD > 3 mil./1 yr.



Trend of COPD mortality

- COPD kills more people than lung cancer and breast cancer together.
- COPD kills > 250 people / 1 hour.
- COPD is the only cause of mortality with growing trend.

Rank order of main causes of mortality

	1990	2020
Heart attacks	1	1
Cerebrovascular disease	2	2
COPD	**6**	**3**
Respiratory infections	3	4
Lung cancer	10	5
Road accidents	9	6
Tuberculosis	7	7
Stomach cancer	14	8

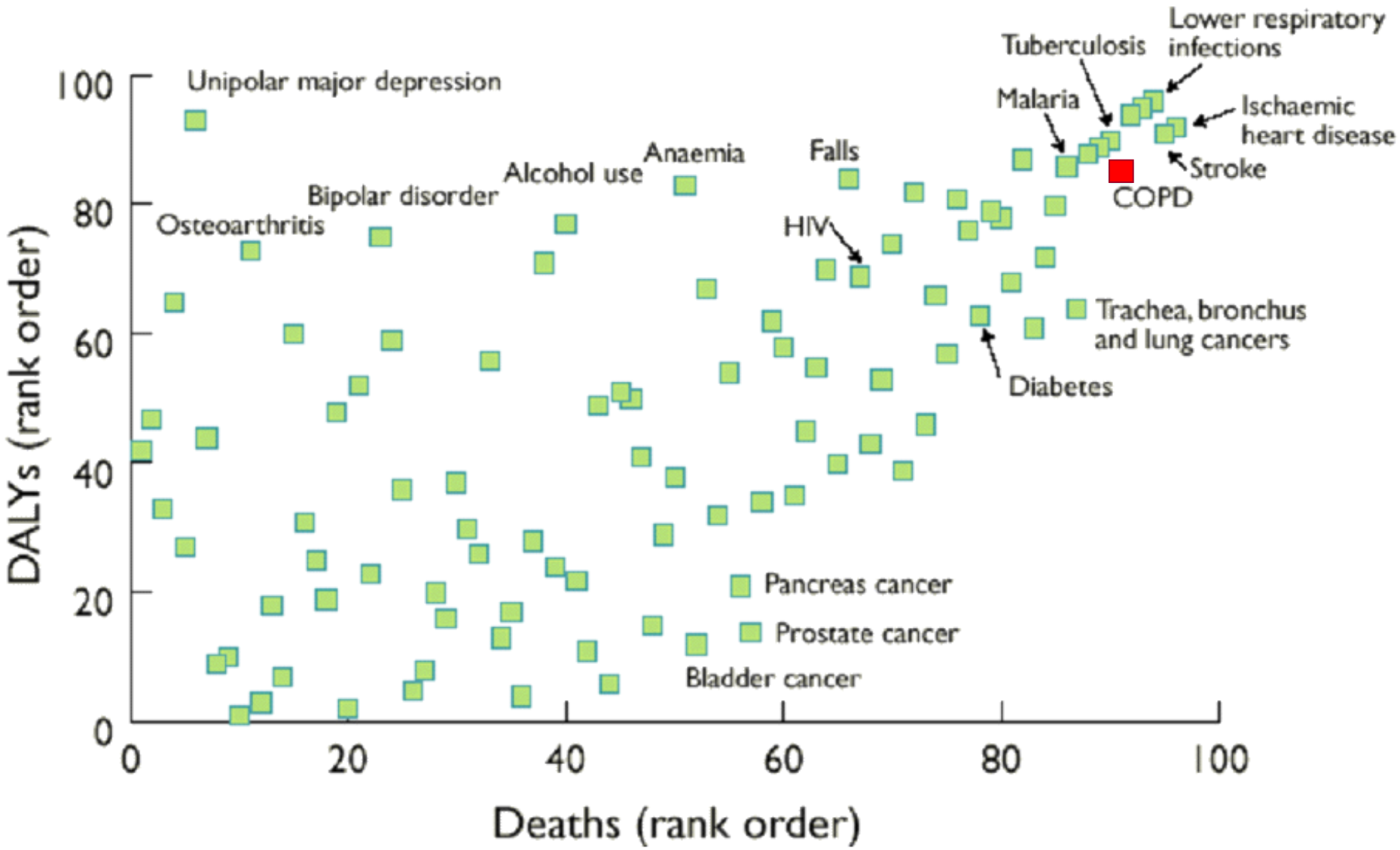
WHO Global Burden of Disease Study

COPD prevalence

	Year	Age	M	F	∑
GB	1999	60-75			9,9
ES	1998	40-60			6,8
ES	2000	40-60	14,3	3,9	9,1
FIN	1994	≥65	12,5	3,0	
J	1996	≥40	13,2	4,7	8,7
THA	2002	≥60			7,1
USA	1988-94	65-75			12,0
SK	2008	>40			4,8

Vondra, 2008

Burden of COPD - DALYs



GOLD

G lobal Initiative for Chronic
O bstructive
L ung
D isease

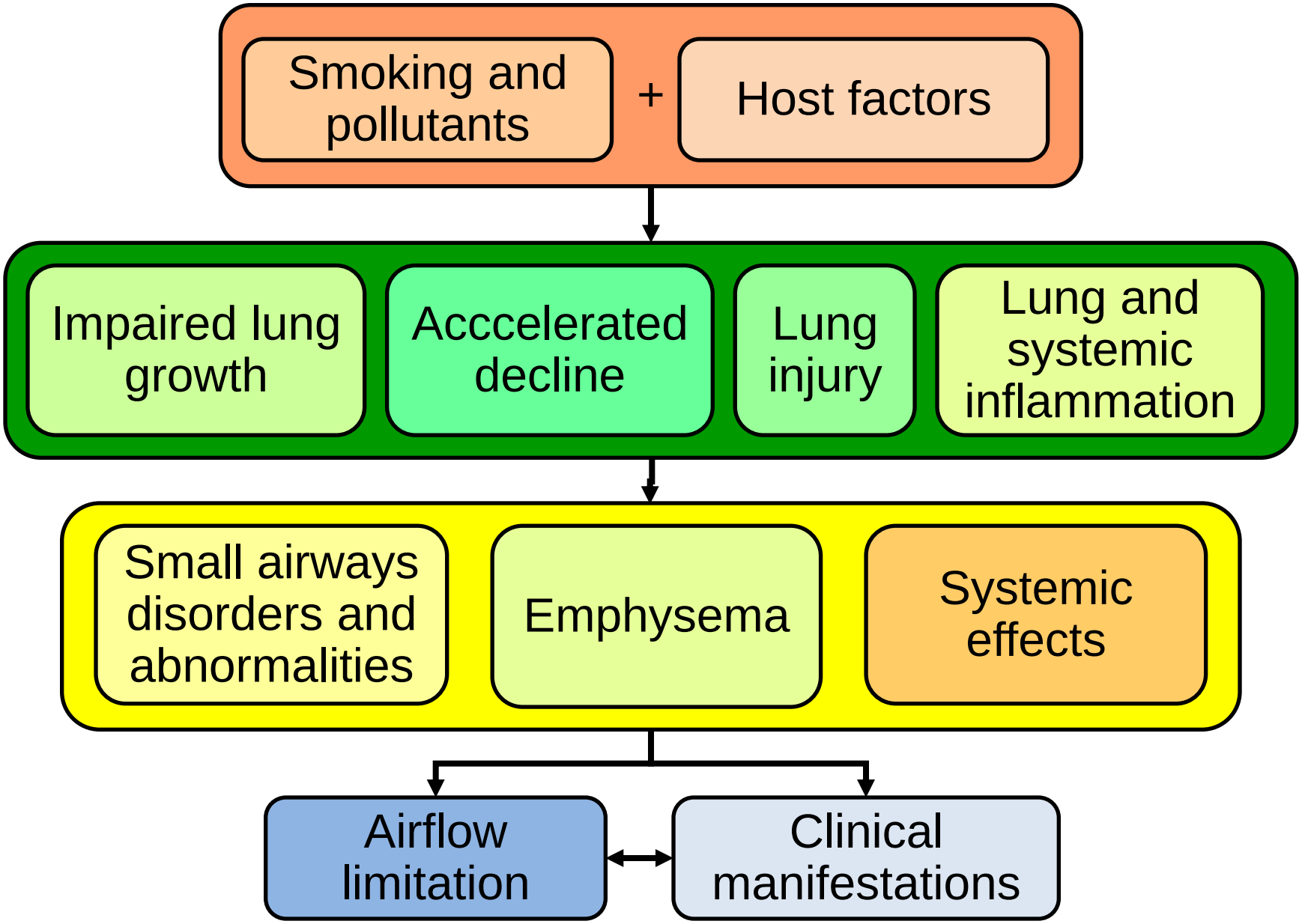
- Launched in 1997
- National Heart, Lung, and Blood Institute
- National Institutes of Health (USA)
- World Health Organization
- to raise awareness of COPD
- to improve prevention and treatment
- Guidelines „**Global Strategy for Diagnosis, Management, and Prevention of COPD“**
- www.goldcopd.org

Definition

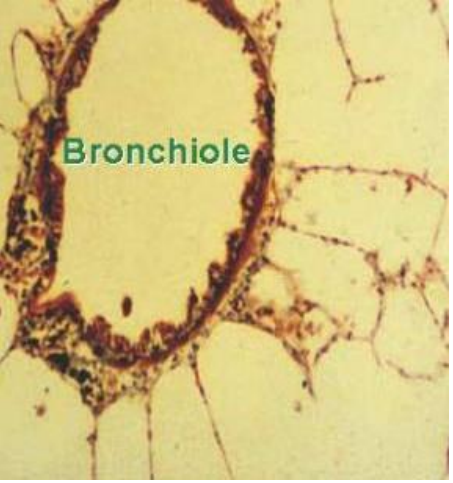
- Common preventable and treatable disease, characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or aleolar abnormalities usually caused by significant exposure to noxious particles and gases.

GOLD 2019

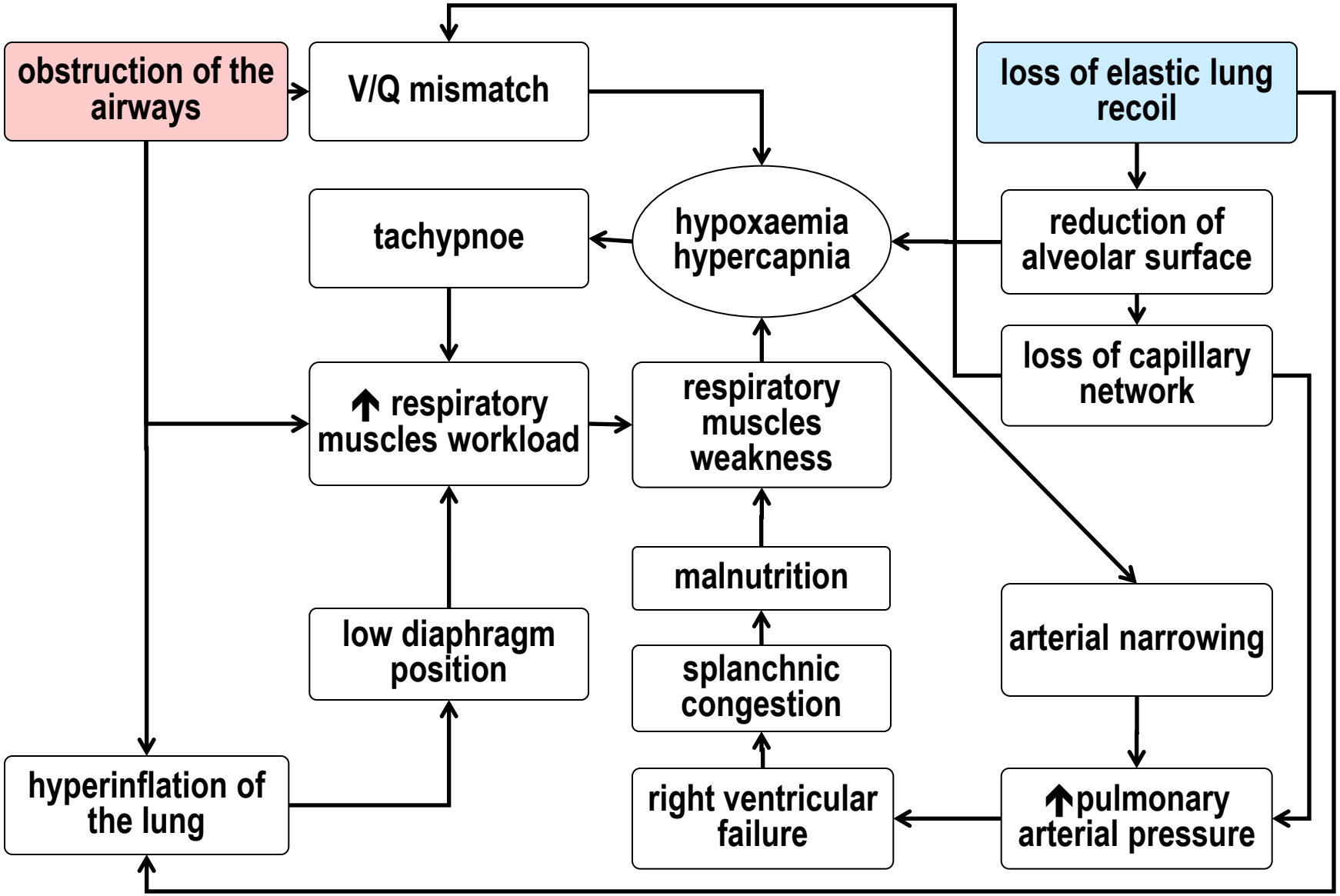
Pathogenesis I



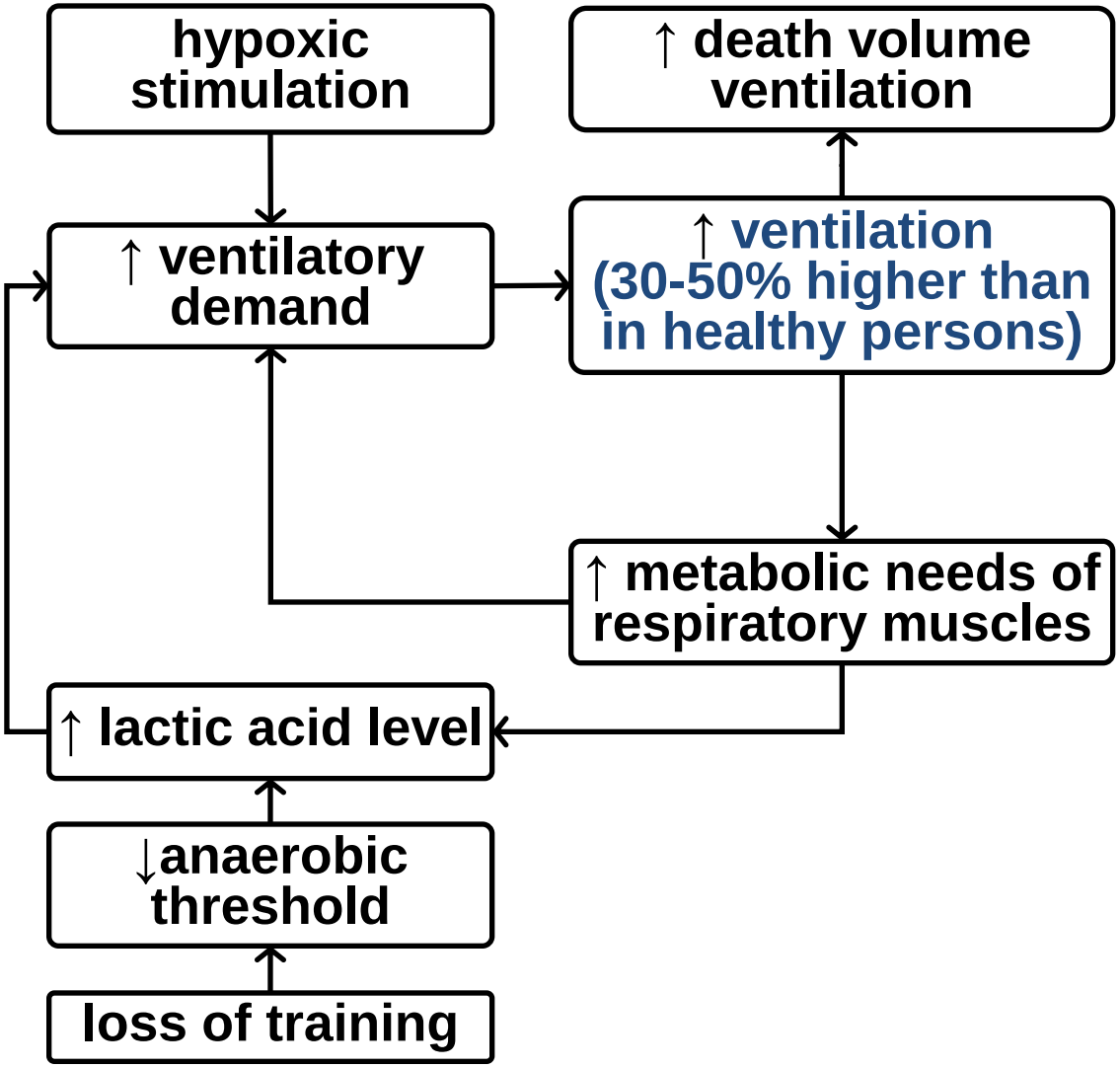
Pathogenesis II



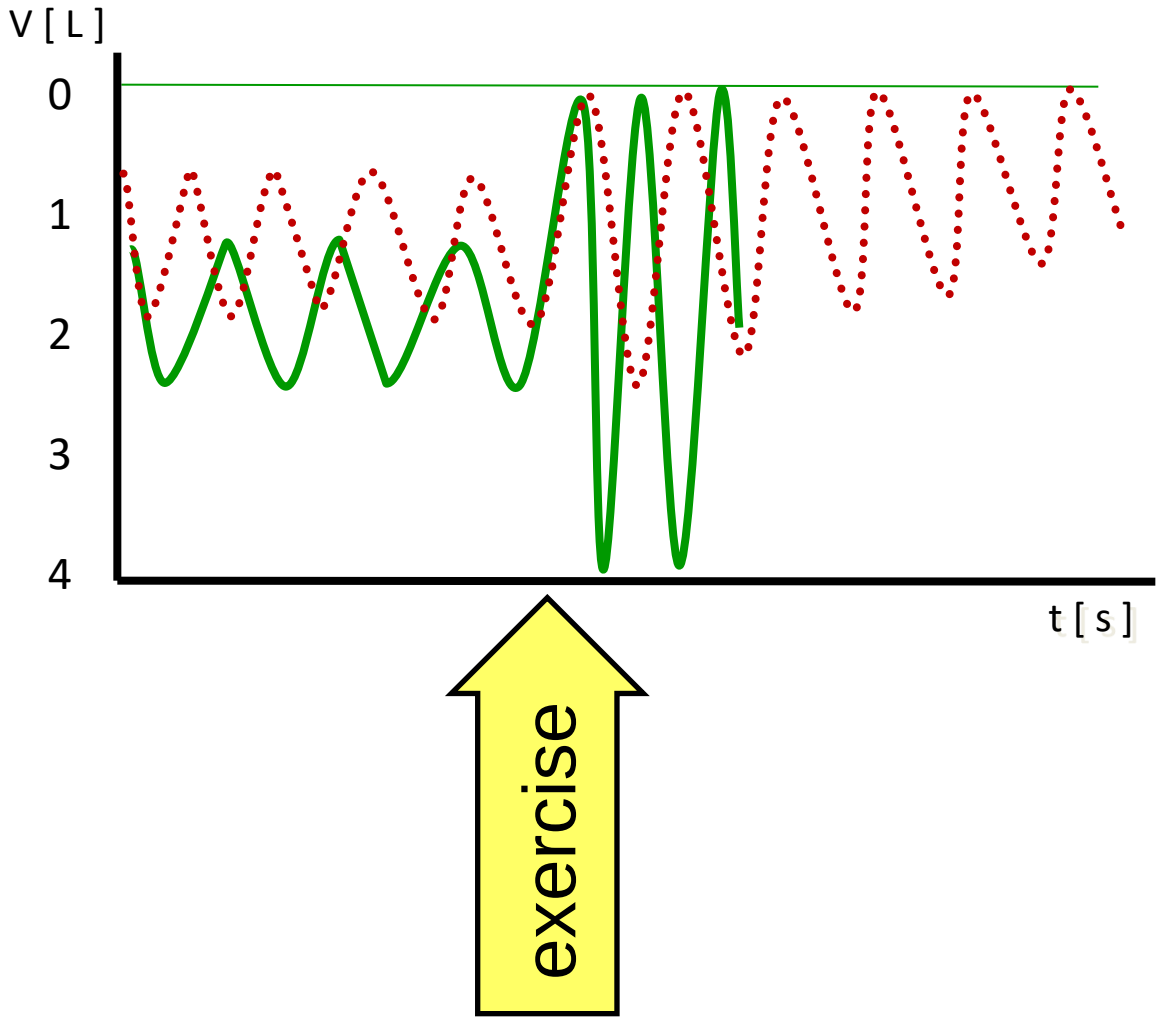
Pathogenesis III



Respiratory – metabolic interrelationships



Exercise limitation



Clinical features – symptoms

- Dyspnea
- Cough
- Sputum production
- Memory disturbances, confusion
- Morning headache

Clinical features – history

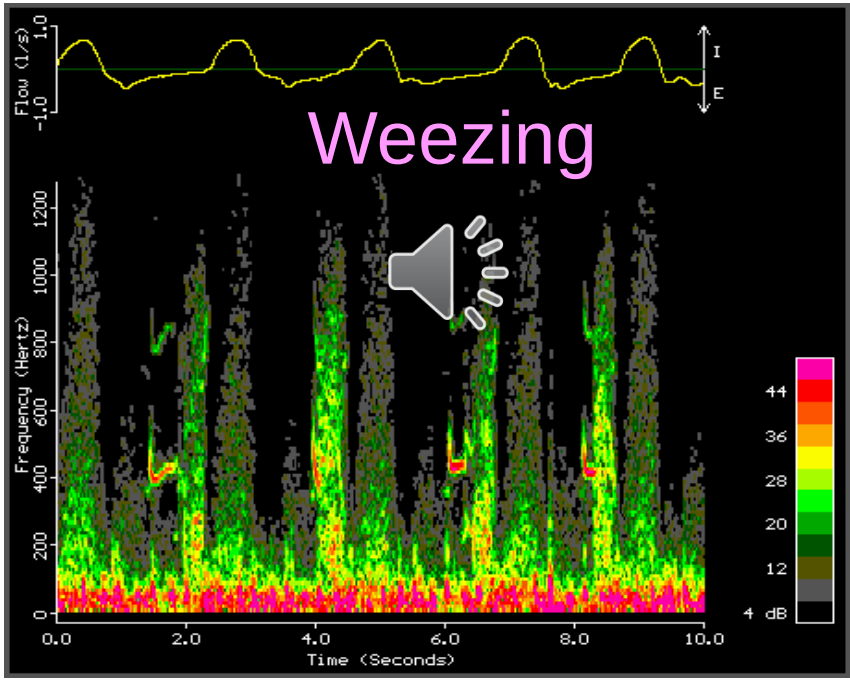
- Exposure to risk factors (smoking, biomass fuel, open fire, occupational and environmental exposure...)
- Past history (asthma, allergy, sinusitis, nasal polyposis, respiratory infections in childhood, other chronic respiratory and non-respiratory diseases)
- Family history of COPD or other chronic respiratory diseases
- Pattern of symptoms development
- Comorbidities (heart disease, osteoporosis, musculoskeletal disorders, malignancies)
- Impact of disease on patient’s life
- Possibilities for reducing risk factors

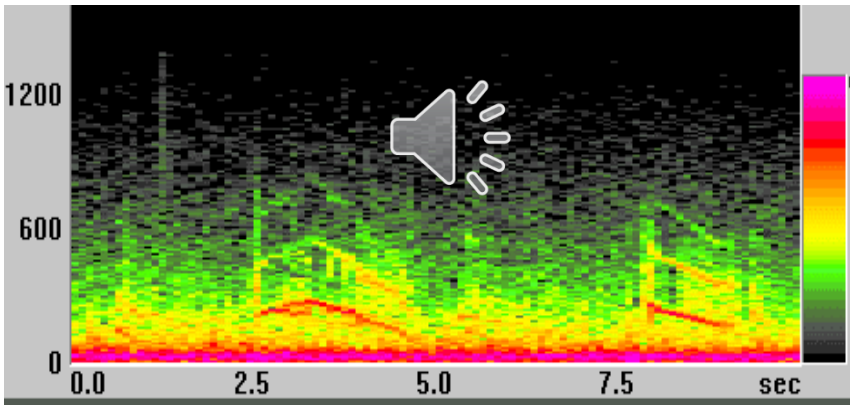
Clinical features - inspection

- Consciousness
- Posture
- Nourishment status
- Cyanosis/pink skin
- Accessory breathing muscle use
- Chest shape
- Breathing rate
- Jugular vein distension
- Leg edema
- Digital clubbing

Clinical features – auscultation and percussion

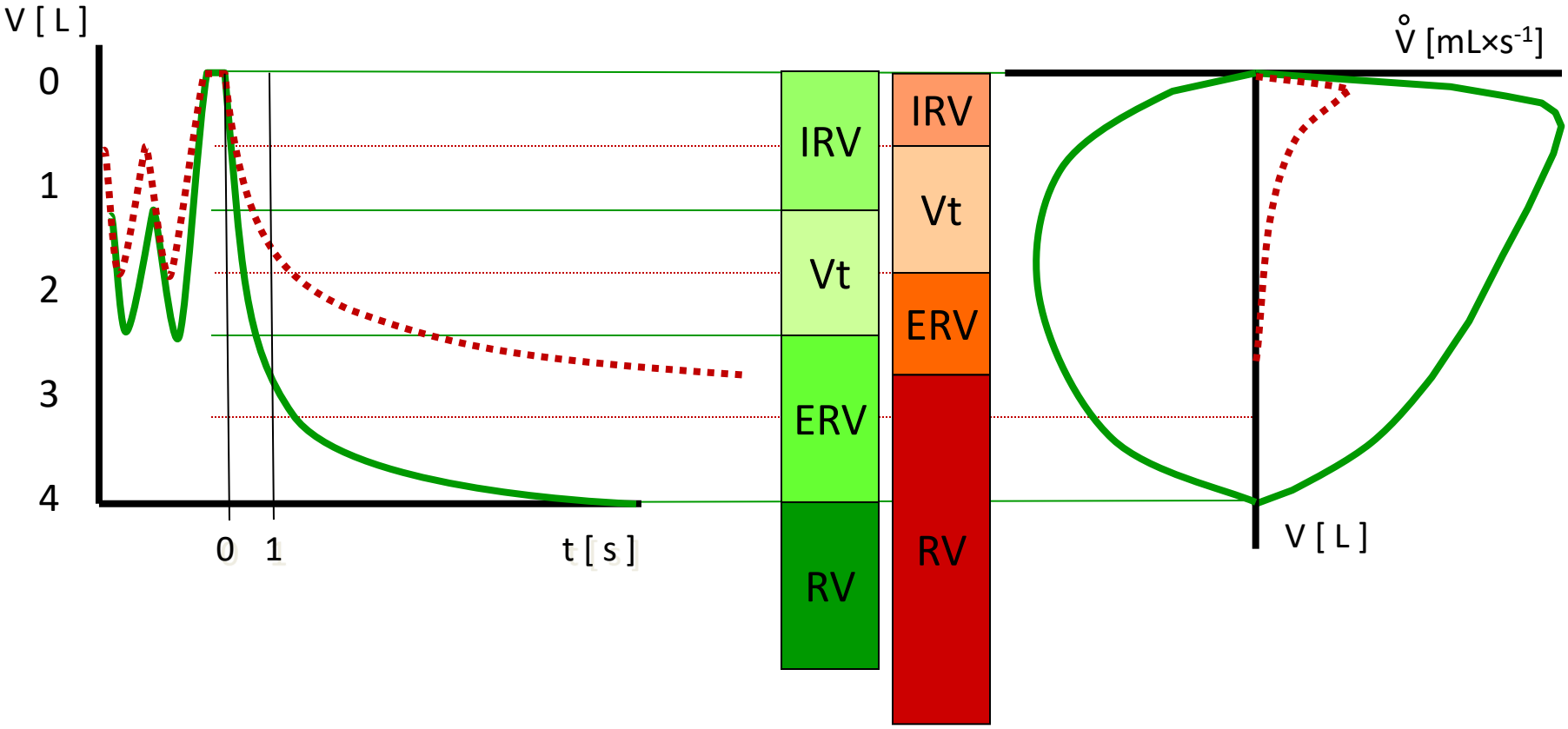
- Hypersonorous percussion
- Diminished main breathing sound
- Expirium prolongation
- Expiratory wheezing and rales





Different phenotypes of COPD

Diagnosis pulmonary function tests



FVC=4 [L], FEV1=3,4 (L), FEV1/FVC=85%

FVC=3,4 [L], FEV1=1,7 (L), FEV1/FVC=50%

Obstruction severity assessment GOLD 2019

FEV1/FVC<70%

GOLD 1: Mild	$FEV_1 \geq 80\%$ predicted
GOLD 2: Moderate	$50\% \leq FEV_1 < 80\%$ predicted
GOLD 3: Severe	$30\% \leq FEV_1 < 50\%$ predicted
GOLD 4: Very Severe	$FEV_1 < 30\%$ predicted

Diagnosis radiography

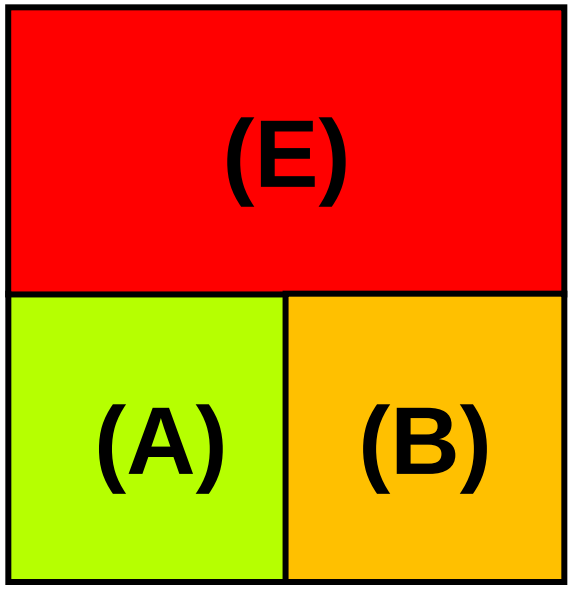
Laboratory tests

- Blood gases (if FEV1<50% predicted)
- Sputum
- Markers of inflammation
- Alpha1-antitrypsin

Combined severity assessment GOLD 2023

Assessment of Airflow Limitation)

	FEV1 [% RV]
GOLD1	≥ 80
GOLD2	50-79
GOLD3	30-49
GOLD4	<30



Risk
(Exacerbation history)

≥ 2 or ≥ 1 leading to hospital admission

0-1 (not leading to hospital admission)

mMRC 0-1
CAT < 10

mMRC ≥ 2
CAT ≥ 10

Symptoms
(mMRC or CAT score)

mMRC = modified Medical Research Council Questionnaire
CAT = COPD Assessment Test

Differential diagnosis

Disease	Suggestive features
Asthma	Onset early Variability of the symptoms Allergy, rhinitis, eczema Family history
Congestive heart failure	X-ray: dilated heart, pulmonary edema Dyspnea worsening shortly after lying down Restrictive ventilatory disorder
Bronchiectasis	Copious purulent sputum X-ray, CT
Tuberculosis	X-ray Microbiological confirmation
Obliterative bronchiolitis	Younger age, nonsmokers RA or acute fume exposure or bone marrow transplantation CT on expiration
Diffuse panbronchiolitis	Asian descent, males, nonsmokers Chronic sinusitis HRCT (centrilobular nodules and hyperinflation)

Treatment of stable COPD

1. **Smoking cessation!**
2. Drugs
3. Oxygen supplementation
4. Physiotherapy
5. Nutrition support
6. Vaccination
7. Non-invasive ventilatory support
8. Surgical treatment
9. Palliative approaches

Drugs used for COPD treatment

Abbrev.	Meaning	Effect	Drugs
SAMA	Short-Acting Muscarinic Antagonists	Anticholinergic bronchodilator	ipratropium, oxitropium
LAMA	Long-Acting Muscarinic Antagonists	Anticholinergic bronchodilator	tiotropium, aclidinium, umeclidinium
SABA	Short-Acting Beta-Agonists	Adrenergic bronchodilator	salbutamol, fenoterol
LABA	Long-Acting Beta-Agonists	Adrenergic bronchodilator	formoterol, salmeterol
ULABA	Ultra-Long-Acting Beta-Agonists	Adrenergic bronchodilator	indakaterol, vilanterol, olodaterol
MX	Methylxanthines	bronchodilator	theophylline, aminophylline
ICS	Inhaled CorticoSteroids	anti-inflammatory	budesonide, ciclesonide, fluticasone
iPDE	Phosphodiesterase inhib.	anti-inflammatory	roflumilast, ensifentrine
SS	Systemic Steroids	anti-inflammatory	prednisone, methylprednisolone
AZI, ERY		biofilm	azitromycine, erythromycine
		Anti-IL4 MAb	dupilumab

Pharmacologic management

E

LABA + LAMA
LABA + LAMA + ICS if Eo>300×10^6/l

A

a bronchodilator

B

LABA + LAMA

Long-term home oxygen therapy

- PaO_2 < 7.3 kPa
- PaO_2 7.3 – 8.0 kPa and one of:
  - precapilary pulmonary hypertension on echocardiography, right-heart catheterization or CT
  - ECG signs of right chamber hypertrophy
  - HCT > 55 % or $PaCO_2$ > 6.1 kPa
  - VC < 2 L or FEV_1 < 1.5 L
- PaO_2 > 8.0 kPa + pulmonary hypertension proven by catheterization

Non-invasive ventilatory support

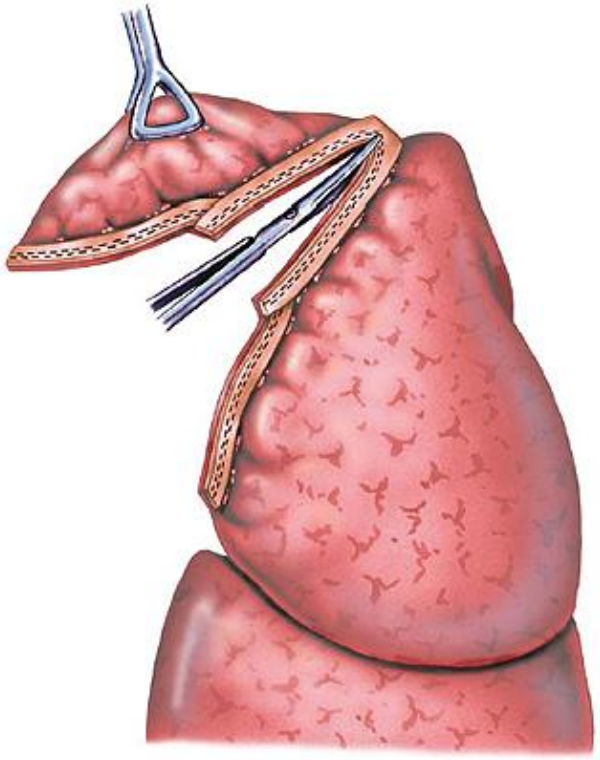
- Respiratory acidosis (pH≤7.35 and/or PaCO2≥6.0 kPa)
- Severe dyspnea, use of accessory respiratory muscles, paradoxical motion of the abdomen, intercostal recession

Invasive mechanical ventilation

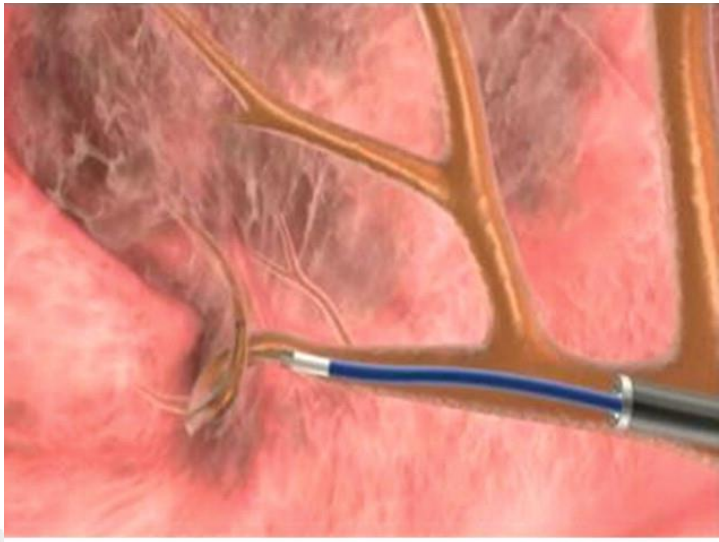
- Unable tolerate NIV or NIV failure.
- Respiratory or cardiac arrest.
- Respiratory pauses with loss of consciousness or gasping.
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation.
- Massive aspiration.
- Persistent inability to remove respiratory secretions.
- Heart rate <50/min with loss of alertness.
- Severe haemodynamic instability without response to fluids and vasoactive drugs.
- Severe ventricular arrhytmias.
- Life-threatening hypoxaemia in patients unable to tolerate NIV.

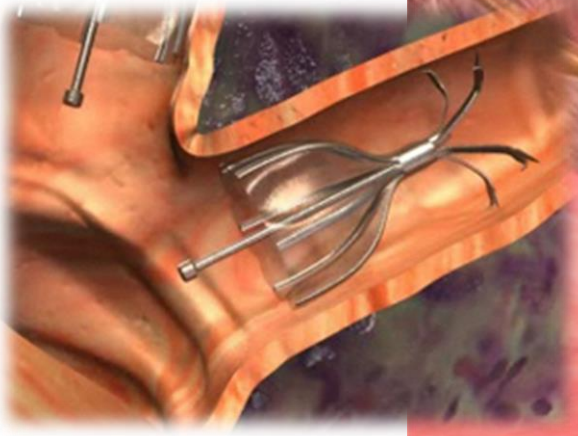
Surgical treatment

- Bullectomy
- Volume-reduction surgery
- Lung transplantation



Bronchoscopic volume-reduction





Other endoscopic and surgical measures

- N_2 kryospray.
- Rheoplasty (ablation of mucin-producing cells by pulsed electric field).
- Targeted lung denervation (radio-frequency energy).
- Thermoplasty.
- LTX.

Management of exacerbations

=acute event with worsening of the symptoms (dyspnea, cough, sputum production) beyond day-to-day variations

- oxygen supplementation
- intensify bronchodilators (SABA, SAMA)
- systemic steroids
- antibiotics
- non-invasive ventilatory support
- treat associate conditions (heart failure, arrhytmias...)
- monitor fluid balance and nutrition
- low-molecular weight heparin

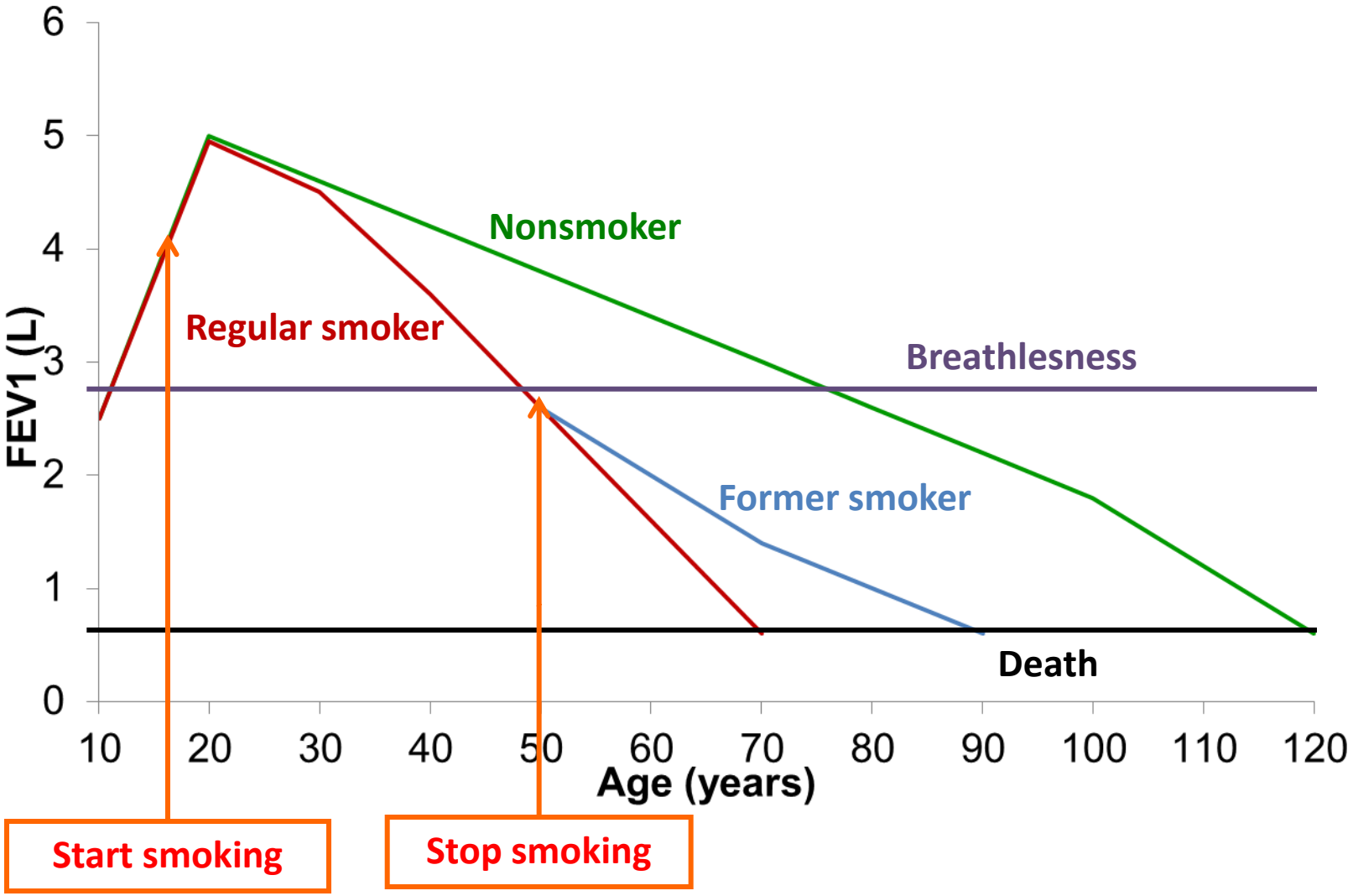
Criteria for hospital admission

- Marked increase in intensity of symptoms
- Severe underlying COPD
- Onset of new physical signs (cyanosis, peripheral edema)
- Failure to respond to initial medical management
- Presence of serious comorbidities
- Frequent exacerbations
- Older age
- Insufficient home support

Manage comorbidities

- ischaemic heart disease (heart failure, arrhytmias)
- high blood pressure
- lung cancer
- anxiety, depression
- osteoporosis
- diabetes
- OSAS
- GERD
- bronchiectasis

Prognosis



Anthonisen, 1994