



BPCO

Nouvelle taxonomie

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AFMP 2021



LA BPCO une maladie

Définition d'une maladie

1980 J D SCADDING : 4 clés

1. Description clinique
2. Anomalies structurelle (anatomie)
3. Dysfonction fonctionnelle (Physiopathologie)
4. Cause (étiologie)



LA BPCO une maladie

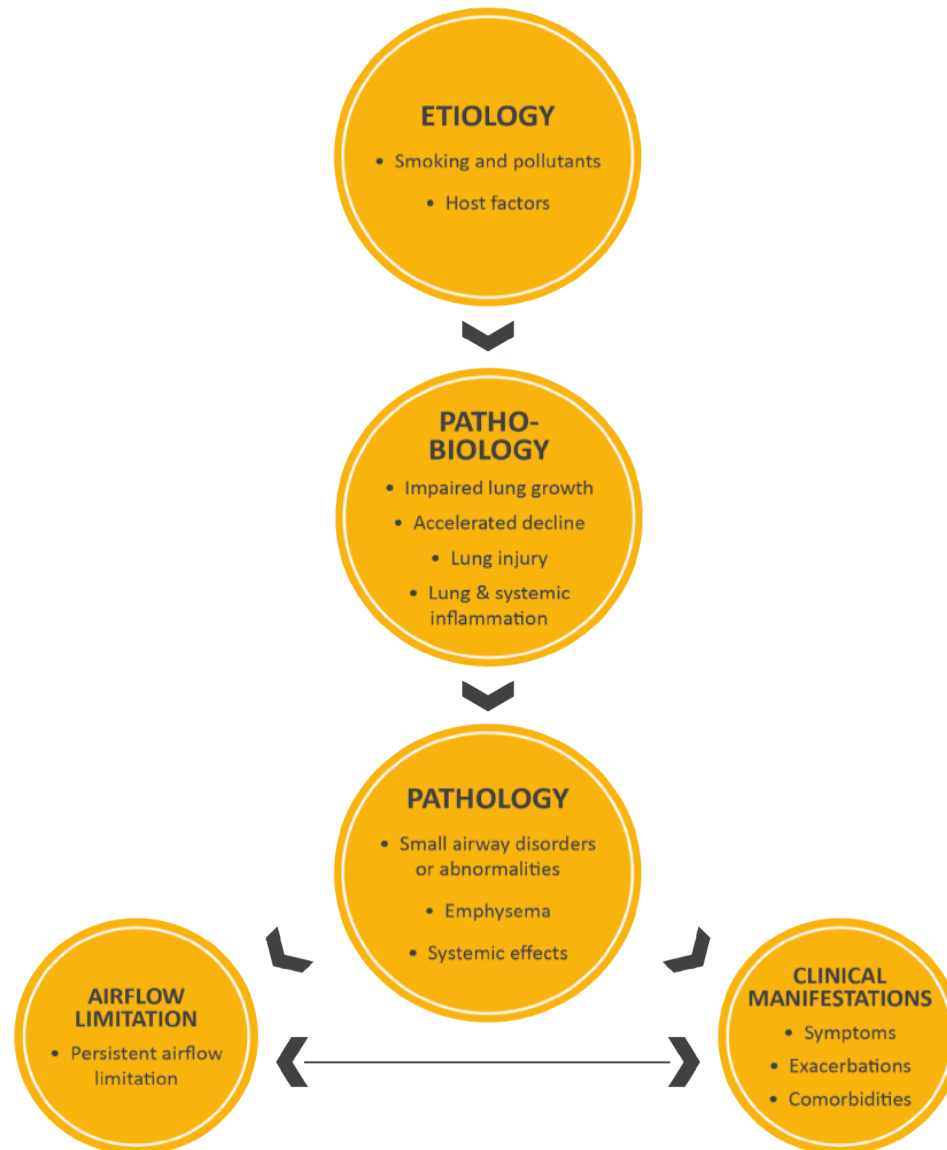
René Laennec 1821:

1ere description de la BPCO

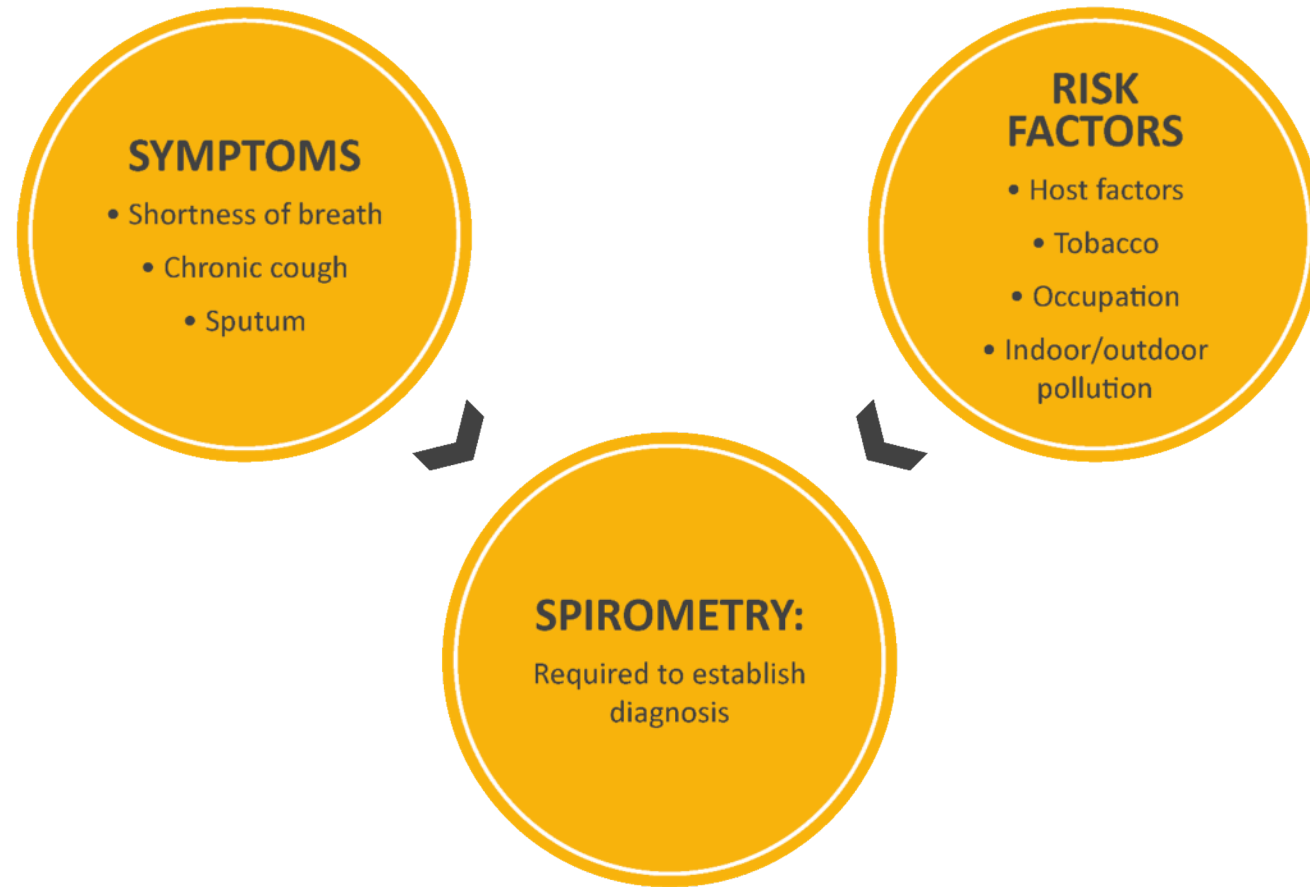
GOLD 2021:

La BPCO est une maladie qu'on peut prévenir et guérir, caractérisée par des symptômes respiratoires persistants et une limitation des débits aériens par anomalies des voies respiratoires et/ou des alvéoles habituellement causée par l'inhalation de particules toxiques ou des gaz et influencé par des facteurs propres au hôte dont les anomalies de développement pulmonaire.

ETIOLOGY, PATHOBIOLOGY AND PATHOLOGY OF COPD LEADING TO AIRFLOW LIMITATION AND CLINICAL MANIFESTATIONS



▶ PATHWAYS TO THE DIAGNOSIS OF COPD



▶ KEY INDICATORS FOR CONSIDERING A DIAGNOSIS OF COPD

Consider COPD, and perform spirometry, if any of these indicators are present in an individual over age 40. These indicators are not diagnostic themselves, but the presence of multiple key indicators increases the probability of a diagnosis of COPD. Spirometry is required to establish a diagnosis of COPD.

Dyspnea that is:	Progressive over time. Characteristically worse with exercise. Persistent.
Chronic Cough:	May be intermittent and may be unproductive. Recurrent wheeze.
Chronic Sputum Production:	Any pattern of chronic sputum production may indicate COPD.
Recurrent Lower Respiratory Tract Infections	
History of Risk Factors:	Host factors (such as genetic factors, congenital/developmental abnormalities etc.). Tobacco smoke (including popular local preparations). Smoke from home cooking and heating fuels. Occupational dusts, vapors, fumes, gases and other chemicals.
Family History of COPD and/or Childhood Factors:	For example low birthweight, childhood respiratory infections etc.



RESPIRATORY INSUFFICIENCY*

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LONDON

I HAVE chosen respiratory insufficiency as my subject because it is a common and important condition which is inadequately dealt with in most textbooks. Moreover, there has been in the last few years a good deal of work on disordered respiratory physiology. It will be my purpose to show that this work, although it has not issued in any dramatic therapeutic advance, may be made to help in our everyday clinical tasks of recognising, classifying, and assessing disorders.

I should like to illustrate this by three very ordinary cases.

The first patient was a man of 45 who complained of exertional dyspnoea, first noticed fifteen years previously and becoming steadily worse. He had had no cough until four years previously, and had since had sputum only intermittently. Physical examination and radiographic examination of the chest were unhelpful. This history is of course suggestive of uncomplicated emphysema, but what clinched the diagnosis was observation of the patient during mild exercise. When he walked briskly round the room nothing abnormal was at first noticed, but after a few minutes he was becoming uncomfortable and on halting was seen to be making respiratory efforts disproportionate to the exercise, and indeed his ventilation was probably greater than expected. Moreover, examination of his lips and tongue revealed a bluish tint which slowly disappeared as he recovered from the exercise.

The second patient had a background disability similar to that of the first, but he came under care in a very different way. He was admitted as an emergency, delirious and obviously very ill. He was deeply cyanosed and his breathing was very distressed. Numerous crepitations could be heard over both lungs, and the sputum was purulent. The jugular pressure was raised but there was no oedema. The patient responded rapidly to treatment with oxygen and antibiotics, and returned to his work as a hospital porter, apparently none the worse.

The third patient was a woman in her fifties who complained of swelling of her legs. She had little cough and no sputum. She was found to have considerable oedema, an enlarged liver, and a raised jugular pressure—in fact, she had heart-failure. She was strikingly cyanosed, but not distressed; and indeed she denied any difficulty with breathing. The cyanosis could be mitigated by a voluntary increase in ventilation, and was abolished by breathing oxygen, which however made her stuporose.

These three patients were all suffering from respiratory insufficiency: the first in chronic form; the second from an acute exacerbation, with temporary cardiac overload, of a chronic state; and the third from a chronic form, presenting as established cardiac failure. These examples differ so much as to make clear, I hope, the need for some fairly elaborate scheme of classification; and to specify the patient's functional state we need, I shall suggest, at least four components or dimensions of classification. Their choice is suggested by the results of physiological measurements, but I shall first develop the ideas on a clinical basis.

The three patients described were all cyanosed, though the first was so only on exercise. This cyanosis was due to deficient oxygen-saturation of the arterial blood and is

a decrease in arterial oxygen-saturation on moderate exertion as the criterion of respiratory insufficiency.

Why does the arterial saturation of such patients fall on exercise? In health this fall does not take place because ventilation increases more or less proportionately to the increase in oxygen consumption. The result is that about the same proportion of oxygen is removed from the inspired air, and so there is little alteration in the composition of the alveolar air or in the gas tension of the arterial blood. If a normal subject voluntarily restrains his ventilation during exercise (and this can be managed), his arterial saturation will drop. The patient we are considering behaves as though their ventilation was not increasing during exercise by the normal amount. But when we actually measure their ventilation, we find as a rule that it is normal or somewhat raised. It is clear then that they suffer from some failure to make proper use of the ventilation they achieve. We may call this a decrease in the ventilatory utilisation, which is our first functional component.

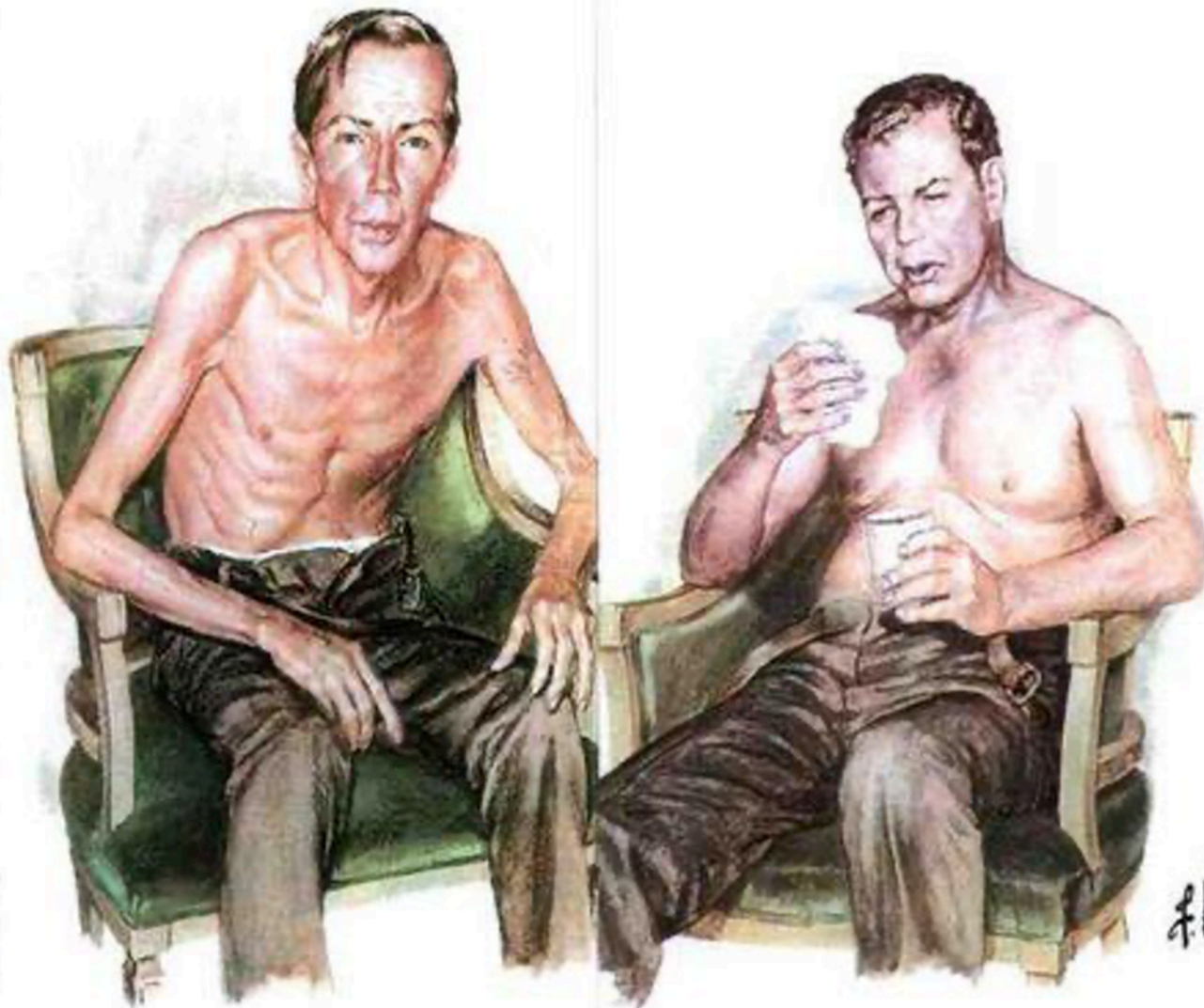
We may then ask why the patients' respiratory effort is disproportionate to the exercise. To some extent this may be due to excess ventilation; but usually this is not itself sufficient, and we conclude that the relation between mechanical effort and respiratory movement is changed so that the work cost of ventilation is increased. We call this a decrease in mechanical efficiency, which is our second component.

Usually the patient's sense of subjective effort, which probably reflects the output of the respiratory centre, is in proportion to the mechanical respiratory work he is performing. But sometimes this is not so. For example in poliomyelitis with respiratory involvement the patient may feel very dyspnoeic—that is, he is conscious of great respiratory effort, whereas the work achieved is small. We must therefore be prepared to take into account a reduction in the mechanical result of respiratory centre activity: a decrease in neuromuscular efficiency, or third component.

Finally, we observe that some patients become very dyspnoeic on exercise when only slightly cyanosed, while others are undistressed although grossly cyanosed at rest. Of course, we should take into account also the arterial CO_2 tension and pH, but when we do so we are still driven to the conclusion that there is considerable variation between patients in the response of the respiratory centre to chemical stimuli. We can say that some patients have a decrease in the central sensitivity—our fourth component.

Each of these components represents the relation characteristic of the patient at that time, between two physiological variables which can be measured or assessed. When the variables and the connecting component functions are arranged in order they form a closed loop. Thus for a given metabolic rate, the ventilatory utilisation defines the relation between the ventilation and the blood gases determining the chemical stimulus. The chemical stimulus will produce a respiratory central output drive depending on the central sensitivity. The drive will produce mechanical work depending on neuromuscular function, and finally the mechanical function will determine what the work will produce in ventilation. And so the loop is closed.

The effect of this arrangement is that a deterioration in a function is not followed by a proportional change in the dependent "downstream" variable, but by a small change combined with an increase in the "upstream" variables. For example, if the mechanical function at the utilisation were both halved, and the total respiratory functional efficiency thus reduced to about a quarter of normal, we should expect a deviation of blood gases at exercise not of four times normal but only of about two



*The Frederick W. Price memorial lecture, delivered at Queen's University, Belfast, on April 20, 1965.

National Emphysema Treatment Trial

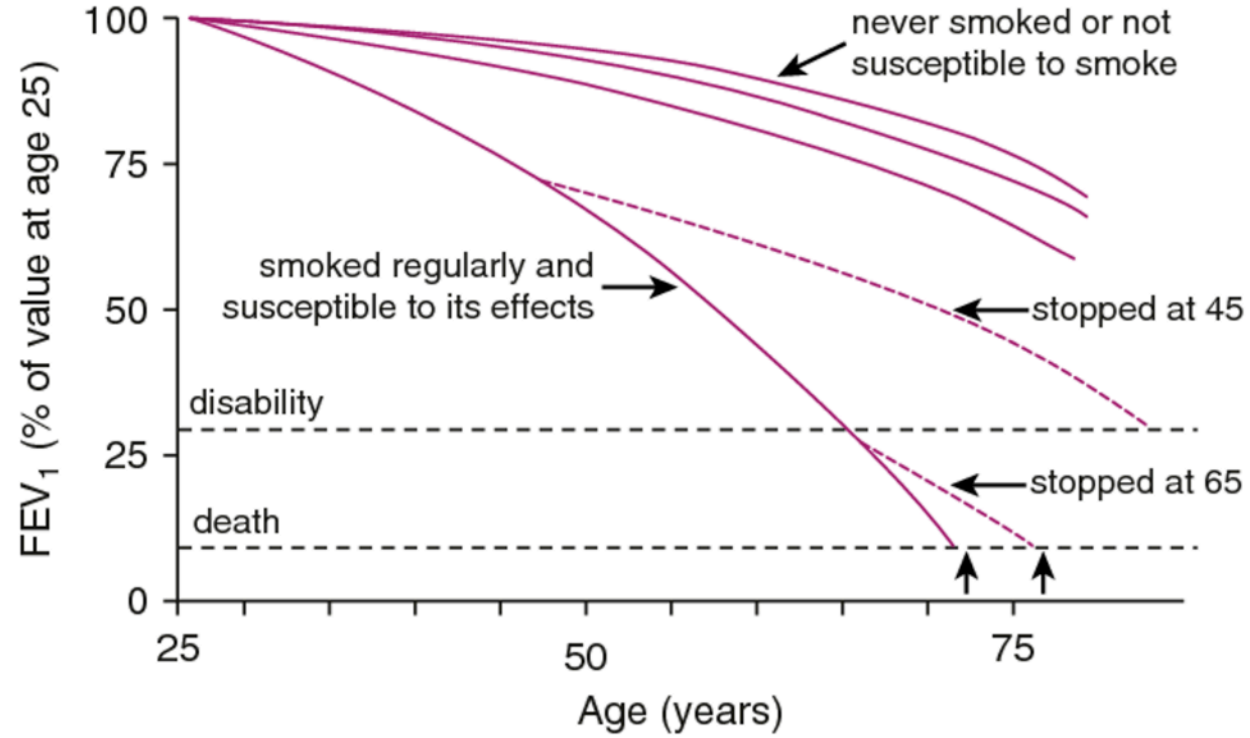
The Major Outcomes of Lung Volume Reduction Surgery in Severe Emphysema

Gerard J. Criner¹ and Alice L. Sternberg²

¹Temple University School of Medicine, Philadelphia, Pennsylvania; and ²Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland

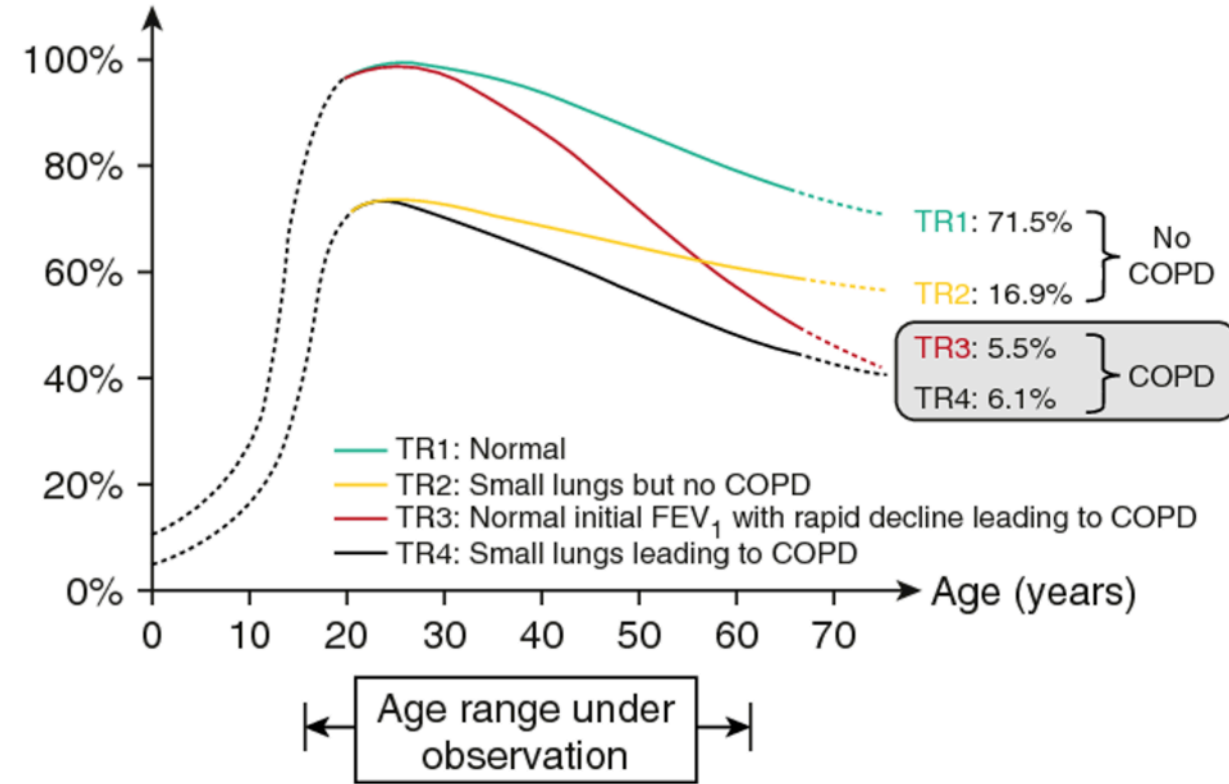
- the National Emphysema Treatment Trial,
- some phenotypic characteristics were associated with increased mortality after lung volume reduction surgery
- whereas this therapy reduced mortality in other COPD subjects

YESTERDAY



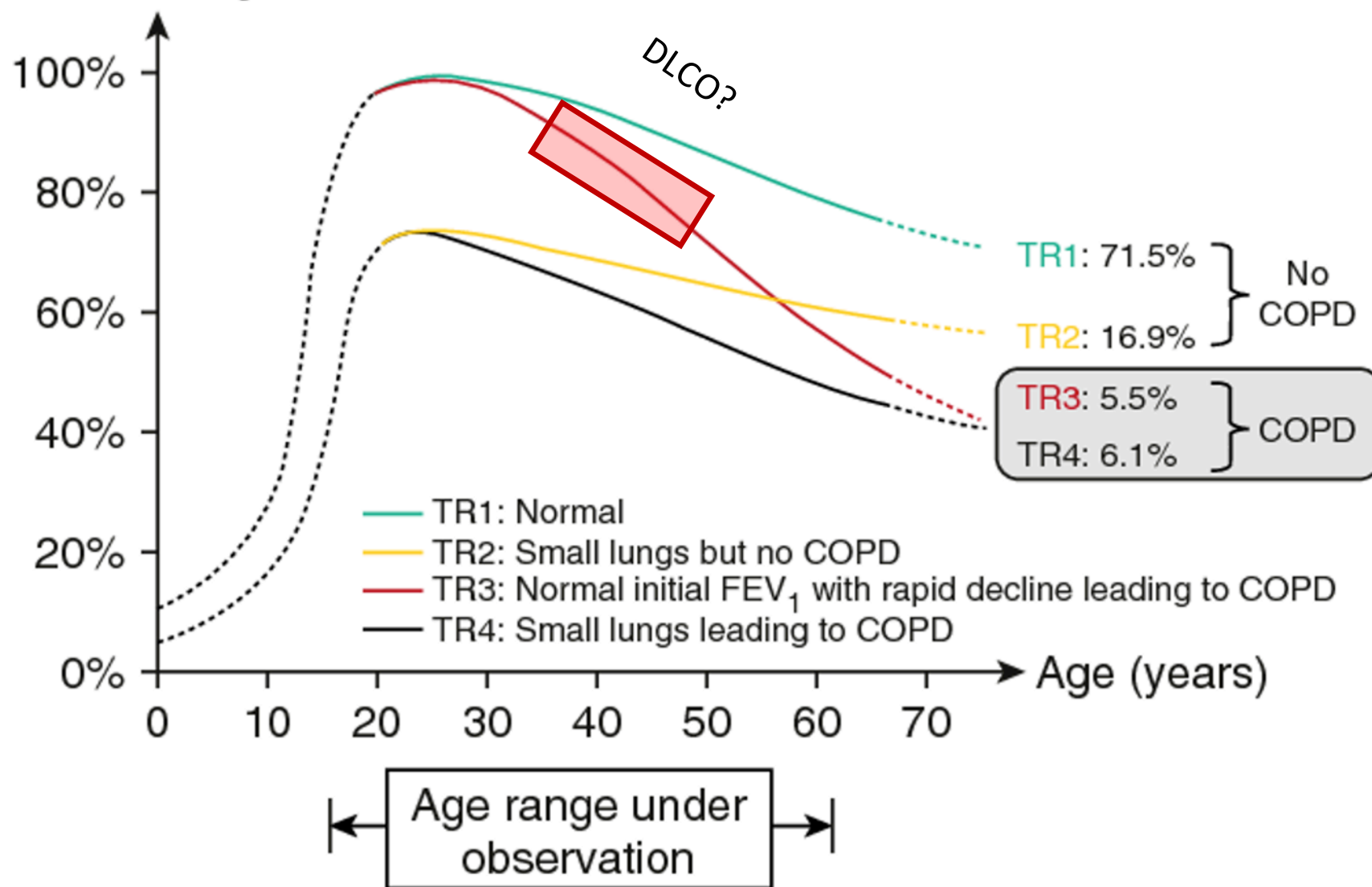
TODAY

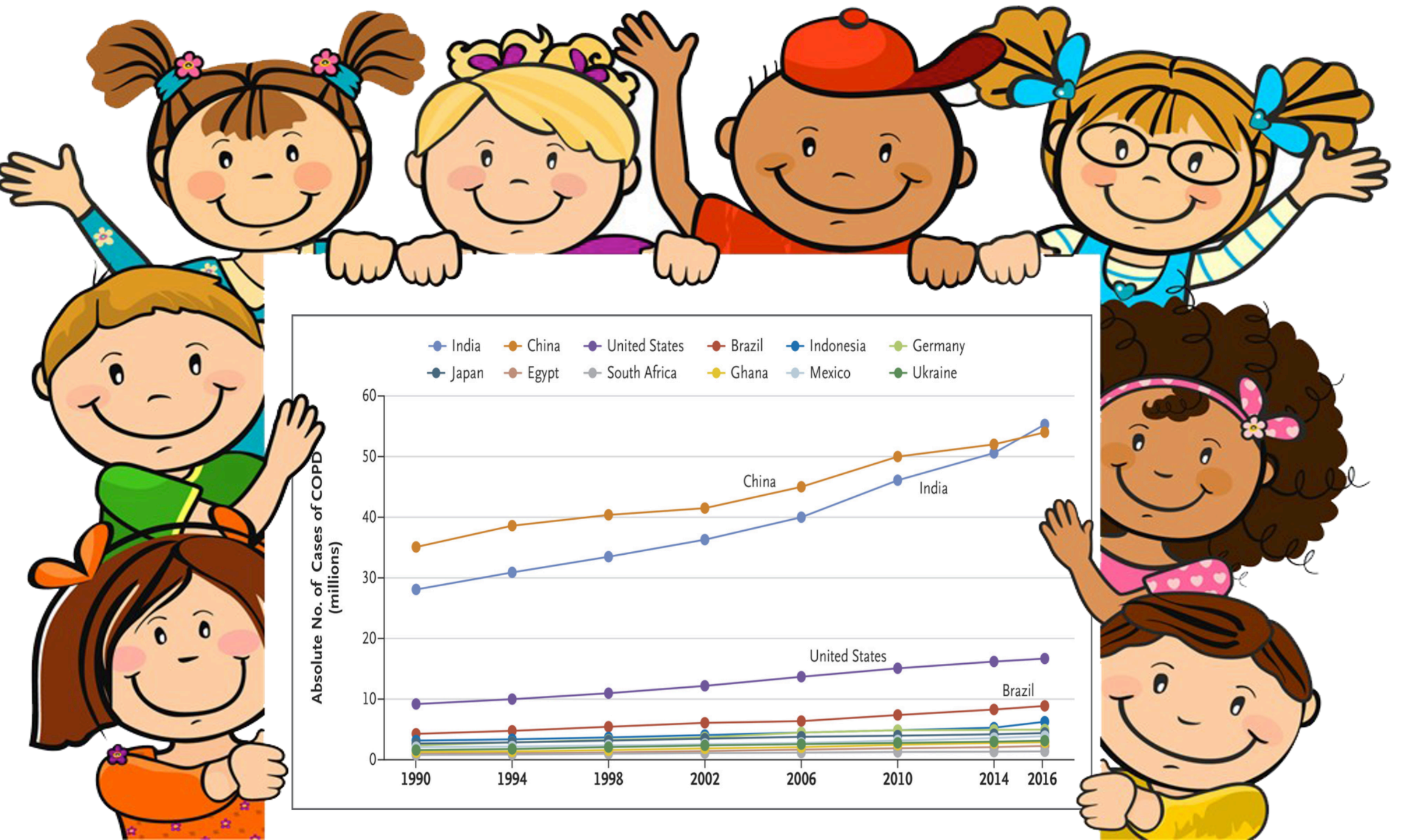
FEV₁ in percent of predicted maximally attained value



TODAY

**FEV₁ in percent of predicted
maximally attained value**







40 aine

Tabagique

Sédentaire

Peu symptomatique

EFR normale

DLCO altérée

Lésions d'emphyseme sur le scanner

➡ Traitement précoce

Tabac

BPCO

Emphysème sévère

Déclin plus rapide du VEMS



Biomasse

BPCO

Epaississement bronchique

Un VEMS qui s'améliore sous BD



Asthme-BPCO

ACO

Plus d'exacerbations

Plus d'hospitalisation

Moins de mortalité



Phénotypes BPCO et TDM

STATE OF THE ART

Imaging Advances in Chronic Obstructive Pulmonary Disease

Insights from the Genetic Epidemiology of Chronic Obstructive Pulmonary Disease (COPDGene) Study

Surya P. Bhatt¹, George R. Washko², Eric A. Hoffman³, John D. Newell, Jr.³, Sandeep Bodduluri¹, Alejandro A. Diaz², Craig J. Galban⁴, Edwin K. Silverman⁵, Raúl San José Estépar⁶, and David A. Lynch⁷; for the COPDGene Investigators

¹UAB Lung Imaging Core and UAB Lung Health Center, Division of Pulmonary, Allergy and Critical Care Medicine, University of Alabama at Birmingham School of Medicine, Birmingham, Alabama; ²Division of Pulmonary and Critical Care Medicine, ⁵Channing Division of Network Medicine, and ⁶Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts; ³Department of Radiology, University of Iowa Carver College of Medicine, Iowa City, Iowa; ⁴Department of Radiology and Center for Molecular Imaging, University of Michigan, Ann Arbor, Michigan; and ⁷Department of Radiology, National Jewish Health, Denver, Colorado

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Phénotypes BPCO et TDM

Les données de COPDGene

- Informations considérables vs spirométrie
 1. identification précoce de la maladie;
 2. Diagnostic + des fumeurs symptomatiques sans TVO;
 3. Etendue des atteintes interstitielles débutantes des fumeurs;
 4. Et mesure des comorbidités extra pulmonaires : Patho coronarienne, Pathologie vasculaire pulmonaire, la cachexie et l'ostéoporose.
- Élément Pronostic

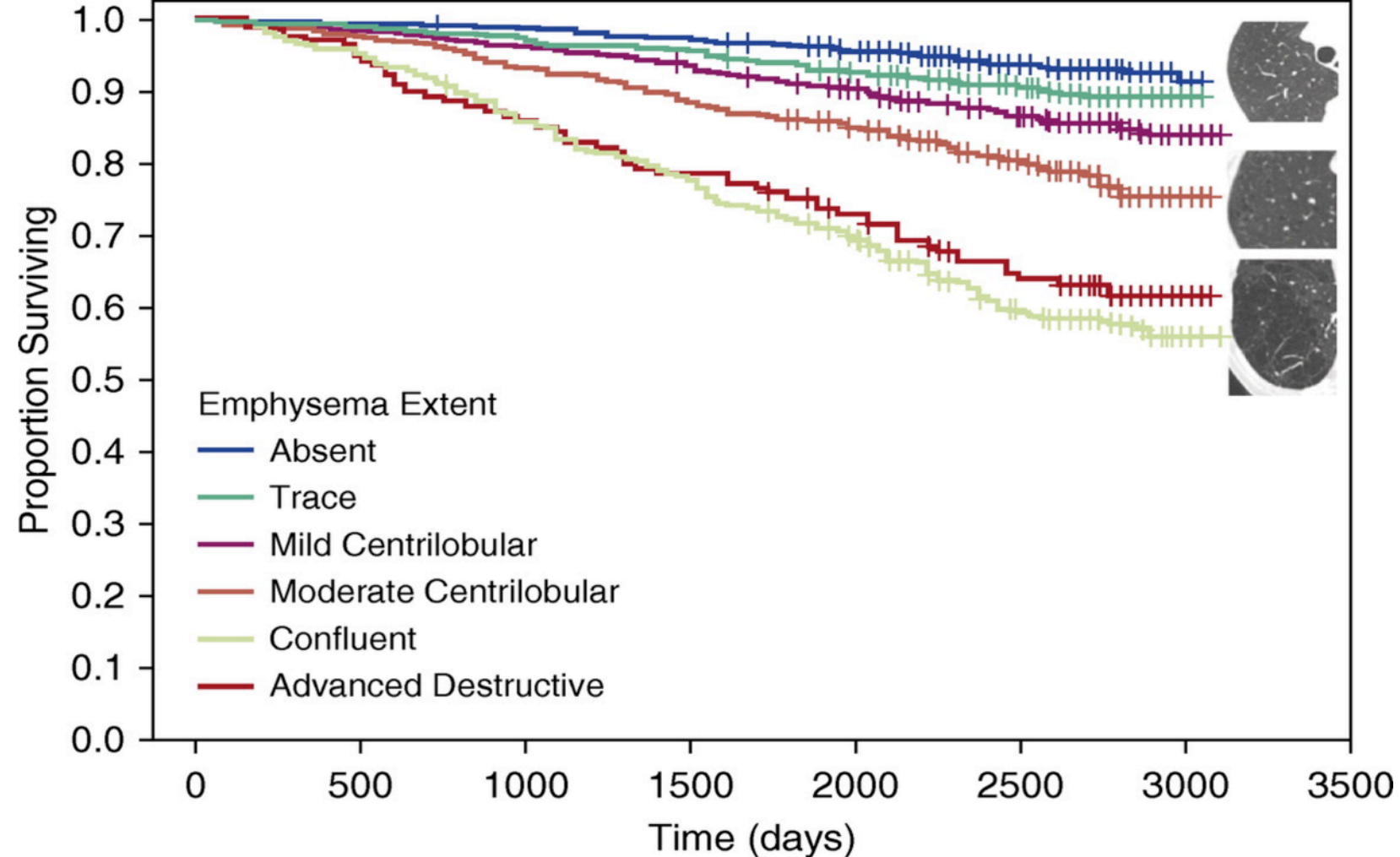


Figure 1. Visual analysis of parenchymal emphysema. Kaplan-Meier survival curves show distinct differences in survival for different emphysema patterns based on the Fleischner Society grading system: the best survival was with absent and trace emphysema (top); those with moderate centrilobular emphysema (center) had intermediate survival; and those with confluent or advanced destructive emphysema (bottom) showed poor survival. These differences persisted after adjustment for potential covariates. Adapted by permission from Reference 11.

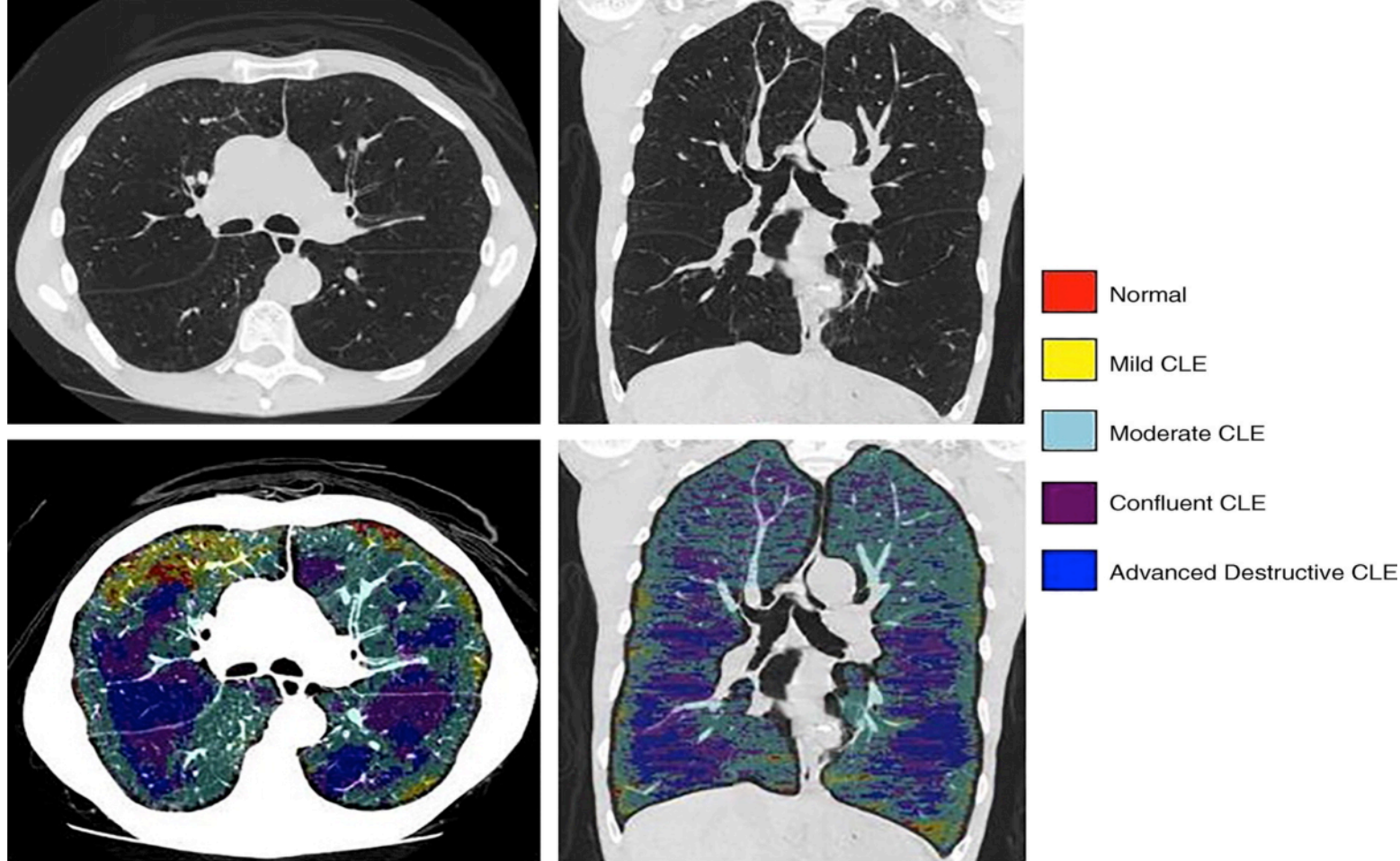
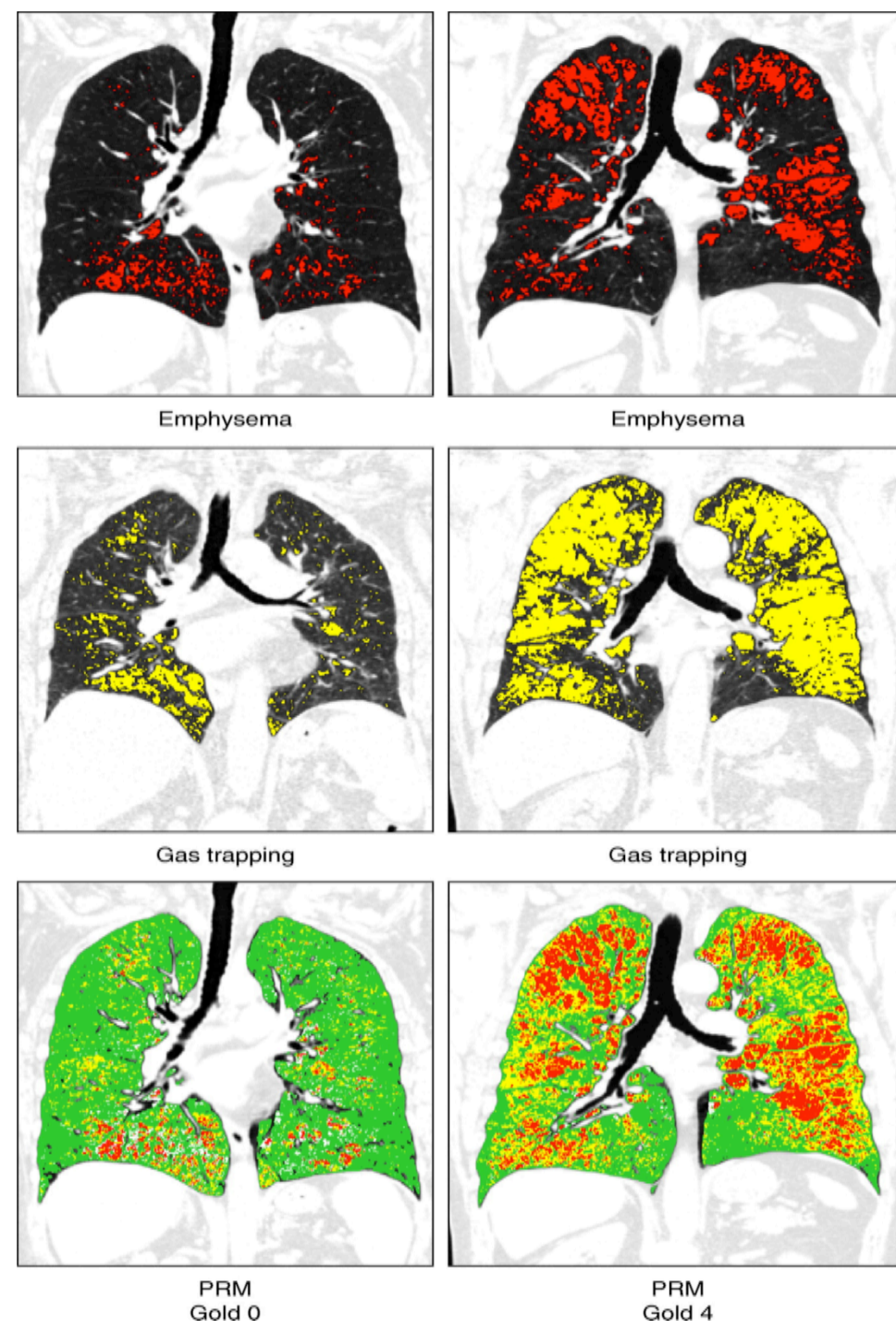


Figure 2. Emphysema subtyping with local histogram. Emphysema subtyping using the local histogram approach for a 61-year-old man with advanced emphysema (low-attenuation area percentage, 38.2%), FEV1 percent predicted of 26.7%, and body mass index of 16.6 kg/m². The top panels show computed tomographic scans for axial and coronal views, and the bottom panels show emphysema subtype labels overlaid on top of the computed tomographic images. Nonemphysematous parenchyma is shown in red, mild centrilobular emphysema (CLE) in yellow, moderate CLE in cyan, confluent CLE in purple, and advanced destructive emphysema in dark blue.

Figure 3. Parametric response mapping (PRM). Top panels show areas of emphysema (low-attenuation area percentages less than -950 Hounsfield units at end inspiration) in red; middle panels show areas of gas trapping (low-attenuation area percentages less than -856 Hounsfield units at end expiration) in yellow; and lower panels show PRM with PRM emphysema voxels in red, PRM functional small airway disease (fSAD) voxels in yellow, and PRM normal voxels in green. Representative images are shown for subjects with different stages of disease. The left column shows computed tomographic (CT) images of a 76-year-old woman without airflow obstruction (FEV1 % predicted, 100%; Global Initiative for Chronic Obstructive Lung Disease [GOLD] stage 0). Quantitative CT density analysis showed 6% emphysema and 19% gas trapping. PRM analysis showed that nonemphysematous gas trapping or fSAD was 13%. The right column shows CT images of a 73-year-old man with GOLD stage 4 (FEV1 % predicted, 23%), 19% emphysema, and 54% gas trapping. PRM analysis showed that fSAD was 38%.



Am J Respir Crit Care Med, 2019
<https://www.atsjournals.org/doi/abs/10.1164/rccm.201807-1351SO>

Published in: Surya P. Bhatt; George R. Washko; Eric A. Hoffman; John D. Newell Jr.; Sandeep Bodduluri; Alejandro A. Diaz; Craig J. Galban; Edwin K. Silverman; Raúl San José Estépar; David A. Lynch; *Am J Respir Crit Care Med* 199286-301.
 DOI: 10.1164/rccm.201807-1351SO
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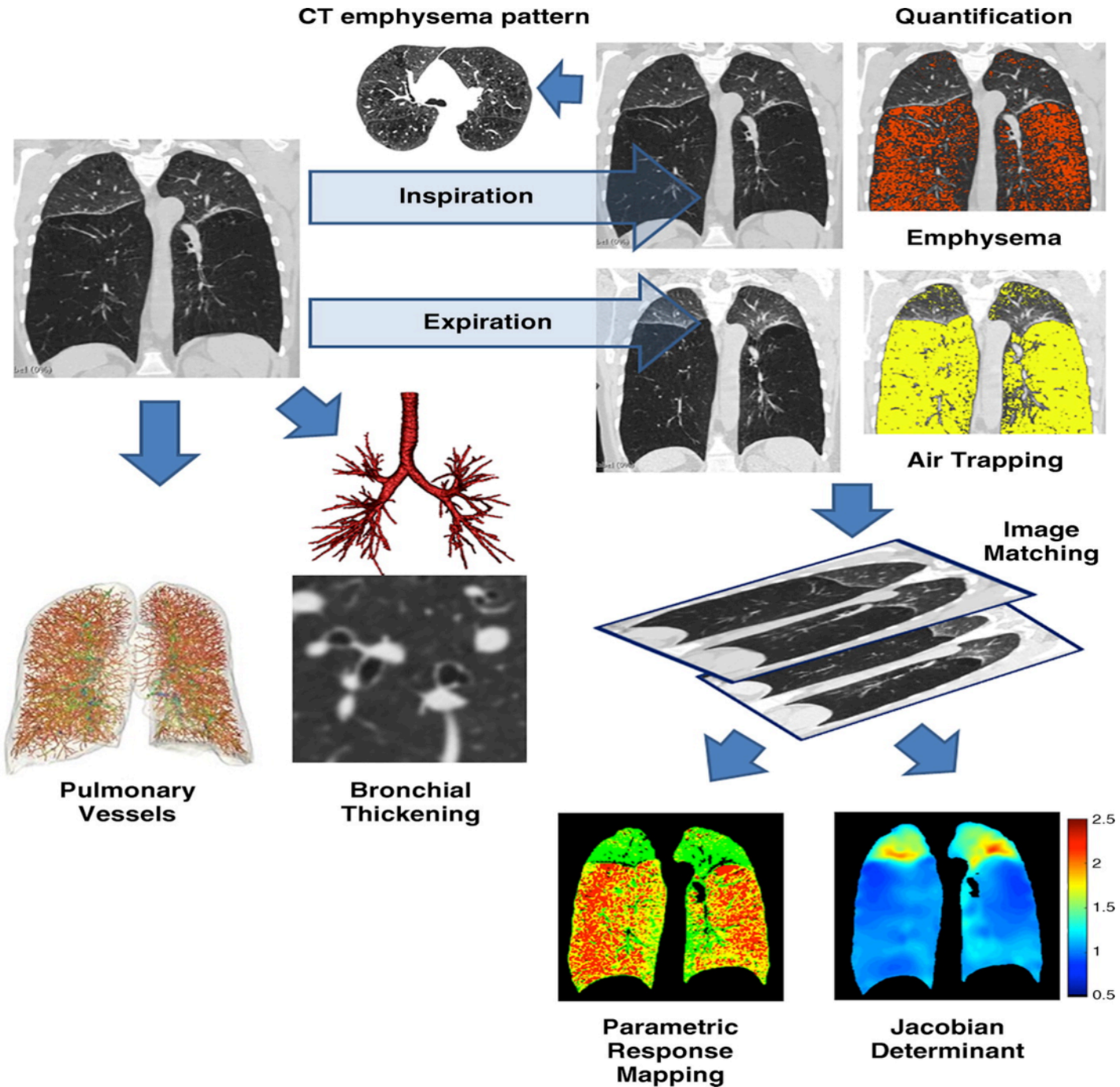
Figure 9. Summary of imaging features that can be derived from computed tomography (CT). The figure shows a summary of the main measurements that can be made using inspiratory computed tomographic scans. These include qualitative and semiquantitative determination of emphysema and emphysema subtype, quantitative estimates of emphysema using density histograms, bronchial wall thickness, and pulmonary vasculature. The addition of expiratory scans enables image matching and the computation of functional small airway disease using parametric response mapping, as well as the Jacobian determinant, an estimate of lung mechanics.

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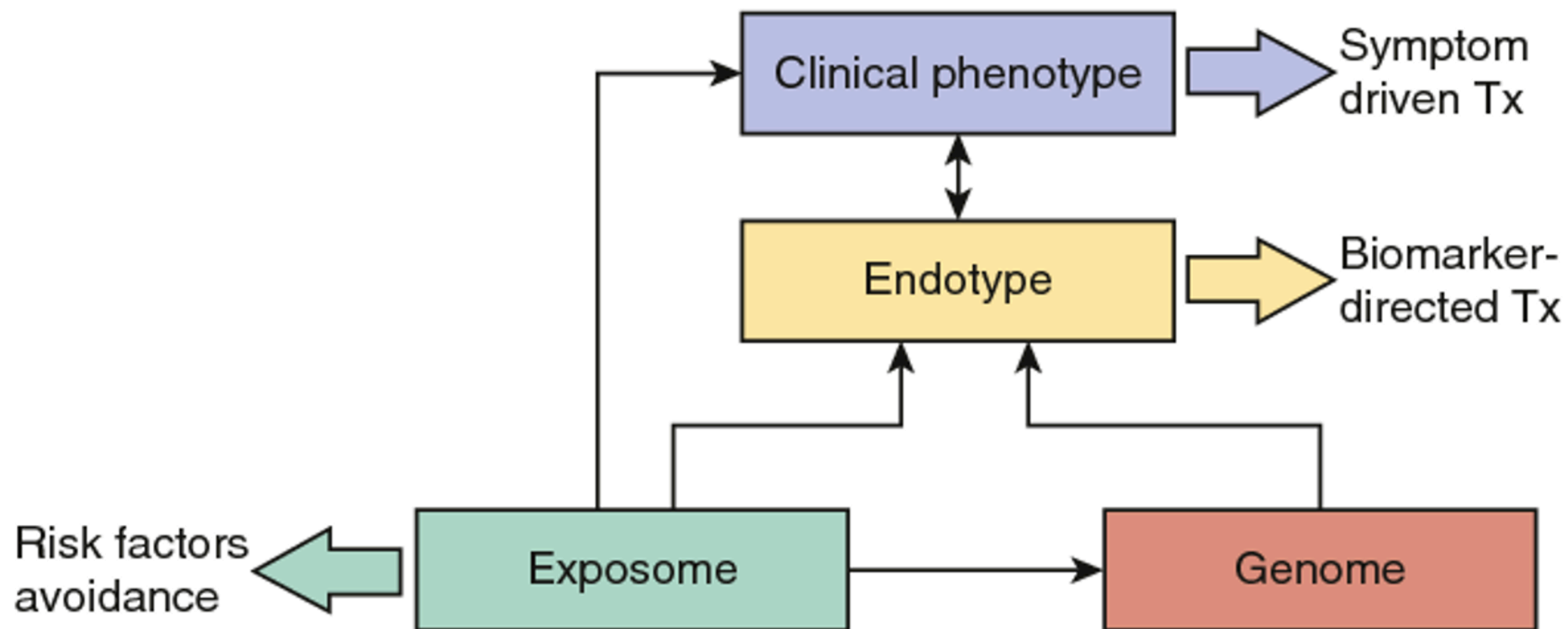
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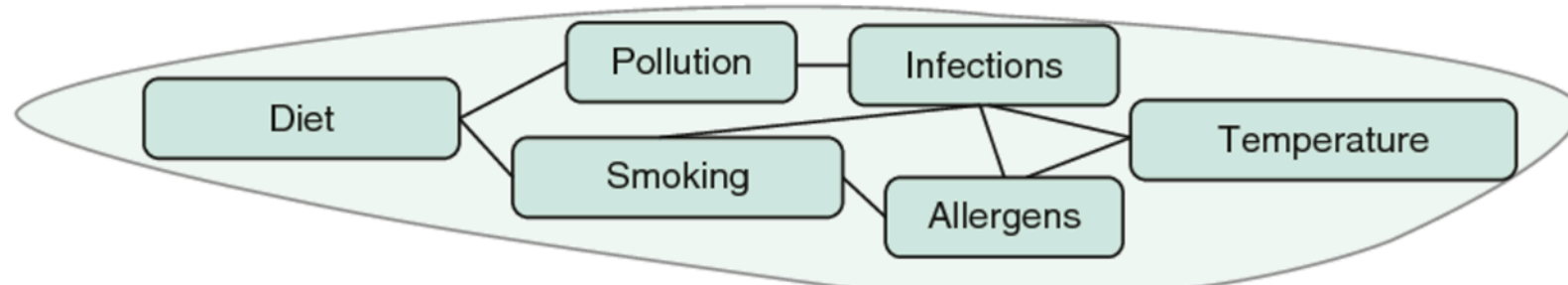
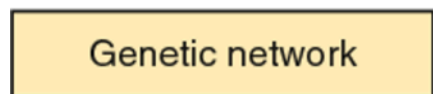
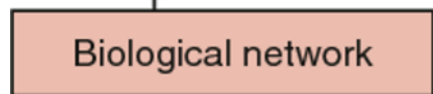
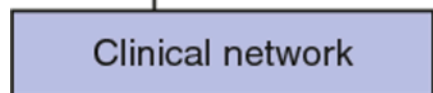
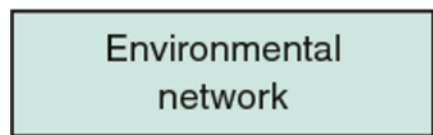
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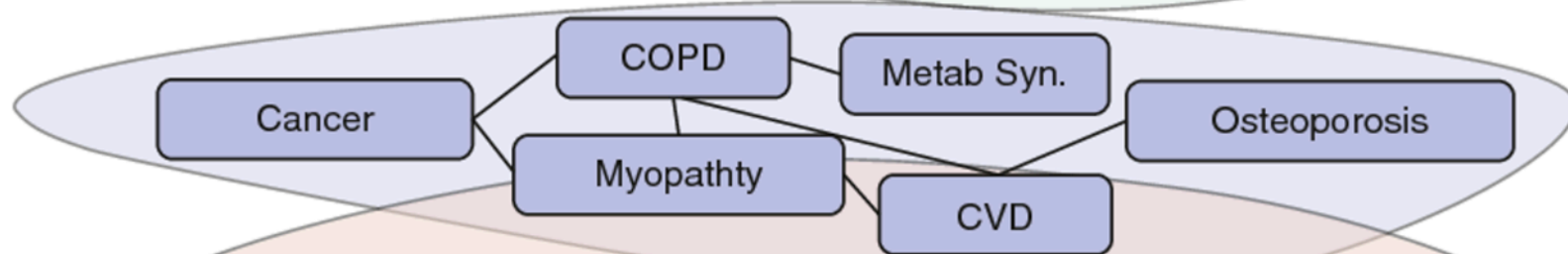




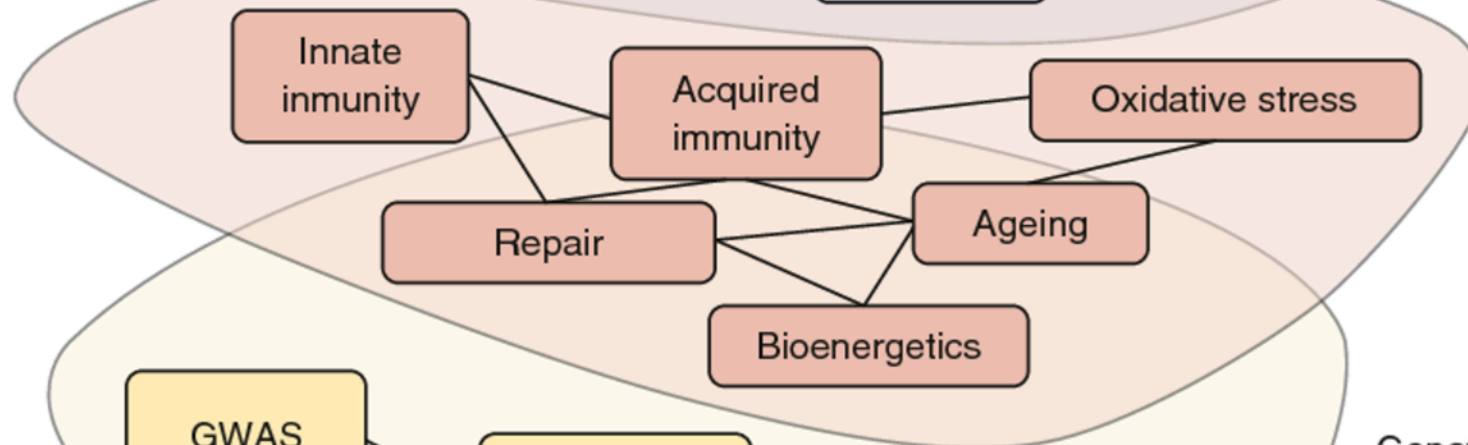




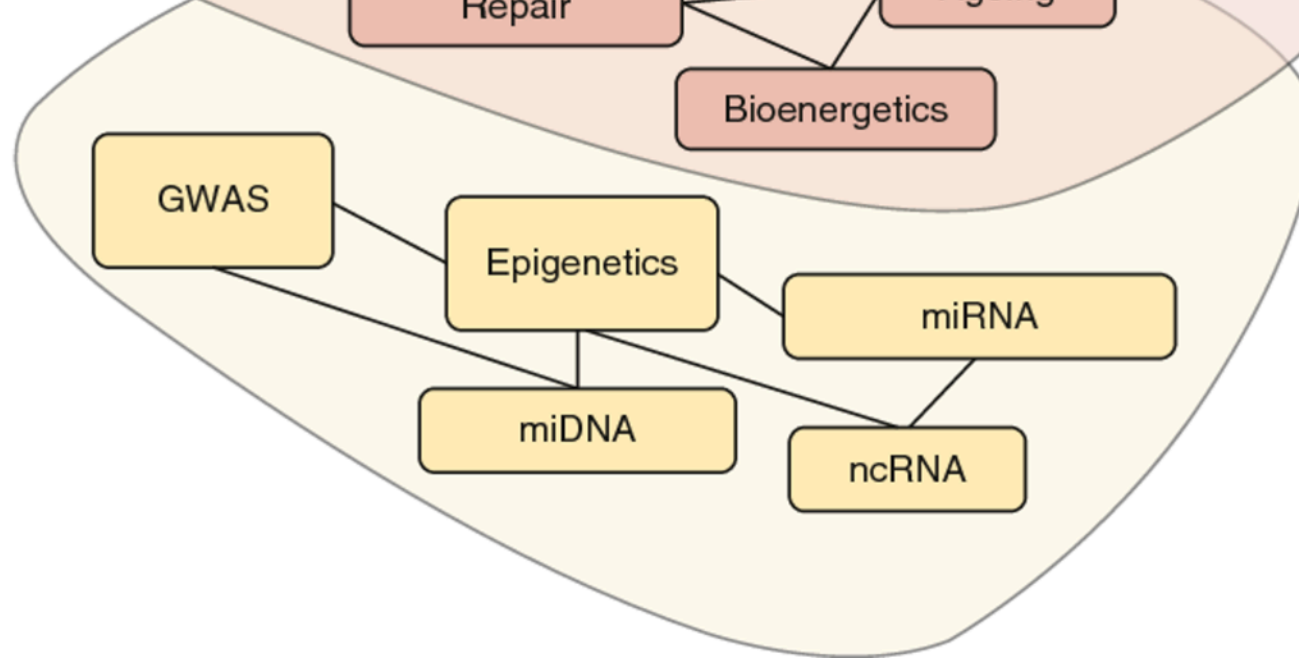
- Life-style
- ✓ *Modifiable factors*
 - ✓ *Integrated care*



- Clinical phenotypes
- ✓ *New taxonomy*
 - ✓ *CDSS*
 - ✓ *Precision medicine*
 - ✓ *Guidelines network*



- Endotypes
- ✓ *Diagnostic biomarkers*
 - ✓ *Therapeutic targets*



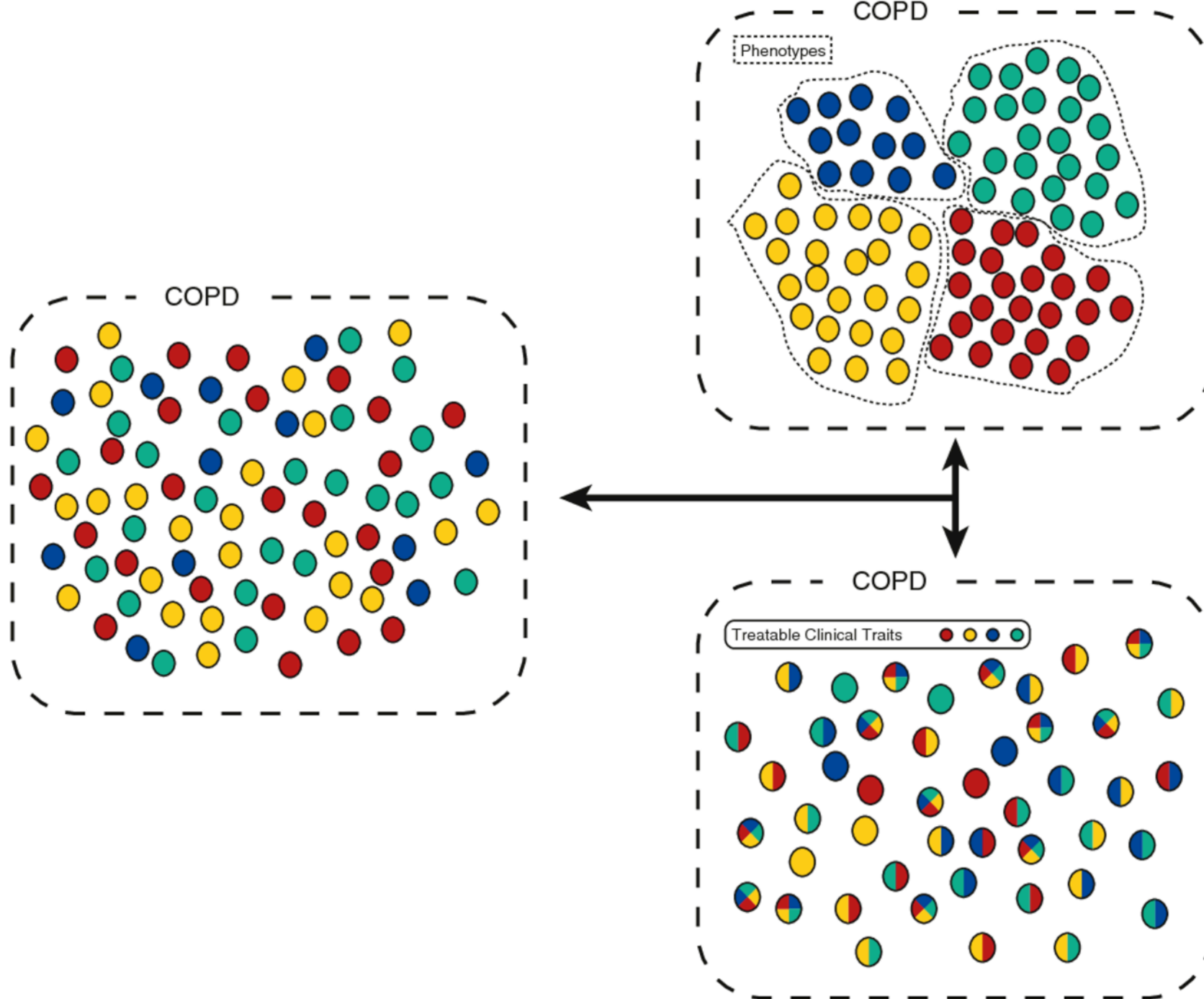
- Genetic markers
- ✓ *Risk assessment*



ENDOTYPES, BIOMARKERS, AND TREATABLE TRAITS

- 2 endotypes cibles :
 - Alpha1 AT
 - Eosinophilie (GOLD)
- Aucune autre cible identifiée traitable









Scadding conditions	Pre-COPDs	COPDs
Function	No airflow limitation	Airflow limitation
Symptoms	Cough; sputum; dyspnoea	Dyspnoea; cough; sputum
Structure	Emphysema; abnormal airways	Emphysema; abnormal airways
Aetiology	Genetic (AAT deficiency); cigarettes; biomass; infectious; asthma; developmental; unknown	

Generic treatment

Maintain a healthy lifestyle: aim for ideal body weight, exercise, appropriate vaccination
If symptomatic use inhaled bronchodilators

Specific treatment**C
O
P
D
s**

Genetic
AAT deficiency
(COPDg)

Cigarette
smoking
(COPDc)

Biomass
exposure
(COPDb)

Infectious
(COPDi)

Asthma
(COPDa)

Abnormal lung
development
(COPDd)

Unknown
or idiopathic
(COPDu)

AAT
replacement

Smoking
cessation

Abolish
exposure;
modify the
environment

Judicious use
of antibiotics

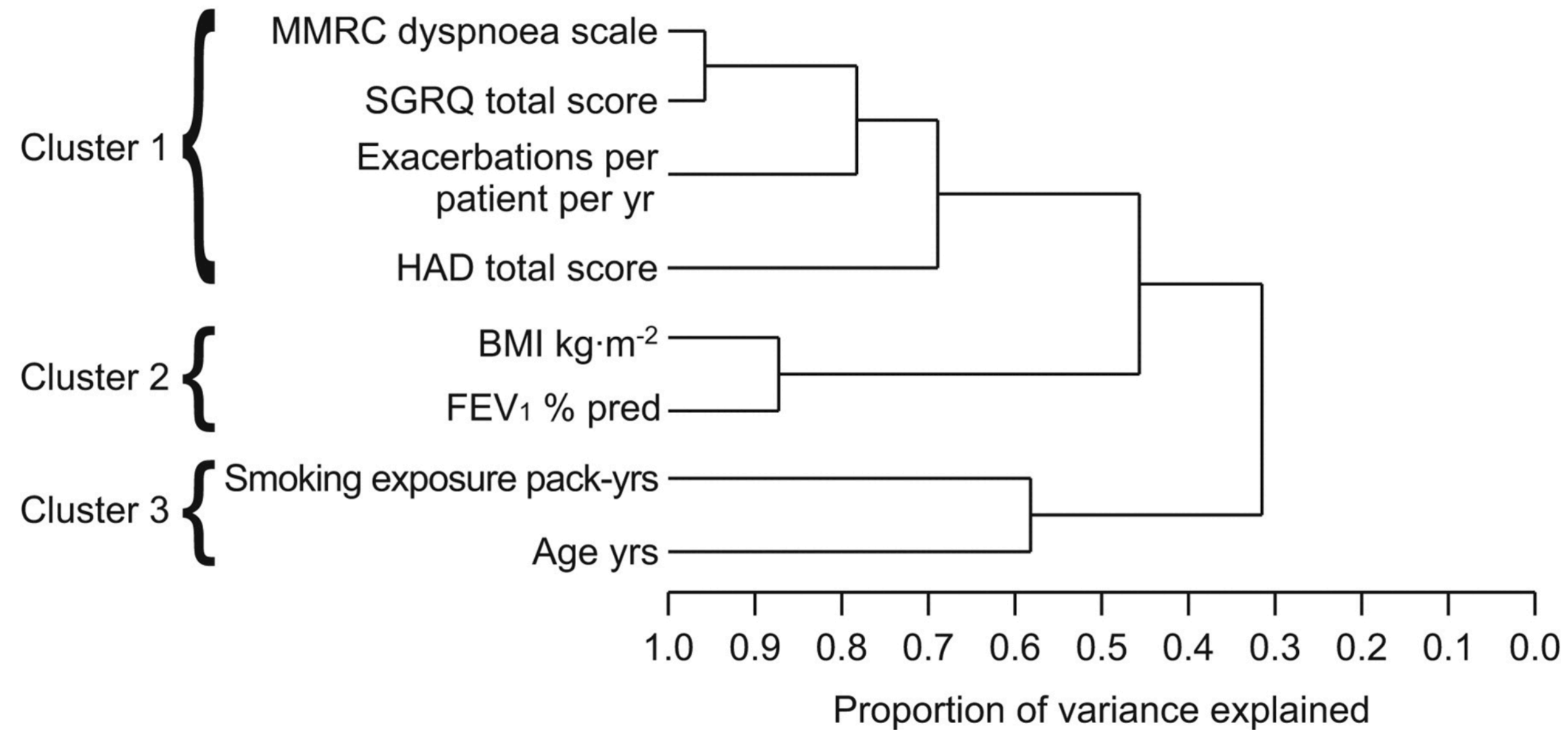
Allergen
exposure
avoidance;
consider ICS,
leukotriene
inhibitors or
biologicals

Primary and secondary
prevention; avoidance of
environmental exposures



Clinical COPD phenotypes: a novel approach using principal component and cluster analyses

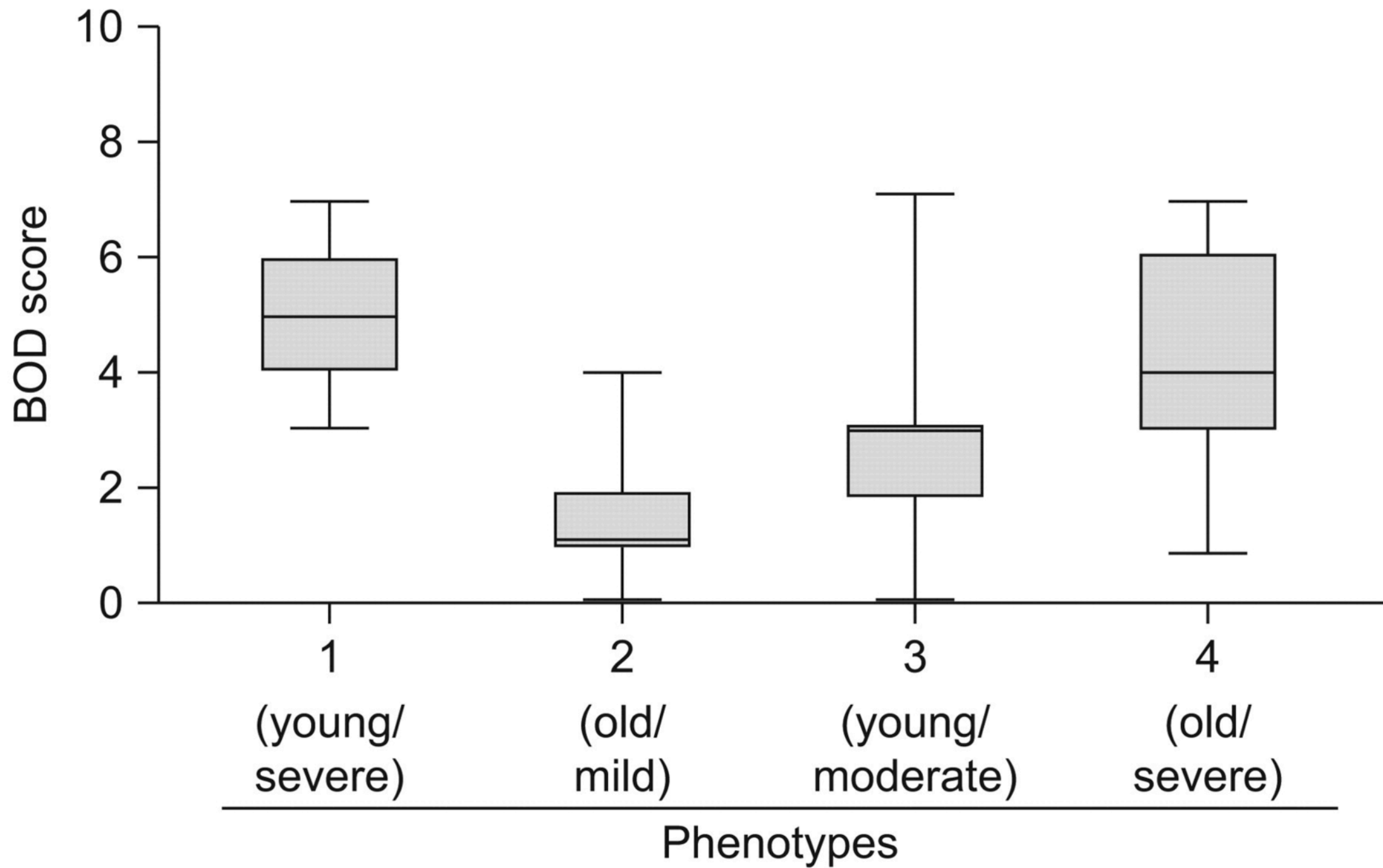
**P-R. Burgel^{*}, J-L. Paillasseur[#], D. Caillaud[¶], I. Tillie-Leblond⁺, P. Chanez[§],
R. Escamilla^f, I. Court-Fortune^{**}, T. Perez⁺, P. Carré^{##}, and N. Roche^{¶¶} on behalf of
the Initiatives BPCO Scientific Committee⁺⁺**

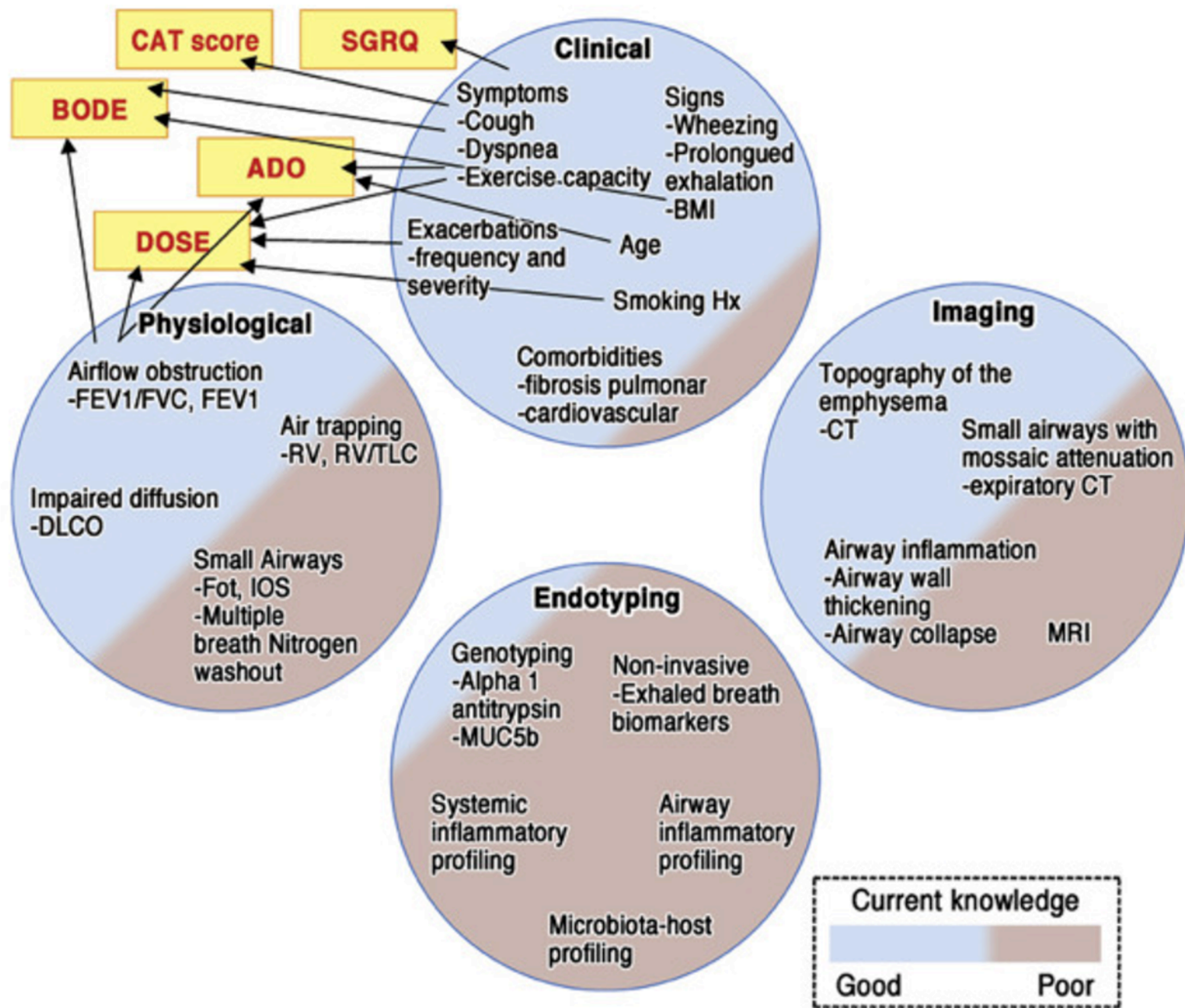


Summary of chronic obstructive pulmonary disease phenotypes identified using principal component analysis-based cluster analysis

	Phenotype 1: young/severe	Phenotype 2: old/mild	Phenotype 3: young/moderate	Phenotype 4: old/severe
Age	Young	Old	Young	Old
Respiratory disease[#]	Very severe	Mild	Moderate	Moderate
Nutritional status	Underweight	Overweight	Normal	Overweight
Chronic heart failure	None	None	None	Frequent
Depression	Very frequent	None	None	Frequent
HRQoL impairment	Very severe	Mild	Moderate	Severe

HRQoL: health-related quality of life. [#]: taking into account airflow obstruction, dyspnoea and exacerbation rate.





Nouvelle approche diagnostique
Nouvelle classification
Combiner clinique, biologie, génétique, environnement
Individualiser les endotypes
Traitement de précision

Agir rapidement, précocement, efficacement avec des
frappes chirurgicales

