Family Medicine Grand Rounds

October 25th 2023 8-9 am

UCLA David Geffen School of Medicine

Interstitial Lung Disease: An Overview for the Generalist

Terese C. Hammond, MD

Associate Clinical Professor of Medicine

Pulmonary Critical Care Sleep Medicine

I have no conflicts of interest to disclose

Lecture Objectives

- Overview of the common ILDs
- Discuss the epidemiology of ILD, including populations at high risk for developing ILD and significant disparities in diagnosis
- Develop familiarity with the pathophysiology, symptoms and diagnosis of ILDs
- Discuss “Best Evidence” in the treatment of ILD

Let's begin with a case….

A 75-year-old man presents to your clinic with a 12-month history of dry cough and shortness of breath

- No other symptoms or medical problems
- No medications
- Seen at urgent care and told he had "allergies" and given antihistamine

SHx: Former smoker with a 40-pack-year history, and he is a retired carpenter. He has no pets and no known environmental exposures other than wood dust

Physical Examination

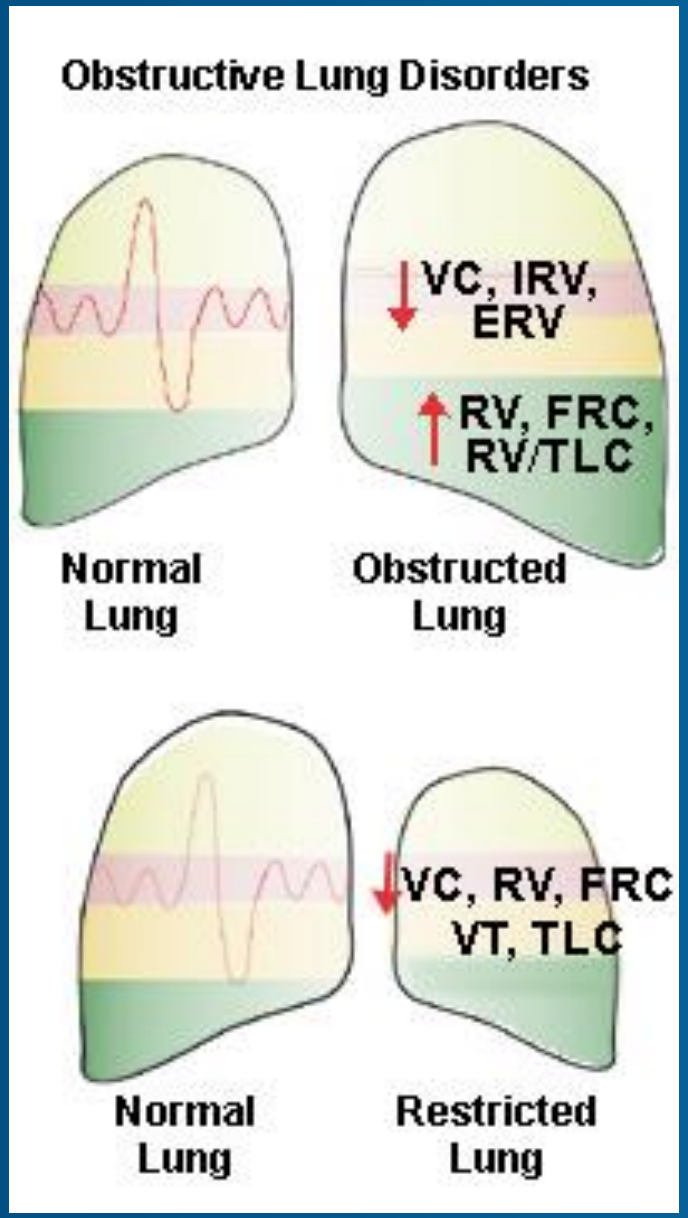
Alert, mildly breathless at rest, oriented

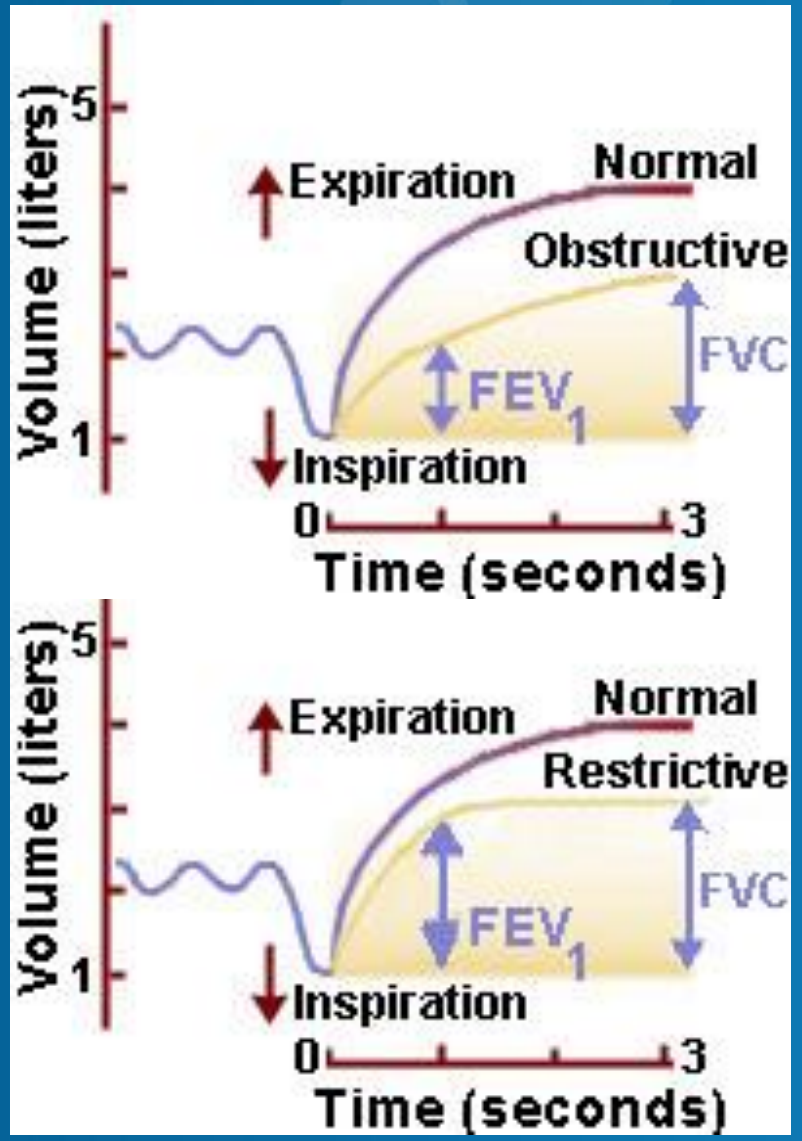
BP 135/75 mm Hg, pulse rate is 88/min, and respiration rate is 24/min. Oxygen saturation is 88% breathing ambient air

- No JVD
- Cardiac examination is normal
- Pulmonary examination discloses inspiratory crackles at the lung bases bilaterally
- Digital clubbing is present

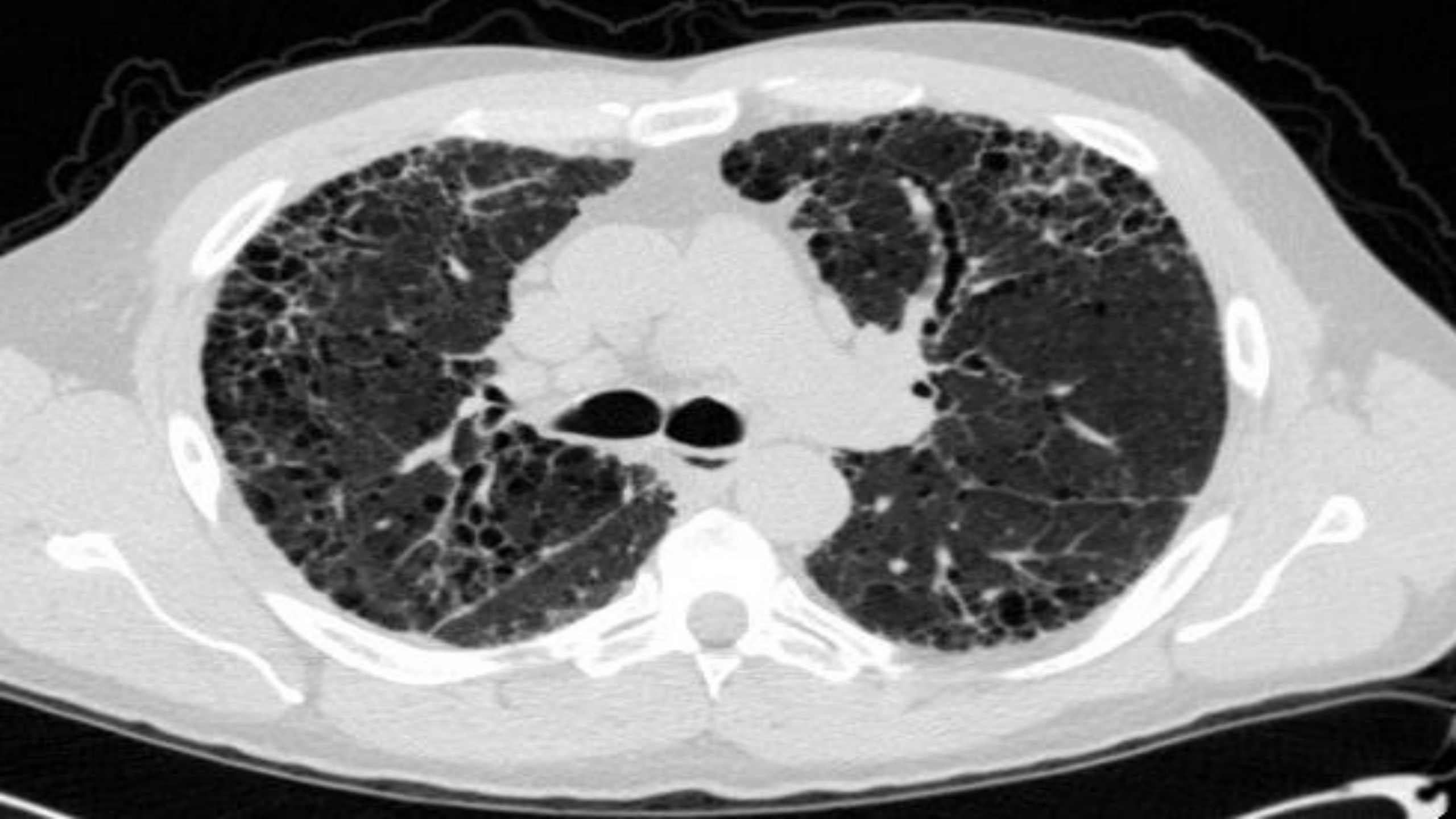
Spirometry

Results: Increased FEV1, decreased FVC, normal FEV1/FVC and decreased DLCO





https://www.medicine.mcgill.ca/physio/vlab/other_exps/resp/Lungdiseases_n.htm



Question

Which of the following is the most likely diagnosis?

a) COPD
b) CHF
c) Hypersensitivity pneumonitis
d) Idiopathic pulmonary fibrosis

Answer

- “D”: Idiopathic pulmonary fibrosis
  - Characterized by progressive dyspnea, cough > 6 months and dry inspiratory crackles
  - Classic CT finding:
    - basal and peripheral disease with evidence of honeycomb changes
    - NO ground-glass opacities or nodules.

Interstitial Lung Disease

- ILD are a diverse (>200) group of disorders
- **A**ffect the interstitium, a potential space in the gas exchange area of the lungs between the capillaries and the alveoli
- The name is partly a misnomer
- These entities frequently involve, alveolar epithelium, alveolar space, pulmonary microvasculature, respiratory bronchioles and/or pleura
- Some call it diffuse parenchymal lung disease (DPLD)

Epidemiology of ILD

Uncommon compared to other pulmonary problems

- 81/100,000 in males and 67/100,000 in females

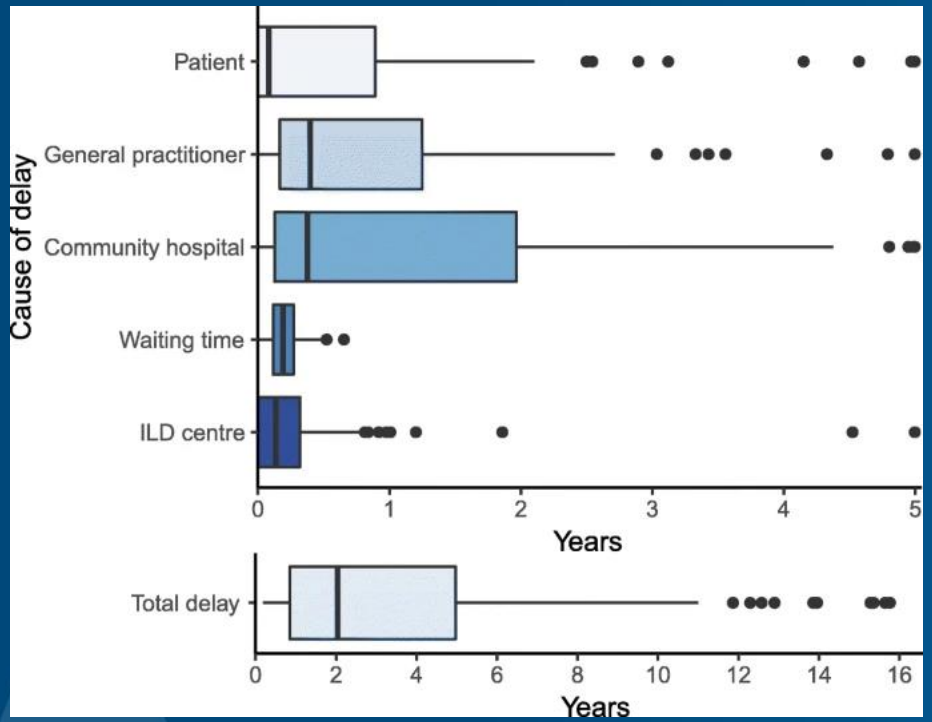
Often misdiagnosed as COPD, bronchitis, asthma or heart disease

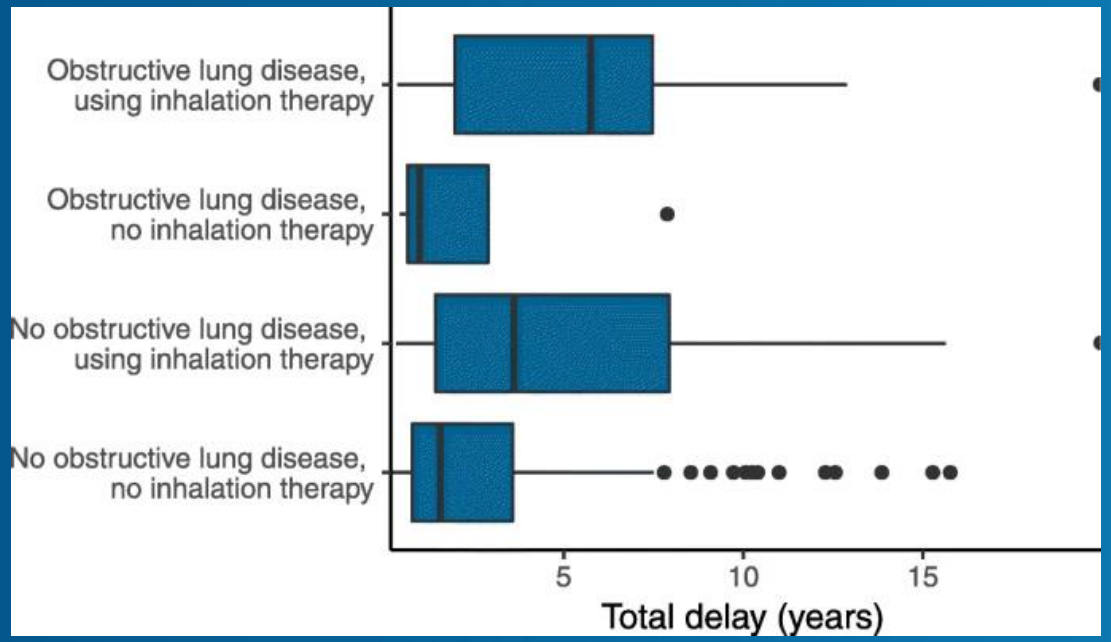
- In a US survey of 1,583 patients with ILD, 54.6% reported a delay of > 1 year between on set of symptoms and IPF diagnosis

Some ILDs such as Sarcoidosis or LAM disproportionately affect women, especially women of color

Interstitial Lung Disease

Despite increased awareness of IPF, the diagnostic delay is still 2.1 years. Male sex, older age and treatment attempts for alternative diagnoses are risk factors for a delayed diagnosis of IPF





Hoyer, Nils, et al. "Risk factors for diagnostic delay in idiopathic pulmonary fibrosis." *Respiratory research* 20.1 (2019): 1-9.

Interstitial Lung Disease

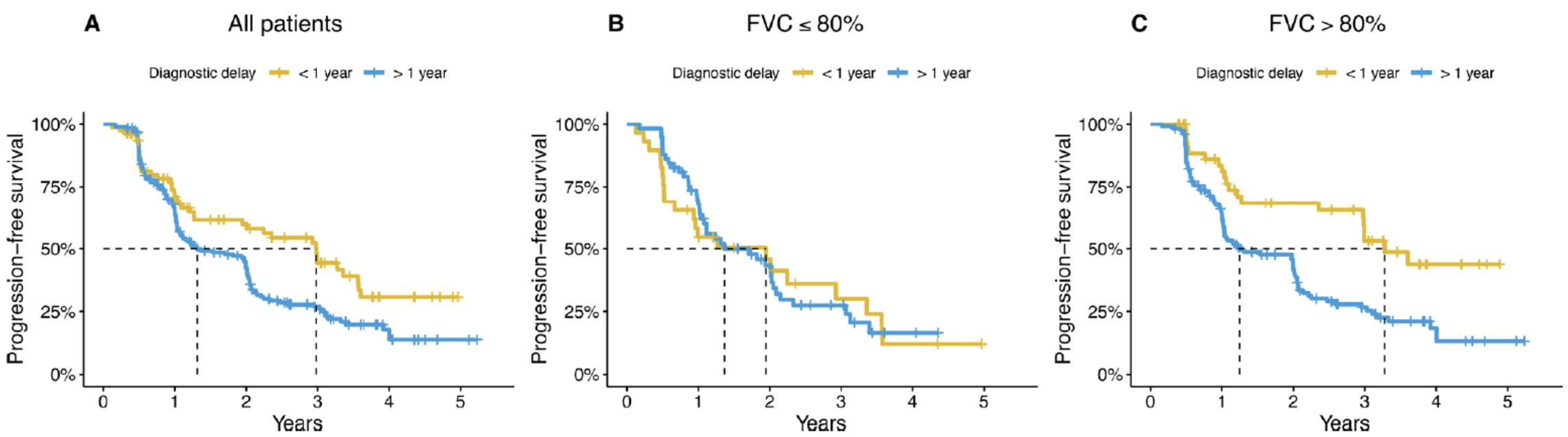
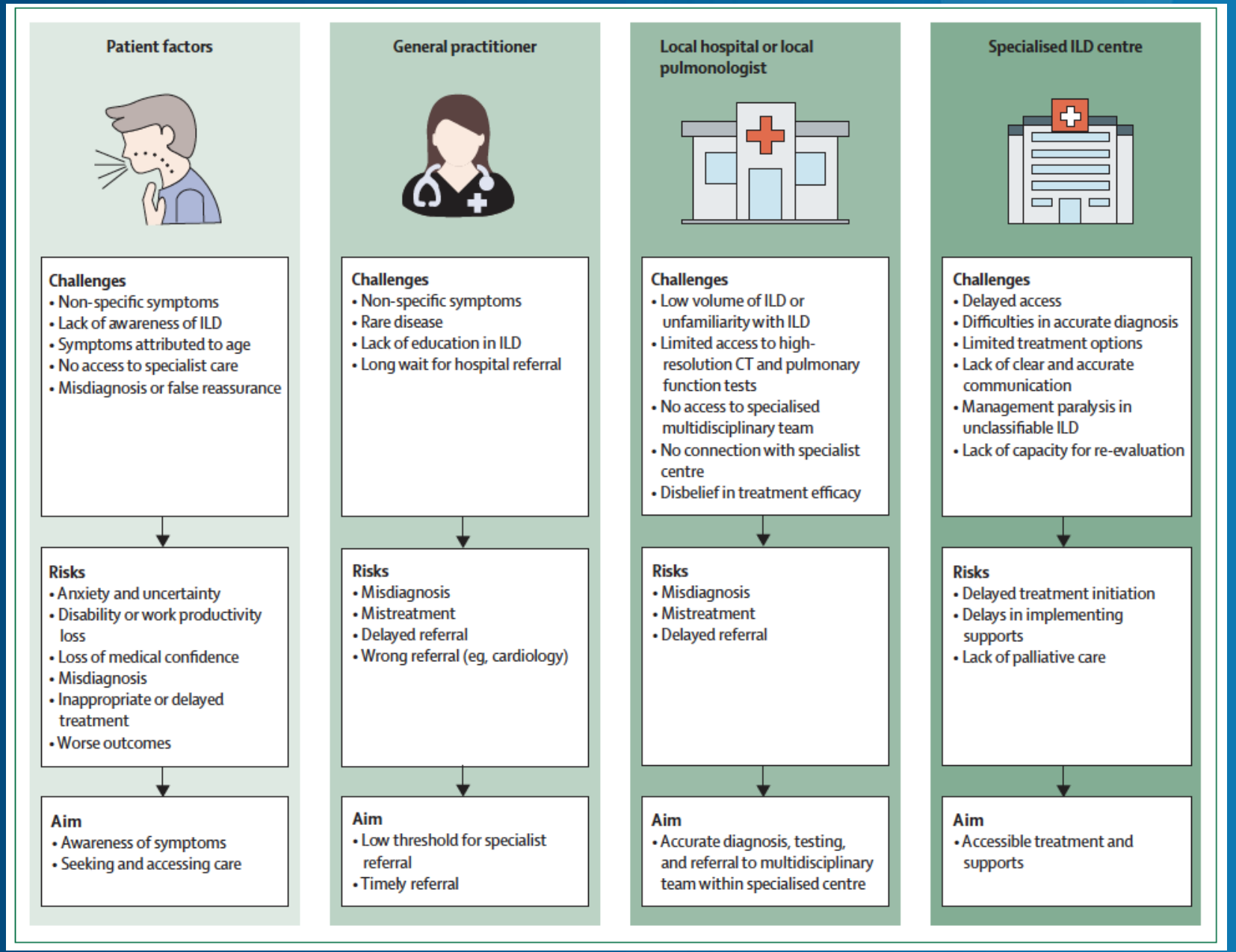


Figure 1 Progression-free survival in patients with a short (<1 year) or long (>1 year) diagnostic delay in the entire cohort (A) and stratified according to forced vital capacity (FVC) at the time of diagnosis≤80% predicted (B) or >80% predicted (C).

Hoyer, Nils, et al. "Diagnostic delay in IPF impacts progression-free survival, quality of life and hospitalisation rates." *BMJ Open Respiratory Research* 9.1 (2022): e001276.

Barriers to Diagnosis of ILD

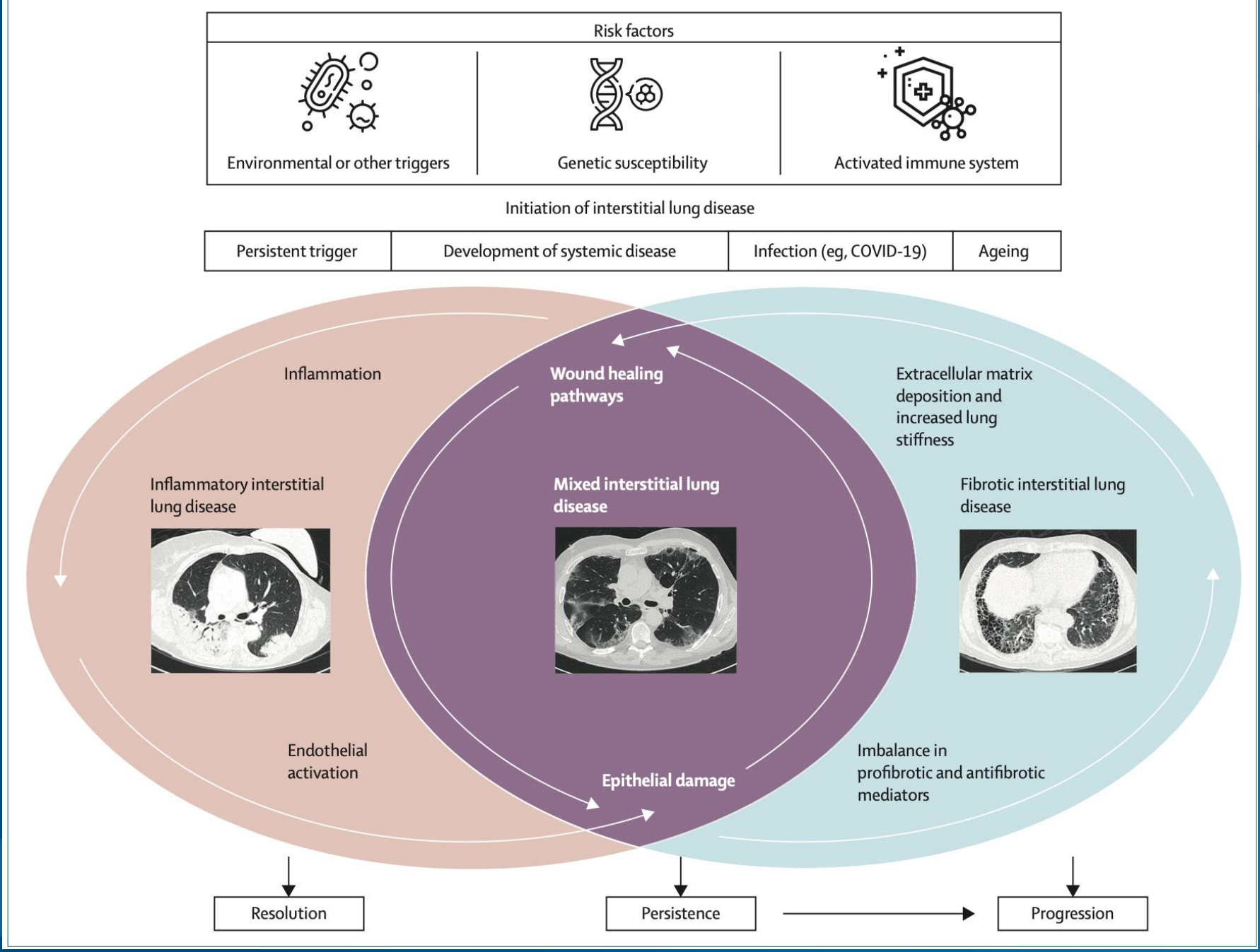


Spagnolo, Paolo, et al. "Early diagnosis of fibrotic interstitial lung disease: challenges and opportunities." *The Lancet Respiratory Medicine* 9.9 (2021): 1065-1076.

Epidemiology of ILD: IPF or NOT IPF?

Idiopathic Pulmonary Fibrosis (IPF) is the most common idiopathic interstitial pneumonia

- Terrible prognosis: 5 year survival rate of 20-40% is lower than many cancers
- Sporadic form most common, but familial forms may account for 5-20% of cases
- Prevalence of IPF in US is 14-27.9/100,000
- Incidence of IPF increases with age and is higher in men than women (10.7 vs. 7.4/100,000)



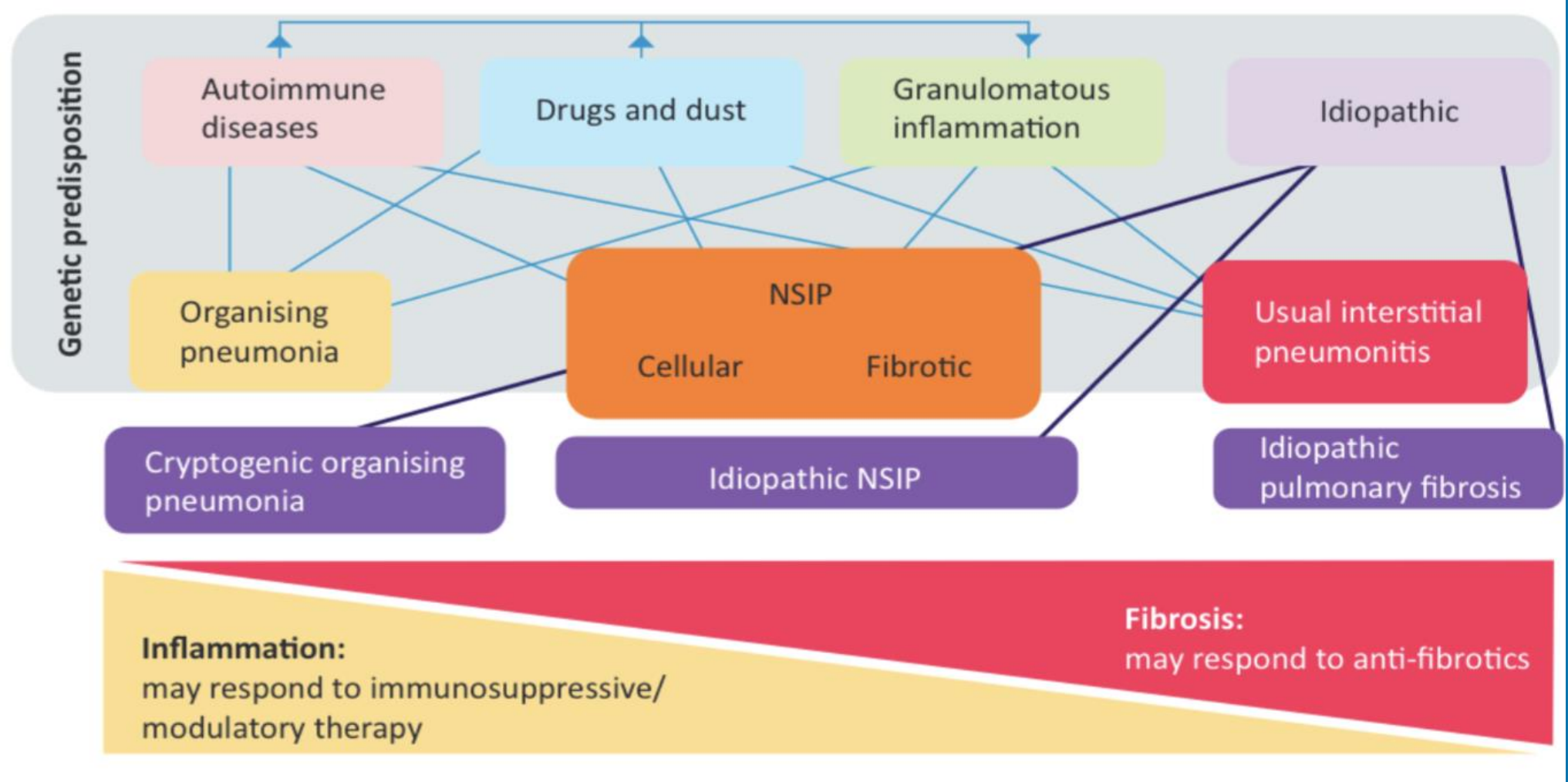
Wijsenbeek, Marlies, Atsushi Suzuki, and Toby M. Maher. "Interstitial lung diseases." *The Lancet* 400.10354 (2022): 769-786.

Epidemiology of ILD

Associations with ILD

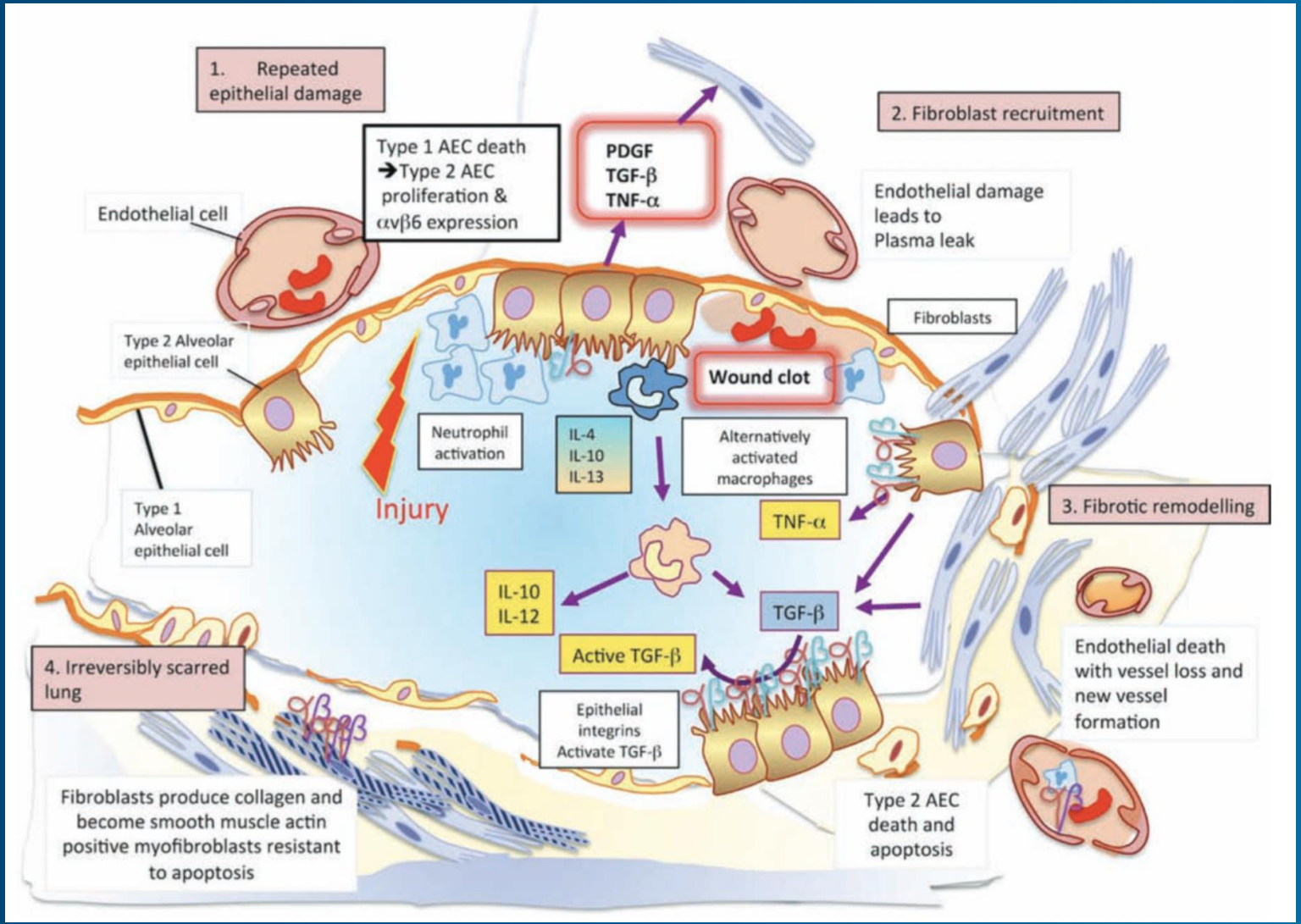
- Environmental or occupational exposures
  - Asbestosis or silicosis
  - “Coal worker’s lung”
  - “Bird breeder’s lung”
  - “Wood worker’s lung”
- Drugs
  - Nitrofurantoin, phenytoin, bleomycin, busulfan, azathioprine, amiodarone
- Connective tissue disorders
- Radiation exposure
- Smoking/Vaping
- Genetics

Pathophysiology of ILD



Mikolasch, Theresia A., Helen S. Garthwaite, and Joanna C. Porter. "Update in diagnosis and management of interstitial lung disease." *Clinical medicine* 17.2 (2017): 146.

Pathophysiology of ILD



Mikolasch, Theresia A., Helen S. Garthwaite, and Joanna C. Porter. "Update in diagnosis and management of interstitial lung disease." *Clinical medicine* 17.2 (2017): 146.

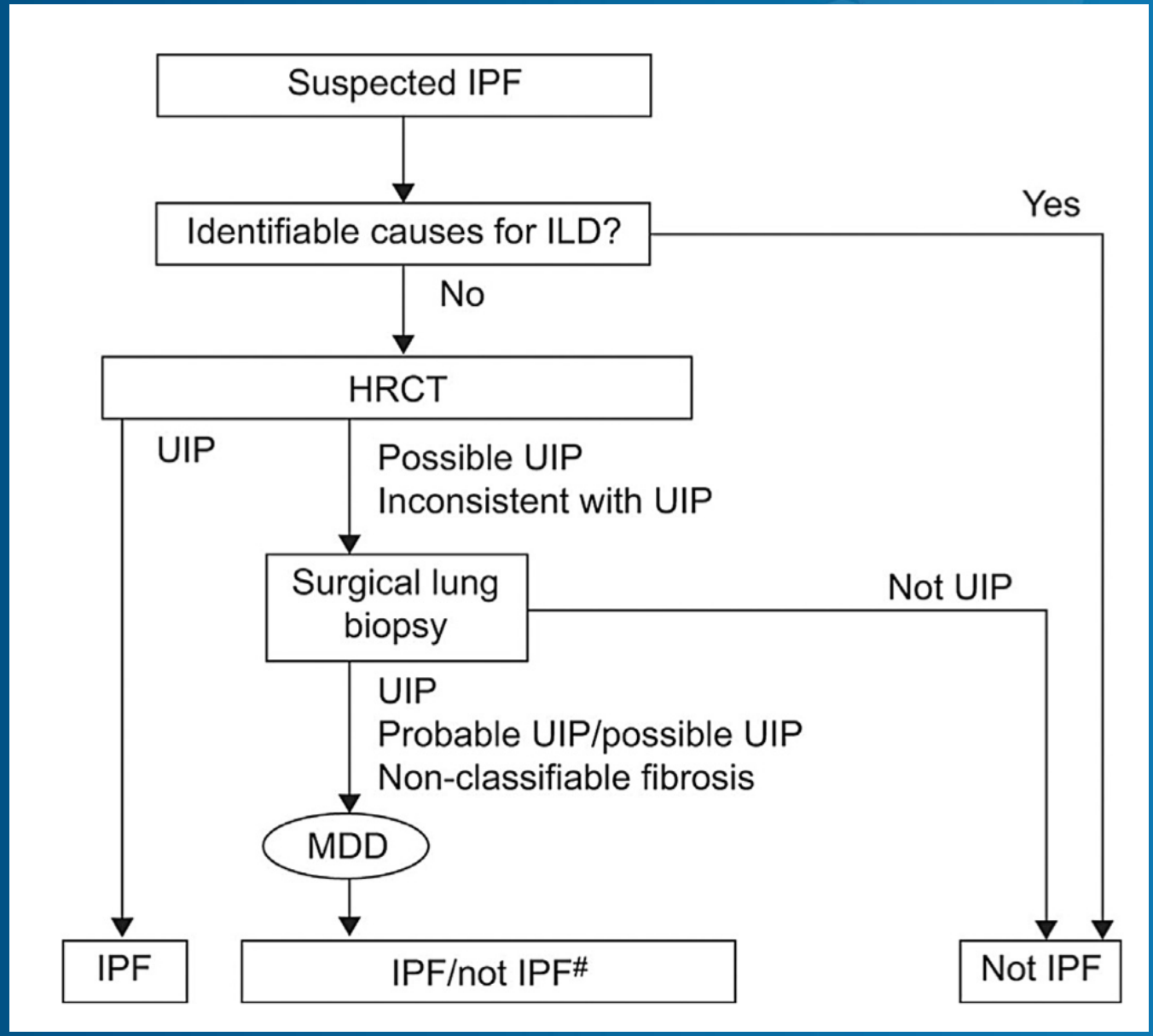
ILD Diagnosis

Major Diagnostic Challenge:

- NON-SPECIFICITY OF SYMPTOMS
- Think of ILD in middle-aged or elderly patients with breathless and/or cough out of proportion to contributory factors (i.e. obesity, COPD)
- Especially if they fail to benefit from regular therapy
- OR if their presumptive diagnosis is NOT fully supported by objective evidence
  - Low lung volumes in someone with “COPD”
  - Lack of obstructive pattern on PFTs

ILD Diagnosis

- ILD is often suspected on the basis of an abnormal chest x-ray
- Review all previous films to assess the rate of change in disease activity
- Remember, chest radiograph is normal in 10% of patients with ILD (particularly those with HP)
- CXR is poorly predictive of histology
- REALLY THE FIRST STEP IN TRIAGE IS IPF OR SOMETHING ELSE
- High resolution CT scan is the GOLD STANDARD



Aiello, Marina, et al. "The earlier, the better: impact of early diagnosis on clinical outcome in idiopathic pulmonary fibrosis." *Pulmonary Pharmacology & Therapeutics* 44 (2017): 7-15.

ILD Diagnosis

Table 2
Histological criteria for usual interstitial pneumonia (UIP) pattern in idiopathic pulmonary fibrosis (IPF).

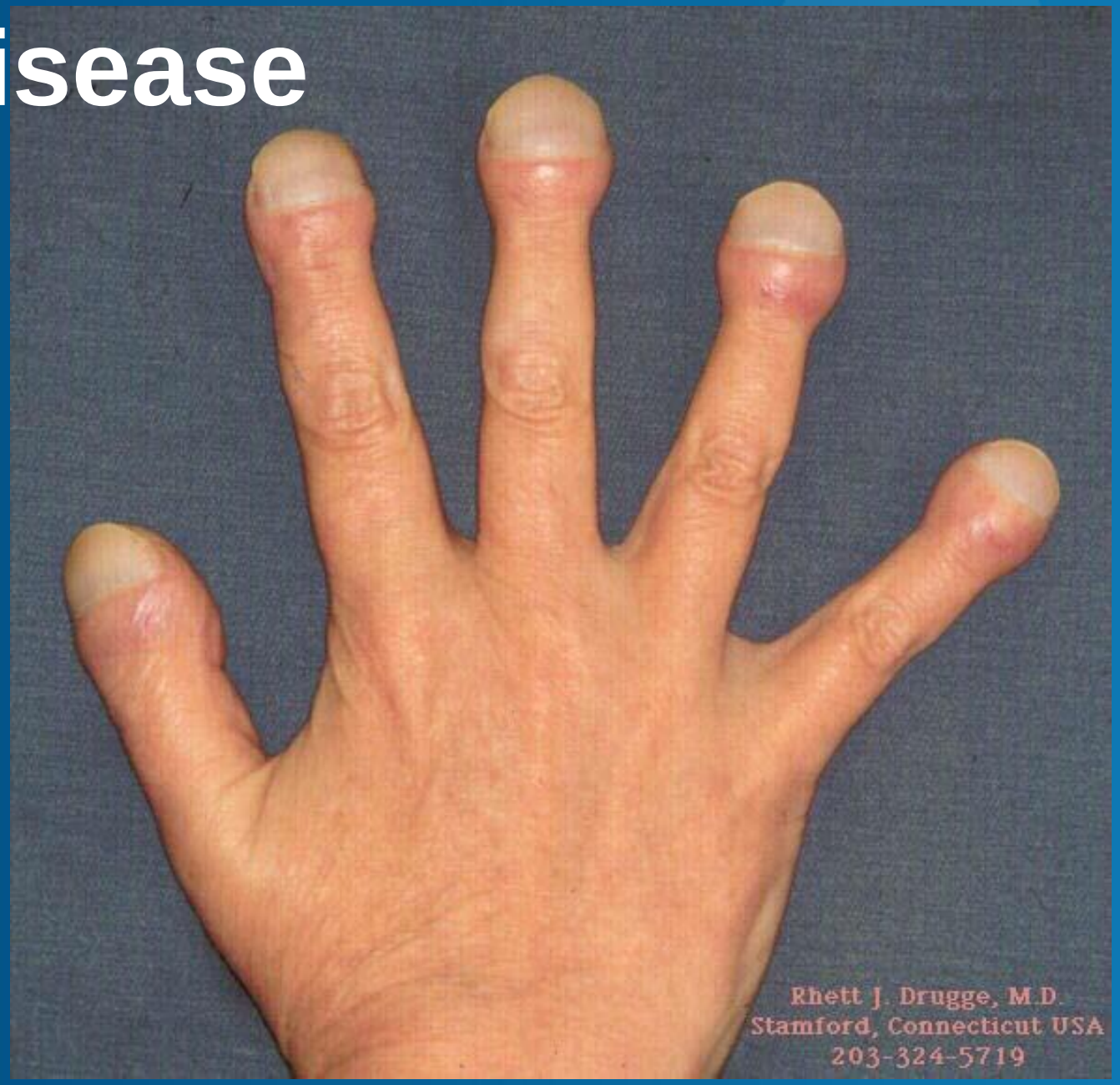
UIP Pattern (All Four Criteria)	Probable UIP Pattern	Possible UIP Pattern (All Three Criteria)	Not UIP Pattern (Any of the Six Criteria)
Evidence of marked fibrosis/ architectural distortion, ± honeycombing in a predominantly subpleural/paraseptal distribution	Evidence of marked fibrosis/ architectural distortion, ± honeycombing	Patchy or diffuse involvement of lung parenchyma by fibrosis, with or without interstitial inflammation	Hyaline membranes[a]
Presence of patchy involvement of lung parenchyma by fibrosis	Absence of either patchy involvement or fibroblastic foci, but not both	Absence of other criteria for UIP (see UIP PATTERN column)	Organizing pneumonia[a,b]
Presence of fibroblast foci	Absence of features against a diagnosis of UIP suggesting an alternate diagnosis (see fourth column) OR	Absence of features against a diagnosis of UIP suggesting an alternate diagnosis (see fourth column)	Granulomas[b]
Absence of features against a diagnosis of UIP suggesting an alternate diagnosis (see fourth column)	Honeycomb changes only[c]		Marked interstitial inflammatory cell infiltrate away from honeycombing Predominant airway centred changes Other features suggestive of an alternate diagnosis

Aiello, Marina, et al. "The earlier, the better: impact of early diagnosis on clinical outcome in idiopathic pulmonary fibrosis." *Pulmonary Pharmacology & Therapeutics* 44 (2017): 7-15.

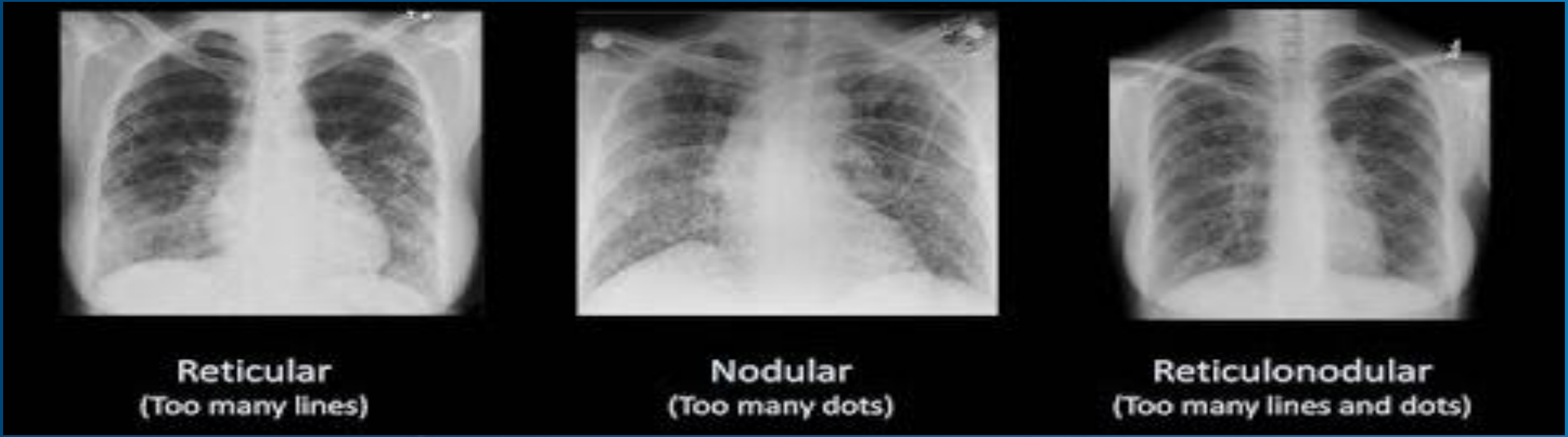
Interstitial Lung Disease

Clinical Manifestations

- Progressive dyspnea with exertion or a persistent dry cough
- Physical exam has little diagnostic specificity
  - Presence or absence of diffuse crackles adds little
  - Clubbing is nonspecific
  - Cyanosis and cor pulmonale are late manifestations
  - Extra thoracic findings are directive but not diagnostic

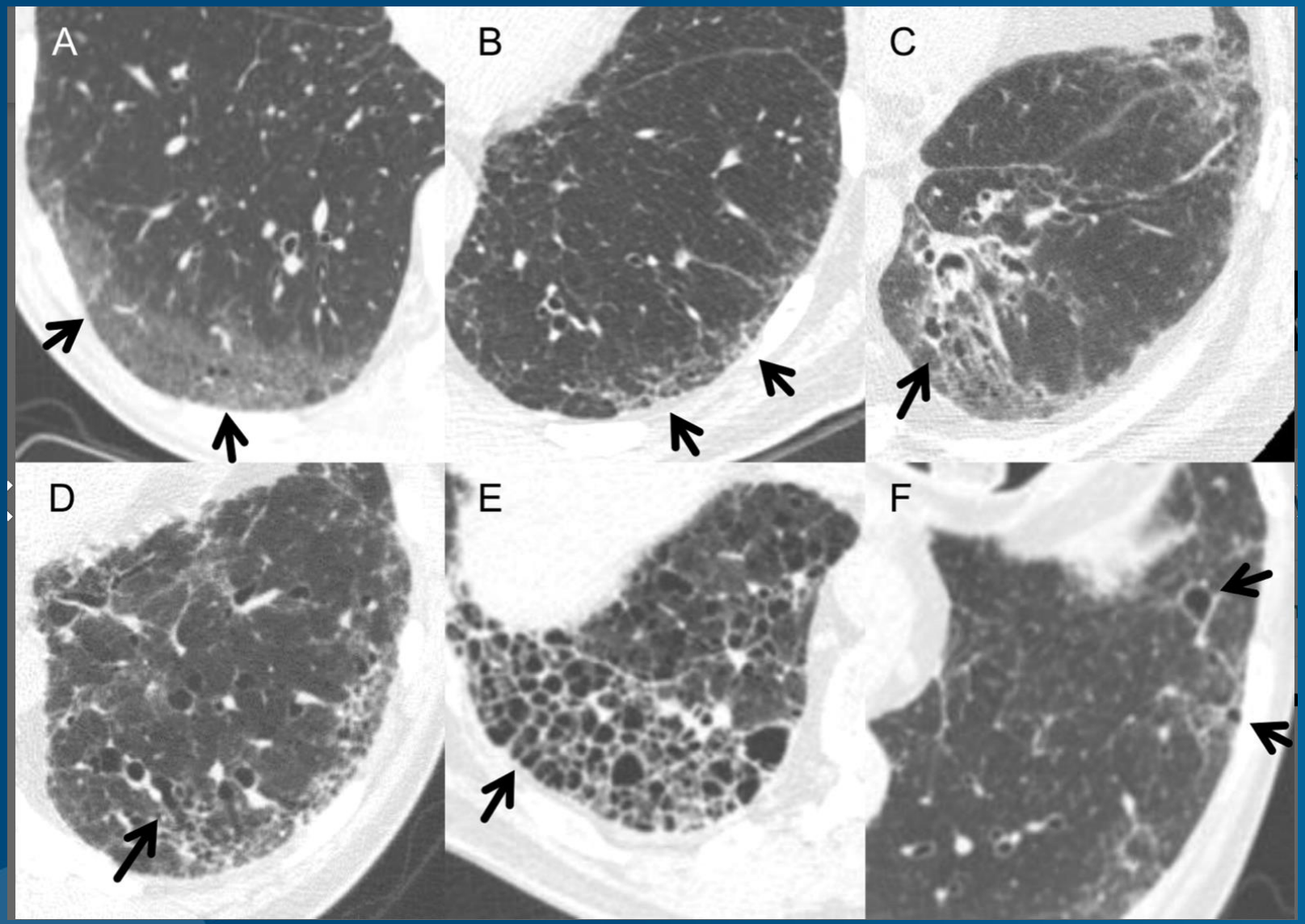


Imaging: Patterns helpful in differential: Chest Xray



Hata, Akinori, et al. "Interstitial lung abnormalities: state of the art." *Radiology* 301.1 (2021): 19-34.

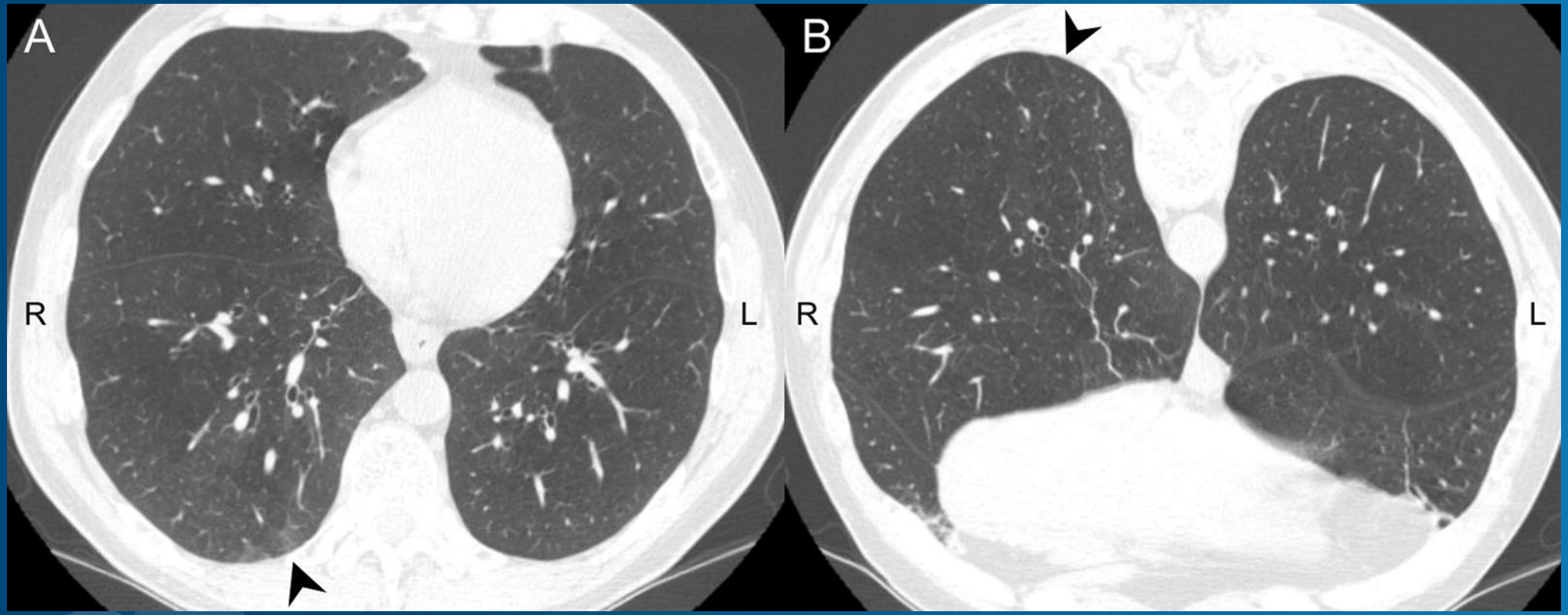
High Resolution CT Chest



A. Ground-glass abnormality
B. Reticular abnormality with ground-glass opacity (arrows) is seen in subpleural area
C. Lung distortion is suggested by volume loss and displacement of bronchi and vessels toward medial side (arrow). Distortion accompanies ground-glass abnormality and traction bronchiectasis.
D. Traction bronchiectasis
E. Honeycombing
F. Nonemphysematous cysts

Hata, Akinori, et al. "Interstitial lung abnormalities: state of the art." *Radiology* 301.1 (2021): 19-34.

Supine versus Prone



Hata, Akinori, et al. "Interstitial lung abnormalities: state of the art." *Radiology* 301.1 (2021): 19-34.

Labs

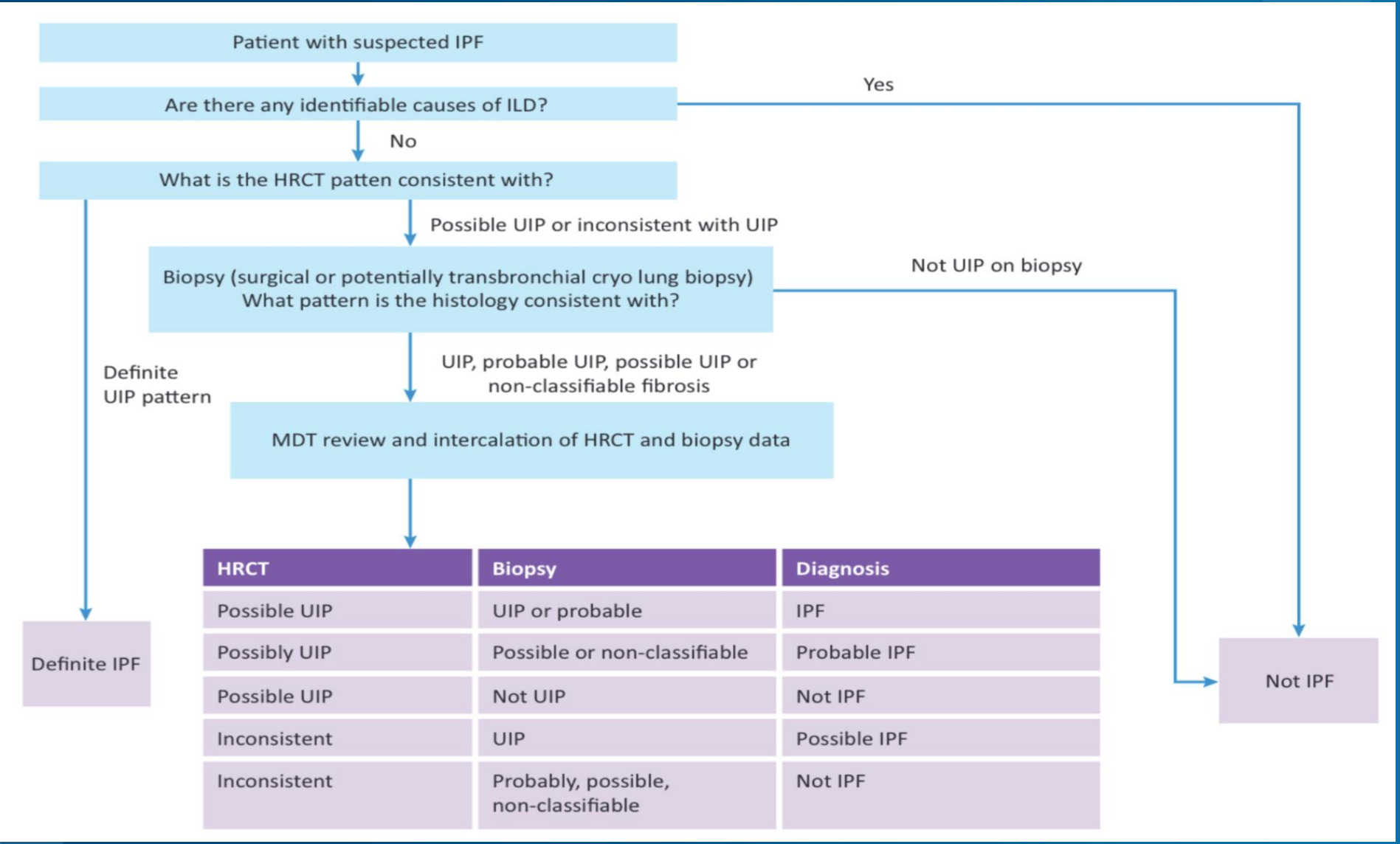
- Peripheral eosinophilia > 10%
  - Chung-Strauss syndrome
  - Acute/Chronic eosinophilic pneumonia
- Abnormal renal function:
  - Pulmonary-renal syndromes ANCA/Anti-GBM
- Connective tissue disease findings:
  - RF/ANA/Anti-DNA
- Precipitating antibodies to specific antigens
  - Hypersensitivity pneumonitis

Table 4 Clues for specific diagnoses from blood and urine testing

Laboratory test	Abnormal result	Suggested disorder
CBC	Microcytic anemia	Occult pulmonary hemorrhage
	Normocytic anemia	CTD, chronic disease
	Leukocytosis	Infection, hematologic malignancy
	Eosinophilia	Eosinophilic pneumonia, drug toxicity
	Thrombocytopenia	CTD, sarcoidosis
Calcium	Hypercalcemia	Sarcoidosis
Creatinine	↑	CTD, pulmonary-renal syndrome, sarcoidosis; amyloidosis
Liver function	↑ GGT, ALT, AST	Sarcoidosis, amyloidosis, CTD (polymyositis)
Urine	Abnormal sediment with RBC casts and/or dysmorphic RBCs	Vasculitis (CTD, PAG, GPS, MPA)
Muscle enzymes	↑Increased CK, aldolase	PM, DM-PM
Angiotensin Converting Enzyme (ACE)	↑	Sarcoidosis (non-specific; can be increased in other ILD)
Lymphocyte proliferation	Stimulated by beryllium	CBD
Serum antibodies	↓ Quantitative immunoglobulins	Immunodeficiency (CVID)
	↑ ANA, RF, anti-CCP	CTD, RA
	↑ C-ANCA	PAG
	↑ P-ANCA	CTD, vasculitis
	↑ anti-GBM	GPS
	Positive specific precipitin	Supportive of HP
	↑ anti-Jo-1 or other anti-synthetase autoantibodies	PM, DM-PM
	↑ SS-A, SS-B	Sjögren's syndrome

Meyer, Keith C. "Diagnosis and management of interstitial lung disease." *Translational respiratory medicine* 2 (2014): 1-13.

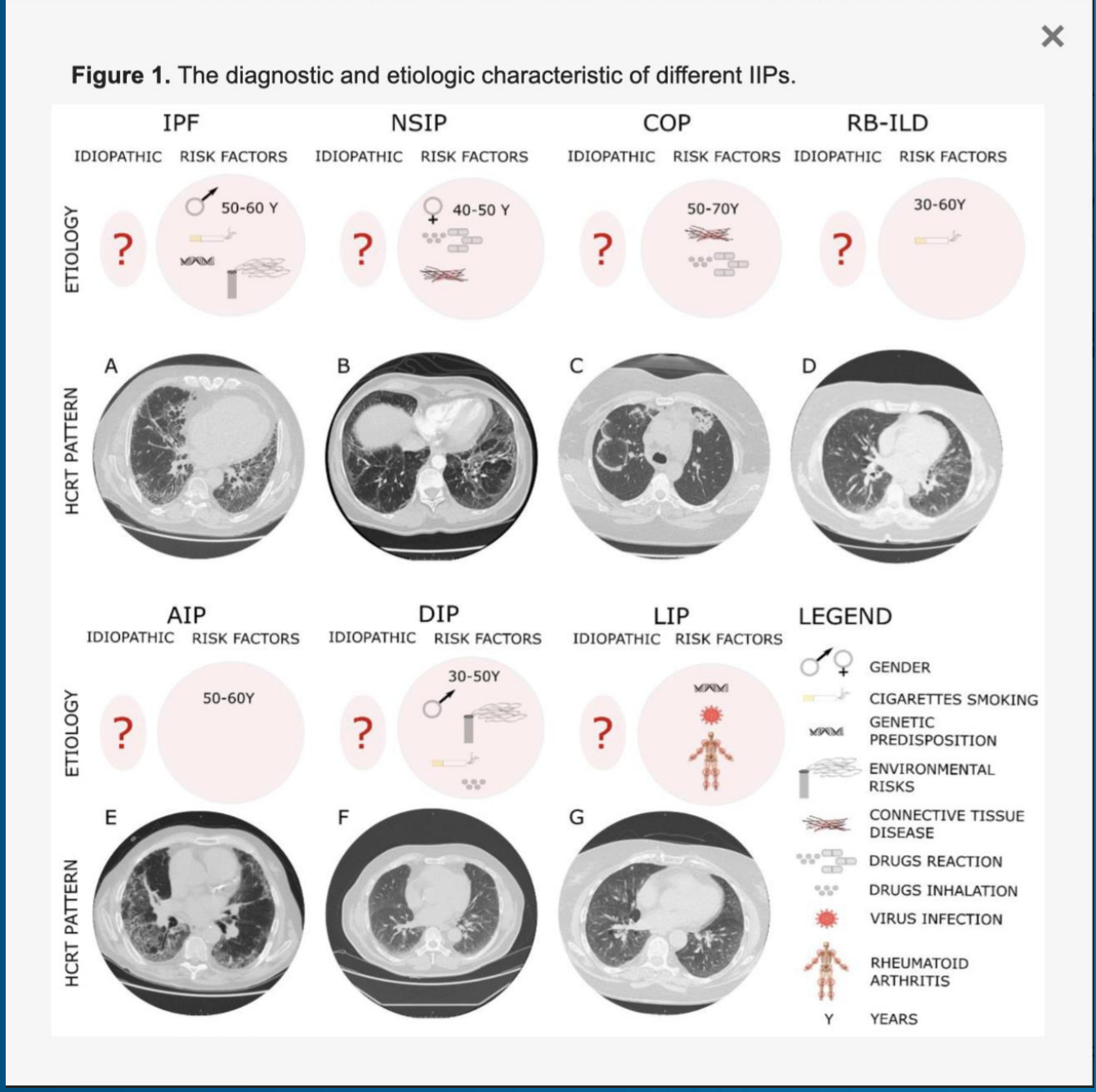
Diagnosis of IPF



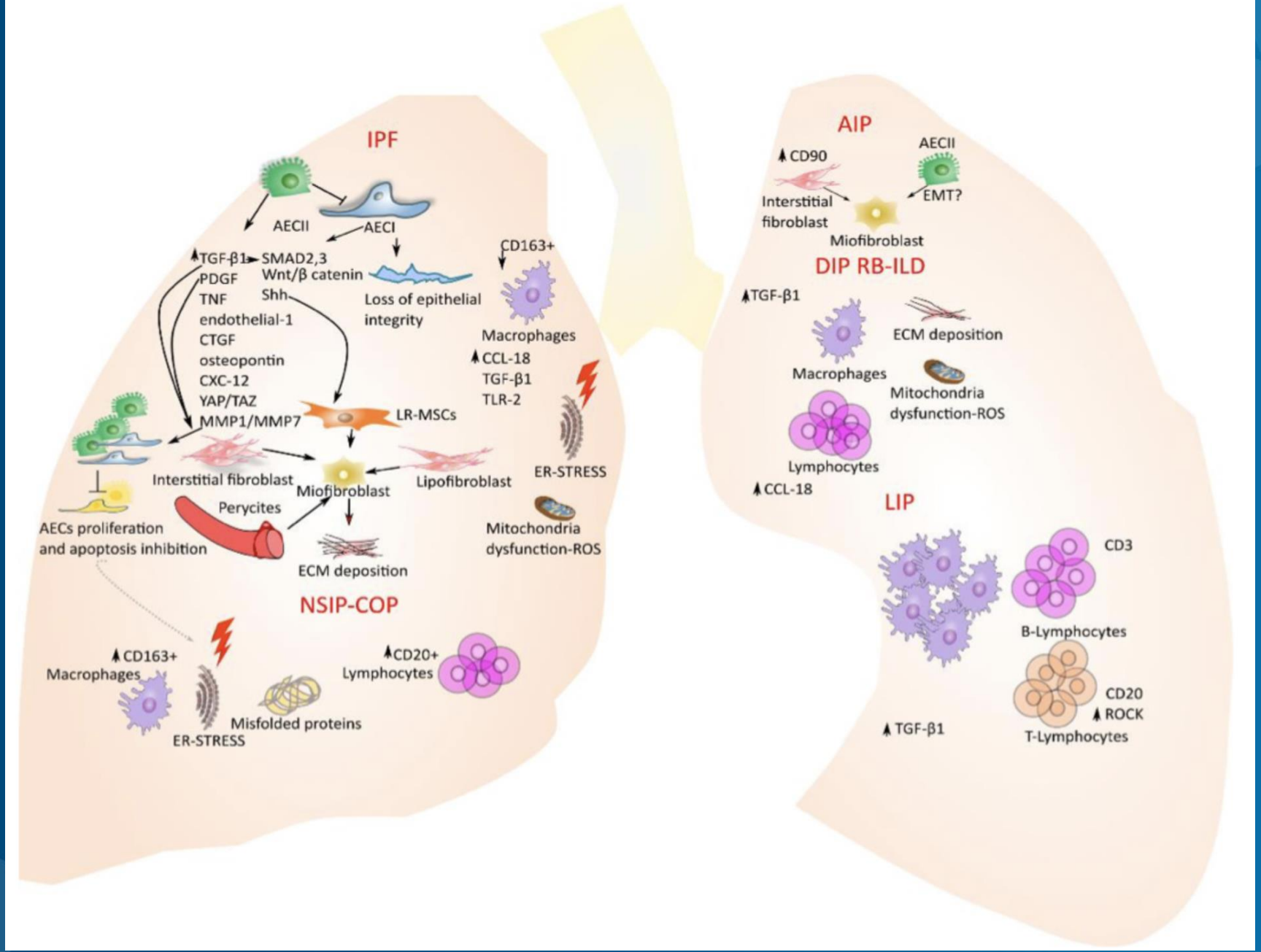
HRCT	Biopsy	Diagnosis
Possible UIP	UIP or probable	IPF
Possibly UIP	Possible or non-classifiable	Probable IPF
Possible UIP	Not UIP	Not IPF
Inconsistent	UIP	Possible IPF
Inconsistent	Probably, possible, non-classifiable	Not IPF

Spagnolo, Paolo, et al. "Early diagnosis of fibrotic interstitial lung disease: challenges and opportunities." *The Lancet Respiratory Medicine* 9.9 (2021): 1065-1076

Diagnosis of IPF



Samarelli, Anna Valeria, et al. "Fibrotic idiopathic interstitial lung disease: The molecular and cellular key players." *International Journal of Molecular Sciences* 22.16 (2021): 8952.



Samarelli, Anna Valeria, et al. "Fibrotic idiopathic interstitial lung disease: The molecular and cellular key players." *International Journal of Molecular Sciences* 22.16 (2021): 8952.

ILD Genetics

TABLE 1 Key findings in publications on genetics in interstitial lung disease.

ILD	Gene	Finding	Method	Study
IPF	*MUC5B, TERC, DSP, TERT*, and *RTEL1*	Variants significantly associated with IPF risk	WGS	4
IPF	*PARN*	Heterozygous mutation associated with IPF risk	Whole exome sequencing	11
IPF	Introns of *KNL1, NPRL3, STMN3* and *RTEL1*. Intergenic variant in 10q25.1	Novel variants associated with IPF risk	GWAS meta-analysis	6
IPF	*PKN2*	Variant in antisense RNA associated with FVC decline	GWAS meta-analysis	7
IPF	*PCSK6*	Variant associated with reduced survival	GWAS	8
IPF and FPF	Rare telomere-related variants	Associated with disease progression and reduced survival	WGS	10
IPF and FPF	*KIF15*	Rare and common variants link nontelomerase pathway of cell proliferation with IPF susceptibility	Gene burden analysis	12
FHP	*MUC5B, IVD, TERC* and *DSP*	Common IPF variants significantly associated with fibrotic HP	Candidate SNP genotyping	5
CHP	*TOLLIP*	Functional changes associated with rapid FVC decline	Candidate SNP genotyping	13
ILA	Mean telomere length	Associated with interstitial lung abnormalities	qPCR and Southern blot analysis	9

Abbreviations: CHP, chronic hypersensitivity pneumonitis; FHP, fibrotic hypersensitivity pneumonitis; FPF, familial pulmonary fibrosis; FVC, forced vital capacity; GWAS, genome wide association studies; IPF, idiopathic pulmonary fibrosis; qPCR, quantitative polymerase chain reaction; SNP, single nucleotide polymorphism; WGS, whole genome sequencing.

Smith, David JF, and R. Gisli Jenkins. "Contemporary Concise Review 2022: Interstitial lung disease." *Respirology* 28.7 (2023): 627-635.

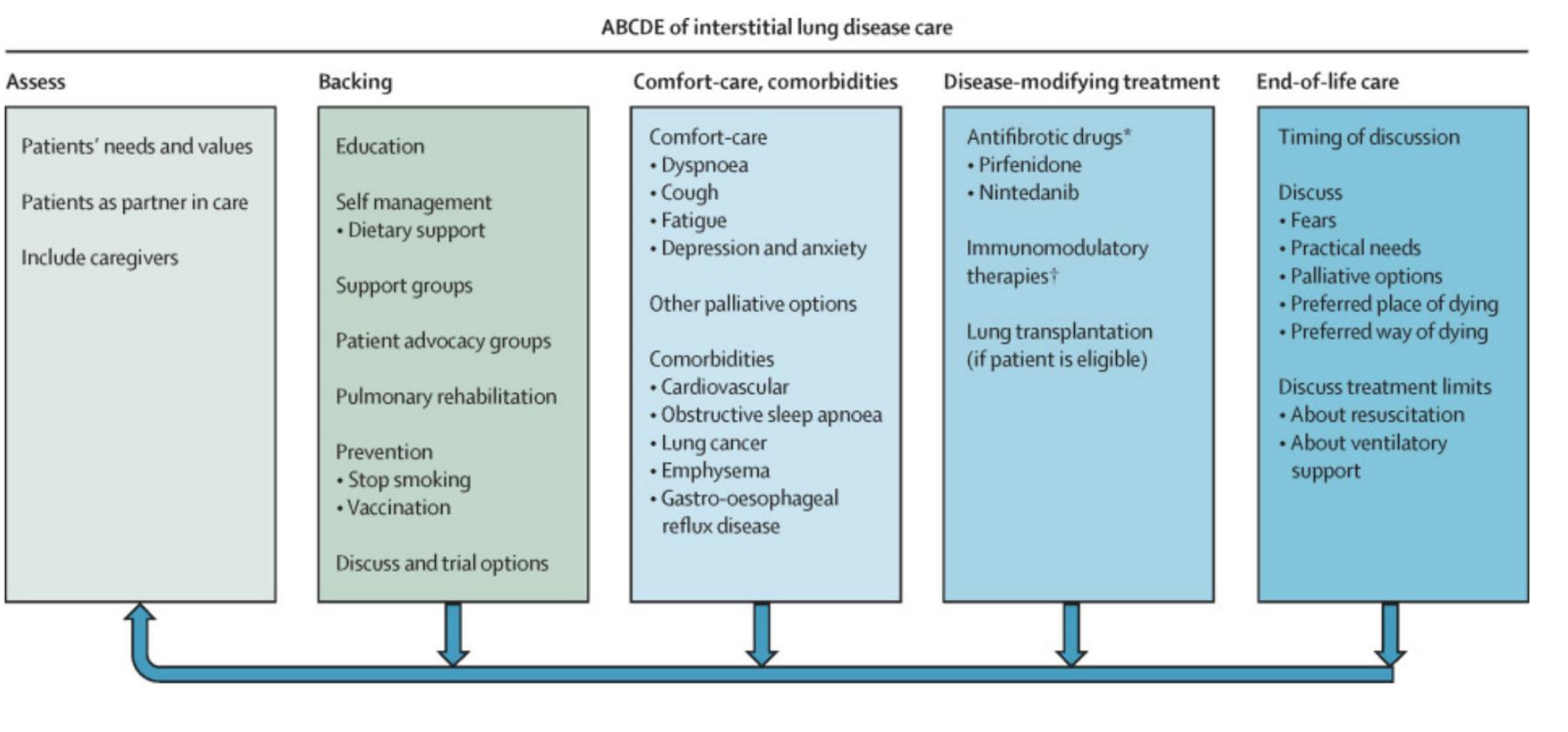
ILD Biomarkers

ILD	Marker	Association	Study
Non-CTD fibrotic ILDs	RF and anti-CCP	Not associated with improved outcomes or treatment response	37
IPF	OPN, MMP7, ICAM1, POSTN	Progression and mortality	38
IPF	MMP-7	Worse mortality and disease progression	39
IPF	ccf-dsDNA	Rapid progression of disease. Associated with amino acid, energy and lipid metabolism in IPF	40
IPF	CYFRA 21-1	Localizes to hyperplastic epithelium. Higher in IPF. Predictive of progression and mortality	41
IPF	FUT3	Lower risk of developing IPF	42
PFILD	PLAUR, ITGB6, SPON1, HGF, PRSS8, KRT19 and 11 others	Associated with PFILD	43

Abbreviations: CTD: connective tissue disease; ILD, interstitial lung disease; IPF, idiopathic pulmonary fibrosis; PFILD, progressive fibrosing ILD.

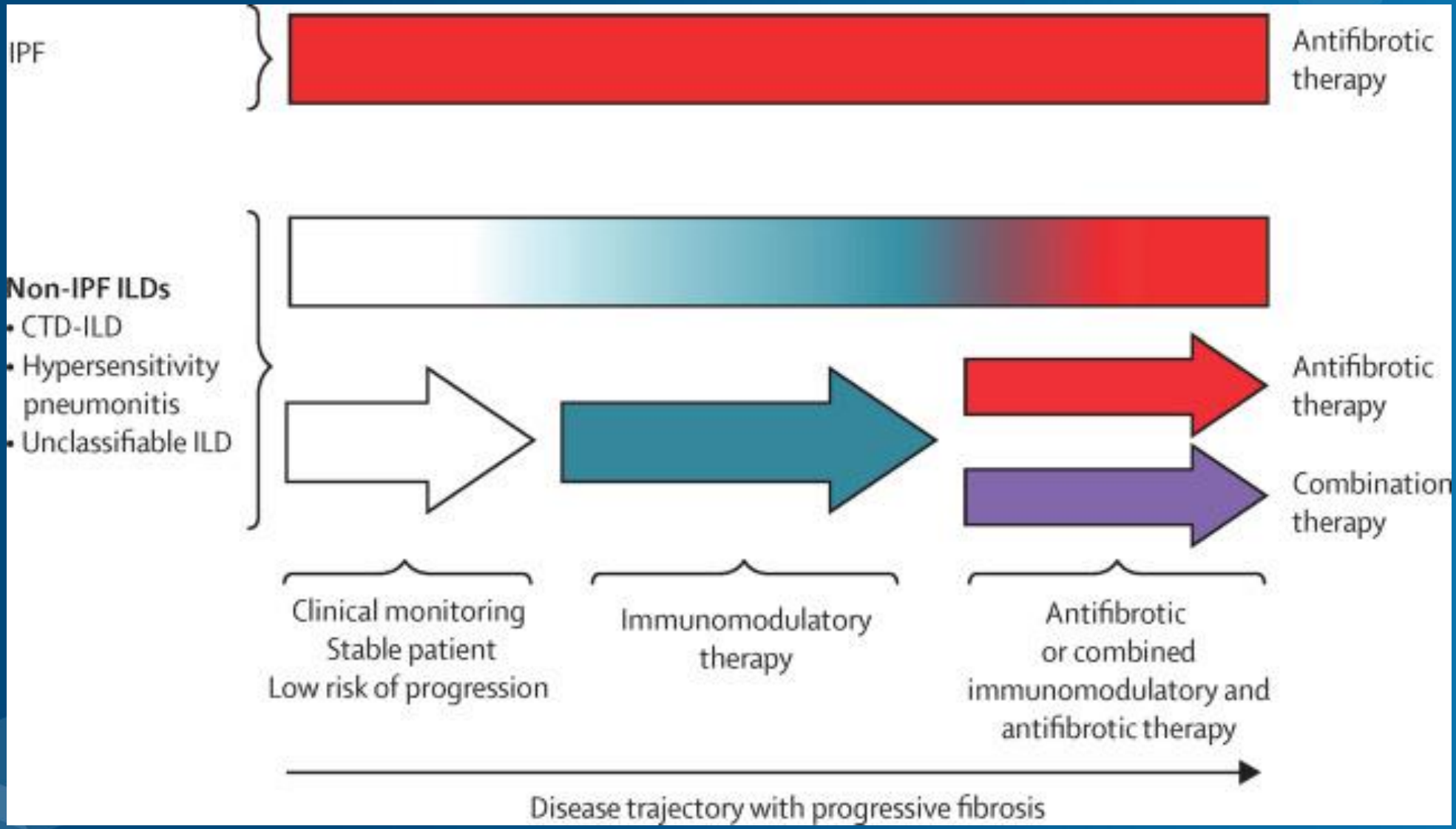
Smith, David JF, and R. Gisli Jenkins. "Contemporary Concise Review 2022: Interstitial lung disease." *Respirology* 28.7 (2023): 627-635.

ILD Management



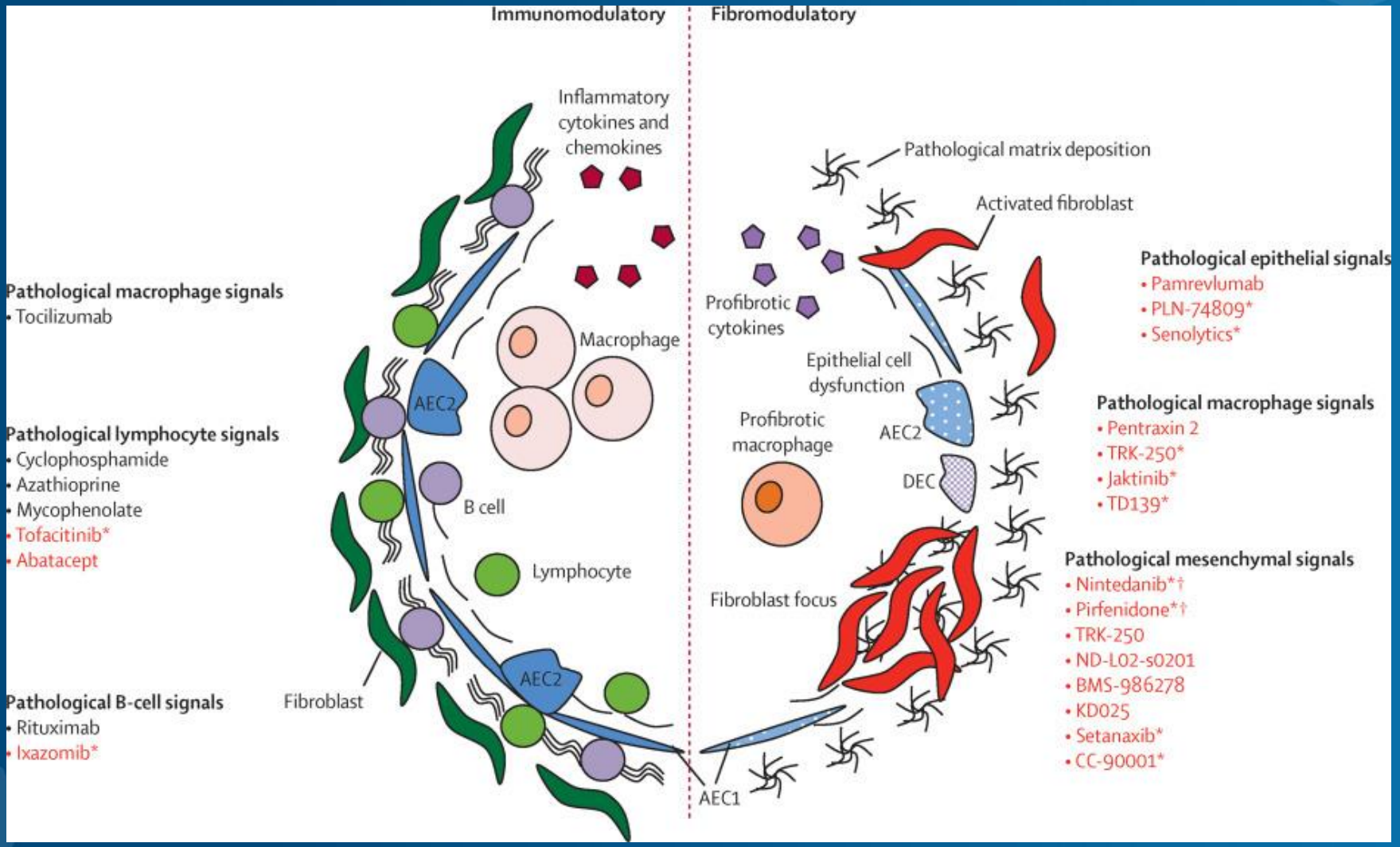
Kreuter, Michael, et al. "Palliative care in interstitial lung disease: living well." *The Lancet Respiratory Medicine* 5.12 (2017): 968-980.

ILD Treatment



Johannson, Kerri A., et al. "Treatment of fibrotic interstitial lung disease: current approaches and future directions." *The Lancet* 398.10309 (2021): 1450-1460.

ILD Treatment



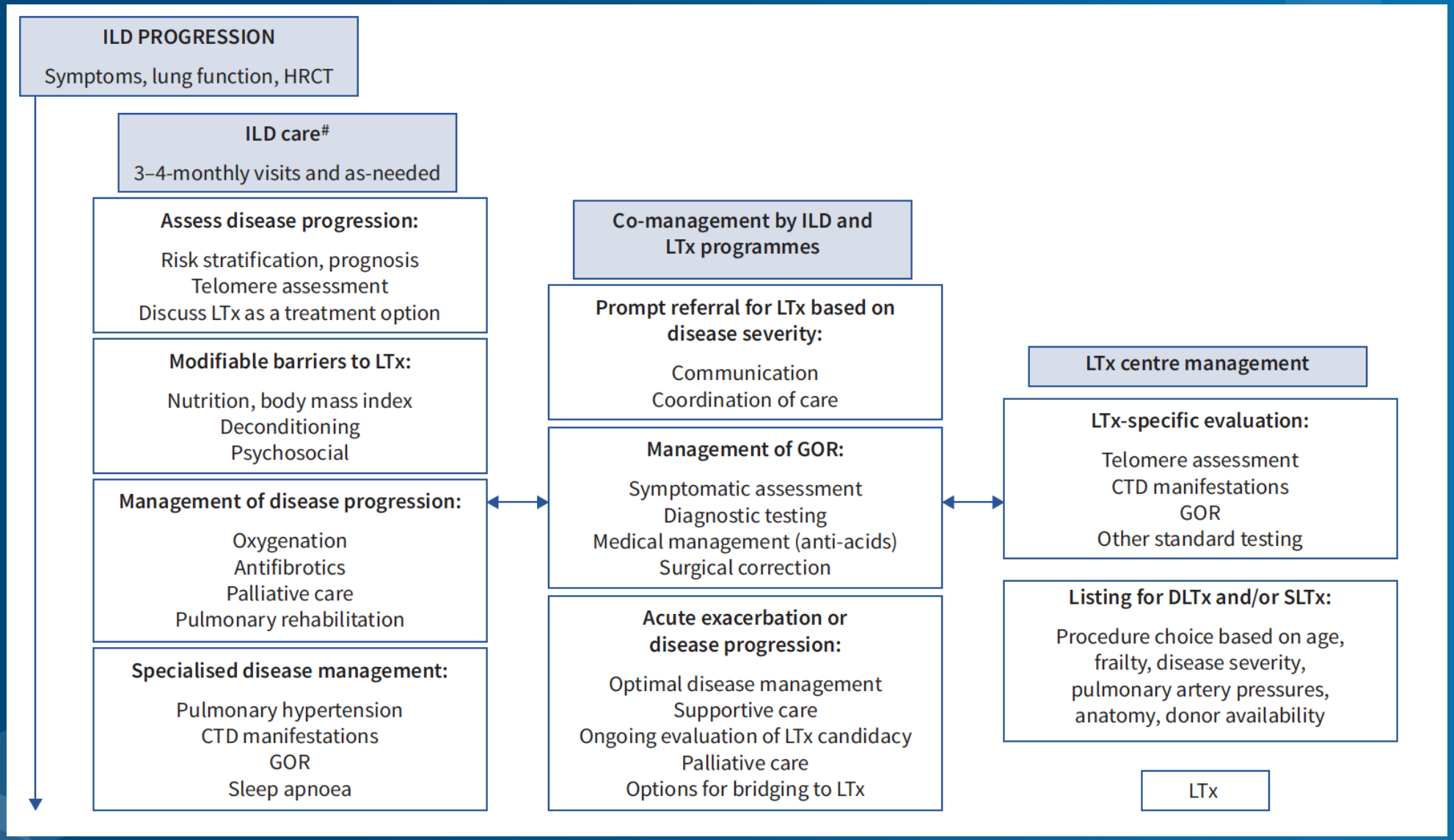
Johannson, Kerri A., et al. "Treatment of fibrotic interstitial lung disease: current approaches and future directions." *The Lancet* 398.10309 (2021): 1450-1460.

Criteria for referral and listing for lung transplantation in patients with interstitial lung disease (ILD)

Timing of Transplant Referral	Timing of Transplant Listing
Histopathological UIP	*Hospitalization for respiratory decline, pneumothorax or acute exacerbation*
Radiographic probable or definite UIP pattern	*Desaturation to <88% on 6MWT or >50 m decline in 6MWD over 6 months*
FVC <80% or DLCO <40% pred	*Pulmonary hypertension on right heart catheterization or echocardiography*
Relative decline in pulmonary function over the past 2 years: *FVC ⩾10% or* *DLCO ⩾15% or* *FVC ⩾5%* *with symptomatic or radiographic progression*	*Absolute decline in pulmonary function over the past 6 months despite appropriate treatment:* *FVC >10% or* *DLCO >10% or* *FVC >5% with radiographic progression*
Any resting or exertional oxygen requirement	
For inflammatory ILDs, disease progression despite treatment	

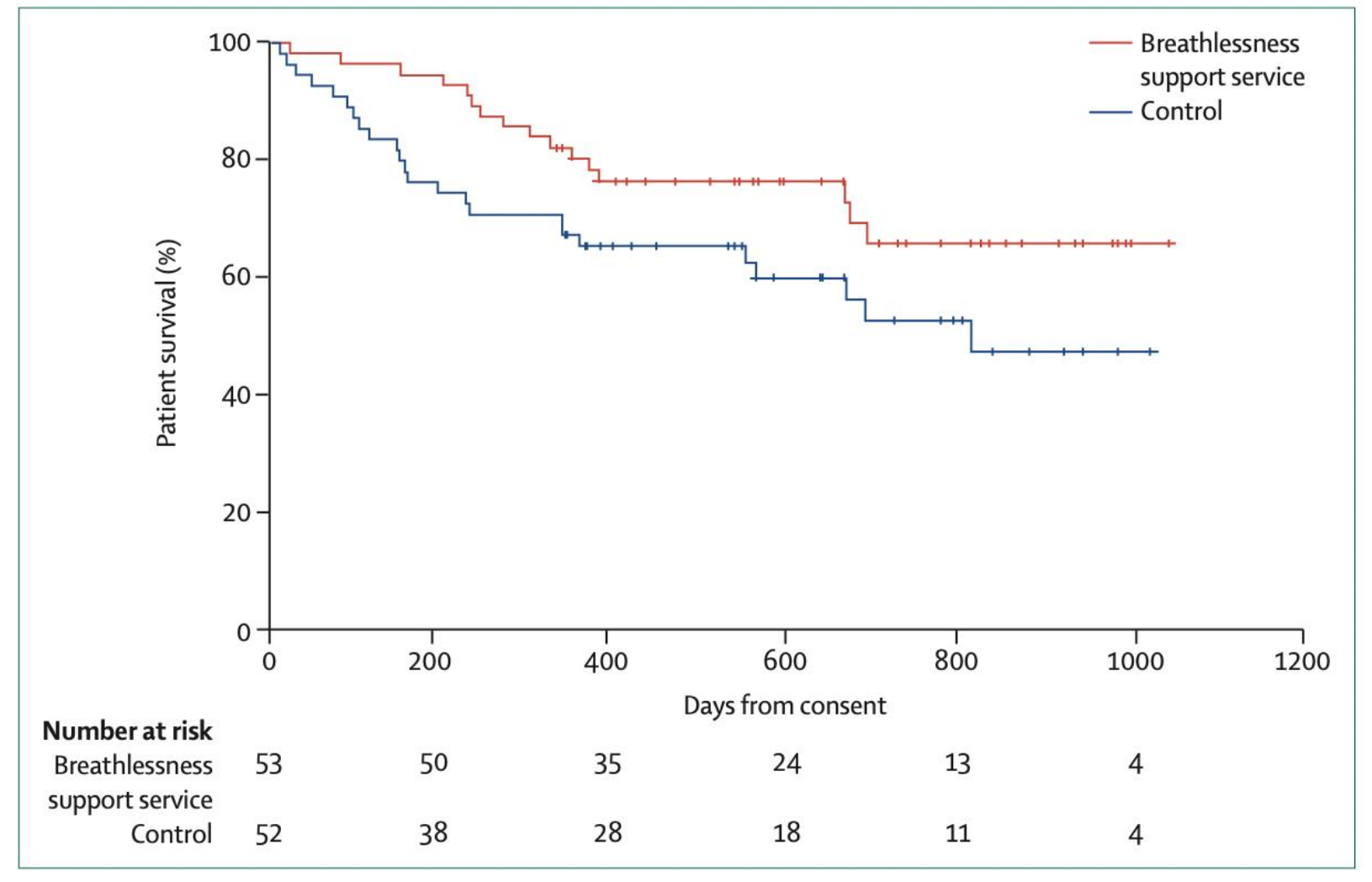
Kapnadak, Siddhartha G., and Ganesh Raghu. "Lung transplantation for interstitial lung disease." *European Respiratory Review* 30.161 (2021).

Lung transplantation in ILD



Kapnadak, Siddhartha G., and Ganesh Raghu. "Lung transplantation for interstitial lung disease." *European Respiratory Review* 30.161 (2021).

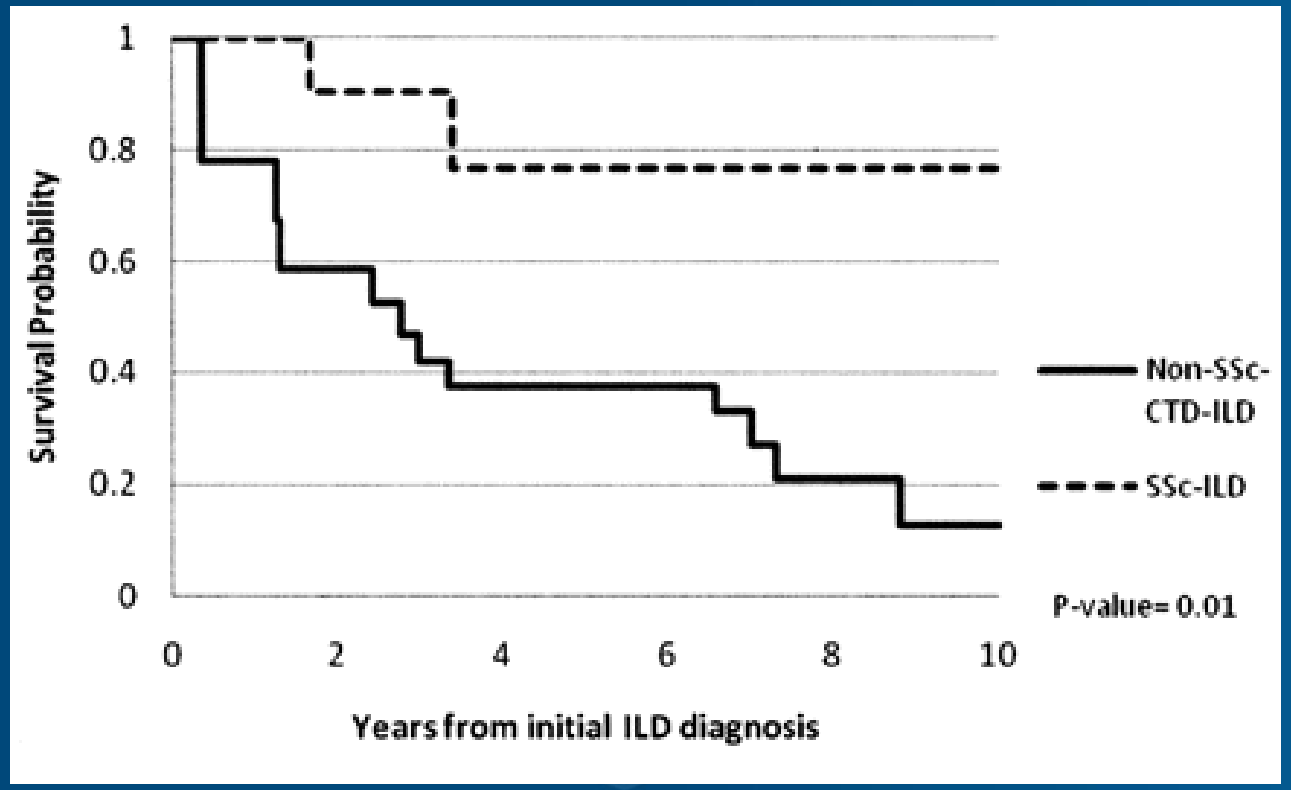
ILD Palliative Care



Kreuter, Michael, et al. "Palliative care in interstitial lung disease: living well." *The Lancet Respiratory Medicine* 5.12 (2017): 968-980.

SOME FLAVORS OF ILD

ILD and Connective Tissue Disease



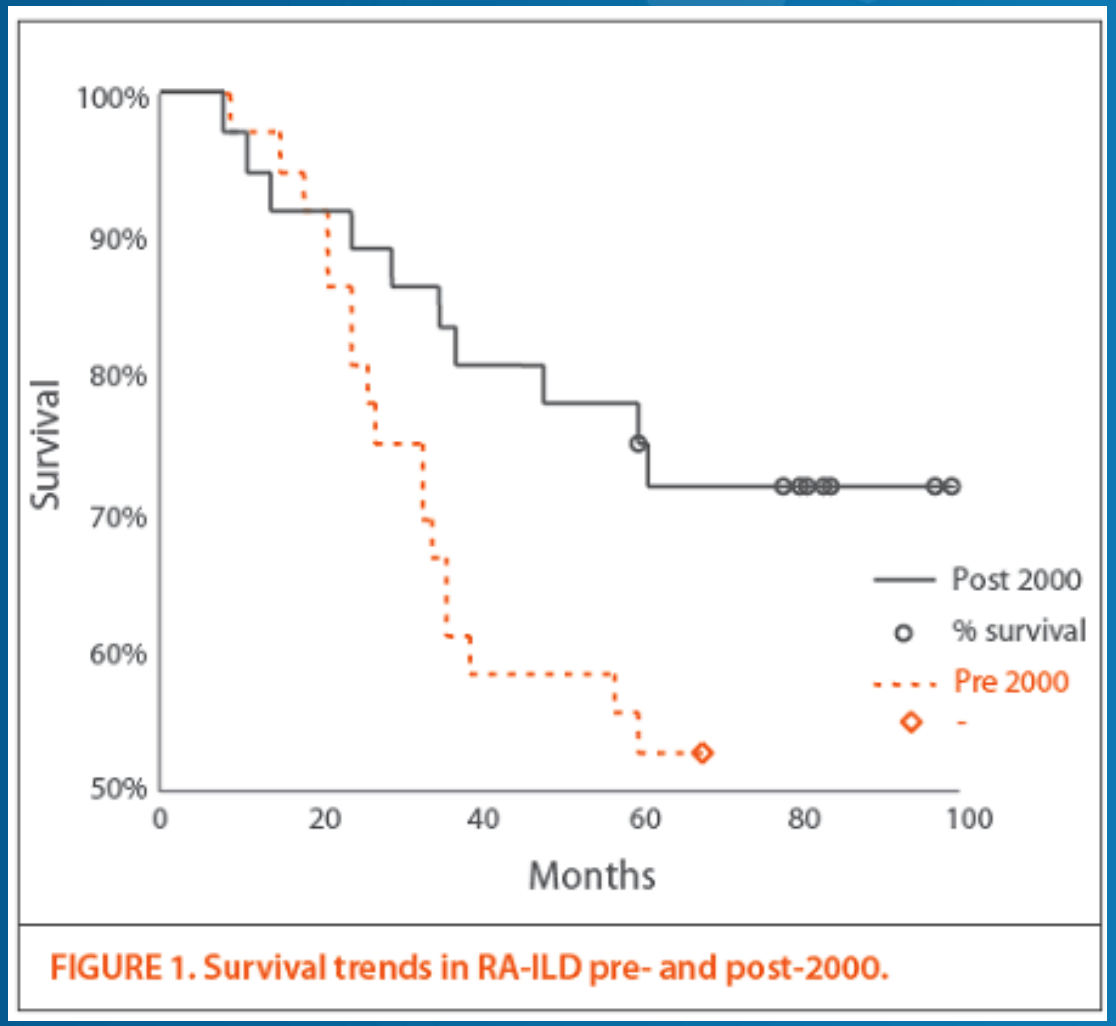


FIGURE 1. Survival trends in RA-ILD pre- and post-2000.

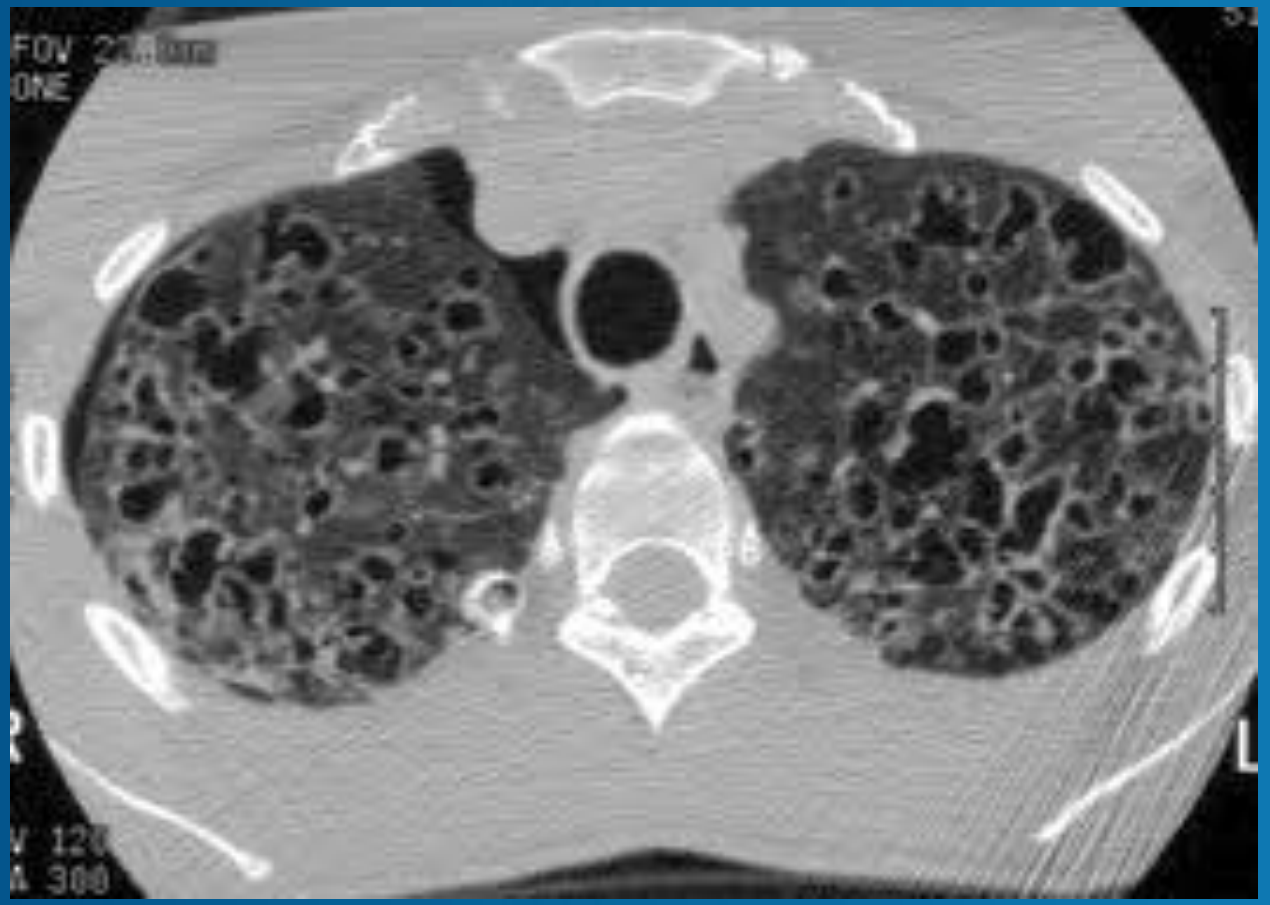
Pre/Post Disease Modifying Drugs

Chung et al. The Journal of Rheumatology vol. 38 no. 4 693-701 (2011)

Chan et al. Reports on the Rheumatic Diseases | Series 7 | Summer 2013 | Topical Reviews No 3

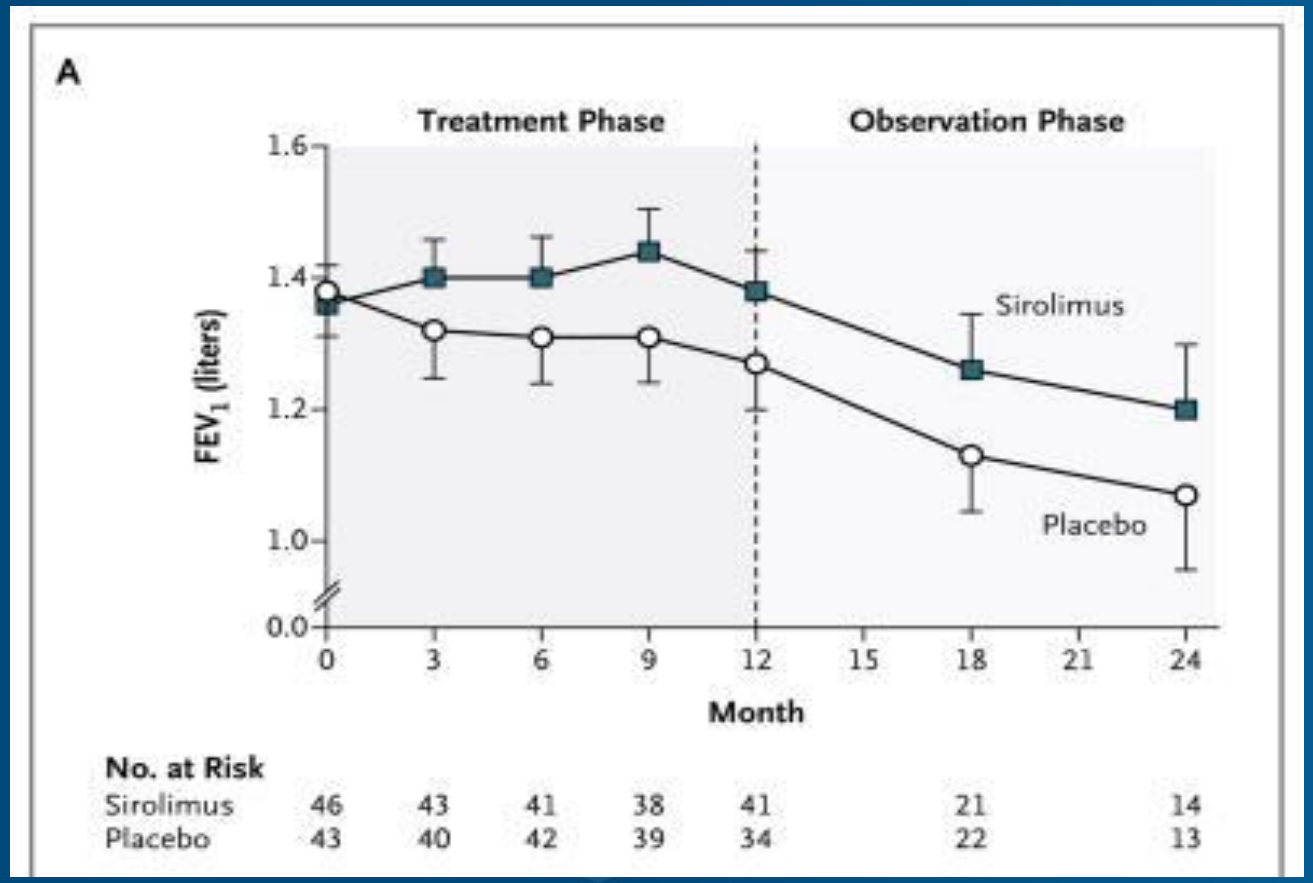
Rapamune (Sirolimus) for Lymphangioleiomyomatosis (LAM)

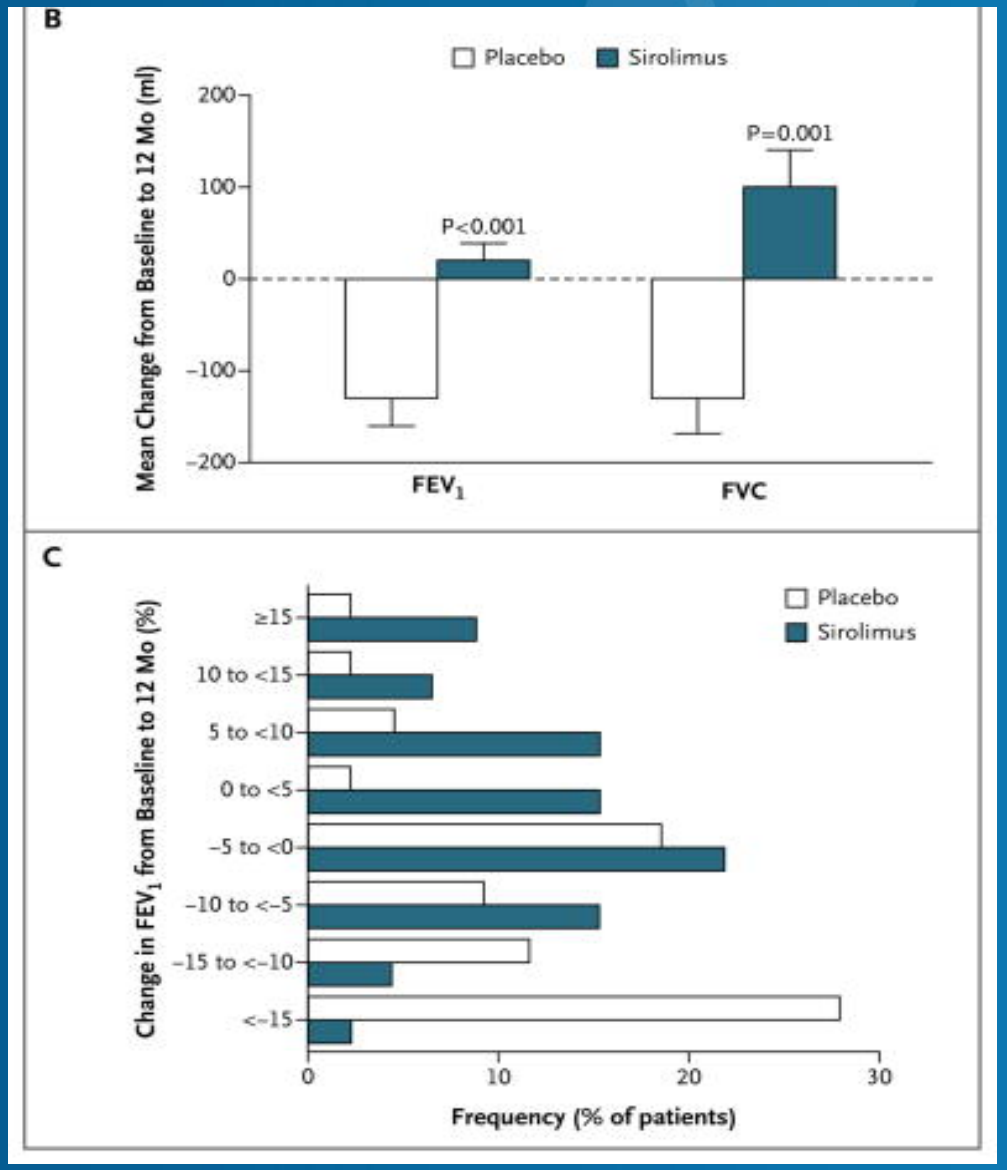
- Uncommon (3-7 per 1 million women)
- Average age of diagnosis 35 years
- Associated with cystic destruction of the lung, chylous pleural effusions, and abdominal tumors such as renal angiomyolipomas.
- 30 to 40% of women with tuberous sclerosis complex (TSC) have LAM
- Clinically, respiratory impairment, recurrent pneumothoraxes, and hypoxemia develop in most patients within a decade after the onset of symptoms



Lynch et al. N Engl J Med. 2011 Apr 28; 364(17): 1595–1606
https://www.thelamfoundation.org/learn-about-lam/what-is-lam/

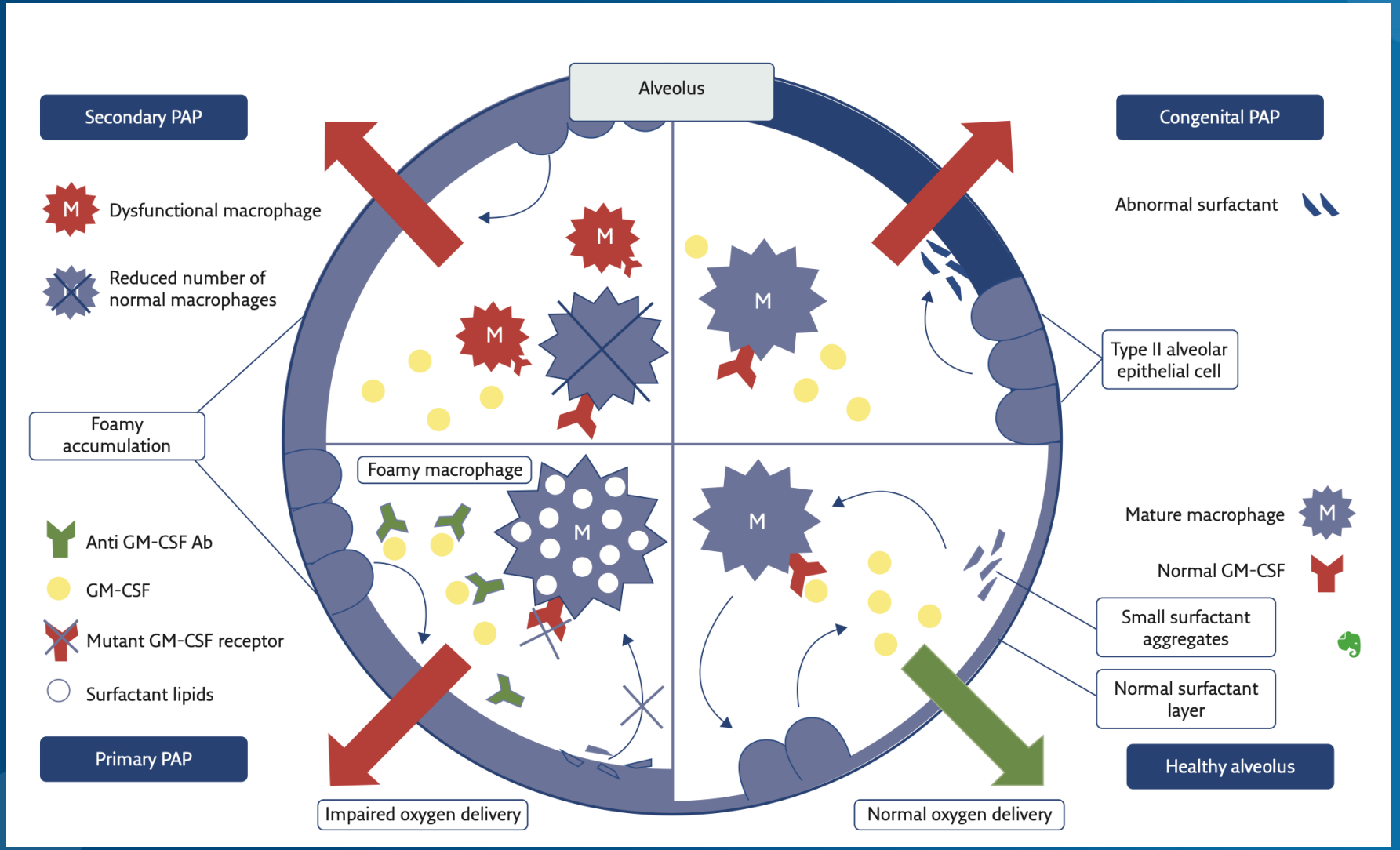
Rapamune in LAM





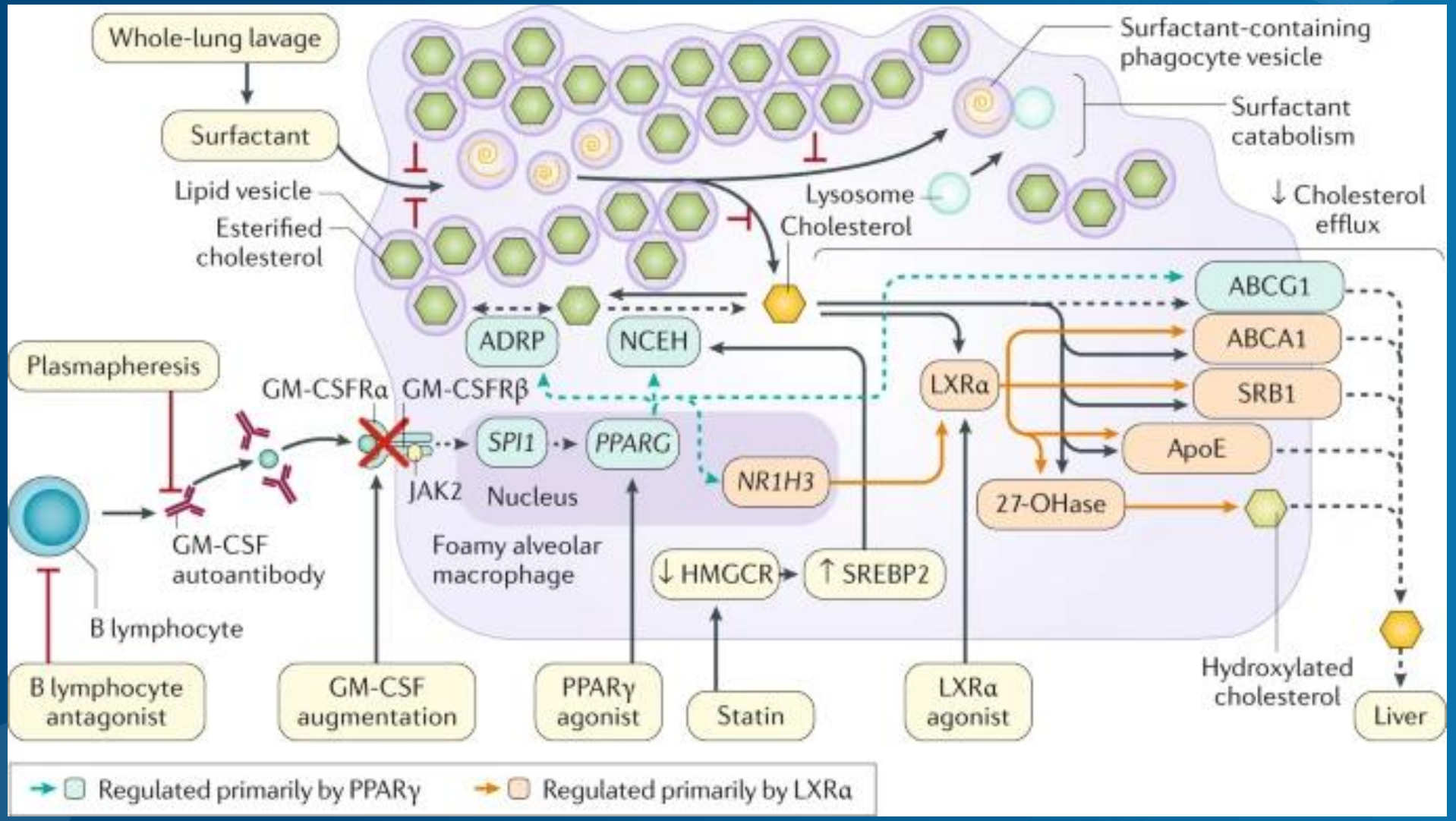
Lynch et al. N Engl J Med. 2011 Apr 28; 364(17): 1595–1606

Pulmonary Alveolar Proteinosis PAP



Salvaterra, Elena, and Ilaria Campo. "Pulmonary alveolar proteinosis: from classification to therapy." *Breathe* 16.2 (2020).
Ataya, Ali, et al. "The role of GM-CSF autoantibodies in infection and autoimmune pulmonary alveolar proteinosis: a concise review." *Frontiers in Immunology* 12 (2021): 752856.

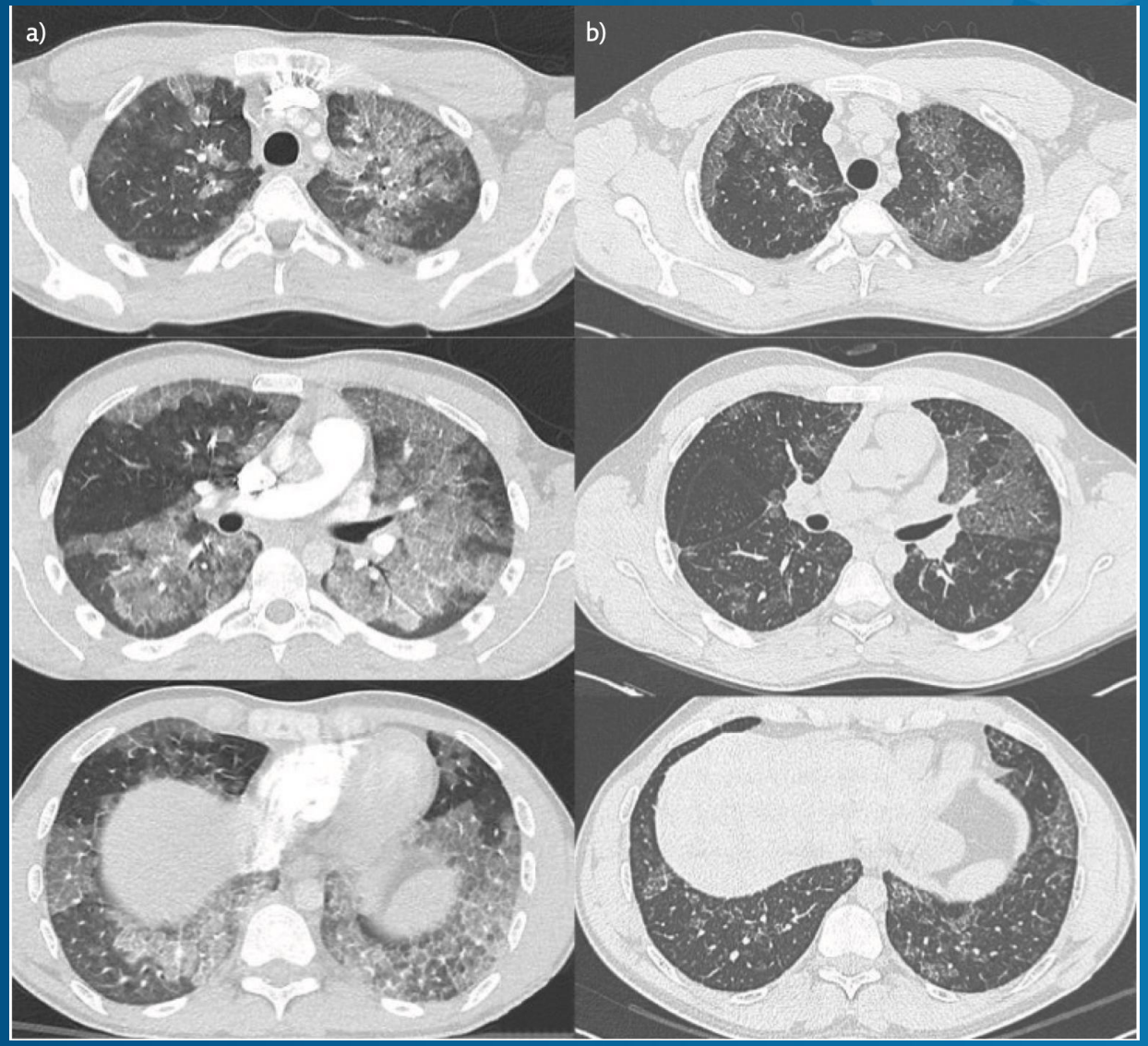
Pulmonary Alveolar Proteinosis PAP



Trapnell, Bruce C., et al. "Pulmonary alveolar proteinosis." *Nature Reviews Disease Primers* 5.1 (2019): 16.

Pulmonary Alveolar Proteinosis PAP “Crazy Paving”

Pre and Post Whole Lung Lavage



Salvaterra, Elena, and Ilaria Campo. "Pulmonary alveolar proteinosis: from classification to therapy." *Breathe* 16.2 (2020).

Sarcoidosis: “A Common Uncommon Disease”

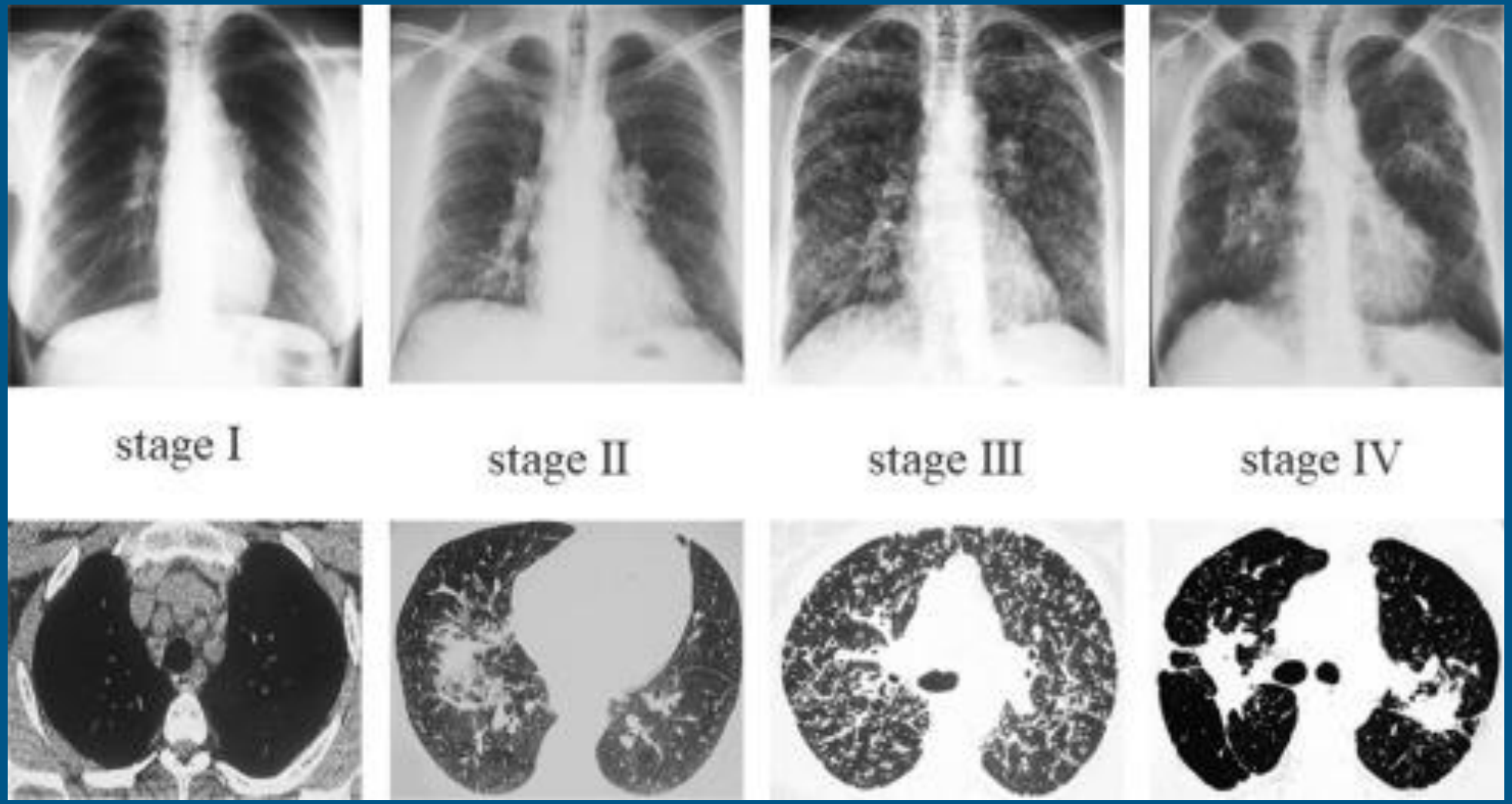
F:M 60:40
African American Female
LifeTime Risk 2.7%
20-40 years old: 50-100 / 100,000 per yr
Black Women’s Health Study
Prevalence 1.6% (1023/59,000)
Annual incidence 70/100,000

Incidence

Sarcoid	50 / 100,000
IPF	15 / 100,000
SLE	40 / 100,000

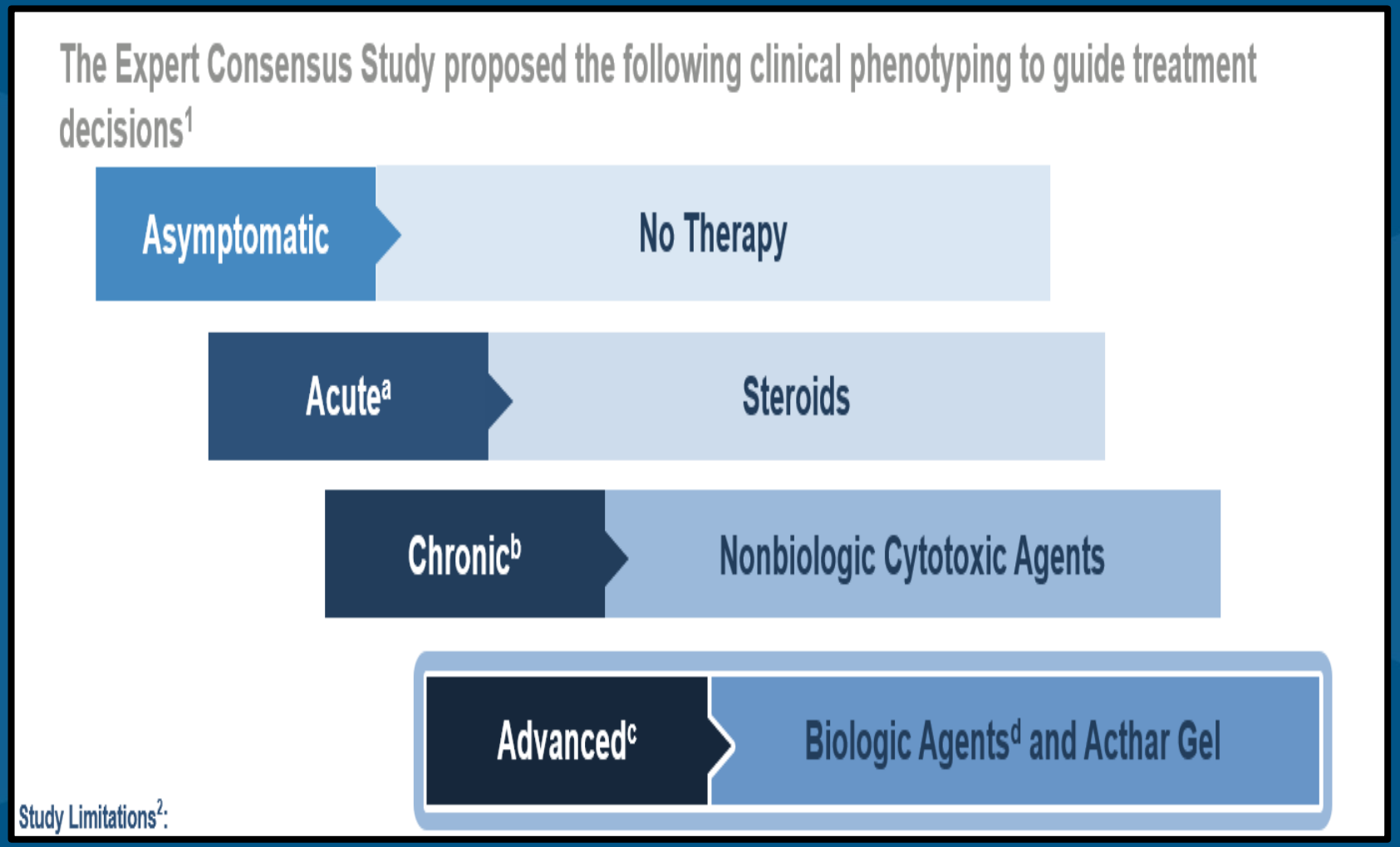
Arkema, Elizabeth V., and Yvette C. Cozier. "Sarcoidosis epidemiology: recent estimates of incidence, prevalence and risk factors." *Current opinion in pulmonary medicine* 26.5 (2020): 527.

Sarcoidosis



Baughman, Robert P., and Elyse E. Lower. "The lung in autoimmune diseases: sarcoidosis." *Handbook of Systemic Autoimmune Diseases*. Vol. 17. Elsevier, 2022. 169-188.

Treatment of Sarcoidosis:



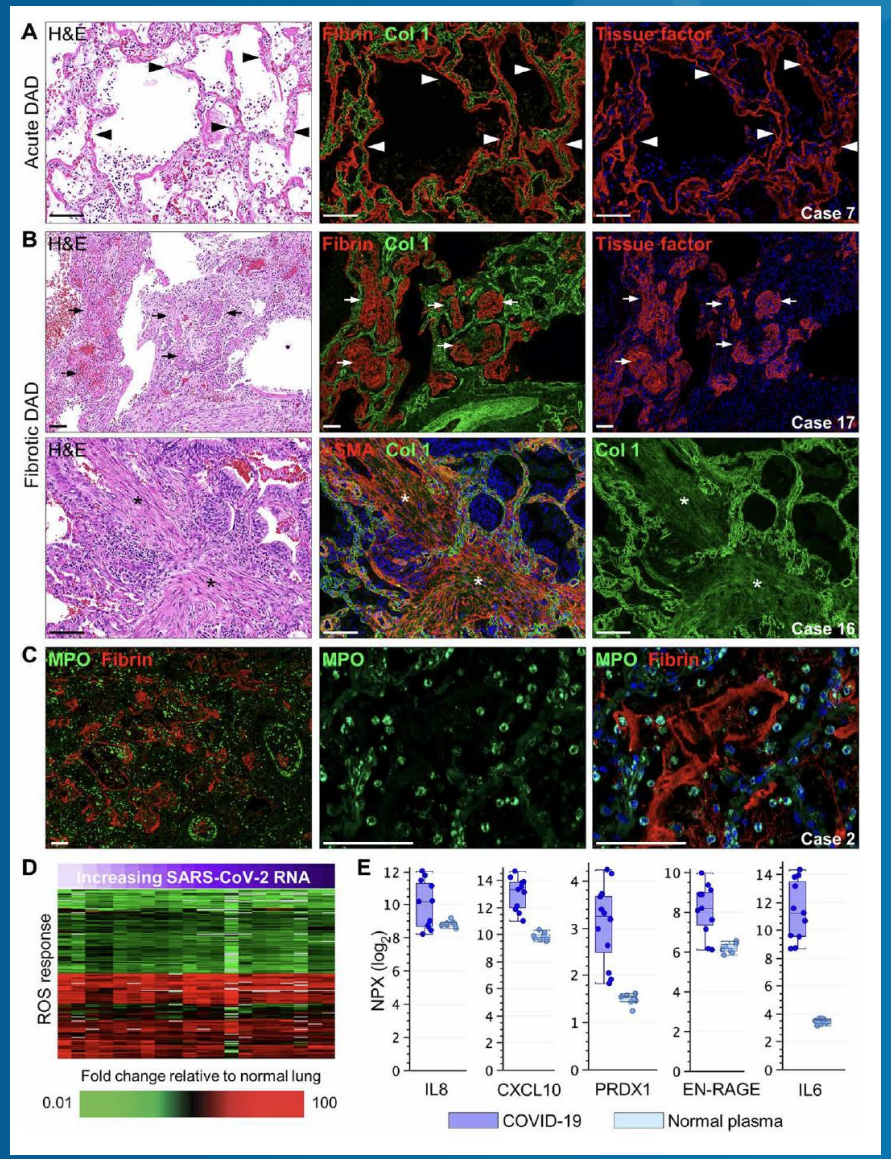
Crouser, Elliott D., et al. "Diagnosis and detection of sarcoidosis. An official American Thoracic Society clinical practice guideline." *American journal of respiratory and critical care medicine* 201.8 (2020): e26-e51

Acute Interstitial Pneumonia and Diffuse Alveolar Damage (AIP/DAD)

60% mortality, with most deaths occur within the first 6 months

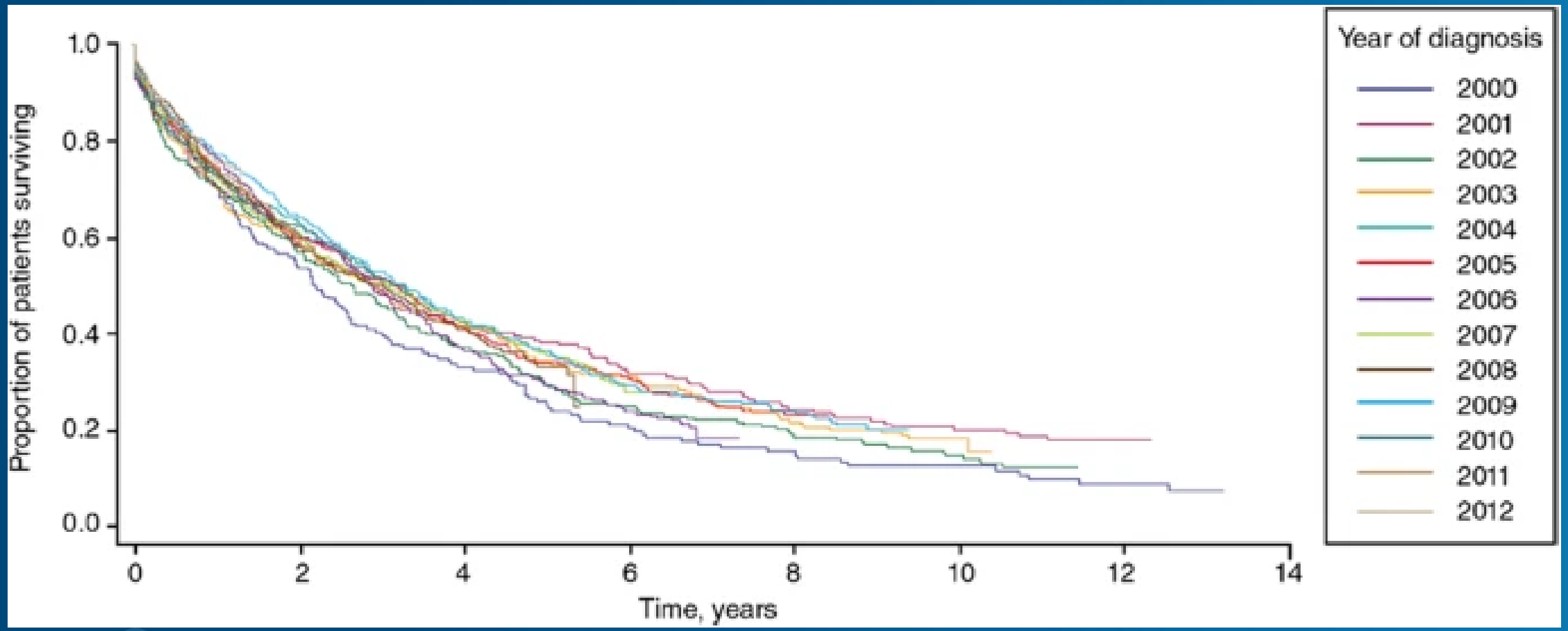
People who survive usually do not have recurrence of disease

- Acute onset; ARDS, COVID-19
- Mainly in smokers, M:F 2:1, 4th-5th decade
- 50% fever, 50% clubbing
- Dyspnea lasts weeks to months
- Supportive care, steroids and antibiotics have shown little benefit



D'Agnillo, Felice, Hammond, TC et al. "Lung epithelial and endothelial damage, loss of tissue repair, inhibition of fibrinolysis, and cellular senescence in fatal COVID-19." *Science Translational Medicine* 13.620 (2021): eabj7790.

Idiopathic Pulmonary Fibrosis (IPF):



Maher, Toby M., and Mary E. Strek. "Antifibrotic therapy for idiopathic pulmonary fibrosis: time to treat." *Respiratory research* 20.1 (2019): 1-9.

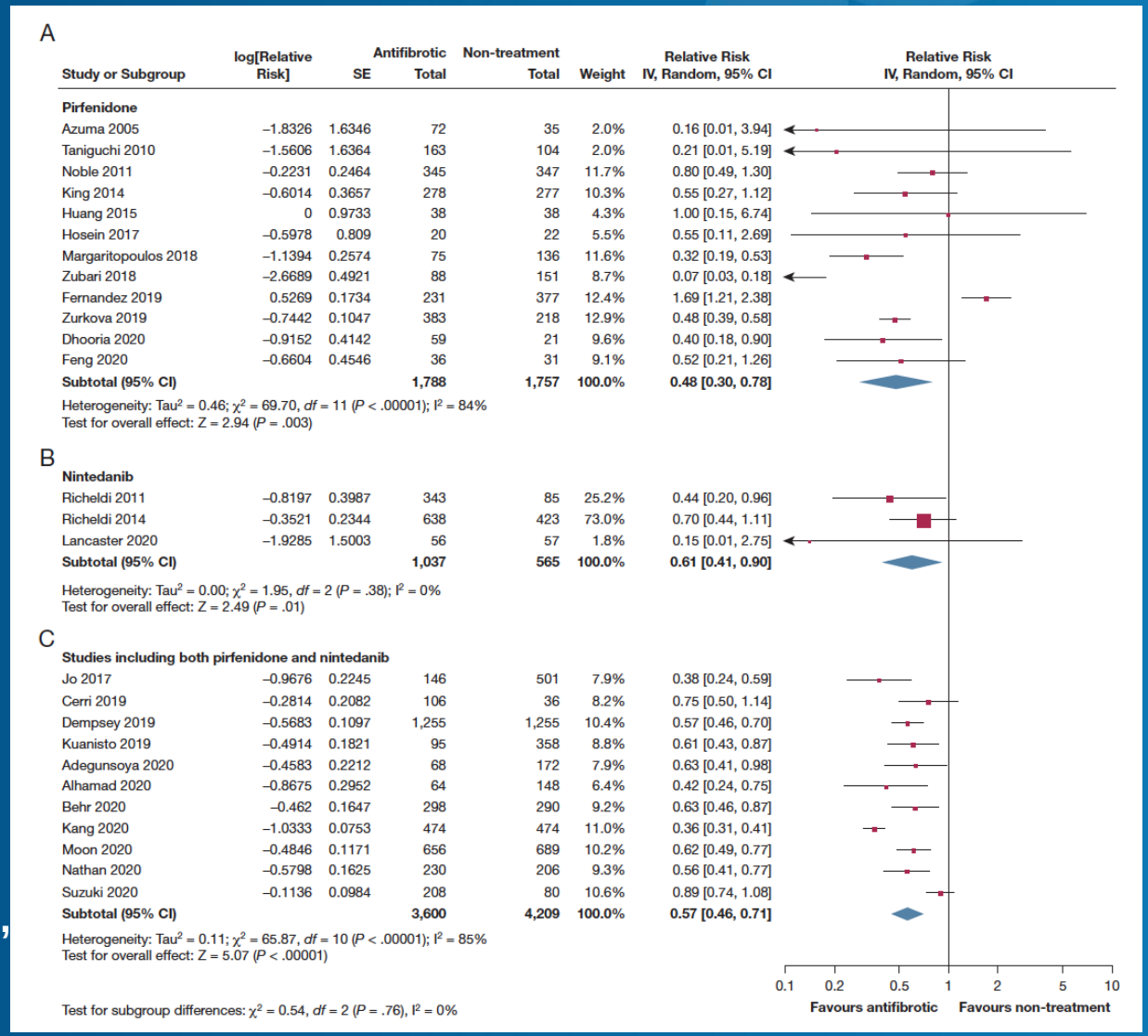
Idiopathic Pulmonary Fibrosis (IPF):

Nintedanib (Ofev)

- Inhibits multiple tyrosine kinase inhibitors
- Dose: 150mg PO q12, 100mg q 12 with mild hepatic dysfunction
- Take with food, swallow whole with liquid, do not chew (bitter)
- LFTs and pregnancy test
- ~ 5% nausea, diarrhea, abdominal pain, vomiting, LFTs increase, decreased appetite, weight loss, HTN

Pirfenidone

- Antifibrotic inhibits TGF-β
- Full dose 801mg tid (titrate up over 14 days)
- Take with food to reduce nausea and dizziness
- ~10% with side effects above, plus arthralgia, URI, GERD, insomnia



Petnak, Tananchai, et al. "Impact of antifibrotic therapy on mortality and acute exacerbation in idiopathic pulmonary fibrosis: a systematic review and meta-analysis." *Chest* 160.5 (2021): 1751-1763.

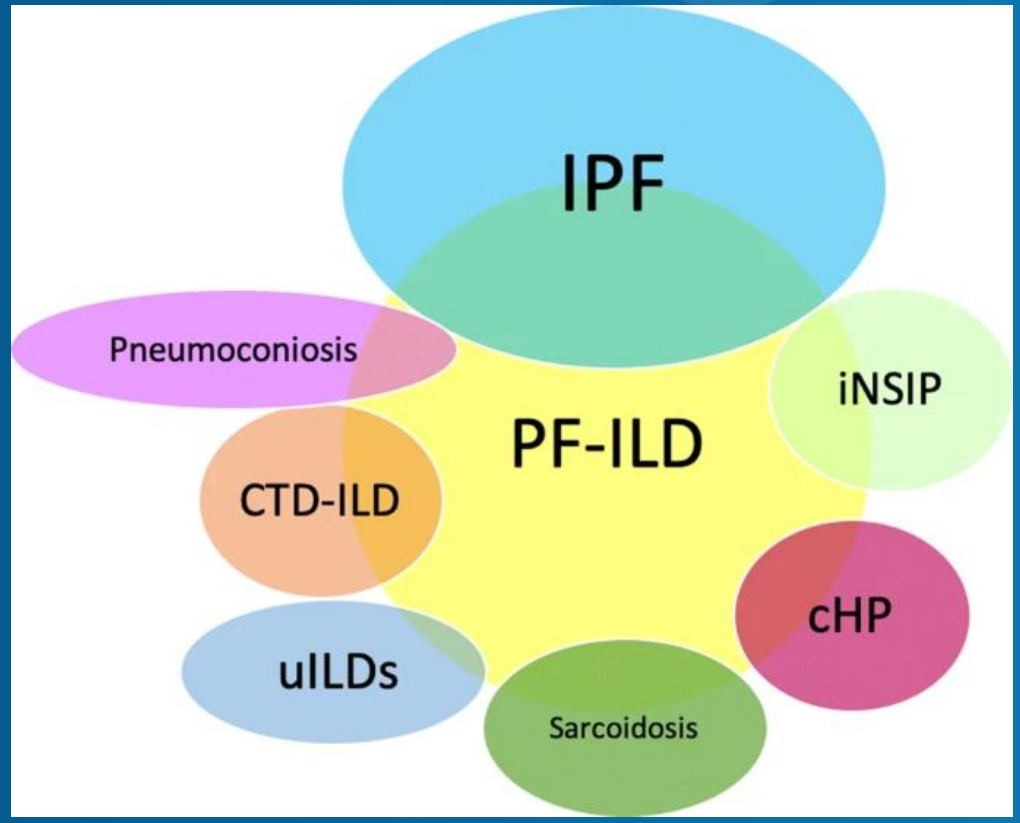
Idiopathic Pulmonary Fibrosis (IPF):

Table 2. Proteins biomarkers with strongest transplant-free survival association in combined cohort (n=1226) analysis.

Protein	HR	95% CI Low	95% CI High	FDR p-value
LTBP2	2.43	2.09	2.82	1.76 x 10-28
COL24A1	2.11	1.86	2.39	1.76 x 10-28
KRT19	1.60	1.47	1.74	7.00 x 10-24
ITGB6	2.78	2.30	3.36	3.84 x 10-23
SPINT1	2.78	2.28	3.38	1.79 x 10-21
ROBO2	3.41	2.66	4.37	1.30 x 10-19
SDC1	1.68	1.51	1.86	2.31 x 10-19
SCGB3A2	1.29	1.22	1.36	2.50 x 10-19
AREG	1.98	1.71	2.28	2.39 x 10-18
PLA2G10	1.60	1.44	1.77	6.74 x 10-17
SPON1	2.24	1.86	2.69	2.32 x 10-15
ICAM5	2.23	1.84	2.70	3.89 x 10-14
GDF15	1.71	1.49	1.96	6.55 x 10-12
MZB1	1.53	1.37	1.71	6.72 x 10-12
IGFBP1	1.23	1.17	1.30	5.06 x 10-11
WFDC2	1.84	1.56	2.17	8.27 x 10-11
RSPO1	1.60	1.41	1.82	1.34 x 10-10
SERPINA3	4.24	2.84	6.33	2.36 x 10-10
EVPL	1.73	1.49	2.02	4.06 x 10-10
CXCL17	1.52	1.35	1.71	4.06 x 10-10

Estimates adjusted for age, sex, percent predicted FVC, percent predicted DLCO, smoking history, anti-fibrotic exposure, and immunosuppressant exposure at the time of blood draw

Abbreviations: HR = hazard ratio; CI = confidence interval; FDR = false discovery rate



Interstitial lung disease subtypes associated with a progressive fibrosing phenotype. cHP chronic hypersensitivity pneumonitis, CTD-ILD connective tissue disease interstitial lung disease, iNSIP idiopathic non-specific pneumonia, IPF idiopathic pulmonary fibrosis, PF-ILD progressive fibrosing interstitial lung disease, uILD unclassified interstitial lung disease

Oldham, Justin M., et al. "Proteomic Biomarkers of Survival in Idiopathic Pulmonary Fibrosis." *American Journal of Respiratory and Critical Care Medicine* ja (2023).

Questions?

UCLA David Geffen School of Medicine

THammond@mednet.ucla.edu