Chronic Obstructive Pulmonary Disease

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- Medical School: Univ of Pennsylvania
- Medical Residency: Univ of Pennsylvania
- Pulmonary and Critical Care fellowship: Harvard combined program
- Respiratory epidemiology fellowship: Brigham and Women's Hospital
- Associate Professor of Medicine at HMS
  - Clinical focus: COPD, Alpha-1 antitrypsin deficiency
  - Research focus: COPD epidemiology and genetics

Disclosures

- Grant support:
  - Bayer
- Consulting fees:
  - Apogee Therapeutics, Chiesi, Ono Pharma, Sanofi, Takeda, Verona Pharma

Outline

- COPD exacerbations
- Assessment of stable COPD
- Treatment of stable COPD
  - Preventing exacerbations
- Lung volume reduction
- New concepts in COPD diagnosis

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*Case #1

A 72F former smoker presents to the ED with 3 days of dyspnea, productive cough, and chest tightness. She is tachycardic, tachypneic, SaO_2 88% on room air, and wheezing on exam.

Besides COPD exacerbation, the differential diagnosis includes:

A. Community acquired pneumonia
B. Pulmonary embolism
C. Acute decompensated heart failure
D. (A) and (C) only
E. All of the above

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COPD exacerbation: definitions

Symptom-based (Anthonisen)
- Increased dyspnea
- Increased sputum volume
- Increased sputum purulence

- Mild → Moderate → Severe
  - 1 → 2 → 3 symptoms

- Limitations
  - subjective
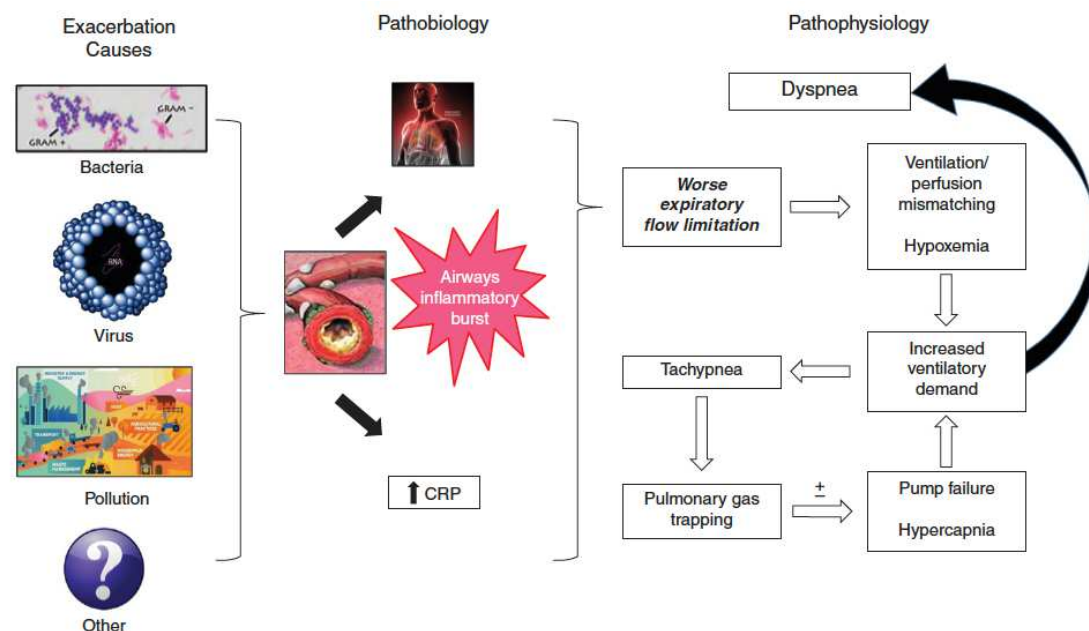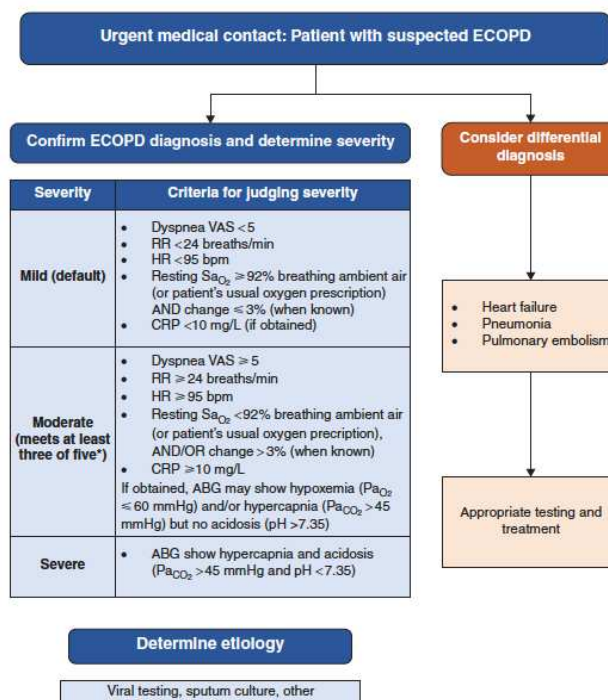 - non-specific

Utilization-based
- Acute worsening of symptoms
- Requires additional therapy
  - Mild: short-acting bronchodilators
  - Moderate: antibiotics and/or systemic corticosteroids
  - Severe: ED visit or hospitalization

- Limitations
  - post-hoc
  - healthcare access
  - local medical practices

Anthonisen NR, Ann Intern Med 1987;106:196

Calverley P, COPD 2005;2:143

Rome proposal

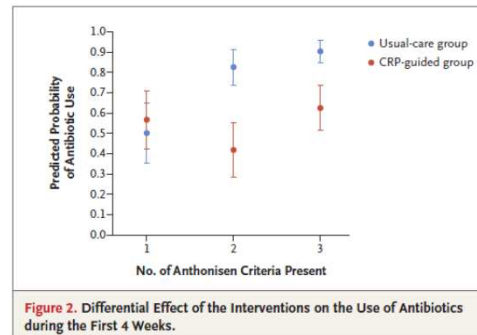Celli BR et al, AJRCCM 2021;204:1251

- Modified Delphi method
- Goal: more objective
- Limitations
  - Arbitrary cutoffs
    - Change from baseline?
  - Discounts some symptoms
  - ED/hospital-based
  - No clinical validation

Urgent medical contact: Patient with suspected ECOPD

Confirm ECOPD diagnosis and determine severity

Consider differential diagnosis

Severity	Criteria for judging severity
Mild (default)	• Dyspnea VAS <5 • RR <24 breaths/min • HR <95 bpm • Resting Sa_{O_2} ≥92% breathing ambient air (or patient's usual oxygen prescription) AND change ≤3% (when known) • CRP <10 mg/L (if obtained)
Moderate (meets at least three of five*)	• Dyspnea VAS ≥5 • RR ≥24 breaths/min • HR ≥95 bpm • Resting Sa_{O_2} <92% breathing ambient air (or patient's usual oxygen precription), AND/OR change >3% (when known) • CRP ≥10 mg/L If obtained, ABG may show hypoxemia (Pa_{O_2} ≤60 mmHg) and/or hypercapnia (Pa_{CO_2} >45 mmHg) but no acidosis (pH >7.35)
Severe	• ABG show hypercapnia and acidosis (Pa_{CO_2} >45 mmHg and pH <7.35)

Differential diagnosis:
- Heart failure
- Pneumonia
- Pulmonary embolism

Appropriate testing and treatment

Determine etiology

Viral testing, sputum culture, other

Exacerbation Causes — Bacteria, Virus, Pollution, Other

Pathobiology — Airways inflammatory burst — ↑ CRP

Pathophysiology — Dyspnea

Worse expiratory flow limitation → Ventilation/perfusion mismatching / Hypoxemia

Increased ventilatory demand

Tachypnea

Pulmonary gas trapping → ± → Pump failure / Hypercapnia

Celli BR et al, AJRCCM 2021;204:1251

CRP to guide antibiotic prescription

- Primary care, N=653
- Point of case testing
  - < 20 mg/L should not use antibiotics
  - 20-40 may be beneficial
  - > 40 likely to be beneficial

Figure 2. Differential Effect of the Interventions on the Use of Antibiotics during the First 4 Weeks.

Less antibiotic use
No evidence of harm

Butler et al, NEJM 2019;381:111

Procalcitonin in COPD inpatients

- Pre/post intervention
  - <0.1 µg/L antibiotics strongly discouraged
  - 0.1-0.25 discouraged
  - 0.25-0.5 recommended
  - >0.5 strongly recommended

Less antibiotic use
Shorter LOS
No difference in readmission rate

Small studies – not consistent results

Table 2 Antibiotic Durations and Secondary Outcomes of Total Cohort

Variable	Pre-intervention (n = 166)	Post-intervention (n = 139)	P value
Duration of total antibiotics, mean (SD), days	5.3 (3.2)	3.0 (2.9)	0.01
Duration of IV antibiotics, mean (SD), days	2.5 (2.4)	1.9 (1.8)	0.02
Total antibiotic duration, n (%)			
0 to 1 day	24 (14.5)	61 (43.8)	
2 to 5 days	73 (44.0)	48 (34.6)	
6 to 7 days	37 (22.3)	18 (13.0)	
8 to 10 days	23 (13.8)	10 (7.2)	
11 to 14 days	8 (4.8)	2 (1.4)	
More than 14 days	1 (0.6)	0 (0)	
Inpatient LOS, mean (SD), days	4.1 (3.9)	2.9 (2.0)	0.01
All-cause 30-day readmission, n (%)	24 (14.5)	23 (16.6)	0.25
Respiratory-related 30-day readmission, n (%)	18 (10.8)	13 (9.4)	0.18

Bremmer, J Gen Internal Med 2018

Pulmonary embolism in exacerbations

- Meta-analyses: 16-17% of unexplained acute exacerbations, mostly ER or inpatient   Aleva FE, Chest 2017;151:544. Fu X, PLoS ONE 2021;16:e0256480
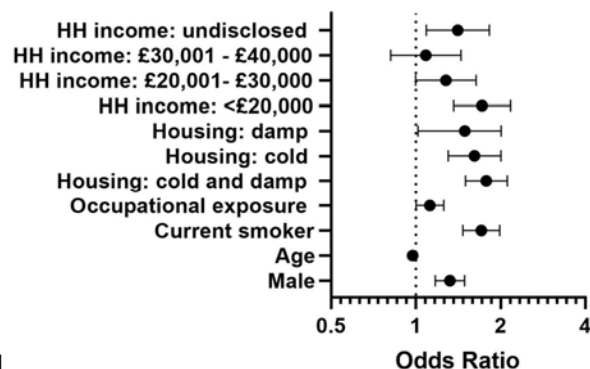
- French multi-center study   Couturaud F, JAMA 2021;325:59
  - Hospital admissions
  - Geneva score: age, previous VTE, surgery, cancer, tachycardia, hemoptysis, LE pain, edema   Le Gal G, Ann Intern Med. 2006;144:165
    - High → CT-PE, LE ultrasound
    - Low → d-dimer, 2/3 led to CT and US
  - PE in 5.9%: segmental or more proximal
    - 11.7% in patients with suspected PE
    - 4.3% in patients without suspected PE

Social determinants of health

- Current smoking

- Low SES, income

- Air pollution

- Housing, indoor exposures

- Medication non-adherence
  - Inhaler technique
  - Polypharmacy
  - Triple therapy inhalers ~$600 /30d

HH income: undisclosed
HH income: £30,001 - £40,000
HH income: £20,001- £30,000
HH income: <£20,000
Housing: damp
Housing: cold
Housing: cold and damp
Occupational exposure
Current smoker
Age
Male

0.5   1   2   4

Odds Ratio

Hogea SP, Clin Respir J 2019; Pasquale CB, JCOPDF 2021; Williams PJ, BMJ Open Respir Res 2022
https://www.gskforyou.com/gsk-pricing-information/
https://www.breztri.com/cost-affordability.html

*Case # 2

68M presents to the ED with a COPD exacerbation. He is treated with nebulized albuterol/ipratropium and supplemental O_2 via nasal cannula.

ABG: pH 7.32, $PaCO_2$ 55 mmHg, PaO_2 100 mmHg, SaO_2 99% on 6 lpm O_2

Which of the following will reduce his risk of mortality?

A. Prednisone 40 mg daily
B. Azithromycin x 5 days
C. Bilevel positive airway pressure (BiPAP)
D. Reducing supplemental O_2 to keep SaO_2 89-93%
E. Intubation and mechanical ventilation

Non-invasive ventilation for AE-COPD

- Acute hypercapneic respiratory failure
  - RR > 25-30
  - Respiratory acidosis: pH < 7.35
- *Caution in severe acidosis, altered mental status, hemodynamic instability*

Fewer intubations

Fewer hospital days
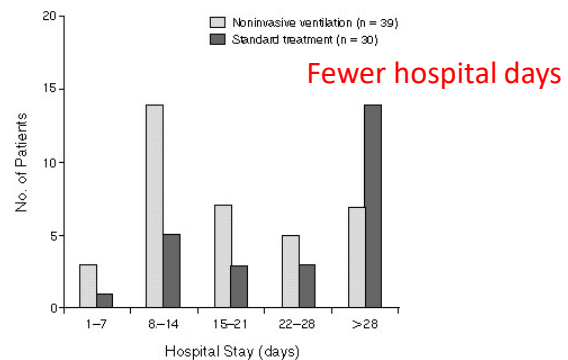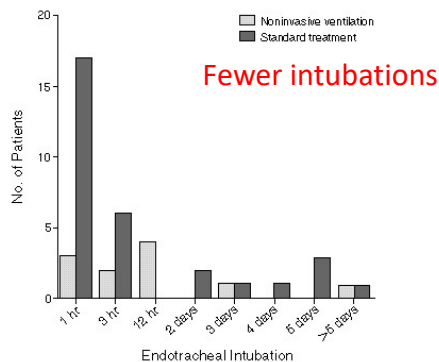
Brochard, NEJM 1995

Exacerbations treatment: Antibiotics
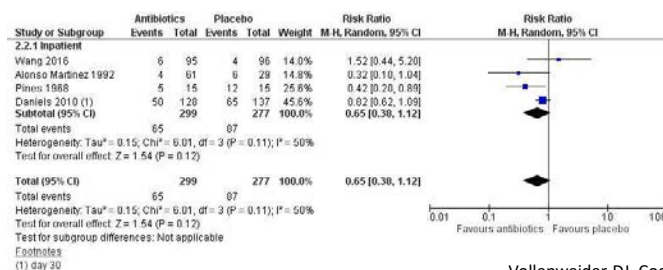
Vollenweider DJ, Cochrane Database Syst Rev 2018:CD010257

- Reduce treatment failure – only significant in outpatients
- Usually 5-7 days
- Respiratory flora: *H.influenzae, S.pneumo, M.catarrhalis*
  - E.g., Amox/clav, macrolides, doxycycline, quinolones
- Risk factors for pseudomonas
  - Previous sputum isolate, severe COPD, bronchiectasis, prior hospitalization

Exacerbations treatment: Systemic steroids

Benefits:

↓ treatment failure, symptoms, LOS

↑ FEV$_1$

Dose/duration:

Benefit of lower doses

No difference in oral vs IV

Prednisone 40 mg x 5d non-inferior to 14d

**Side effects:** hyperglycemia, etc.
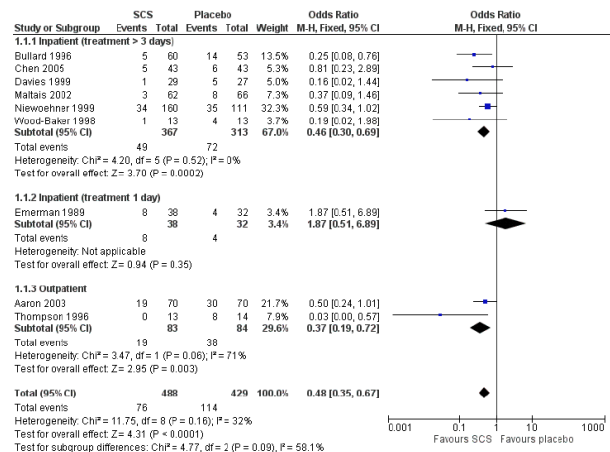
Walters JAE, Cochrane Database Syst Rev 2014:CD001288.
Davies L, Lancet 1999;354:456. Leuppi JD, JAMA 2013;309:2223.
Sivapalan P, Lancet Respir Med 2019;7:699

Eosinophil-guided oral steroid use

- Inpatients (Denmark) n=318
  - All received IV steroids x 1 dose
  - Oral steroids only if daily BEC ≥ 300
  - 5 days max
- Non-inferior
  - Days alive out of hospital (at 14d)
  - Readmission
- Mean 2 vs 5 days of steroids
  - Lower cumulative dose
  - Improved diabetes control
- Similar non-inferiority in UK outpatients

Readmission or death

Antibiotic treatment within 90d
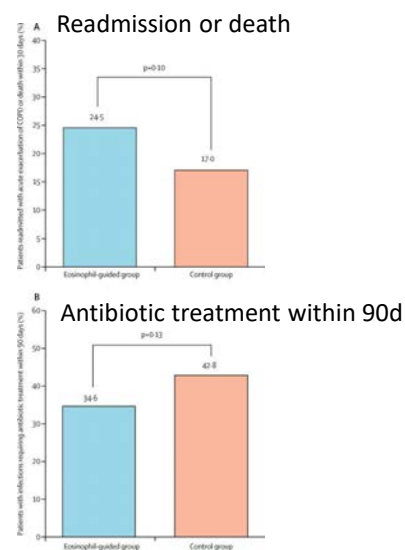
Sivapalan P, Lancet Respir Med 2019; Ramakrishnan S, Lancet Respir Med 2024

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*Case #3

You are discharging a 70F after a COPD exacerbation. At baseline, she has daily cough and sputum and has to stop walking after a few minutes. She uses supplemental oxygen at 2 lpm. She was treated with antibiotics for acute bronchitis 6 months ago. Her last FEV_1 was 45% predicted. She still smokes.

Which of the following is her strongest risk factor for a COPD exacerbation in the next year?

A. Chronic bronchitis symptoms
B. $FEV_1 < 50\%$ predicted
C. History of two or more exacerbations in the past year
D. Use of supplemental O_2
E. Current smoking

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 B. $FEV_1 < 50\%$ predicted
 C. <u>History of two or more exacerbations in the past year</u>
 D. Use of supplemental O_2
 E. Current smoking

Exacerbation Risk: Past exacerbations are the best predictor of future exacerbations
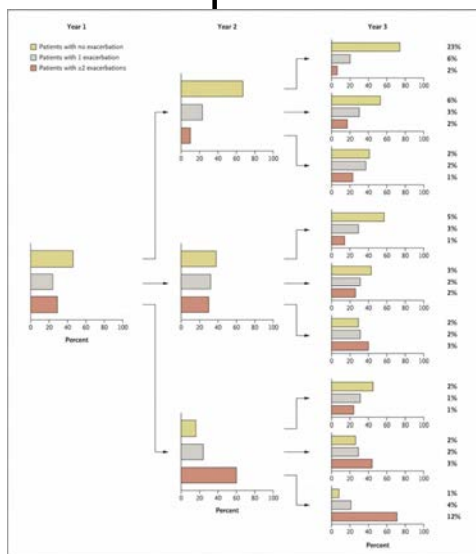
High risk:
2 or more exacerbations in previous year, or
1 or more hospitalizations

Hurst JR, NEJM 2010; 363:1128

Assessment: Symptoms and Signs of COPD

Symptoms
Cough
Sputum
Dyspnea
Wheeze
Chest tightness
Weight loss
Muscle weakness
Edema
Depression

Physical Exam
Tripod posture
Skin: cyanosis
Breathing: tachypnea, pursed lip breathing, prolonged expiration, accessory muscle use
Barrel Chest
Breath Sounds: distant, wheezes
Cardiac: distant, increased P2, JVD, edema
Cachexia

COPD Assessment Test (CAT)

I never cough	0 1 2 3 4 5	I cough all the time
I have no phlegm (mucus) in my chest at all	0 1 2 3 4 5	My chest is completely full of phlegm (mucus)
My chest does not feel tight at all	0 1 2 3 4 5	My chest feels very tight
When I walk up a hill or one flight of stairs I am not breathless	0 1 2 3 4 5	When I walk up a hill or one flight of stairs I am very breathless
I am not limited doing any activities at home	0 1 2 3 4 5	I am very limited doing activities at home
I am confident leaving my home despite my lung condition	0 1 2 3 4 5	I am not at all confident leaving my home because of my lung condition
I sleep soundly	0 1 2 3 4 5	I don't sleep soundly because of my lung condition
I have lots of energy	0 1 2 3 4 5	I have no energy at all

Modified MRC Dyspnea scale

Grade	Description of Breathlessness
0	I only get breathless with strenuous exercise.
1	I get short of breath when hurrying on level ground or walking up a slight hill.
2	On level ground, I walk slower than people of the same age because of breathlessness, or have to stop for breath when walking at my own pace.
3	I stop for breath after walking about 100 yards or after a few minutes on level ground.
4	I am too breathless to leave the house or I am breathless when dressing.

Mahler DA, Chest 1988;93:580
Jones P, ERJ 2009;34:648

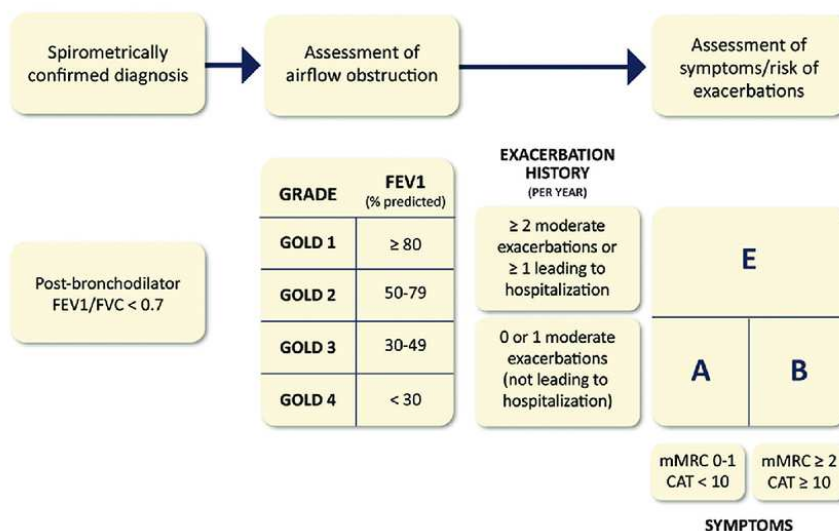# Classification of Severity of Airflow Limitation in COPD*

In patients with $FEV_1/FVC < 0.70$:

GOLD 1: Mild $\qquad$ $FEV_1 \geq 80\%$ predicted

GOLD 2: Moderate $\qquad$ $50\% \leq FEV_1 < 80\%$ predicted

GOLD 3: Severe $\qquad$ $30\% \leq FEV_1 < 50\%$ predicted

GOLD 4: Very Severe $\quad$ $FEV_1 < 30\%$ predicted

*Based on Post-Bronchodilator FEV_1

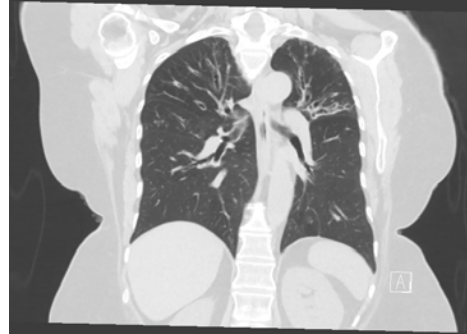© 2014 Global Initiative for Chronic Obstructive Lung Disease

Other assessments

- Chest CT scan
  - Differential diagnosis
    - Bronchiectasis
    - "symptoms out of proportion"
  - Lung cancer screening
  - Lung volume reduction
- Blood eosinophil count
- Alpha-1 antitrypsin deficiency
  - 1-2% of COPD in USA
  - AAT level +/- genotype or protein phenotype

Comorbidities: COPD is a systemic disease
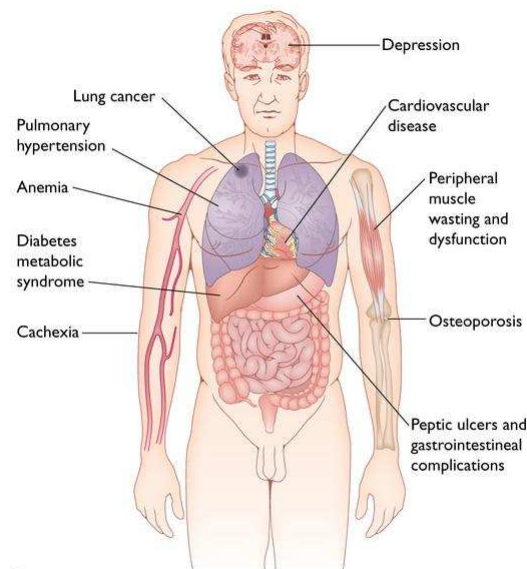
Crapo J, ed.,
Atlas of COPD, 2009

*Case #4

A 65 year old male current smoker with presents with cough and exertional dyspnea (MMRC 2). He had one exacerbation last year. Spirometry: FEV_1 55% predicted, FEV_1/FVC 0.6.
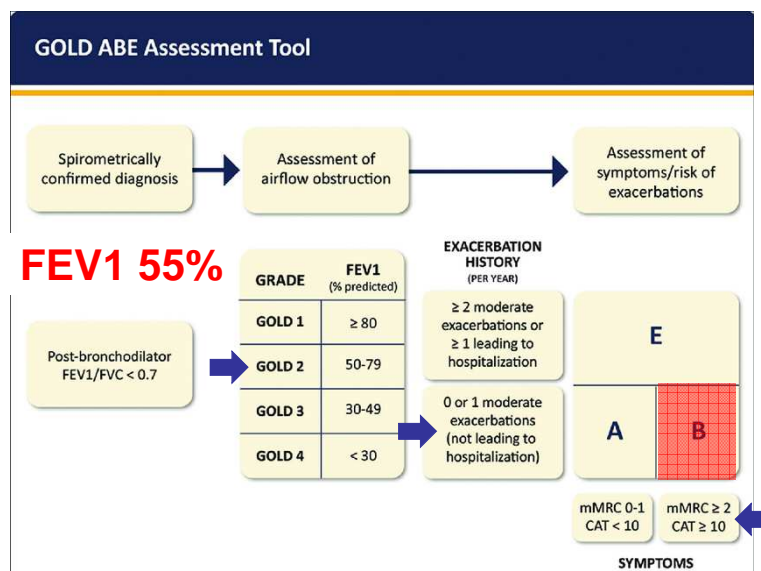
Appropriate treatments include:

A. LABA+LAMA inhaler

B. Triple therapy inhaler (LABA+LAMA+ICS)

C. Nicotine replacement therapy

D. All of the above

E. (A) and (C) only

COPD treatment: overview

- Goals of treatment
    1. Reduce symptoms
    2. Reduce risk
- Smoking Cessation
- Supplemental oxygen
- Pulmonary Rehabilitation
- Vaccinations
    – Influenza, Pneumococcal, COVID-19, RSV

Poole PJ, Cochrane Database Syst Rev 2006; Dransfield MT, AJRCCM 2009;180:499;
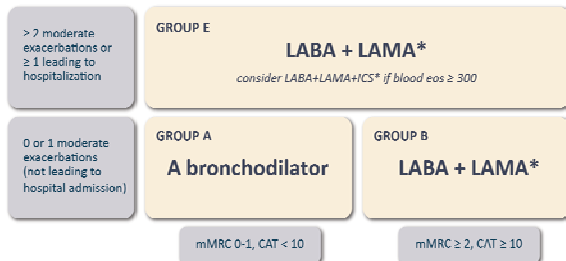Kobayashi M, MMWR 2022;71:109

GOLD grade 2, group B

GOLD ABE Assessment Tool

Spirometrically confirmed diagnosis → Assessment of airflow obstruction → Assessment of symptoms/risk of exacerbations

FEV1 55%

GRADE	FEV1 (% predicted)
GOLD 1	≥ 80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	< 30

Post-bronchodilator FEV1/FVC < 0.7

EXACERBATION HISTORY (PER YEAR)

≥ 2 moderate exacerbations or ≥ 1 leading to hospitalization

0 or 1 moderate exacerbations (not leading to hospitalization)

E

A | B

mMRC 0-1 CAT < 10 | mMRC ≥ 2 CAT ≥ 10

SYMPTOMS

COPD pharmacotherapy

Initial Pharmacological Treatment   Figure 4.2

> 2 moderate exacerbations or ≥ 1 leading to hospitalization	**GROUP E** **LABA + LAMA*** consider LABA+LAMA+ICS* if blood eos ≥ 300
0 or 1 moderate exacerbations (not leading to hospital admission)	**GROUP A** **A bronchodilator** mMRC 0-1, CAT < 10 **GROUP B** **LABA + LAMA*** mMRC ≥ 2, CAT ≥ 10

*single inhaler therapy may be more convenient and effective than multiple inhalers

www.goldcopd.org

Bronchodilators are first-line
Long-acting: LABA or LAMA
Dual bronchodilators: LAMA+LABA
Short-acting bronchodilators in all patients

Targeted use of inhaled corticosteroids
    GOLD E, blood eosinophils ≥ 300
Triple therapy: LABA+LAMA+ICS
Risk of pneumonia

Qaseem, Ann Intern Med 2011; Tashkin, NEJM 2008; Rodrigo, Int J COPD 2017;
Calverley, NEJM 2007; Ernst, AJRCCM 2007; Magnussen, NEJM 2014

Follow-up algorithm

Follow-up Pharmacological Treatment   Figure 4.4

❶ IF RESPONSE TO INITIAL TREATMENT IS APPROPRIATE, MAINTAIN IT.
❷ IF NOT: • Check adherence, inhaler technique and possible interfering comorbidities
    • Consider the predominant treatable trait to target (dyspnea or exacerbations)
      – Use exacerbation pathway if both exacerbations and dyspnea need to be targeted
    • Place patient in box corresponding to current treatment & follow indications
    • Assess response, adjust and review
   • These recommendations do not depend on the ABE assessment at diagnosis
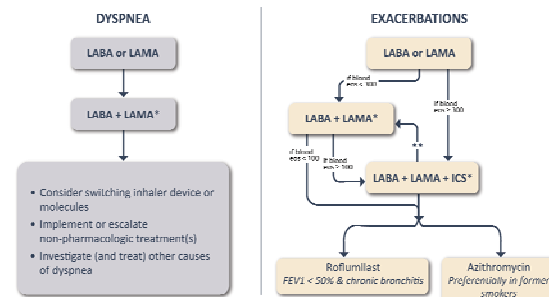
*single inhaler therapy may be more convenient and effective than multiple inhalers
**Consider de-escalation of ICS if pneumonia or other considerable side effects. In case of blood eos ≥ 300 cells/μl de-escalation is more-likely to be associated with the development of exacerbations
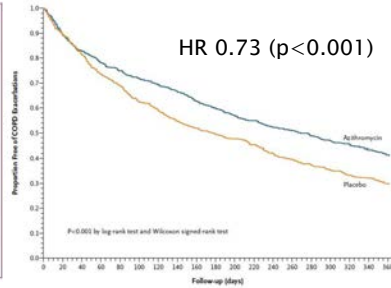
www.goldcopd.org

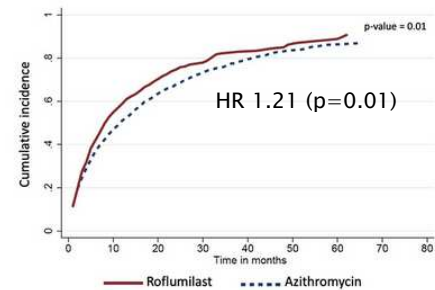# Oral therapies to decrease exacerbation risk

Roflumilast
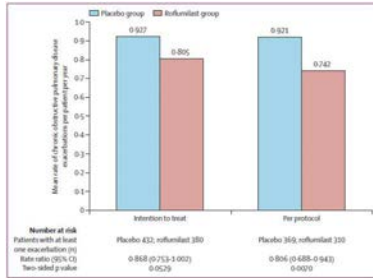
Severe COPD ($FEV_1 < 50\%$) chronic bronchitis exacerbation history
GI side effects

Azithromycin 250mg daily

HR 0.73 (p<0.001)

More effective: older, ex-smokers, milder COPD
Adverse effect: hearing loss

Comparison

p-value = 0.01

HR 1.21 (p=0.01)

VA database study:
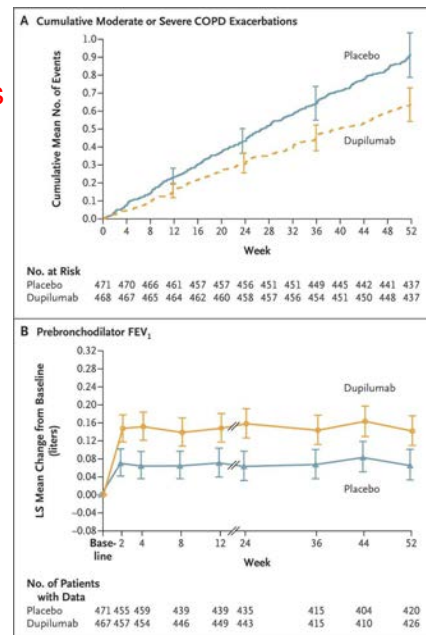Prefers azithromycin

Martinez, Lancet 2015;385:857
Albert, NEJM 2011;365:689
Lam, JCOPDF 2021;8:450

Dupilumab

- Anti-IL4/13 mAb
  - FEV_1 30-80%
  - Blood eos ≥ 300
  - Exacerbation history
  - On LABA/LAMA/ICS
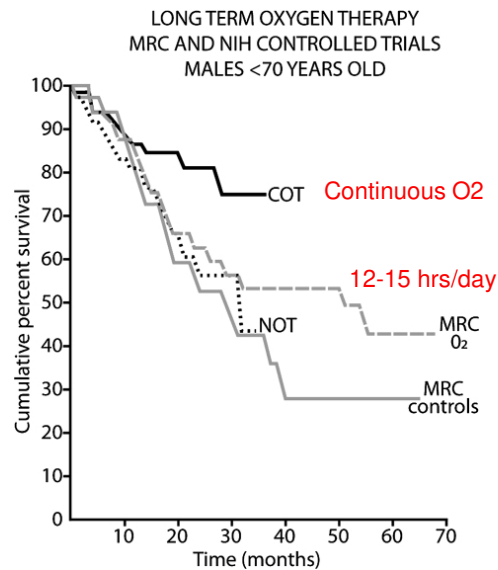- 300mg sc q2wks vs. placebo

Reduced exacerbations RR 0.70

Improved FEV1

Bhatt SP, NEJM 2023;389:205

Supplemental oxygen reduces mortality in hypoxemic COPD patients

Criteria, at rest:

- PaO_2 ≤55 mmHg or SaO_2 ≤88%, or
- PaO_2 ≤60mmHg or SaO_2 ≤89%,
  - with cor pulmonale, right heart failure or polycythemia

LONG TERM OXYGEN THERAPY
MRC AND NIH CONTROLLED TRIALS
MALES <70 YEARS OLD

Cumulative percent survival

Continuous O2

12-15 hrs/day

COT

NOT

MRC O₂

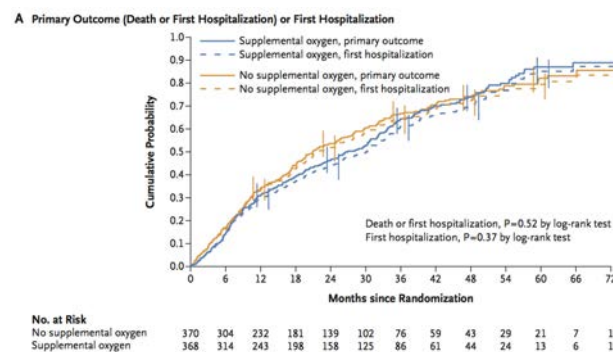MRC controls

Time (months)

Stoller J, Chest 2010

Long Term Oxygen Treatment Trial
NEJM 2016;375:1617-27

1) Moderate hypoxemia
  - SpO_2 89-93%
  - Randomized to 24 hr O_2
2) Exertional hypoxemia
  - SpO_2 <90%
  - Randomized to O_2 with exercise and sleep

A Primary Outcome (Death or First Hospitalization) or First Hospitalization

Supplemental oxygen, primary outcome
Supplemental oxygen, first hospitalization
No supplemental oxygen, primary outcome
No supplemental oxygen, first hospitalization

Cumulative Probability

Death or first hospitalization, P=0.52 by log-rank test
First hospitalization, P=0.37 by log-rank test

Months since Randomization

No. at Risk
No supplemental oxygen 370 304 232 181 139 102 76 59 43 29 21 7 1
Supplemental oxygen 368 314 243 198 158 125 86 61 44 24 13 6 1

No difference in death or hospitalization
No change in secondary outcomes:
- exercise capacity, quality of life, exacerbations, lung function

Long-Term Noninvasive Ventilation in Chronic Stable Hypercapnic Chronic Obstructive Pulmonary Disease
An Official American Thoracic Society Clinical Practice Guideline

Madalina Macrea, Simon Oczkowski, Bram Rochwerg, Richard D. Branson, Bartolome Celli, John M. Coleman III, Dean R. Hess, Shandra Lee Knight, Jill A. Ohar, Jeremy E. Orr, Amanda J. Piper, Naresh M. Punjabi, Shilpa Rahangdale, Peter J. Wijkstra, Susie Yim-Yeh, M. Bradley Drummond, and Robert L. Owens; on behalf of the American Thoracic Society Assembly on Sleep and Respiratory Neurobiology

- Hypercapnic respiratory failure: $PaCO_2 > 45$ mmHg
- Suggest nocturnal NIV
  - Stable, not exacerbation
  - Screen for OSA prior to starting
  - Target normal $PaCO_2$
- Benefit: improve QoL, possibly reduce exacerbations and mortality
- Barriers to implementation

AJRCCM 2020;202:e74-87

Pulmonary Rehabilitation

- Multidisciplinary
- 6-12 weeks outpatient
  - 2-3 times/week
- Exercise
  - Lower body
  - Upper body
  - Respiratory Muscle Training
- Education
- Psychosocial Support

Shortness of breath

Reduced Activity

Decreased exercise capacity
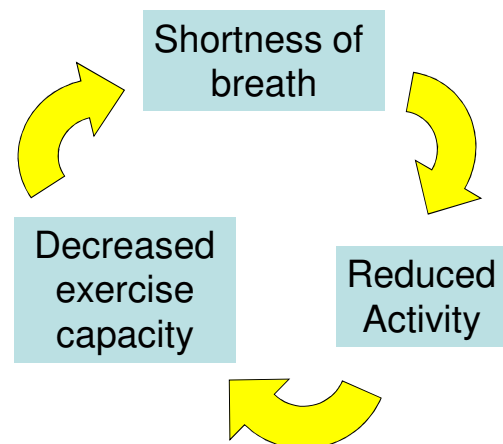
Spruit MA, AJRCCM 2013;188:e13

*Case #5

You are discharging a 72F with stable COPD (FEV_1 55%, GOLD B) after an acute MI, treated with PCI. Her LV function is normal.

In addition to anti-platelet therapy, statin, and ACE-inhibitor, which of the following would you prescribe?

A. Carvedilol
B. Bisoprolol
C. Diltiazem
D. Any of the above
E. (A) or (B) only

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Managing comorbidities

- General rule: treat comorbidities as you normally would
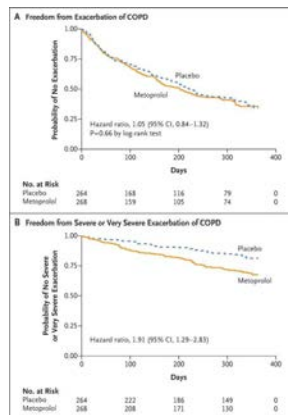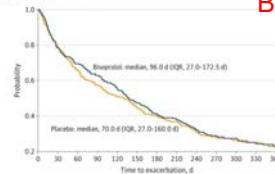- β-blockers in COPD:

Metoprolol

Bisprolol

Cardioselectivity: β1/β2 ratio
Bisprolol 14
Metoprolol 2
Carvedilol 0.2

Metoprolol increased risk of severe exacerbations
no increase in total exacerbations
Bisoprolol – no increased risk

Outline

- COPD exacerbations
- Assessment of stable COPD
- Treatment of stable COPD
  – Preventing exacerbations
- **Lung volume reduction**
- New concepts in COPD diagnosis

*Case #6

A rapid response is called on a 66yo F who underwent bronchoscopic lung volume reduction with LUL endobronchial valves earlier today. She is tachypneic and tachycardic, SaO_2 88% on 6 lpm nasal cannula.

The most likely cause of her acute worsening is:

A. Aspiration
B. Reaction to general anesthesia
C. COPD exacerbation
D. Pneumothorax
E. Pulmonary embolism

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# Surgical or interventional treatments for COPD

- Lung volume reduction
  - Reduce hyperinflation
  - Improve respiratory mechanics
- Surgical
  - Upper lobe predominant
  - Low exercise capacity
- Bronchoscopic valves
- Lung transplantation
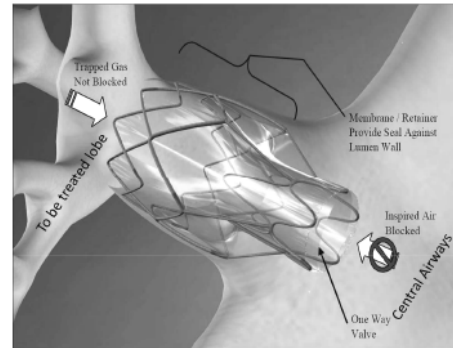
NETT, NEJM 2003;348:2059
*Klooster K, NEJM 2015;373:2325
Davey C, Lancet 2015;386:1066
Yusen R, J Heart Lung Transplant 2015;34:1264

Bronchoscopic Lung Volume Reduction

- Severe airflow obstruction with emphysema
- Hyperinflated lung volumes
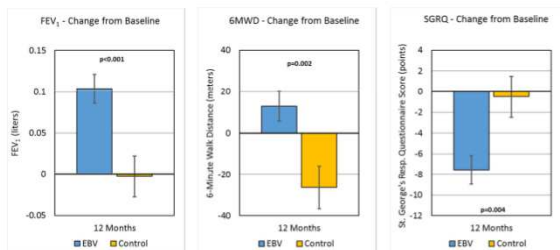
- Improvement in lung function, exercise capacity, quality of life
- Carefully selected patients
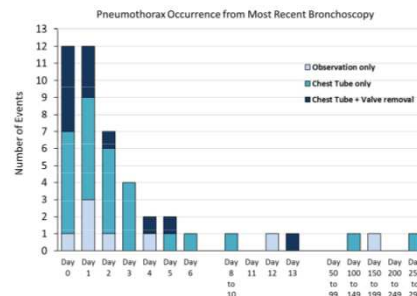
- Pneumothorax in 25%
- Most within 2-3 days

Criner, AJRCCM 2018;198:1151

Outline

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*Case #7

You are discharging a 70M former smoker admitted for "COPD exacerbation".

At baseline, he has daily cough, sputum, and exertional dyspnea.

Work-up in the past year:

       Spirometry: normal

       Blood eosinophil count 50

       Lung screening CT scan: mild bronchial wall thickening

Which of the following is most likely to improve his symptoms?

A. LAMA-LABA inhaler

B. Triple therapy (LAMA-LABA-ICS)

C. Azithromycin 250mg daily

D. Roflumilast

E. None of the above

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Current/former smokers with normal spirometry

Variable	No. (%)		
	Never Smokers (n = 108)	GOLD 0 (n = 4388)	GOLD 1 (n = 794)
Individual Scores			
Chronic bronchitis, by criteria	0	552 (12.6)	125 (15.7)
History of ≥1 severe exacerbation	0	190 (4.3)	39 (4.9)
St George's Respiratory Questionnaire total score >25	4 (3.7)	1143 (26.0)	226 (28.5)
Six-minute walk distance <350 m	4 (3.7)	674 (15.4)	109 (13.7)
Modified Medical Research Council dyspnea score ≥2	4 (3.7)	1029 (23.5)	175 (22.0)
Emphysema >5%	9 (8.3)	428 (9.8)	273 (34.4)
Gas trapping >20%	11 (10.2)	536 (12.2)	319 (40.2)
Sums			
Any impairment	26 (24.1)	2375 (54.1)	585 (73.7)

COPD-like symptoms
CT scan changes
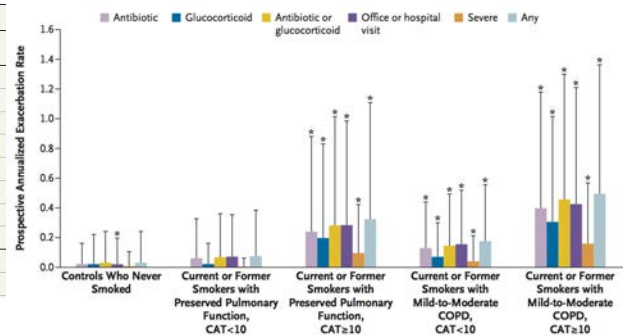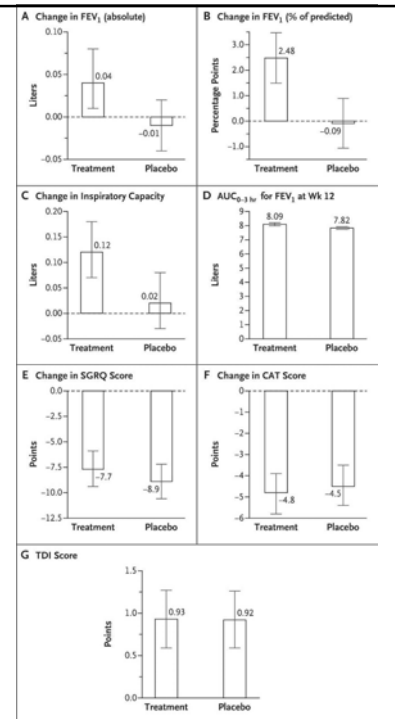
Increased exacerbation risk

COPDGene: Regan, JAMA Intern Med 2015;175:1539
SPIROMICS: Woodruff, NEJM 2016;374:1811

"Tobacco-exposed persons with symptoms and preserved lung function"

- How to treat?
  - Symptoms
    - CAT score ≥ 10
  - No airflow obstruction
    - $FEV_1/FVC ≥ 0.7$
  - Asthma excluded
- LAMA-LABA inhaler did not improve symptoms vs placebo

Han MK, NEJM 2022;387:1173

Summary: COPD exacerbations

- No objective definition or biomarkers
  - Consider differential diagnosis
- Treatment
  - Oxygen and bronchodilators
  - Antibiotics and systemic steroids have small effects
  - Non-invasive ventilation in hypercapneic respiratory failure

Summary: Stable COPD

- Multidimensional assessment
  - symptoms and exacerbation risk
- Assessment and management of comorbidities
- Non-pharmacologic treatments
  - Smoking cessation
  - Pulmonary rehab
  - Vaccines
  - Supplemental O_2 - not clearly beneficial for exercise induced desaturation

Summary: Stable COPD (2)

- COPD medications
  - Bronchodilators are first line therapy: LAMA-LABA
  - Inhaled steroids are add-on - elevated blood eosinophils
  - Daily azithromycin or roflumilast for frequent exacerbators
- Lung volume reduction
  - Selected patients, specialized centers
- New concepts in COPD diagnosis
  - Tobacco-exposed persons with symptoms and preserved lung function

References

- Global Initiative for Chronic Obstructive Lung Disease, Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease, available at www.goldcopd.org
- COPD Foundation, www.copdfoundation.org
  - Patient information, including inhaler instructional videos
- Nici L, et al., Pharmacologic Management of Chronic Obstructive Pulmonary Disease. An Official American Thoracic Society Clinical Practice Guideline. Am J Respir Crit Care Med 2020;201:e56-e69
- Celli B, et al., An Updated Definition and Severity Classification of Chronic Obstructive Pulmonary Disease Exacerbations: The Rome Proposal. Am J Respir Crit Care Med 2021; 204:1251-1258.