

COPD Diagnosis and Epidemiology

인천성모병원 호흡기내과 김윤석

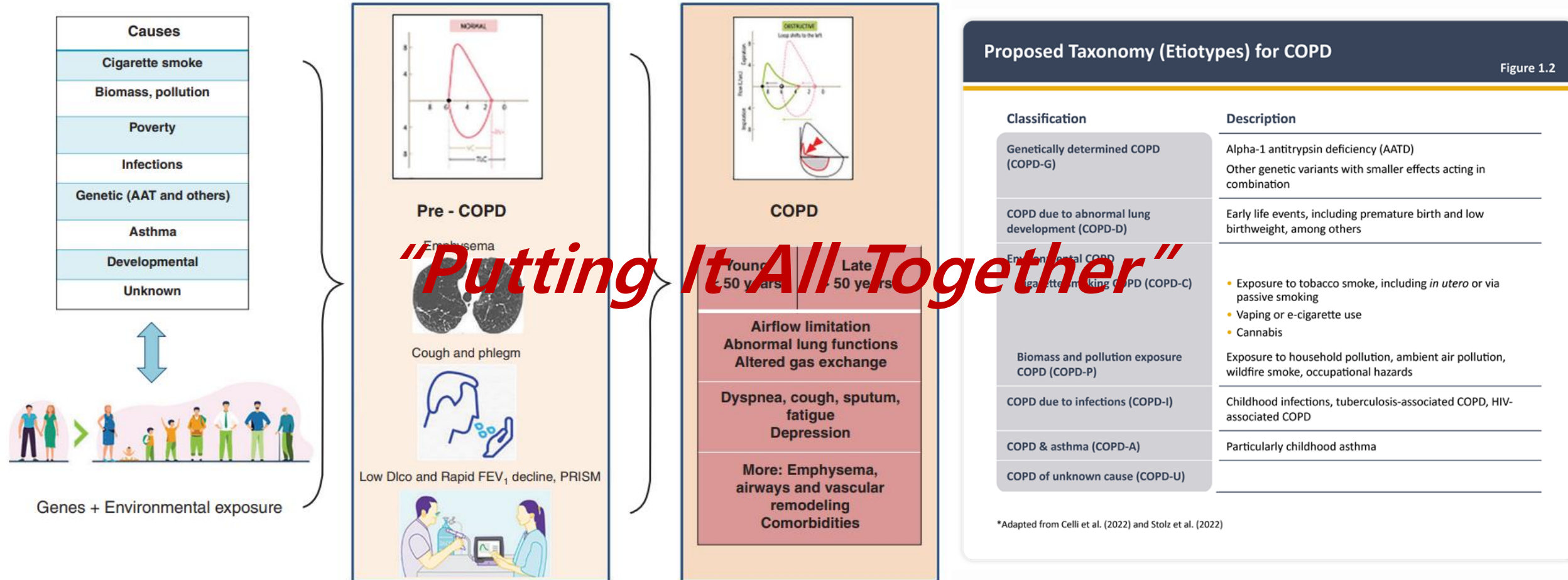
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GOLD report 2025

Definition



Definition

"COPD is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases and influenced by host factors including abnormal lung development. Significant comorbidities may have an impact on morbidity and mortality"

-GOLD 2017

"COPD is a **heterogeneous** lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production and/or exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction."

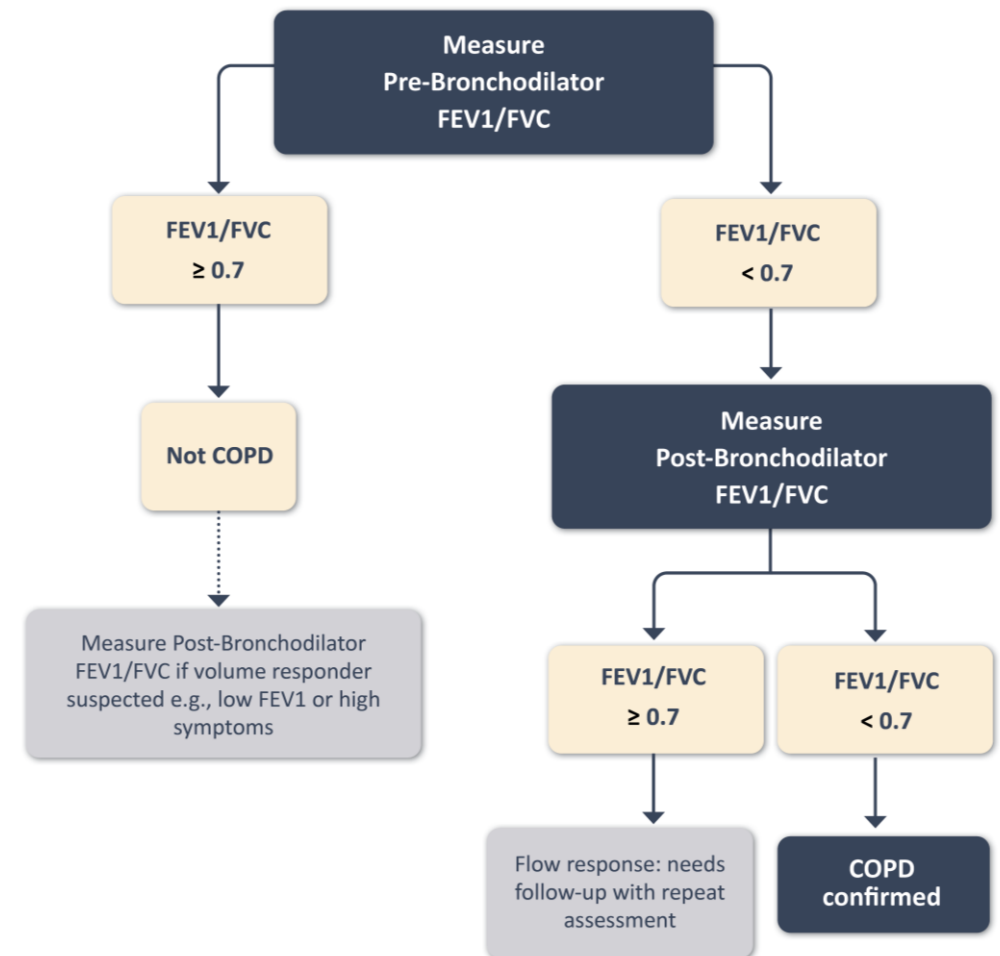
-GOLD 2025(since 2023)

Diagnosis

“the presence of **non-fully reversible airflow obstruction** (FEV1/FVC < 0.7 post-bronchodilation) measured by spirometry confirms the diagnosis of COPD.” (same)

Pre- and Post- Bronchodilator Spirometry

Figure 2.6



Diagnosis

Spirometric criteria to define airflow obstruction

- **Limitations:** over-diagnose COPD in older adults; under-diagnose in younger adults.
→ Using LLN or z-scores (e.g., $z = -1.645$) can address this but leads to different classifications.
- **LLN and z-scores:** Require valid reference equations (e.g., GLI). No longitudinal studies validate LLN for COPD diagnosis.
- **Fixed Ratio vs. LLN:** Prognostic value is similar; fixed ratio is simpler ; favored by GOLD for clinical consistency.
- **Confirmation:** Repeat spirometry if FEV_1/FVC is 0.6–0.8; values <0.6 are unlikely to rise above 0.7.
- **Context:** Non-reversible airflow obstruction is not COPD-specific; clinical context and risk factors are essential.

Diagnosis

Reference values for lung function interpretation

- Prospective Urban and Rural Epidemiological (PURE) study
 - **153,996** healthy people with **less than 5 pack-year** smoking histories in 17 countries
 - FEV1; North America/Europe > Africa, asia
 - Need to correct difference in race, area
- GLI-Global equations ;
 - **369,077 participants** from several cohort → **249 million persons** in the **United States** between 6 and 79 years who are able to produce high-quality spirometric results
 - GLI generated similarly accurate predictions patients with lung disease
 - Not global data

Nevertheless, GOLD recommends using the GLI-Global equations as the reference standard for the assessment of lung function impairment in patients with COPD, despite their limitations.

Diagnosis

SPECIAL ARTICLE

Implications of Race Adjustment in Lung-Function Equations

J.A. Diao, Y. He, R. Khazanchi, M.J. Nguemeni Tiako, J.I. Witonsky, E. Pierson,
P. Rajpurkar, J.R. Elhawary, L. Melas-Kyriazi, A. Yen, A.R. Martin, S. Levy,
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$$\log(\mu) = \beta_{\mu,0} + \beta_{\mu,1} \cdot \log(\text{age}) + \beta_{\mu,2} \cdot \log(\text{height}) + [\text{spline term}]$$

$$\log(\sigma) = \beta_{\sigma,0} + \beta_{\sigma,1} \cdot \log(\text{age}) + [\text{spline term}]$$

$$v = \beta_{v,0} + \beta_{v,1} \cdot \log(\text{age})$$

PFT	Sex	Parameter	Constant	log(height)	log(age)
FEV ₁	male	μ	-11.399108	2.462664	-0.011394
FEV ₁	male	σ	-2.256278	0	0.080729
FEV ₁	male	v	1.22703	0	0
FEV ₁	female	μ	-10.901689	2.385928	-0.076386
FEV ₁	female	σ	-2.364047	0	0.129402
FEV ₁	female	v	1.21388	0	0
FVC	male	μ	-12.629131	2.727421	0.009174
FVC	male	σ	-2.195595	0	0.068466
FVC	male	v	0.9346	0	0
FVC	female	μ	-12.055901	2.621579	-0.035975
FVC	female	σ	-2.310148	0	0.120428
FVC	female	v	0.899	0	0
FEV ₁ /FVC	male	μ	1.022608	-0.218592	-0.027586
FEV ₁ /FVC	male	σ	-2.882025	0	0.068889
FEV ₁ /FVC	male	v	3.8243	0	-0.3328
FEV ₁ /FVC	female	μ	0.9189568	-0.1840671	-0.0461306
FEV ₁ /FVC	female	σ	-3.171582	0	0.144358
FEV ₁ /FVC	female	v	6.649	0	-0.992

Diagnosis

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Implications of Race Adjustment in Lung-Function Equations

Chen, M.J., Nguemeni Tiako, J.I., Witonsky, E., Pierson, R., L. Melas-Kyriazi, A. Yen, A.R. Martin, S. Levy, Borrell, M.H. Cho, E.K. Silverman, E.G. Burchard, and A.K. Manrai

ERS TASK FORCE

Multi-ethnic reference values for spirometry for the 3–95-yr age range: the global lung function 2012 equations

Philip H. Quanjer, Sanja Stanojevic, Tim J. Cole, Xaver Baur, Graham L. Hall, Bruce H. Culver, Paul L. Enright, John L. Hankinson, Mary S.M. Ip, Jinping Zheng, Janet Stocks and the ERS Global Lung Function Initiative

ORIGINAL ARTICLE

A Race-neutral Approach to the Interpretation of Lung Function Measurements

Cole Bowerman^{1,2}, Nirav R. Bhakta³, Danny Brazzale⁴, Brendan R. Cooper⁵, Julie Cooper⁵, Laura Gochicoa-Rangel⁶, Jeffrey Haynes⁷, David A. Kaminsky⁸, Le Thi Tuyet Lan⁹, Refiloe Masekela¹⁰, Meredith C. McCormack¹¹, Irene Steenbruggen¹², and Sanja Stanojevic²; on behalf of the Global Lung Function Initiative

GLI-2012

- from 3–95 yrs of age, based on 74,187 records, healthy & nonsmoking, from 26 countries
- Caucasian, African–American, and North and South East Asian
- LLN 5%, z-score -1.64 is clinically acceptable.
- LLN 2.5%, z-score -1.96 is recommended as the decision limit for epidemiologic study

GLI-global

- Race-neutral approach
- Sitting height
- Wider range of LLN

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- Data from 5 cohorts—NHANES IV, NHANES III, U.K. Biobank, MESA, OPTN.
- Focused on spirometric measures (e.g., FEV1/FVC ratio), COPD severity, and impact on medical, occupational, and financial outcomes.
- GLI-2012 and GLI-Global equations were applied to predict lung function and assess clinical, occupational, and financial outcomes using z-scores and C-statistics.

Diagnosis

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Ventilatory Impairment

- Obstructive Impairment: +3.2M reclassifications with GLI-Global; net increase of new cases.
- Nonobstructive Impairment: +2.34M cases (Black), -6.74M cases (White & Hispanic).

COPD Severity Grading & Occupational Eligibility

- +428K Black individuals classified as moderate-severe COPD; -1.1M White individuals.
- Firefighter eligibility: 2.28M affected; +75.4K Black disqualifications, -1.27M White disqualifications.

Disability Compensation & Lung Transplant Priority

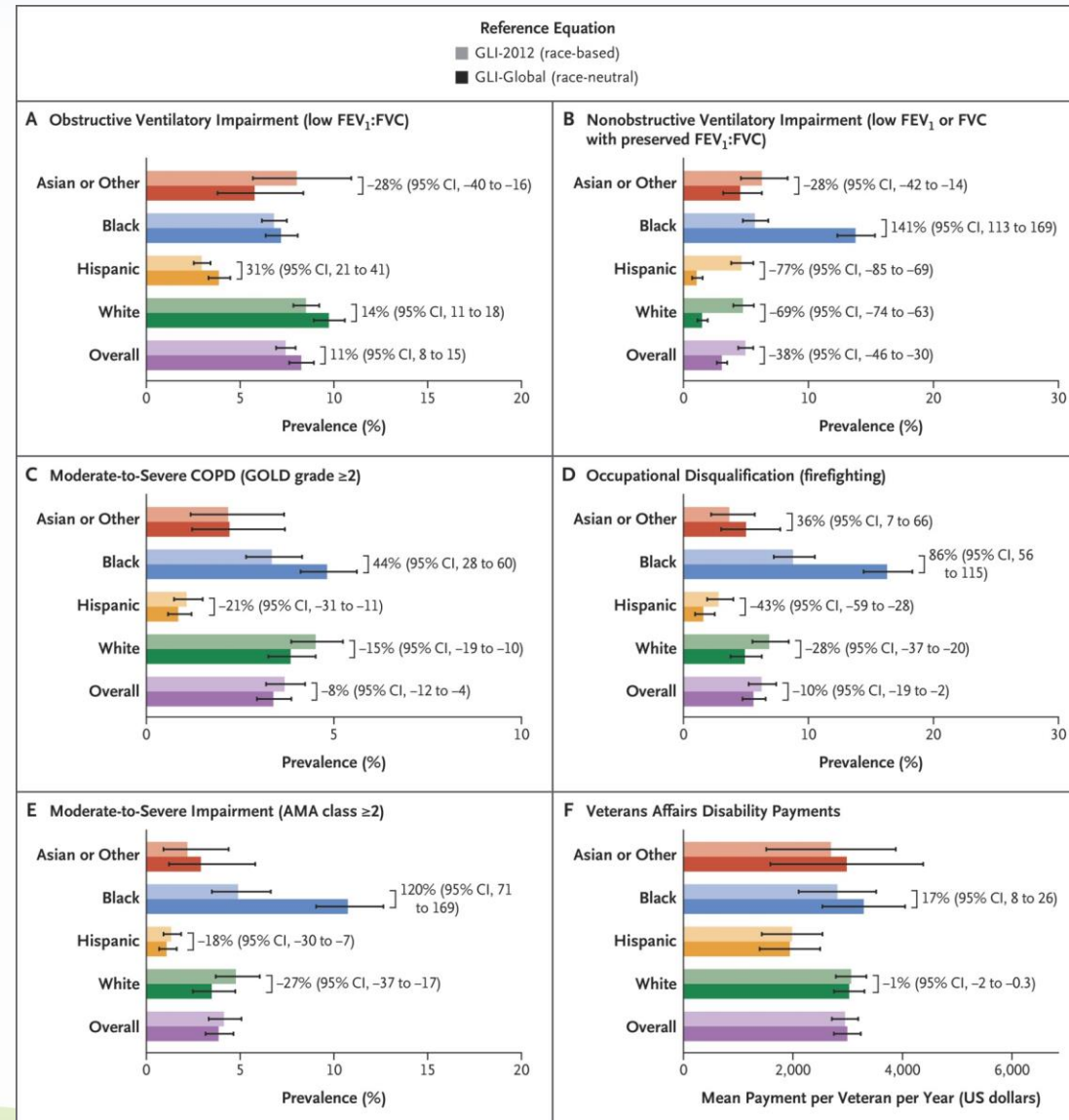
- Disability compensation: +\$1.1B for Black veterans; -\$0.52B for White veterans.
- Transplant priority: 88.8% of waitlist affected; Black/Asian candidates move up, White/Hispanic move down.

Diagnosis

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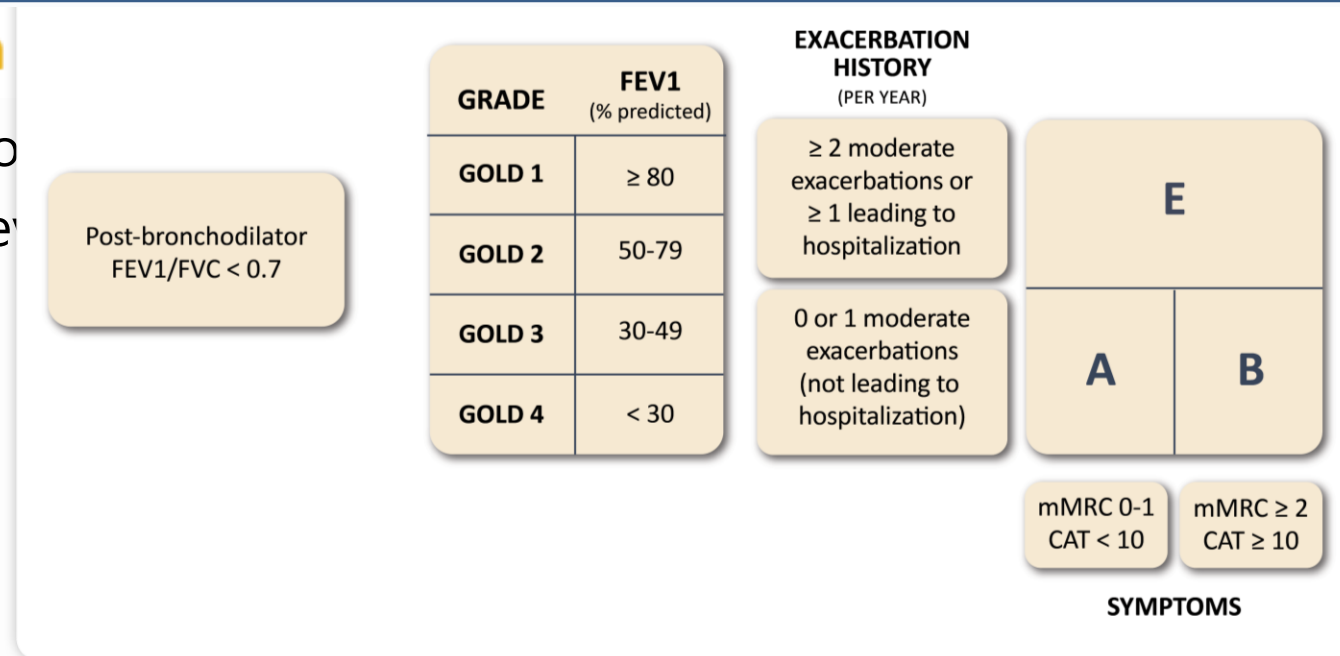
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- Race-neutral equations impact COPD severity grading, pre-employment lung function testing results, disability compensation programs, lung transplantation priorities
- Limited primarily to U.S. data, which may not generalize globally.
- Longitudinal data is required

Diagnosis

Staging the severity of airflow obstruction

- **GOLD** ; Uses **FEV₁** (% of predicted value) to
- **ERS/ATS** Recommends using **z-scores** for severity
 - **Proposed severity system:**
 - **Normal:** z-score > -1.65
 - **Mild:** z-score -1.65 to -2.5
 - **Moderate:** z-score -2.51 to -4
 - **Severe:** z-score < -4.1
 - Z-scores may classify patients differently than percentage predicted values.
 - The impact on management and prognosis remains uncertain.
- **Clinical Insights**
- In patients with airflow obstruction:
 - **Low FEV₁ or rapid decline in FEV₁** is linked to increased mortality.
 - Use the **GLI-Global online calculator** for accurate percentage predictions



Diagnosis

Staging the severity of airflow obstruction



Home Help LungTracker Contact

Welcome to the Global Lung Function Initiative calculators for Spirometry, TLCO and Lung volume

Calculator	Index	Measured	Predicted	Z-Score	LLN	ULN	% Predicted
Spirometry - pre-BD	FEV1	4.3	4.004	0.553	3.091	4.871	107.391
	FVC	5.1	4.867	0.345	3.770	5.982	104.781
	FEV1/FVC	0.843	0.824	0.335	0.721	0.910	102.269
	FEF25-75		0.000		0.000	0.000	
	FEV0.75		0.000		0.000	0.000	
	FEF75		0.000		0.000	0.000	
	FEV0.75/FVC	0.000	0.000	0.000	0.000	0.000	0.000

Normal: z-score > -1.65

Measured values

PRE Bronchodilator	POST Bronchodilator
FEV1 4.3	FEV1
FEV0.75	FEV0.75
FVC 5.1	FVC

spirometry - post-BD

TLCO

FEV1			
FVC			
FEV1/FVC			
FEF25-75			
FEV0.75			
FEF75			
FEV0.75/FVC			
DLCO	31.454	24.687	39.237
VA	6.507	5.331	7.769

Diagnosis

Staging the severity of airflow obstruction

나는 한국인 키는 176cm 74kg 성인 남성이야 폐기능 예측치 만들어 줘



35세 한국인 남성(키 176cm, 체중 74kg)의 폐기능 예측치는 **GLI-2012** 공식을 사용하여 계산할 수 있습니다. 아래는 주요 지표에 대한 예측값입니다:

GLI-2012 기준 예측치

- **FEV₁** (1초 강제호기량): 약 **4.20L**
- **FVC** (폐활량): 약 **5.05L**
- **FEV₁/FVC** 비율: 약 **83%**

GLI-global 방식으로 35세 한국인 남성(키 176cm, 체중 74kg)의 폐기능 예측치 평가해줘 GLI 2012 말고



예상 예측값 (GLI-Global 기준)

1. **FEV₁** (1초 강제호기량): 약 **4.3L**
 - 건강한 성인의 평균값으로, 정상 범위는 $\pm 0.6L$ 정도 변동 가능.
2. **FVC** (강제 폐활량): 약 **5.1L**
 - 정상적인 폐활량으로, 예상값 $\pm 0.7L$ 변동 가능.
3. **FEV₁/FVC** 비율: 약 **84%**
 - 정상 범위: 75-85%.
 - 폐기능 감소가 없을 경우, 비율이 이 범위에 포함되어야 함.

Diagnosis

SCREENING AND CASE-FINDING

- **Screening indicated:** Individuals with symptoms or risk factors (>20 pack-years of smoking, recurrent chest infections).
- **Screening effective tools:**
 - Mailing questionnaires, peak flow measurement.
 - Low-cost tools for low-income countries show good discriminatory properties.
- **Limitations of Current Methods:**
 - Modest sensitivity and specificity in identifying undiagnosed COPD.
 - Limited impact on long-term patient outcomes.
- **Future Directions:**
 - Explore early spirometry use in children/adolescents to predict later COPD risk.
 - Enhance patient access to affordable and effective interventions.
 - Refine case-finding tools for better sensitivity and specificity.

Diagnosis

SCREENING AND CASE-FINDING

Leveraging Lung Cancer Screening for COPD Detection

LDCT in High-Risk Smokers:

Recommended for ages 50–80 with ≥ 20 pack-years of smoking.

Common findings:

Airflow obstruction (34–57%)

Emphysema (68–73%)

Undiagnosed COPD (67–90%)

Opportunities:

Assess symptoms and perform spirometry during LDCT.

Emerging tools: Quantitative density analysis, deep learning.

Key Indicators on Imaging: Emphysema, airway wall thickening, mucus plugging.

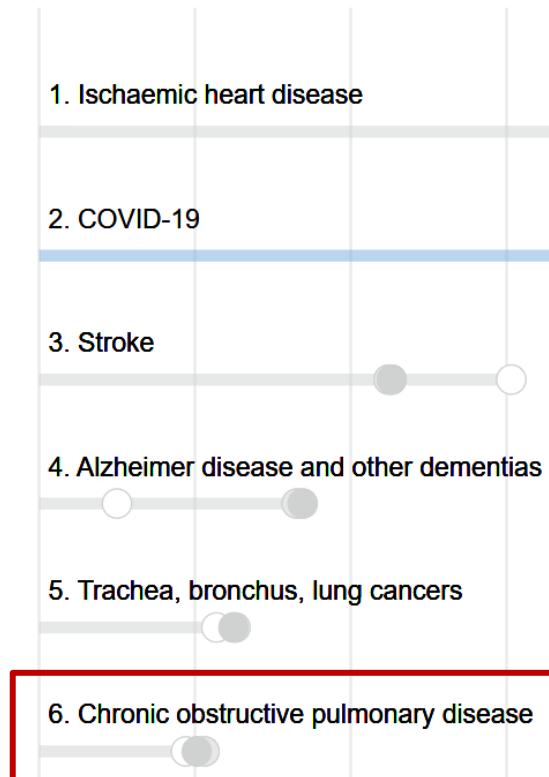
→ Associated with rapid lung function decline and poor quality of life.

GOLD Recommendation: Perform spirometry when imaging abnormalities are identified.

Epidemiology

- **3 million deaths annually**, accounting for **4.72% of all deaths** (GBD, 2017).
- **over 5.4 million deaths annually by 2060**
 - due to increased smoking in LMICs and aging populations.

Leading causes of death in 2021 in high-income countries



Top 10 global causes of death in 2021

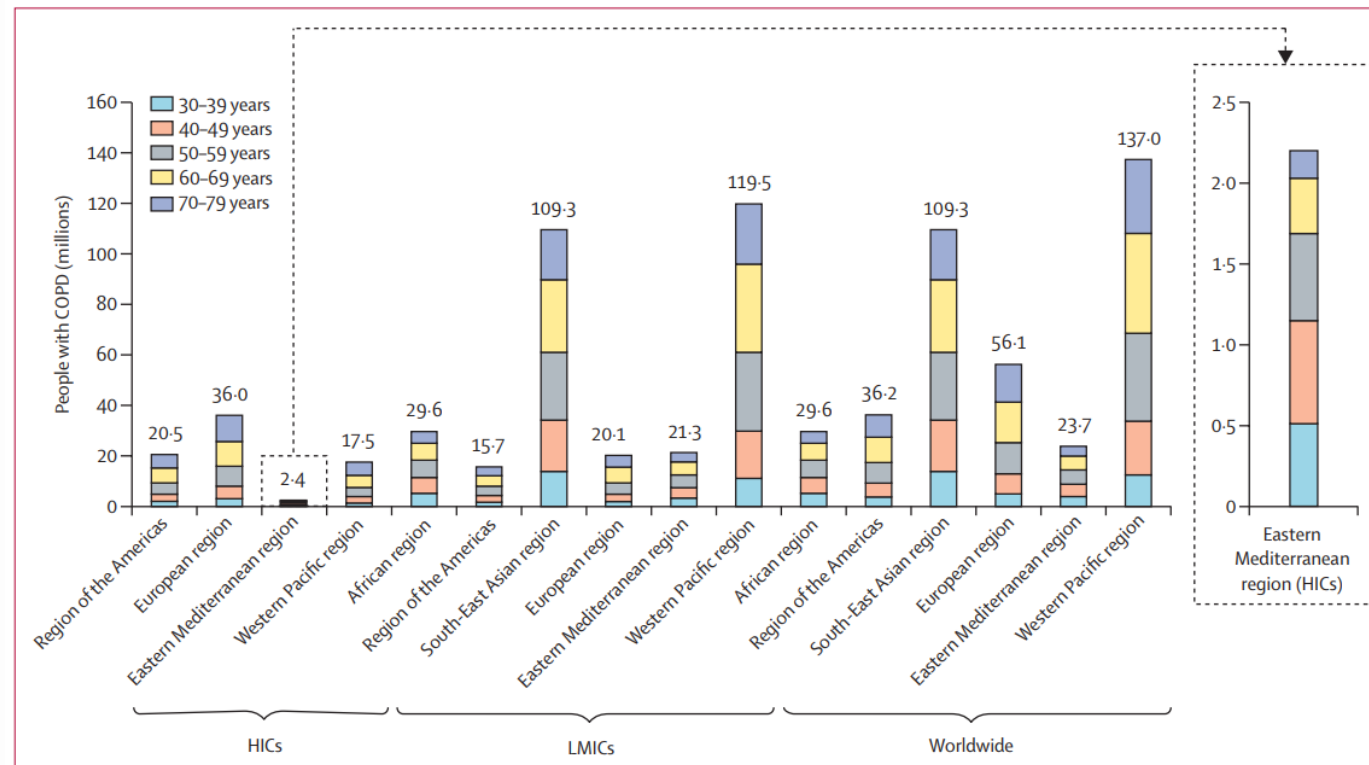
1. Ischaemic heart disease
2. COVID-19
3. Stroke
4. Chronic obstructive pulmonary disease
5. Lower respiratory infections
6. Trachea, bronchus, lung cancers
7. Alzheimer disease and other dementias
8. Diabetes mellitus
9. Kidney diseases
10. Tuberculosis

Top 10 global causes of disability-adjusted life years (DALYs) in 2021

1. COVID-19
2. Ischaemic heart disease
3. Stroke
4. Lower respiratory infections
5. Preterm birth complications
6. Back and neck pain
7. Diabetes mellitus
8. Chronic obstructive pulmonary disease
9. Diarrhoeal diseases
10. Road injury

Epidemiology

- Global prevalence: **10.3%** (95% CI: 8.2%-12.8%) in adults aged ≥ 40 years (BOLD).
- Higher prevalence in:
 - Smokers and ex-smokers.
 - Older adults (≥ 60 years).
 - Men (though women's prevalence is increasing).



Epidemiology

Economic burden



X 18

- Europe: CO₂ emissions for 56% of respiratory disease costs (€38.6 billion).
- U.S.: Projected costs of \$800.9 billion over 20 years.

	Overall				Males				Females			
	Death rate per 100 000	Proportion of all-cause deaths, %	DALY rate per 100 000	Proportion of all-cause DALYs, %	Death rate per 100 000	Proportion of all-cause deaths, %	DALY rate per 100 000	Proportion of all-cause DALYs, %	Death rate per 100 000	Proportion of all-cause deaths, %	DALY rate per 100 000	Proportion of all-cause DALYs, %
All chronic respiratory diseases	51.23 (49.61-52.94)	7.00% (6.76-7.23)	1470.03 (1369.68-1566.56)	4.50% (4.20-4.78)	56.45 (54.32-58.08)	7.12% (6.89-7.30)	1529.43 (1432.75-1624.22)	4.37% (4.12-4.60)	45.97 (42.73-49.34)	6.85% (6.37-7.34)	1410.18 (1288.53-1520.29)	4.65% (4.27-5.03)
Asthma	6.48 (4.43-8.39)	0.88% (0.60-1.14)	297.92 (236.69-370.88)	0.91% (0.76-1.09)	6.30 (3.72-8.85)	0.79% (0.47-1.11)	287.50 (220.90-368.68)	0.82% (0.65-1.02)	6.66 (4.55-8.68)	0.99% (0.68-1.29)	308.43 (237.74-388.97)	1.02% (0.82-1.23)
Chronic obstructive pulmonary disease	41.85 (39.64-43.96)	5.72% (5.43-5.97)	1068.02 (994.47-1135.50)	3.27% (2.96-3.56)	46.68 (43.62-49.25)	5.89% (5.50-6.20)	1128.21 (1045.99-1202.19)	3.22% (2.93-3.49)	36.99 (33.63-39.85)	5.51% (5.00-5.91)	1007.37 (916.25-1088.81)	3.33% (2.95-3.71)
Interstitial lung diseases and pulmonary sarcoidosis	1.93 (1.50-2.37)	0.26% (0.20-0.32)	44.04 (36.19-53.43)	0.13% (0.11-0.16)	2.09 (1.60-2.73)	0.26% (0.20-0.35)	47.93 (38.75-62.32)	0.14% (0.11-0.18)	1.78 (1.19-2.37)	0.26% (0.18-0.35)	40.13 (30.41-52.65)	0.13% (0.10-0.17)
Pneumoconiosis	0.28 (0.27-0.30)	0.04% (0.04-0.04)	6.64 (6.18-7.17)	0.02% (0.02-0.02)	0.50 (0.47-0.53)	0.06% (0.06-0.07)	11.82 (10.98-12.75)	0.03% (0.03-0.04)	0.06 (0.05-0.07)	0.01% (0.01-0.01)	1.42 (1.20-1.66)	0.00% (0.00-0.01)
Other chronic respiratory diseases	0.68 (0.60-0.78)	0.09% (0.08-0.11)	53.40 (47.16-59.63)	0.16% (0.15-0.18)	0.89 (0.76-1.06)	0.11% (0.10-0.13)	53.97 (47.38-61.67)	0.15% (0.14-0.18)	0.48 (0.39-0.56)	0.07% (0.06-0.08)	52.83 (45.68-59.90)	0.17% (0.15-0.20)

Data are point estimate (95% uncertainty interval). DALYs=disability-adjusted life-years.

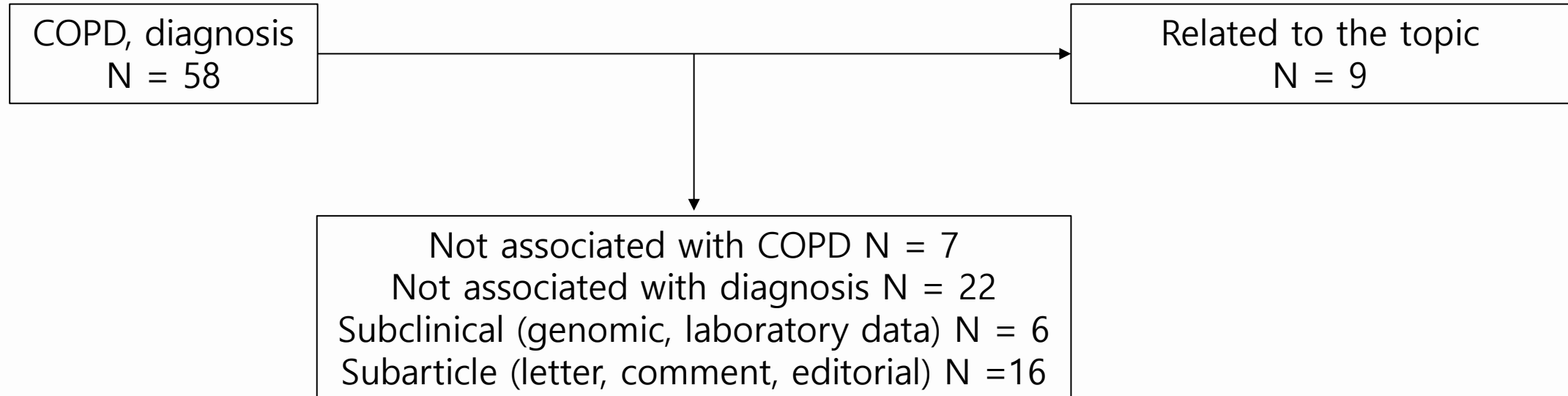
Table 2: Chronic respiratory disease-attributable deaths and DALYs per 100 000 individuals and as a proportion of all-cause deaths and DALYs, respectively, across all super regions, 2017



Diagnosis

Pubmed

Search: (**copd[MeSH Terms] AND (N Engl J Med [ta] OR JAMA [ta] OR Lancet [ta] AND Lancet Respir Med [ta] OR Am J Respir Crit Care Med [ta] OR Eur Respir J [ta] OR Chest [ta] OR Thorax [ta])) AND (diagnosis[MeSH Terms])** Filters: **from 2024 - 2024**



Title	Details	Cited score
Structural Predictors of Lung Function Decline in Young Smokers with Normal Spirometry.	Am J Respir Crit Care Med. 2024 May 15;209(10):1208-1218	15
Early Evidence of Chronic Obstructive Pulmonary Disease Obscured by Race-Specific Prediction Equations.	Am J Respir Crit Care Med. 2024 Jan 1;209(1):59-69	13
Early Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease: The Costs and Benefits of Case Finding.	Am J Respir Crit Care Med. 2024 Apr 15;209(8):928-937	6
Application of the European Respiratory Society/American Thoracic Society Spirometry Standards and Race-Neutral Equations in the COPD Gene Study.	Am J Respir Crit Care Med. 2024 Dec 1;210(11):1317-1328	4
Susceptible Young Adults and Development of Chronic Obstructive Pulmonary Disease Later in Life.	Am J Respir Crit Care Med. 2024 Sep 1;210(5):607-617	4
Can We Use Lung Function Thresholds and Respiratory Symptoms to Identify Pre-Chronic Obstructive Pulmonary Disease? A Prospective, Population-based Cohort Study.	Am J Respir Crit Care Med. 2024 Jun 15;209(12):1431-1440	4
Low smoking exposure and development and prognosis of COPD over four decades: a population-based cohort study.	Eur Respir J. 2024 Sep 12;64(3)	2
Impact of Using Pre- and Postbronchodilator Spirometry Reference Values in a Chinese Population.	Am J Respir Crit Care Med. 2024 Oct 1;210(7):881-889	1
Implications of Global Lung Function Initiative Spirometry Reference Equations in Northeast Asian Patients With COPD	Chest. 2024 Sep 12:S0012-3692(24)05150-X	0

Structural Predictors of Lung Function Decline in Young Smokers with Normal Spirometry

Andrew I. Ritchie^{1,2*}, Gavin C. Donaldson^{1*†}, Eric A. Hoffman^{3,4}, James P. Allinson^{1,5}, Chloe I. Bloom¹,

British Lung Foundation Early COPD partnership

Our study aim is to understand and prevent the development of disabling respiratory disease

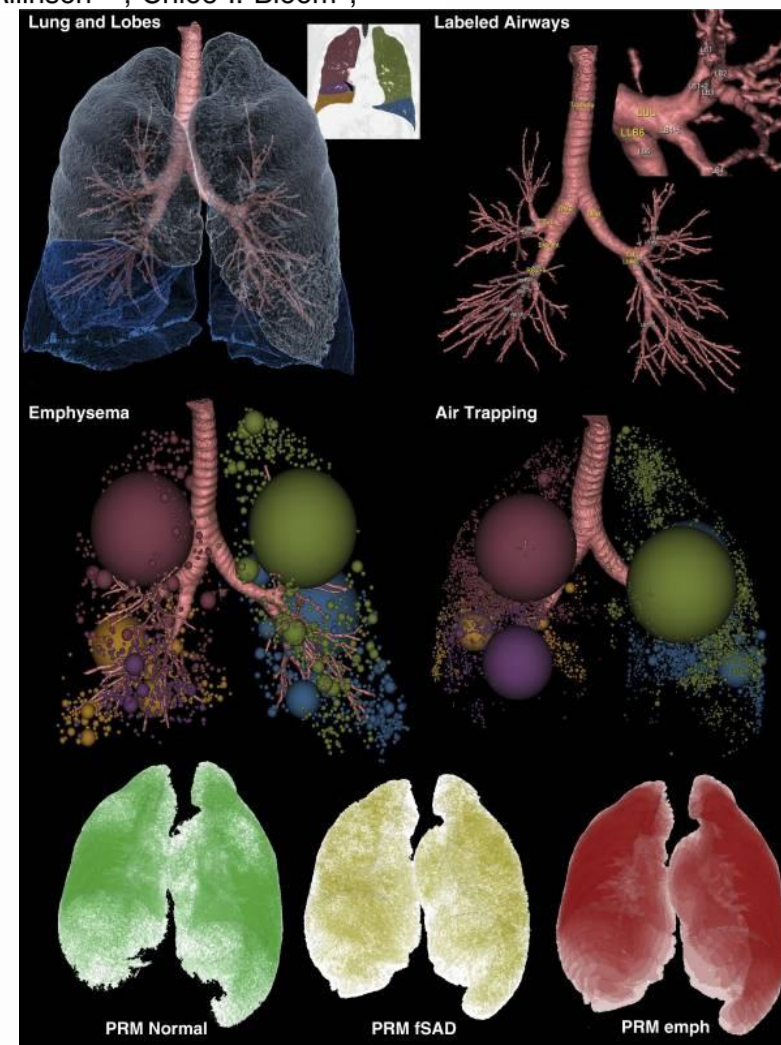
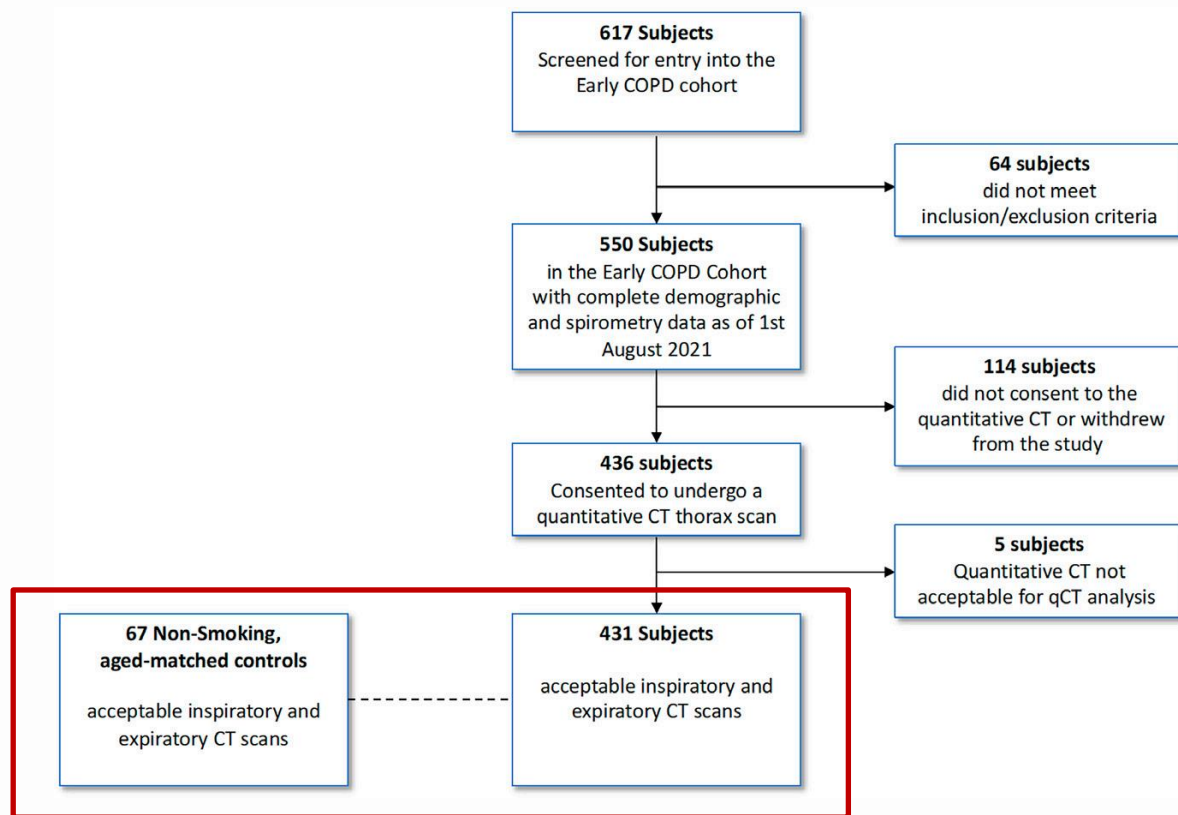
Early
COPD
cohort



- To study the very early stages of the development of COPD
- Recruiting a novel cohort of smokers (age 30-45, > 10PY, current, FEV1>80%)

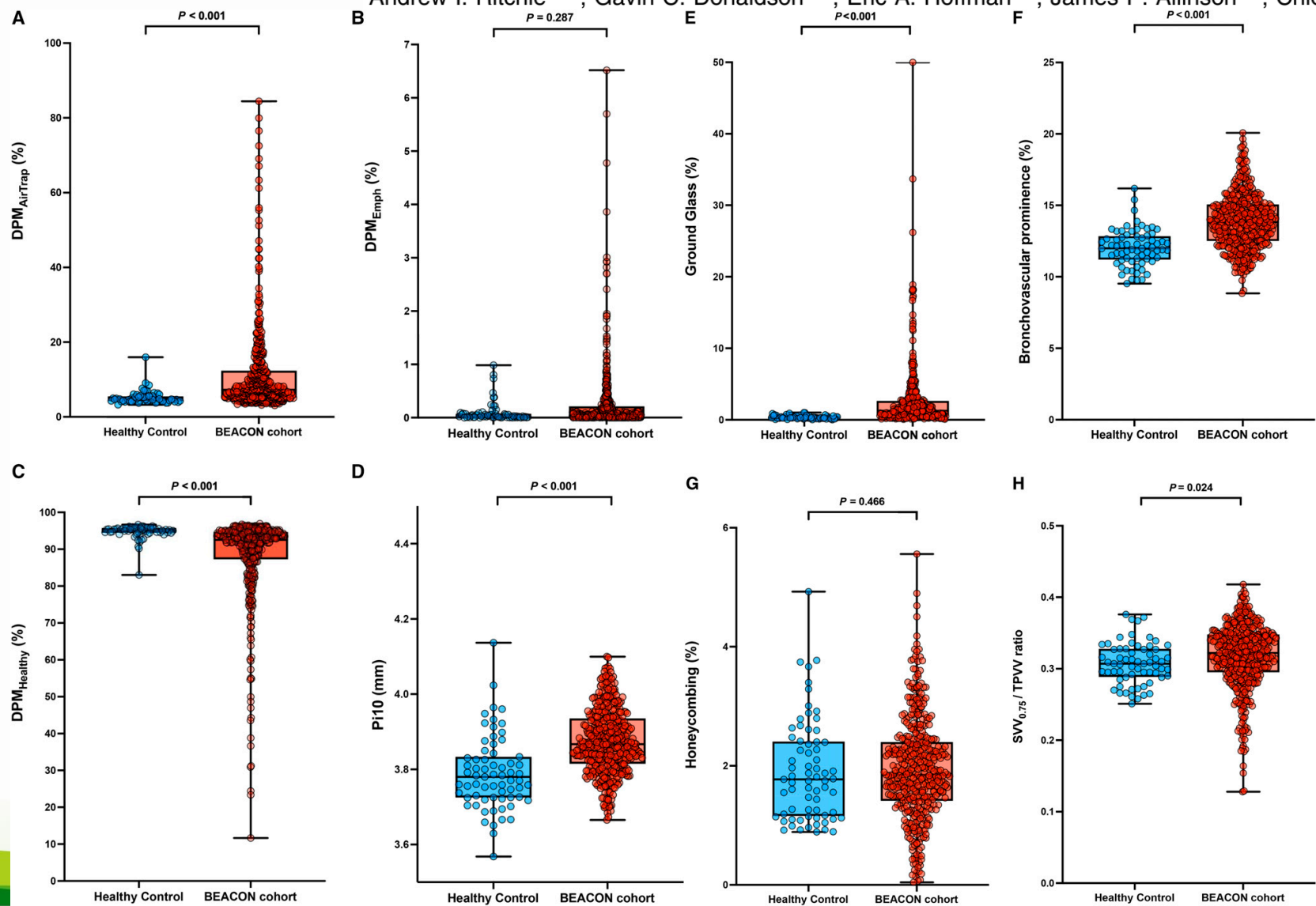
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Smokers vs. Non-smokers:

- **Air trapping ($DPM_{AirTrap}$):** 7.4% vs. 4.7% ($P < 0.001$).
- **Airway wall thickening (Pi10):** 3.85 vs. 3.78 ($P < 0.001$).
- **Ground-glass opacity (GGO):** 1.30% vs. 0.30% ($P < 0.001$).

Radiological changes increased with smoking burden

Structural Predictors of Lung Function Decline in Young Smokers

CT Measurements	Annualised rate of FEV ₁ change per 1% increase in CT Parameter (ml/yr), CI	P-value	Attributable effect of chronic bronchitis on Annualised rate of FEV ₁ change (ml/yr), CI	P-value
a. DPM _{AirTrap} , %	-1.3 (-1.9 to -0.7)	<0.001	-19.9 (-36.8 to 3.1)	0.126
b. DPM _{Emph} , %	-11.8 (-26.4 to 2.8)	0.646	-28.6 (-45.3 to -12.0)	0.006
c. Pi10 (per 0.1mm increase)	-12.1 (-12.1 to -7.3)	<0.001	-35.0 (-14.2 to 21.1)	0.006
d. SVV _{.75} / TPVV [§] (per 0.01 increase in ratio)	-1.1 (-1.4 to -0.8)	<0.001	-35.0 (-168.0 to 98.0)	1.000
e. Ground glass, %	-1.5 (-2.9 to -0.2)	0.135	-0.5 (-139.7 to 128.0)	1.000
f. Broncho-vascular prominence, %	-2.5 (-3.1 to -1.9)	<0.001	0.7 (-16.8 to 18.1)	1.000

All markers correlated with faster FEV1 decline.

James P. Allinson^{1,5}, Chloe I. Bloom¹,

• **Annual FEV1 decline:**

- **-36.4 ml/year** (P < 0.001).
- Accelerated decline with:
 - Air trapping (DPM_{AirTrap})
: **-21.5 ml/year** per 1% increase.
 - Pi10 (airway wall thickening)
: **-29.1 ml/year** per 0.1 mm increase.
 - GGO
: **-23.4 ml/year** per 1% increase.

Structural Predictors of Lung Function Decline in Young Smokers with Normal Spirometry

Andrew I. Ritchie^{1,2*}, Gavin C. Donaldson^{1*†}, Eric A. Hoffman^{3,4}, James P. Allinson^{1,5}, Chloe I. Bloom¹,

Table 2. Examining the Association between Computed Tomography Measurements and Symptom Burden on Baseline FEV₁ and FEV₁ Longitudinal Change in the Study Cohort

	Difference in Baseline FEV ₁ (ml) (95% CI)	P Value	Annualized Rate of FEV ₁ Change (ml/yr) (95% CI)	P Value
Model 1: CT measurements				
Per 1% increase in CT parameter				
Air trapping, emphysema, and medium-large airway wall thickness				
DPM _{AirTrap} , %	−1.4 (−6.1 to 6.1)	NS	−1.5 (−2.1 to −0.1)	<0.001
DPM _{Emph} , %	92.3 (26.4 to 184.3)	NS	−19.5 (−33.5 to −5.6)	0.036
Pi10 (per 0.1-mm increase)	−79.7 (−1,136 to 976.8)	NS	−9.1 (−11.3 to −7.1)	<0.001
Vascular measurement				
SVV _{0.75} :TPVV (per 0.01 increase in ratio)	17.7 (51 to 300)	0.036	−1.1 (−1.3 to −0.8)	<0.001
Additional structural measurements				
Ground-glass opacity, %	−10.4 (−25.3 to 4.5)	NS	−3.4 (−5.5 to −1.3)	0.006
Bronchovascular prominence, %	−26.7 (−57.2 to 0.4)	NS	−2.6 (−3.2 to −2.0)	<0.001
Model 2: symptoms				
Per 1-unit increase in CAT score				
CAT score (per additional 1 unit)	−13.4 (−22.3 to −4.5)	0.003	−1.4 (−2.7 to −0.2)	0.025

CT degree ↓ → FEV1 decline

Structural Predictors of Lung Function Decline in Young Smokers with Normal Spirometry

Andrew I. Ritchie^{1,2*}, Gavin C. Donaldson^{1*†}, Eric A. Hoffman^{3,4}, James P. Allinson^{1,5}, Chloe I. Bloom¹,

- Radiological abnormalities in smokers
 - Early markers of small airway dysfunction and parenchymal damage.
 - Develop **before** clinical symptoms or spirometric changes.
(Chronic bronchitis ; present in only 24% of smokers)
- Smoking burden is the primary driver of these changes.
- **QCT metrics can identify lung damage before COPD develops.**
- Longitudinal CT studies to track progression.

Early Evidence of Chronic Obstructive Pulmonary Disease Obscured by Race-Specific Prediction Equations

Elizabeth A. Regan², Melissa E. Lowe⁶, Barry J. Make¹, Jeffrey L. Curtis^{7,8}, Quan (Grace) Chen⁹, James L. Crooks^{3,4,10},

ERS TASK FORCE

Multi-ethnic reference values for spirometry for the 3–95-yr age range: the global lung function 2012 equations

ORIGINAL ARTICLE

A Race-neutral Approach to the Interpretation of Lung Function Measurements

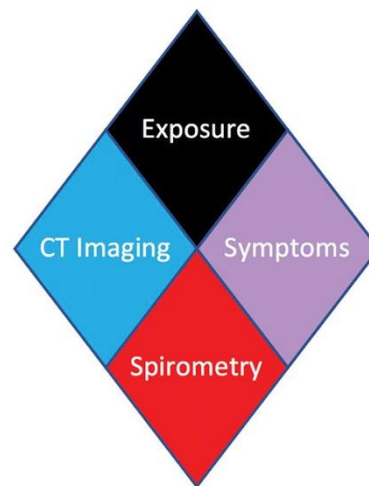
Cole Bowerman^{1,2}, Nirav R. Bhakta³, Danny Brazzale⁴, Brendan R. Cooper⁵, Julie Cooper⁵, Laura Gochicoa-Rangel⁶, Jeffrey Haynes⁷, David A. Kaminsky⁸, Le Thi Tuyet Lan⁹, Refiloe Masekela¹⁰, Meredith C. McCormack¹¹, on Initiative

SPECIAL ARTICLE

Implications of Race Adjustment in Lung-Function Equations

J.A. Diao, Y. He, R. Khazanchi, M.J. Nguemini Tiako, J.I. Witonsky, E. Pierson, P. Rajpurkar, J.R. Elhawary, L. Melas-Kyriazi, A. Yen, A.R. Martin, S. Levy, C.J. Patel, M. Farhat, L.N. Borrell, M.H. Cho, E.K. Silverman, E.G. Burchard, and A.K. Manrai

Figure 1. Features Used to Define COPD in the COPDGene® Study



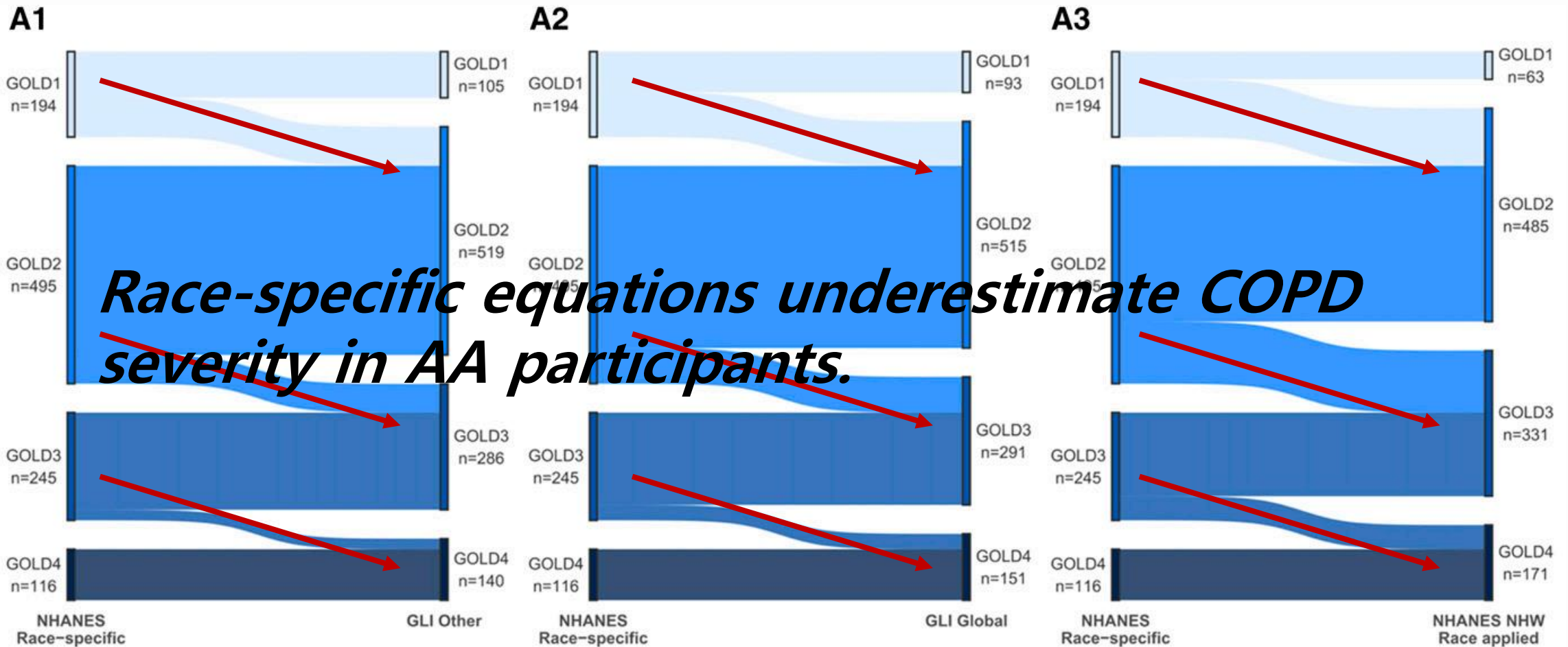
Exposure in the COPDGene® study includes individuals with a total of ≥ 10 pack years smoking. **CT Imaging** includes individuals with quantitative assessment showing $\geq 5\%$ emphysema, a $Pi10 \geq 2.5$ mm or $\geq 15\%$ gas trapping. **Symptoms** include individuals with an mMRC dyspnea score ≥ 2 or chronic bronchitis. **Spirometry** includes individuals with $FEV_1 < 80\%$ predicted or $FEV_1/FVC < 0.70$.



- GOLD(race specific) → GLI ; grading difference by race

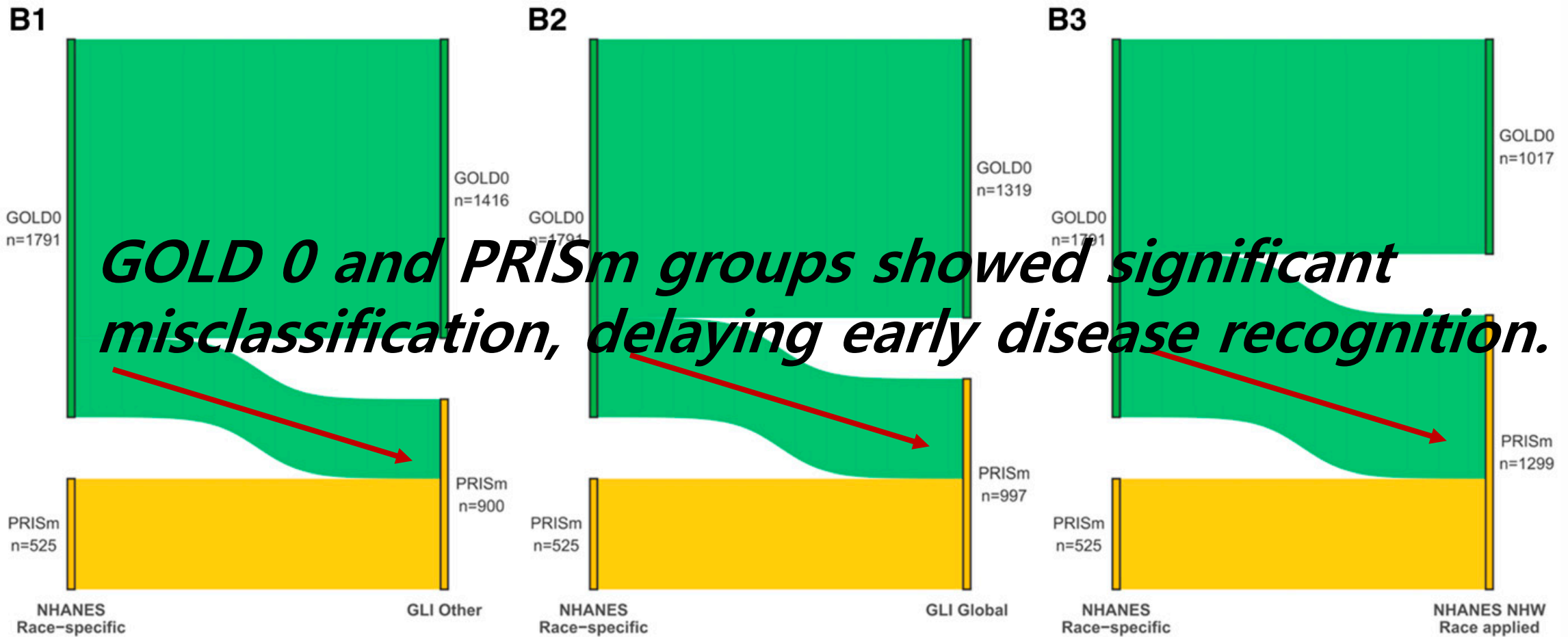
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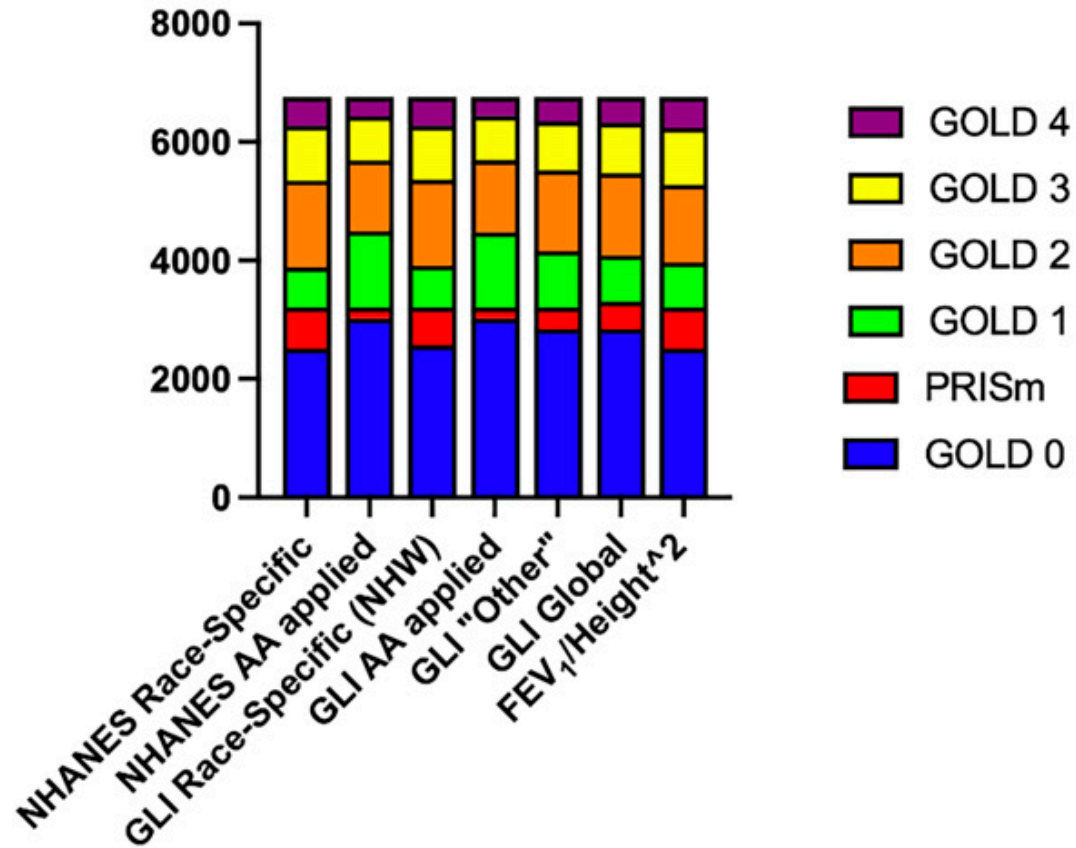
Elizabeth A. Regan², Melissa E. Lowe⁶, Barry J. Make¹, Jeffrey L. Curtis^{7,8}, Quan (Grace) Chen⁹, James L. Crooks^{3,4,10},



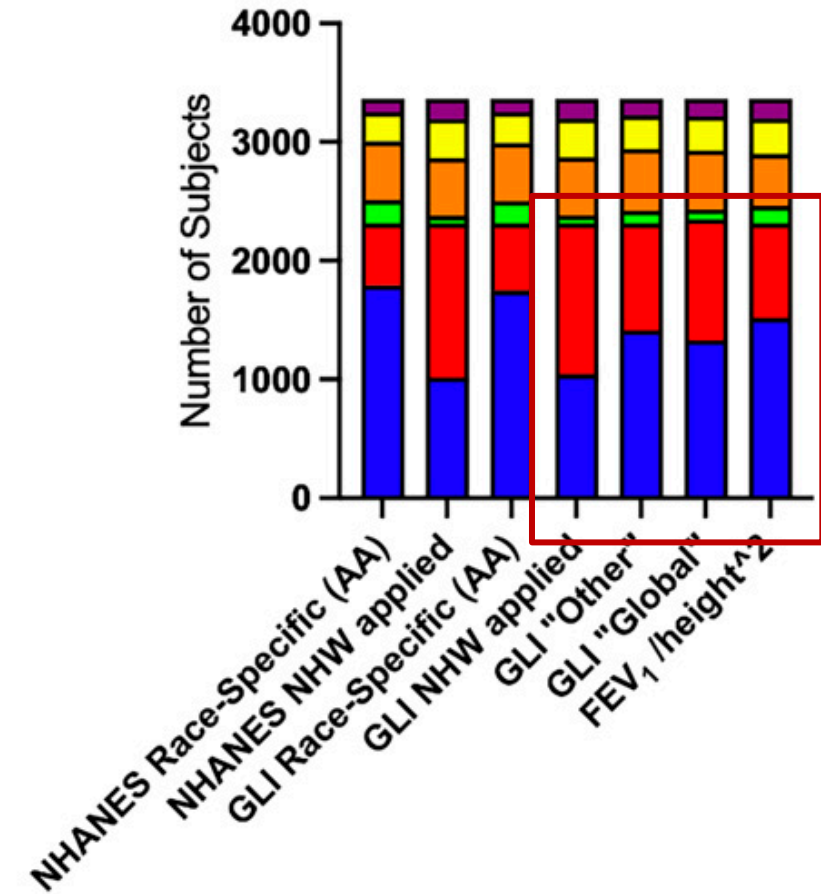
Early Evidence of Chronic Obstructive Pulmonary Disease Obscured by Race-Specific Prediction Equations

Elizabeth A. Regan², Melissa E. Lowe⁶, Barry J. Make¹, Jeffrey L. Curtis^{7,8}, Quan (Grace) Chen⁹, James L. Crooks^{3,4,10},

A Non-Hispanic White Participants



B African-American Participants



Early Evidence of Chronic Obstructive Pulmonary Disease Obscured by Race-Specific Prediction Equations

Elizabeth A. Regan², Melissa E. Lowe⁶, Barry J. Make¹, Jeffrey L. Curtis^{7,8}, Quan (Grace) Chen⁹, James L. Crooks^{3,4,10},

- **Race-specific equations fail** to accurately represent COPD severity in AA individuals.
- *Broader diagnostic criteria* are needed for equitable and effective disease management.
- Focus on early-stage disease detection to prevent progression and test new treatments.

Early Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease

The Costs and Benefits of Case Finding

Shawn D. Aaron^{1*}, Maria Montes de Oca^{2,3*}, Bartolome Celli⁴, Surya P. Bhatt⁶, Jean Bourbeau⁷, Gerard J. Criner⁸,

Case-Finding Tools	Study	AUC	Case-Finding Tools	Study	AUC
Questionnaires COPD-PS	Ronaldson <i>et al.</i> (2018) (37)	0.66	Hand devices PEF COPD-6 score	Ronaldson <i>et al.</i> (2018) (37)	0.77
	Spyratos <i>et al.</i> (2017) (38)	0.79		Fujita <i>et al.</i> (2020) (44)	0.82
CDQ					0.83
					0.76
					0.87
					0.80
					0.84
					0.85
					0.94
Combination tools				0.85	
Changed CDQ + COPD-6 score		Fujita <i>et al.</i> (2020) (44)	0.87	0.85	
COPD-PS + PEF		Soriano <i>et al.</i> (2018) (31)	0.76	0.86	
CAPTURE + PEF		Quezada <i>et al.</i> (2017) (50)	0.95	0.90	
		Martinez <i>et al.</i> (2017) (52)	0.90	0.87	
		Martinez <i>et al.</i> (2023) (81)	0.81		
LFQ					
Simple PUMA	Zhou <i>et al.</i> (2022)	0.78			
	López Varela <i>et al.</i> (2016) (51)	0.70			
	Lopez Varela <i>et al.</i> (2019) (49)	0.70–0.76			
Weighted PUMA CAPTURE	Au-Doung <i>et al.</i> (2022) (42)	0.75			
	López Varela <i>et al.</i> (2016) (51)	0.79			
	Quezada <i>et al.</i> (2017) (50)	0.93			
	Martinez <i>et al.</i> (2017) (52)	0.79			
UCAP-Q	Zhou <i>et al.</i> (2022)	0.67			
	Huynh <i>et al.</i> (2022) (53)	0.81–0.82			

- Case-finding strategy for primary clinic

Early Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease

The Costs and Benefits of Case Finding

Shawn D. Aaron^{1*}, Maria Montes de Oca^{2,3*}, Bartolome Celli⁴, Surya P. Bhatt⁶, Jean Bourbeau⁷, Gerard J. Criner⁸,

Please answer	문항	아니오 (0점)	예 (1점)
1. Have you ever had asthma, emphysema, or chronic bronchitis, or do you have a family history of these conditions?	1. 오염된 공기, 연기, 간접흡연, 먼지 등이 있는 환경에서 살거나 일한 적이 있습니까?	<input type="checkbox"/>	<input type="checkbox"/>
2. Does your job require you to work in a dusty, smoky, or otherwise polluted environment?	2. 계절, 날씨, 공기 질에 따라 호흡이 변합니까?	<input type="checkbox"/>	<input type="checkbox"/>
3. Does your job require you to lift or carry heavy loads?	3. 무거운 짐을 나르거나 흙을 삽질하거나, 조깅, 테니스, 수영 같은 활동을 할 때 숨쉬기가 어렵습니까?	<input type="checkbox"/>	<input type="checkbox"/>
4. Compared with people of your age, do you get out of breath more easily when you walk or climb stairs?	4. 같은 나이 또래와 비교했을 때 쉽게 피로를 느끼나요?	<input type="checkbox"/>	<input type="checkbox"/>
5. In the past 12 months, have you had a cough, phlegm, or wheezing that was not due to a cold or flu, or have you had two or more episodes of pneumonia?	5. 지난 12개월 동안 감기, 기관지염, 폐렴 등으로 인해 직장, 학교, 또는 활동을 몇 번이나 쉬었습니까?	없음 (0점) <input type="checkbox"/> 한 번 (1점) <input type="checkbox"/> 두 번 이상 (2점) <input type="checkbox"/>	

as
or 6 or
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'min for

Total Score (0 to 6)
0 or 1

2, 3, or 4
Record Highest Flow (highest of 3)

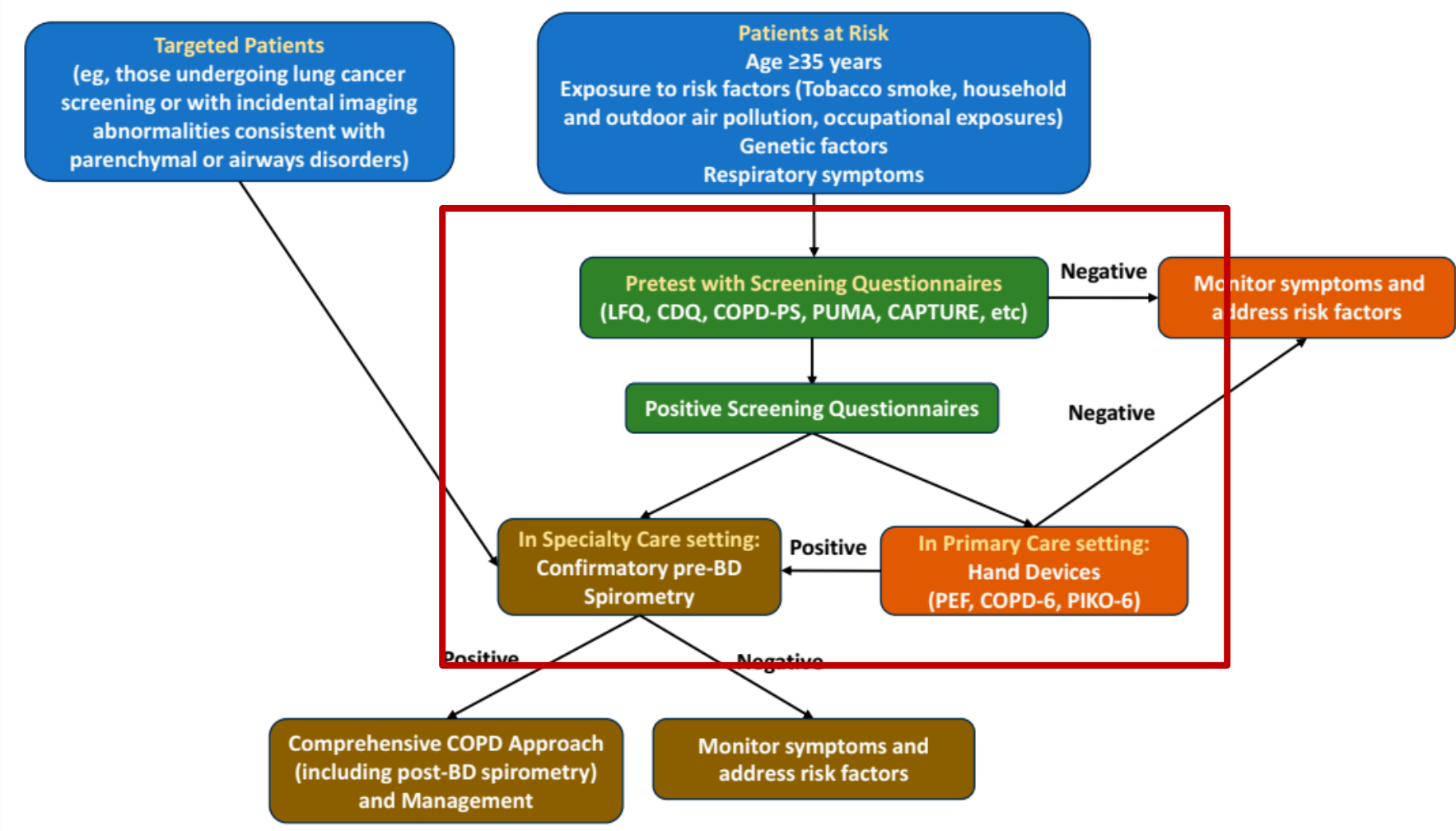
5 or 6

D. Significant likelihood of COPD:
Evaluation including spirometry recommended

Early Diagnosis and Treatment of Chronic Obstructive Pulmonary Disease

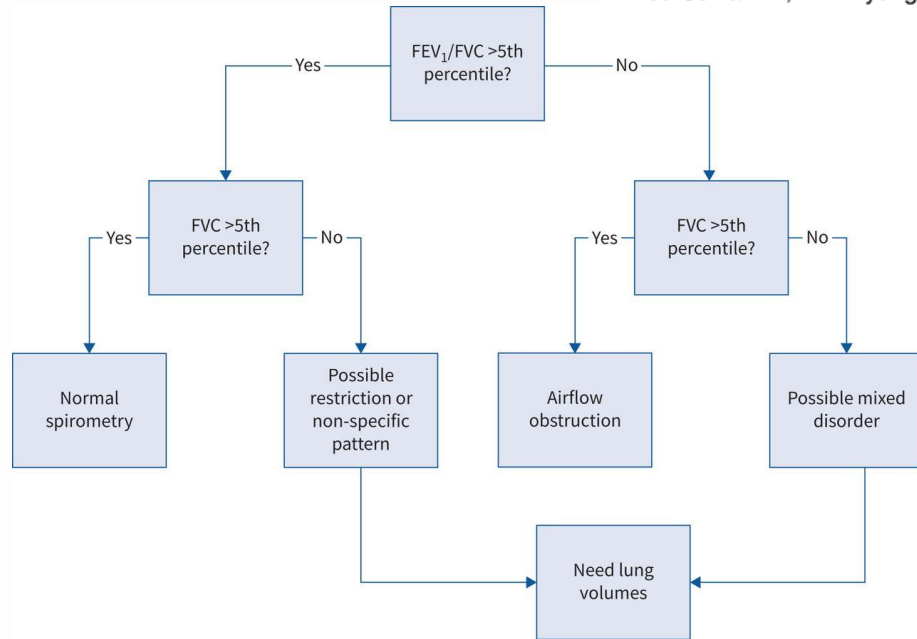
The Costs and Benefits of Case Finding

Shawn D. Aaron^{1*}, Maria Montes de Oca^{2,3*}, Bartolome Celli⁴, Surva P. Bhatt⁶, Jean Bourbeau⁷, Gerard J. Criner⁸.



Application of the European Respiratory Society/American Thoracic Society Spirometry Standards and Race-Neutral Equations in the COPDGene Study

Enrico Schiavi^{1,2}, Min Hyung Ryu^{2,4}, Leonardo Martini², Aparna Balasubramanian⁵, Meredith C. McCormack⁵,



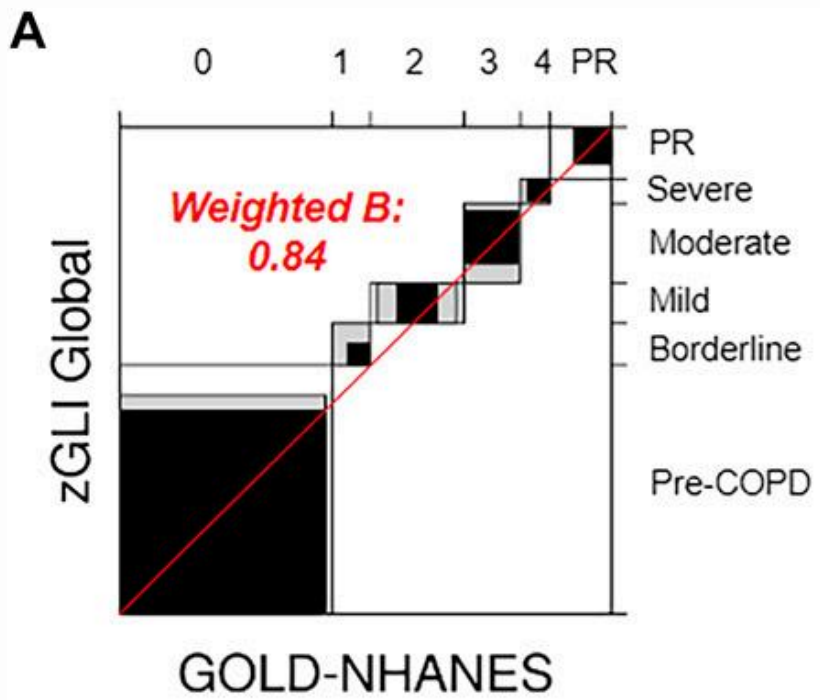
- 10,108 smokers from the COPDGene study.
- GOLD (NHANES III equations) vs. zGLI Race-Specific & Global (race-neutral).
- Prognosis, imaging characteristics, exacerbation rates, and mortality.

Severity of lung function impairment

For all measures use z-score:
 Mild: -1.65 to -2.5
 Moderate: -2.51 to -4.0
 Severe: <-4.1

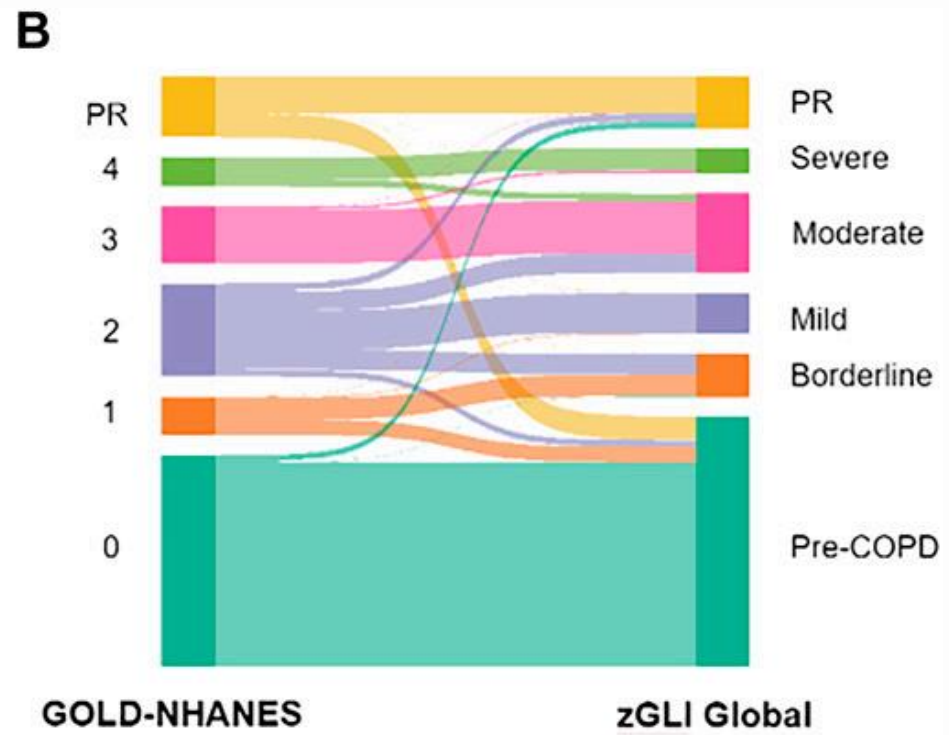
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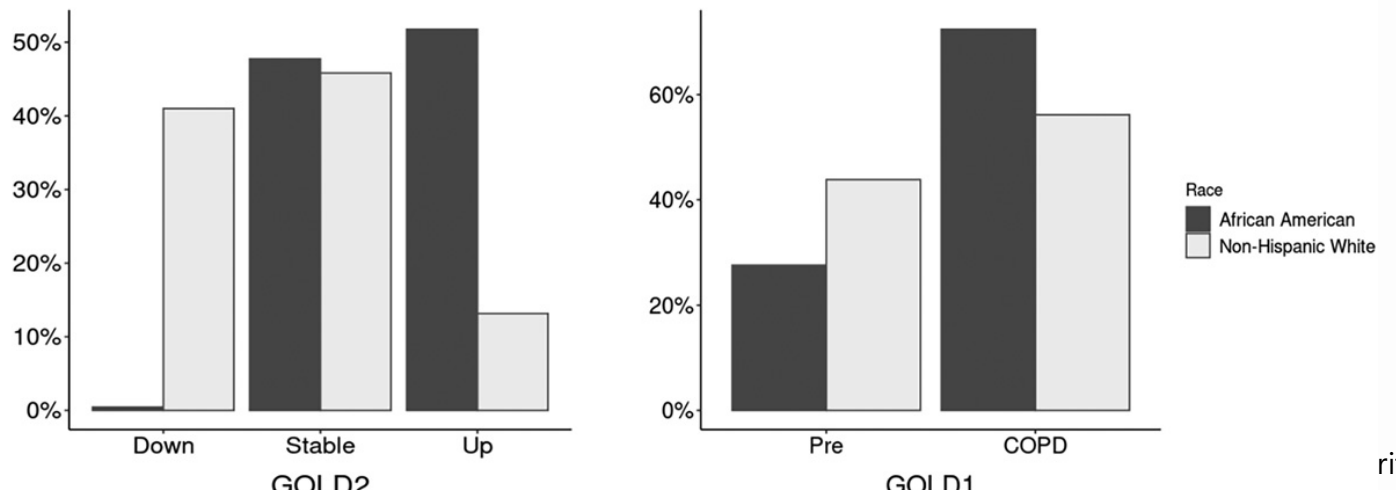
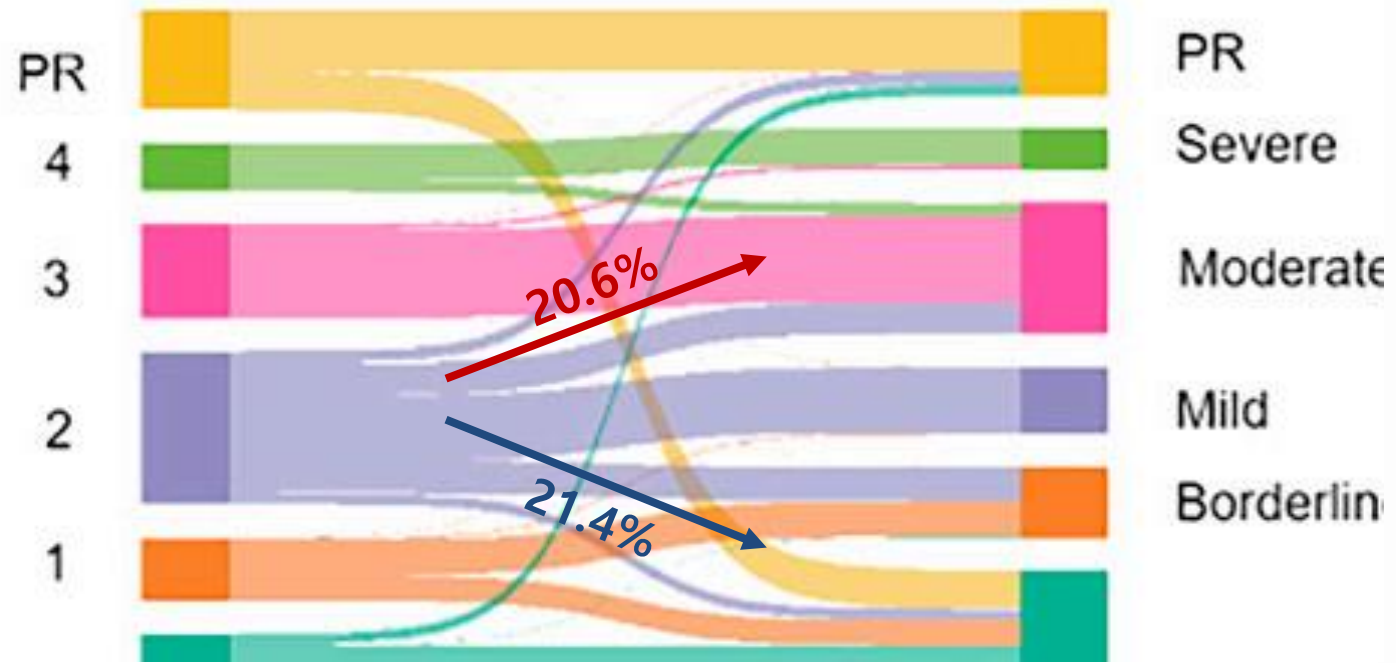


Agreement legend

- Full
- 1 class difference
- >1 class difference

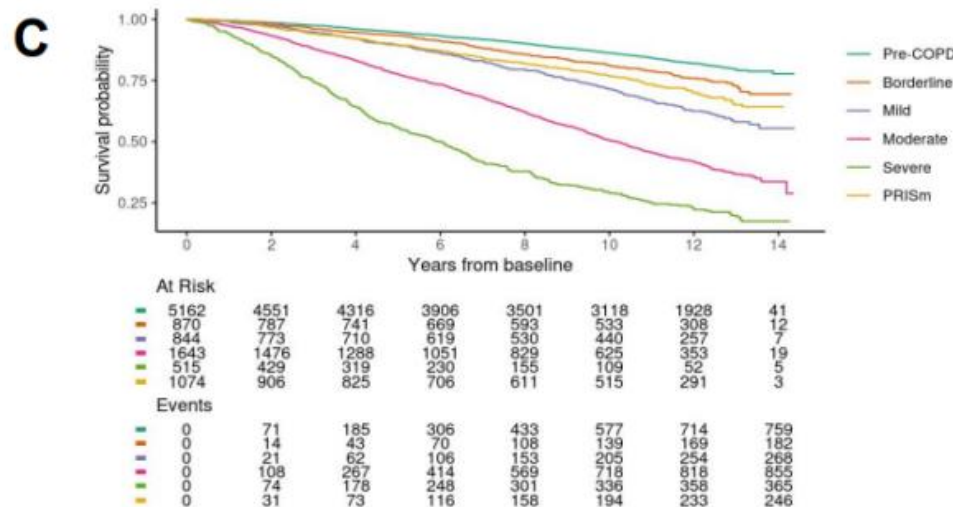
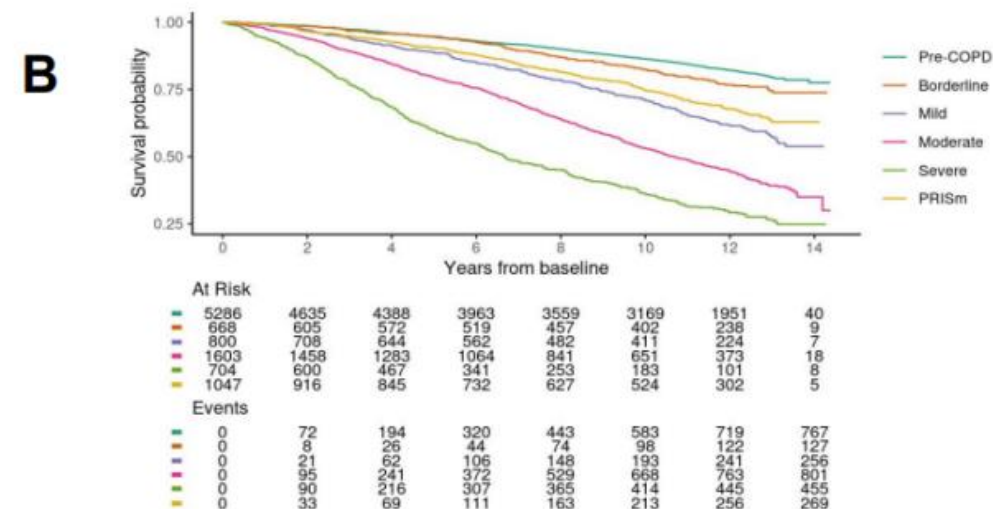
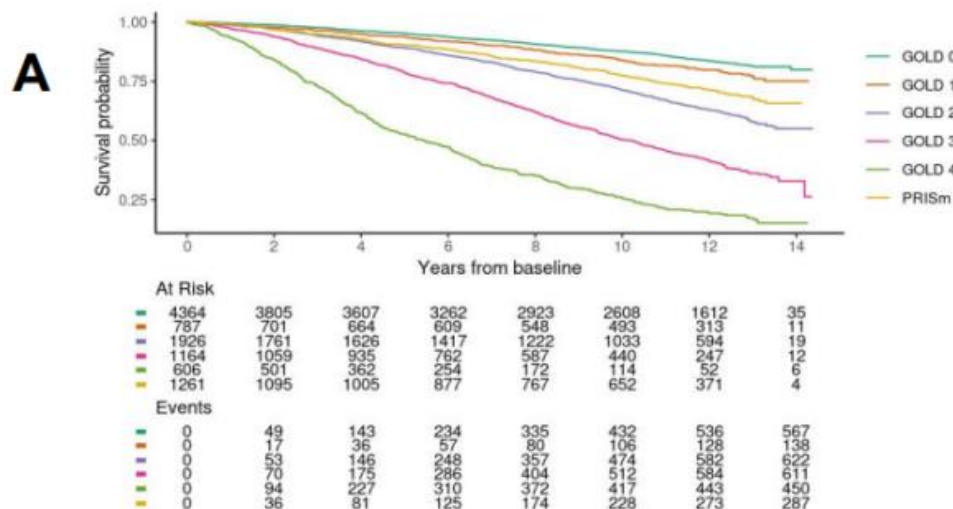


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Application of the European Respiratory Society/American Thoracic Society Spirometry Standards and Race-Neutral Equations in the COPDGen Study

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During a median follow-up time of 10.5 years ± 4.3 (standard deviation), 2,676 (26.5%) participants died

Application of the European Respiratory Society/American Thoracic Society Spirometry Standards and Race-Neutral Equations in the COPDGen Study

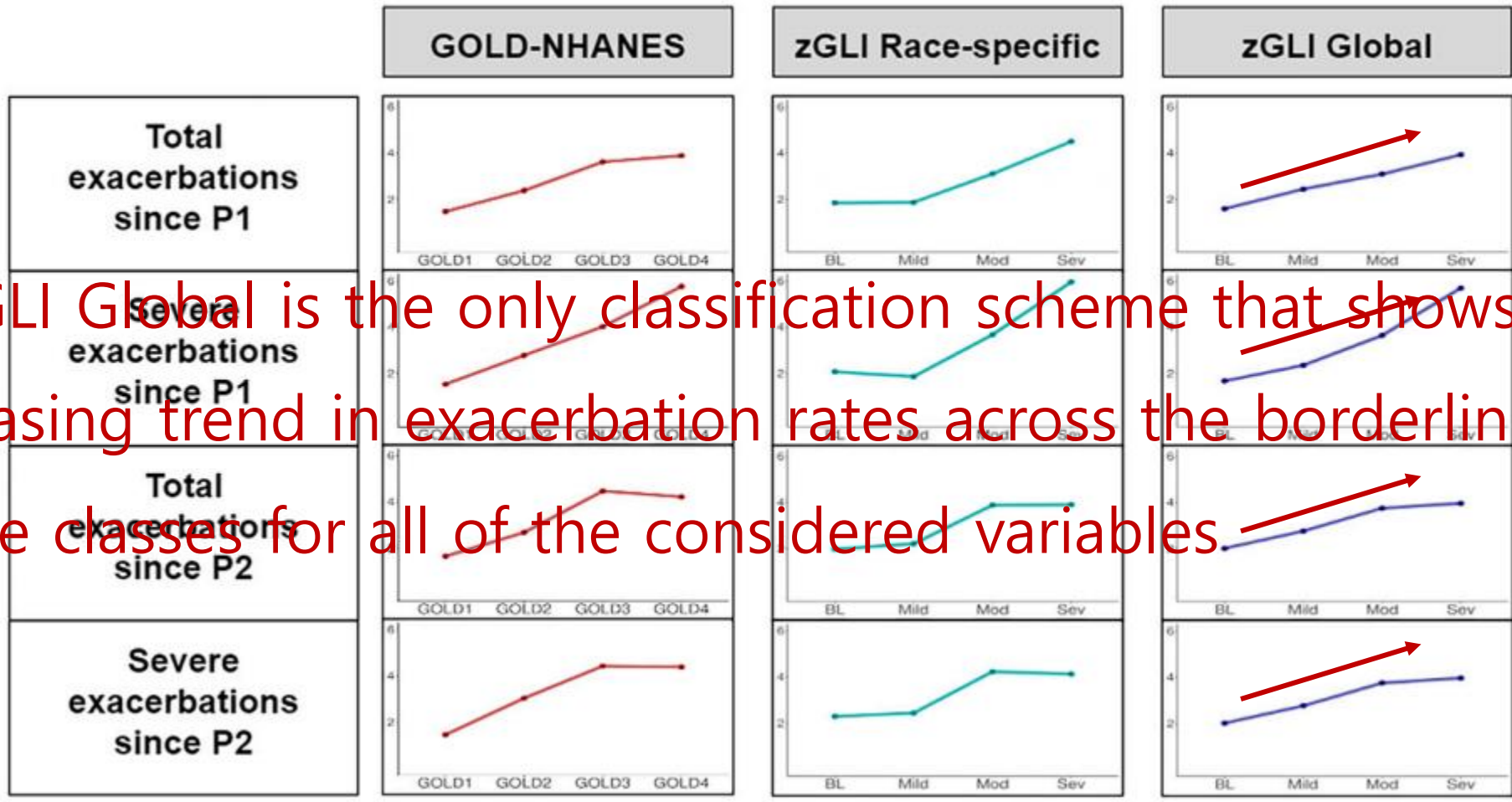
Enrico Schiavi^{1,2}, Min Hyung Ryu^{2,4}, Leonardo Martini², Aparna Balasubramanian⁵, Meredith C. McCormack⁵,

	Adjusted HR* (95% CI)		
	GOLD-NHANES		zGLI Global
GOLD 0	Ref	Pre-COPD	Ref
GOLD 1	1.03 (0.85–1.24)	Borderline	1.23 [†] (1.04–1.44)
GOLD 2	2.11 [†] (1.88–2.37)	Mild	1.95 [†] (1.70–2.25)
GOLD 3	4.11 [†] (3.65–4.62)	Moderate	3.77 [†] (3.42–4.17)
GOLD 4	9.52 [†] (8.37–10.8)	Severe	8.35 [†] (7.34–9.50)
PRISm	1.88 [†] (1.63–2.17)	PRISm	1.83 [†] (1.58–2.12)

→ Concordance was *0.73* for all three classifications.

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→ zGLI Global is the only classification scheme that shows a clear increasing trend in exacerbation rates across the borderline to severe classes for all of the considered variables



Susceptible Young Adults and Development of Chronic Obstructive Pulmonary Disease Later in Life

Yunus Çolak^{1,2,4}, Peter Lange^{1,2,4,5}, Jørgen Vestbo⁶, Børge G. Nordestgaard^{2,3,4}, and Shoaib Afzal^{2,3,4}

- Copenhagen General Population Study (2003–) and Copenhagen Heart Study (1976–1978).
- Participants:** ages 20–50 years (smokers and nonsmokers) without COPD
- Follow-up for 10~25yrs
- Susceptible individuals definition
 1. Chronic bronchitis
 2. PRISm
 3. $LLN > FEV1/FVC > 0.70$

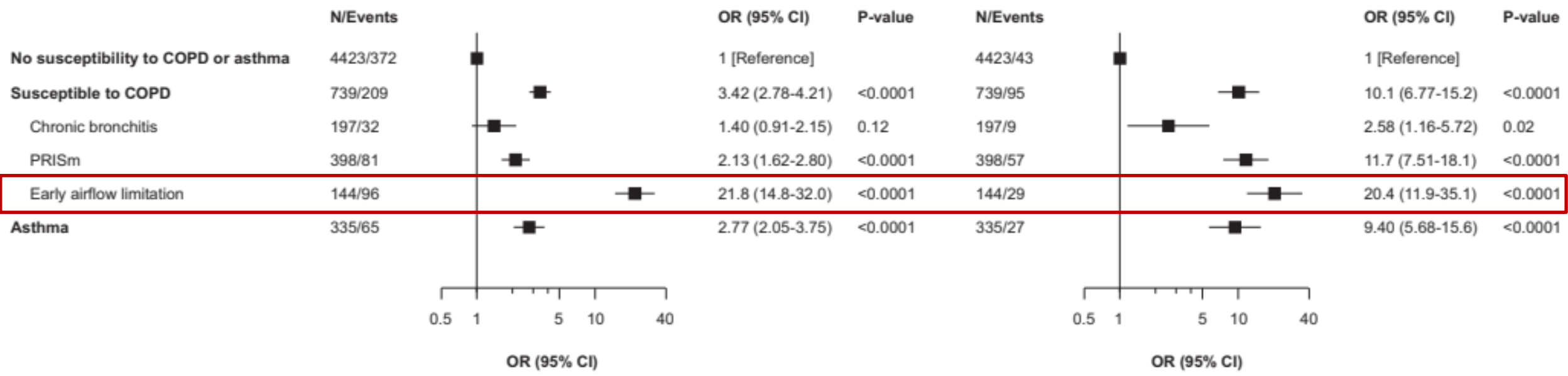
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The Copenhagen General Population Study

COPD at final examination 10 years later

COPD GOLD 2-4 at final examination 10 years later



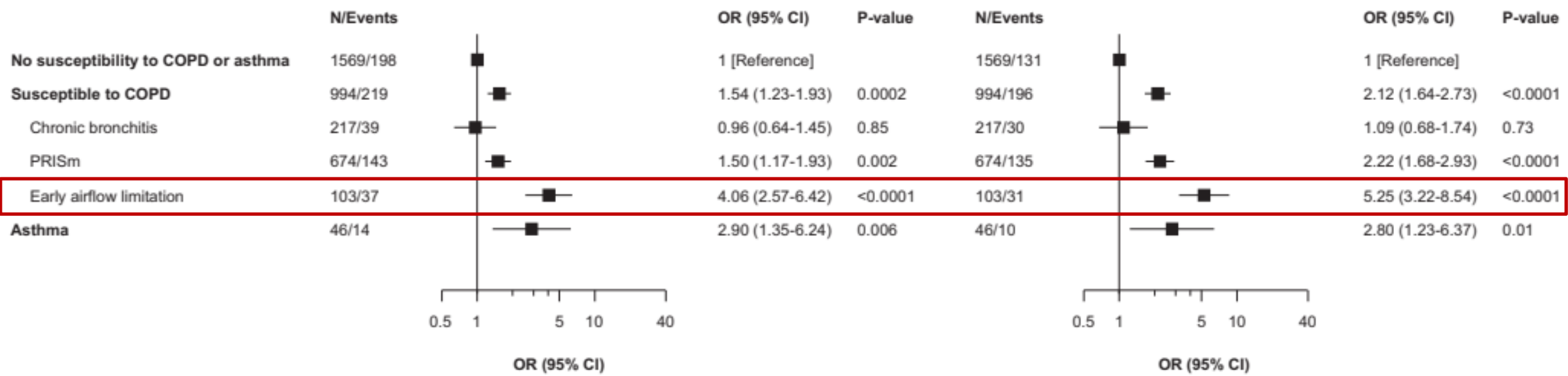
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The Copenhagen City Heart Study

COPD at final examination 25 years later

COPD GOLD 2-4 at final examination 25 years later

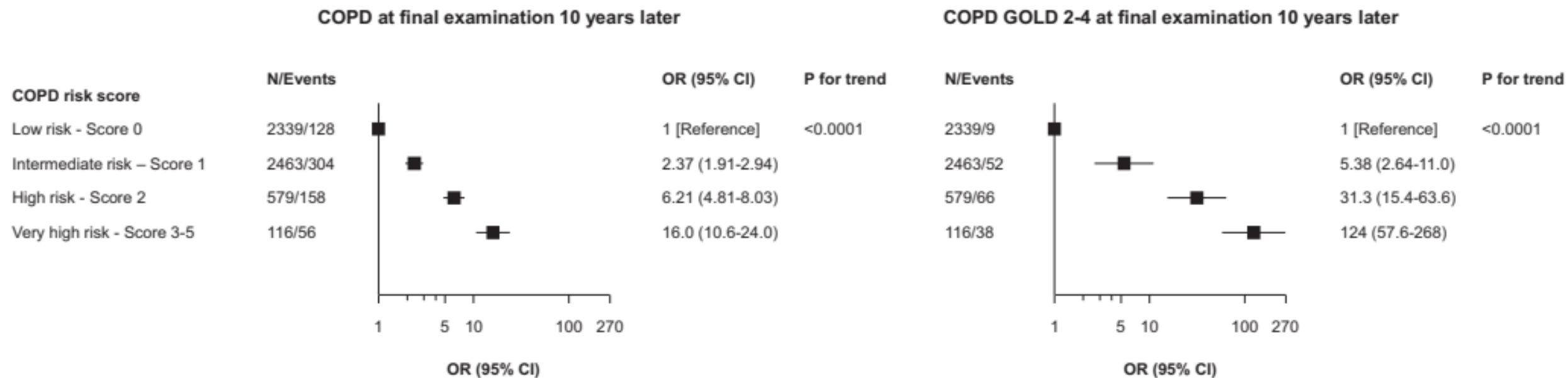


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Table 2. Risk Factors Used for Calculating COPD Risk Score in Individuals without Airflow Limitation

The Copenhagen General Population Study



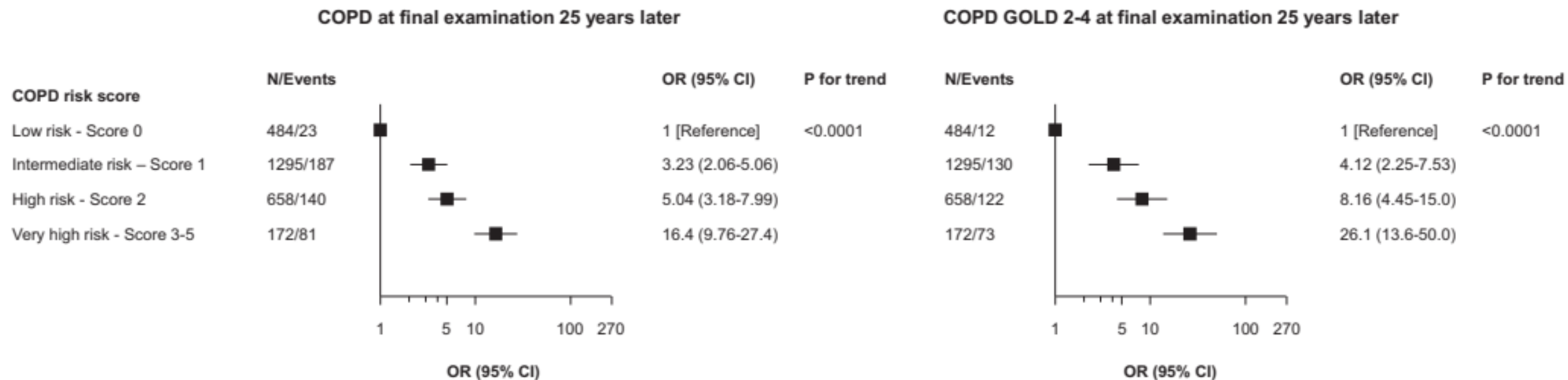
Definition of abbreviations: COPD = chronic obstructive pulmonary disease; LLN = lower limit of normal.

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The Copenhagen City Heart Study

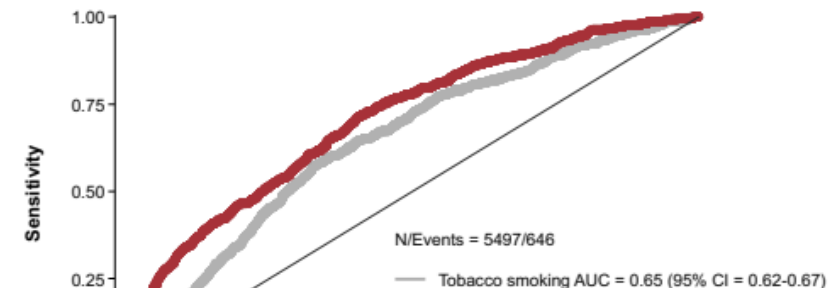


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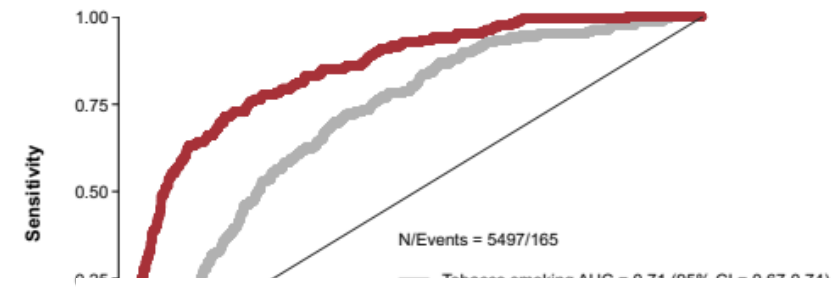
Susceptible Young Adults and Development of Chronic Obstructive Pulmonary Disease Later in Life

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COPD at final examination 10 years later



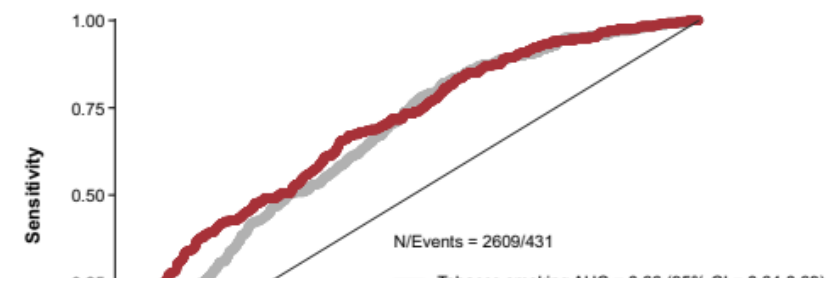
COPD GOLD 2-4 at final examination 10 years later



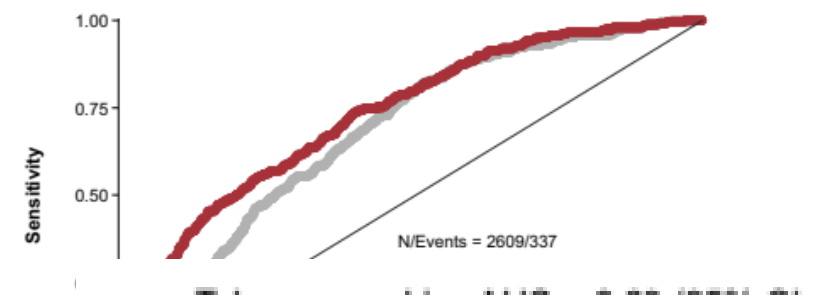
Predictive COPD risk score with AUC:0.69–0.71 for overall COPD

The Copenhagen City Heart Study

COPD at final examination 25 years later



COPD GOLD 2-4 at final examination 25 years later



— Tobacco smoking AUC = 0.66 (95% CI = 0.64-0.69)
 — COPD risk score AUC = 0.69 (95% CI = 0.67-0.72)

— Tobacco smoking AUC = 0.69 (95% CI = 0.66-0.72)
 — COPD risk score AUC = 0.74 (95% CI = 0.71-0.77)

Can We Use Lung Function Thresholds and Respiratory Symptoms to Identify Pre-Chronic Obstructive Pulmonary Disease?

A Prospective, Population-based Cohort Study

Daniel J. Tan^{1,10}, Caroline J. Lodge¹, E. Haydn Walters^{1,2}, Dinh S. Bui¹, Jonathan Pham^{1,3}, Adrian J. Lowe¹,

•Study Population:

1,372 middle-aged adults (average age: 44.9 years, 49.3% female).

•Tasmanian Longitudinal Health Study (TAHS), Australia

•Combination of cross-sectional and longitudinal design.

•**Follow-up Period:** 8.3 years.

•preBD diagnosis + Sx

; Youden index used to evaluate discriminatory accuracy of spirometry thresholds.

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	z-Score	Percentile	Sensitivity	Specificity	LR ⁺	LR ⁻	Y _{Max}
Pre-BD FEV ₁ /FVC	-1.264	<10th	88% (71, 96)	87% (84, 89)	6.79 (5.40, 8.52)	0.14 (0.05, 0.38)	0.75
Pre-BD FEF ₂₅₋₇₅	-1.328	<9th	79% (60, 90)	88% (86, 90)	6.76 (5.13, 8.89)	0.24 (0.12, 0.50)	0.67
Pre-BD FEV ₁	-0.535	<30th	73% (54, 86)	67% (64, 70)	2.20 (1.71, 2.83)	0.41 (0.22, 0.75)	0.40
Post-BD FEV ₁ /FVC	-0.701	<24th	81% (63, 92)	84% (81, 86)	5.09 (3.99, 6.49)	0.22 (0.10, 0.49)	0.65
Post-BD FEF ₂₅₋₇₅	-0.775	<21st	73% (55, 86)	86% (83, 88)	5.23 (3.93, 6.97)	0.31 (0.17, 0.58)	0.59
Post-BD FEV ₁	-0.113	<46th	79% (61, 90)	61% (58, 65)	2.04 (1.65, 2.53)	0.34 (0.17, 0.71)	0.40
D _{LCO}	+0.366	<64th	60% (41, 76)	49% (46, 53)	1.18 (0.86, 1.53)	0.81 (0.51, 1.30)	0.09
K _{CO}	+0.505	<69th	81% (63, 92)	40% (36, 43)	1.35 (1.11, 1.64)	0.47 (0.21, 1.05)	0.21
TLC*	+0.623	>73rd	56% (37, 73)	66% (63, 70)	1.65 (1.15, 2.37)	0.67 (0.43, 1.04)	0.22
RV*	+1.015	>84th	52% (34, 70)	71% (67, 75)	1.82 (1.23, 2.69)	0.76 (0.45, 1.01)	0.23
RV/TLC*	+1.061	>86th	58% (40, 75)	69% (66, 72)	1.90 (1.36, 2.64)	0.60 (0.39, 0.94)	0.27

Can We Use Lung Function Thresholds and Respiratory Symptoms to Identify Pre-Chronic Obstructive Pulmonary Disease?

A Prospective, Population-based Cohort Study

Daniel J. Tan^{1,10}, Caroline J. Lodge¹, E. Haydn Walters^{1,2}, Dinh S. Bui¹, Jonathan Pham^{1,3}, Adrian J. Lowe¹,

	z-Score	Percentile	Risk Ratios (95% CI)	Risk Difference (95% CI)	P Value	Reweighted Population Prevalence*
Pre-BD FEV ₁ /FVC	-1.264	<10th	35.76 (8.88, 143.97)	+16.4% (3.7, 67.4)	<0.001	14.4% (12.3, 16.8)
Pre-BD FEF ₂₅₋₇₅	-1.328	<9th	17.26 (5.52, 53.97)	+13.7% (3.8, 44.5)	<0.001	13.9% (11.8, 16.2)
Pre-BD FEV ₁	-0.535	<30th	3.68 (1.31, 10.30)	+3.8% (0.4, 13.2)	0.01	34.7% (31.6, 38.0)
Post-BD FEV ₁ /FVC	-0.701	<24th	14.91 (4.45, 49.98)	+10.9% (2.7, 38.4)	<0.001	18.3% (15.9, 20.9)
Post-BD FEF ₂₅₋₇₅	-0.775	<21st	10.45 (3.59, 30.42)	+10.3% (2.8, 31.9)	<0.001	16.4% (14.2, 18.9)
Post-BD FEV ₁	-0.113	<46th	3.95 (1.20, 12.94)	+3.5% (0.2, 14.3)	0.02	41.0% (37.7, 44.3)
D _{LCO}	+0.366	<64th	1.09 (0.42, 2.82)	+0.3% (-1.7, 5.3)	0.86	51.8% (48.2, 55.4)
K _{co}	+0.505	<69th	2.34 (0.80, 6.83)	+2.3% (-0.3, 9.9)	0.12	61.0% (57.4, 64.4)
TLC [†]	+0.623	>73rd	2.44 (0.90, 6.63)	+3.4% (-0.2, 13.1)	0.08	35.1% (31.7, 38.7)
RV [†]	+1.015	>84th	2.44 (1.03, 5.78)	+3.4% (0.1, 11.2)	0.04	29.9% (26.7, 33.3)
RV/TLC [†]	+1.061	>86th	2.68 (1.16, 6.21)	+3.5% (0.3, 11.0)	0.02	32.5% (29.2, 35.9)

Can We Use Lung Function Thresholds and Respiratory Symptoms to Identify Pre-Chronic Obstructive Pulmonary Disease?

A Prospective, Population-based Cohort Study

Methods E1: Questionnaire Definitions for Respiratory Symptom Variables

Variable:	Survey Questions:	
Wheeze	"Have you had wheezing or whistling in the last 12 months?"	ex
Wheeze with dyspnoea	"Have you had wheezing or whistling in the last 12 months?" "Have you been breathless at all when the wheezing noise was present?"	3
Woken with chest tightness	"Have you, at any time in the last 12 months, woken up with a feeling of chest tightness in your chest?"	5
Woken with dyspnoea	"Have you, at any time in the last 12 months, woken at night by an attack of shortness of breath?"	0
Dyspnoea (after exercise)	"Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?"	4
Dyspnoea (at rest)	"Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?" "Do you ever get shortness of breath when resting?"	3
Persistent cough	"Do you usually cough when you do not have a cold?"	5
Persistent sputum production	"Do you usually have phlegm in your chest when you do not have a cold?"	2
Chronic Bronchitis	"Have you had cough with phlegm on most days for at least three months of each year for two successive years?"	4

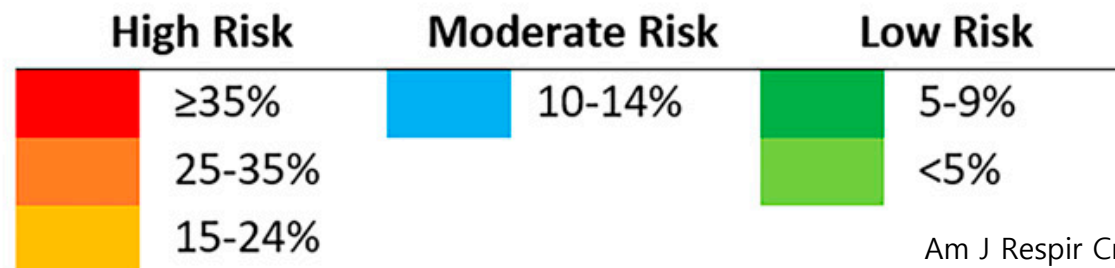
Whee:
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Can We Use Lung Function Thresholds and Respiratory Symptoms to Identify Pre-Chronic Obstructive Pulmonary Disease?

A Prospective, Population-based Cohort Study

Daniel J. Tan^{1,10}, Caroline J. Lodge¹, E. Haydn Walters^{1,2}, Dinh S. Bui¹, Jonathan Pham^{1,3}, Adrian J. Lowe¹

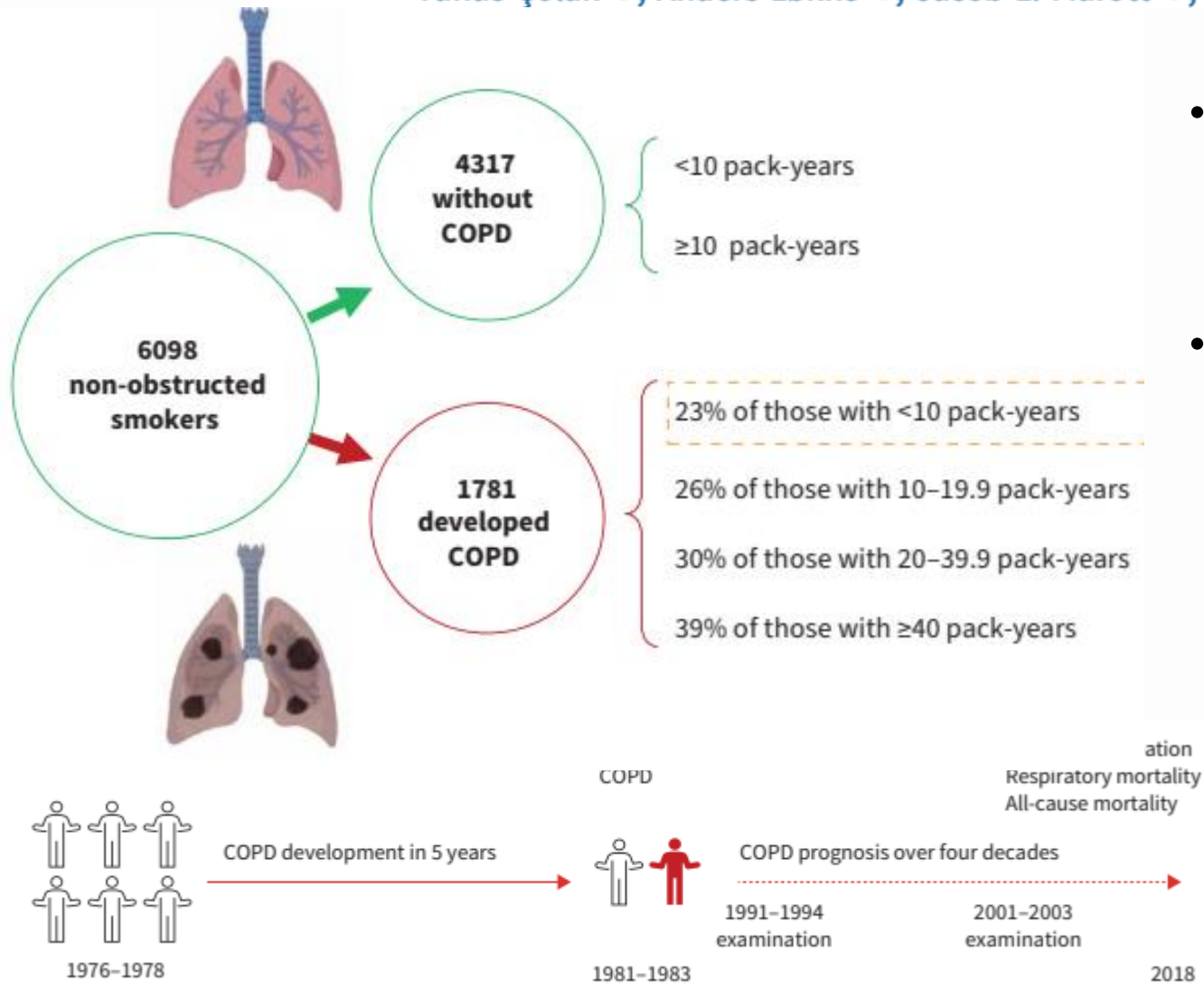
Pre-BD FEV ₁ /FVC Percentile	Women		No Current Asthma	Men		
	100 - 50	1%		<1%	<1%	4%
	50 - 10	<1%	3%	<1%	<1%	
	<10	22%	23%	6%	26%	
	100 - 50	<1%	<1%	Current Asthma	<1%	<1%
	50 - 10	<1%	<1%		<1%	<1%
	<10	20%	33%		29%	50%
	Non-Smoker		Current Smoker	Non-Smoker		Current Smoker
	Smoking Status			Smoking Status		





Low smoking exposure and development and prognosis of COPD over four decades: a population-based cohort study

Yunus Çolak , Anders Løkke , Jacob L. Marott , Peter Lange, Jørgen Vestbo ,

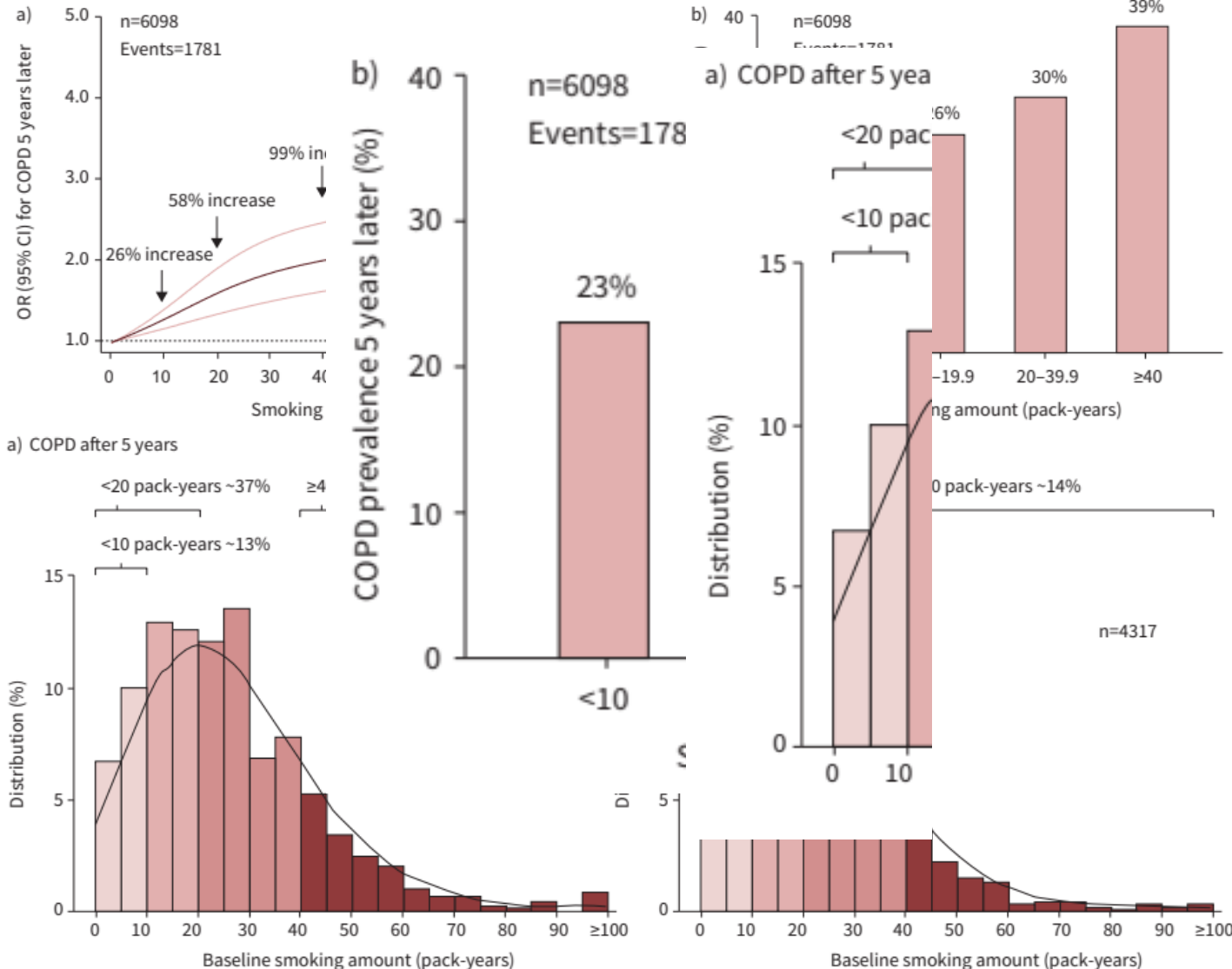


- 14,223 individuals in the Copenhagen City Heart Study
- Non-obstructed smokers aged ≥40 years with a 5-year follow-up.
 - Subgroup: 6098 individuals, tracked for up to 40 years.



Low smoking exposure and development and prognosis of COPD over four decades: a population-based cohort study

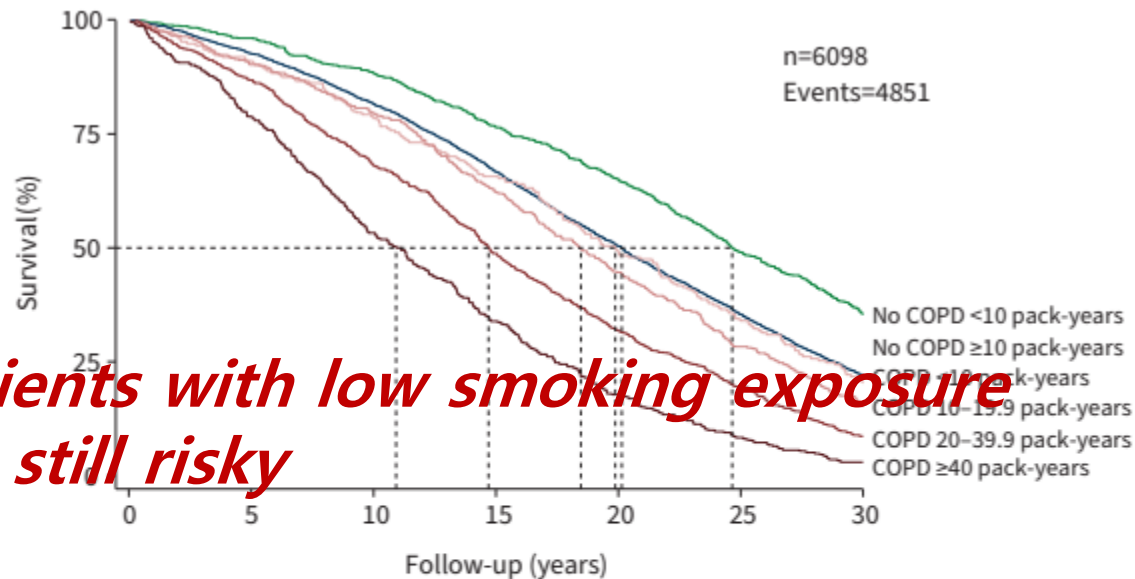
Yunus Colak  Anders Løkke  Jacob L. Marott  Peter Lange  Jørgen Vestbo 





Low smoking exposure and development and prognosis of COPD over four decades: a population-based cohort study

Yunus Çolak , Anders Løkke , Jacob L. Marott , Peter Lange, Jørgen Vestbo ,



Patients with low smoking exposure are still risky

Median survival

- No COPD <10 PY = 24.7 years
- No COPD >10 PY = 20.1 years
- ***COPD <10PY = 19.9 years***
- COPD 10–19.9 PY = 18.5 years
- COPD 20–39.9 PY = 14.7 years
- COPD ≥40 PY = 10.9 years

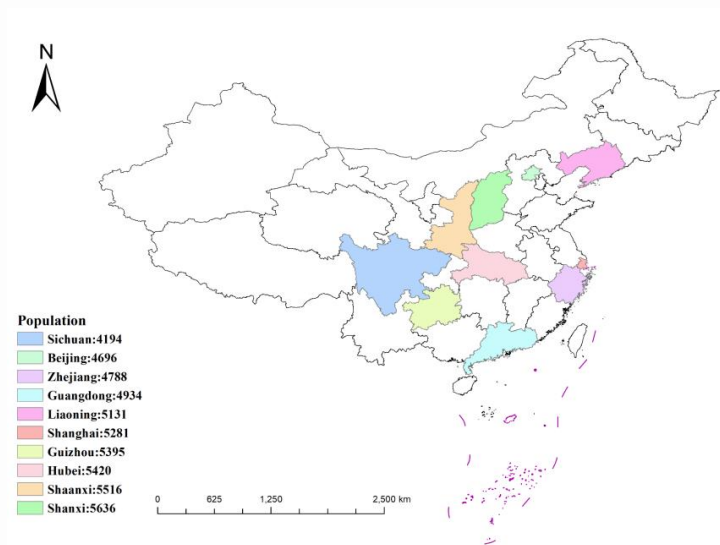
Number at risk		Follow-up (years)						
		0	5	10	15	20	25	30
No COPD								
<10 pack-years	773	742	683	591	503	378	273	
≥10 pack-years	3544	3280	2889	2361	1783	1252	779	
COPD								
<10 pack-years	231	210	180	151	113	78	47	
10–19.9 pack-years	429	387	340	266	191	121	65	
20–39.9 pack-years	749	650	509	365	238	145	65	
≥40 pack-years	372	293	198	126	66	31	11	

Impact of Using Pre- and Postbronchodilator Spirometry Reference Values in a Chinese Population

Ke Huang^{1,2*}, Xueyan Han^{4*}, Zhaoyang Pan⁴, Jianying Xu⁵, Jianping Zhao⁶, Xiangyan Zhang⁷, Yuanlin Song⁸,

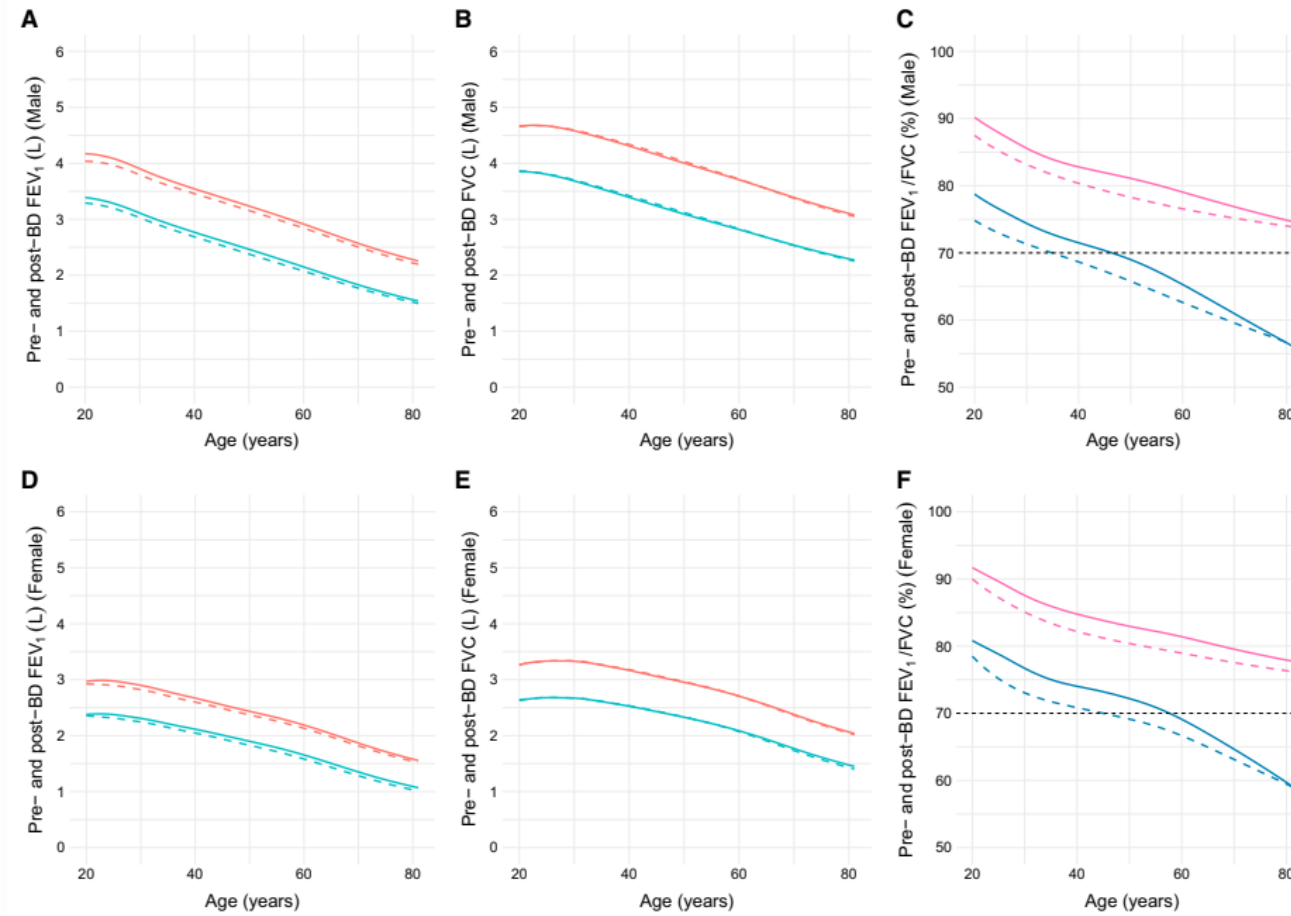
• Study Population

- A reference population of healthy, nonsmoking participants (N = 17,969) → the entire CPH population (N= 50,991)



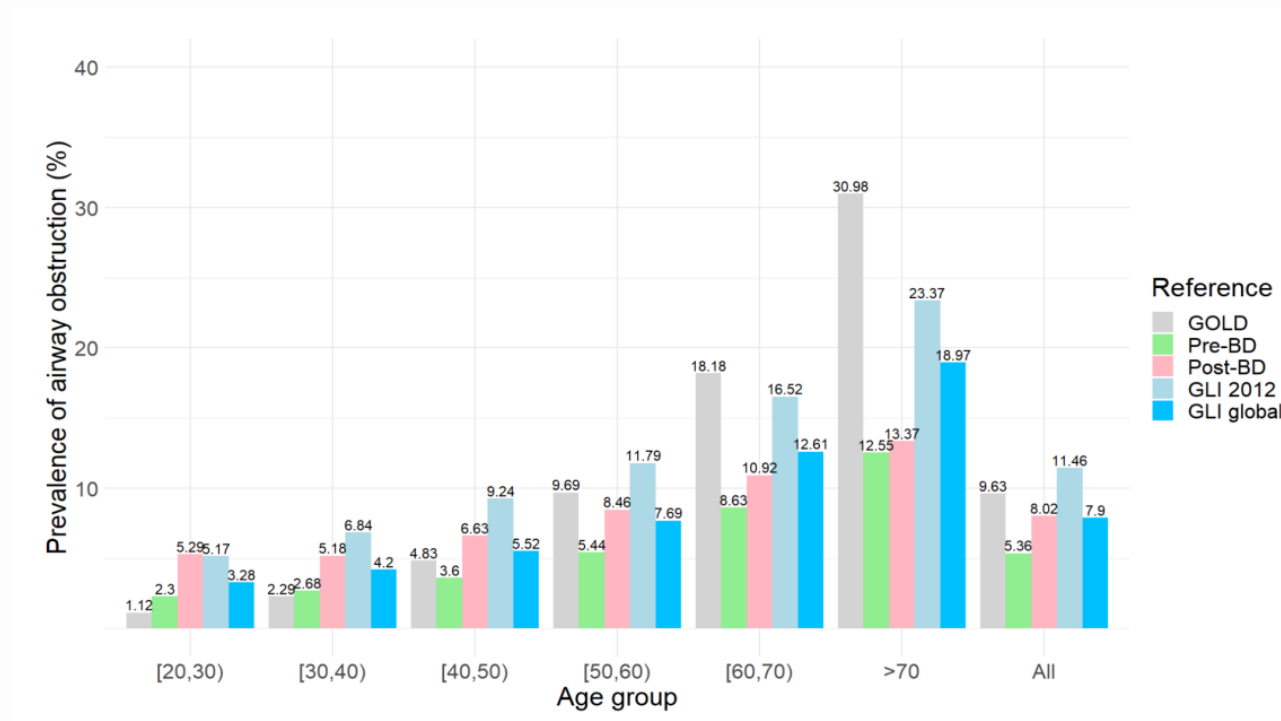
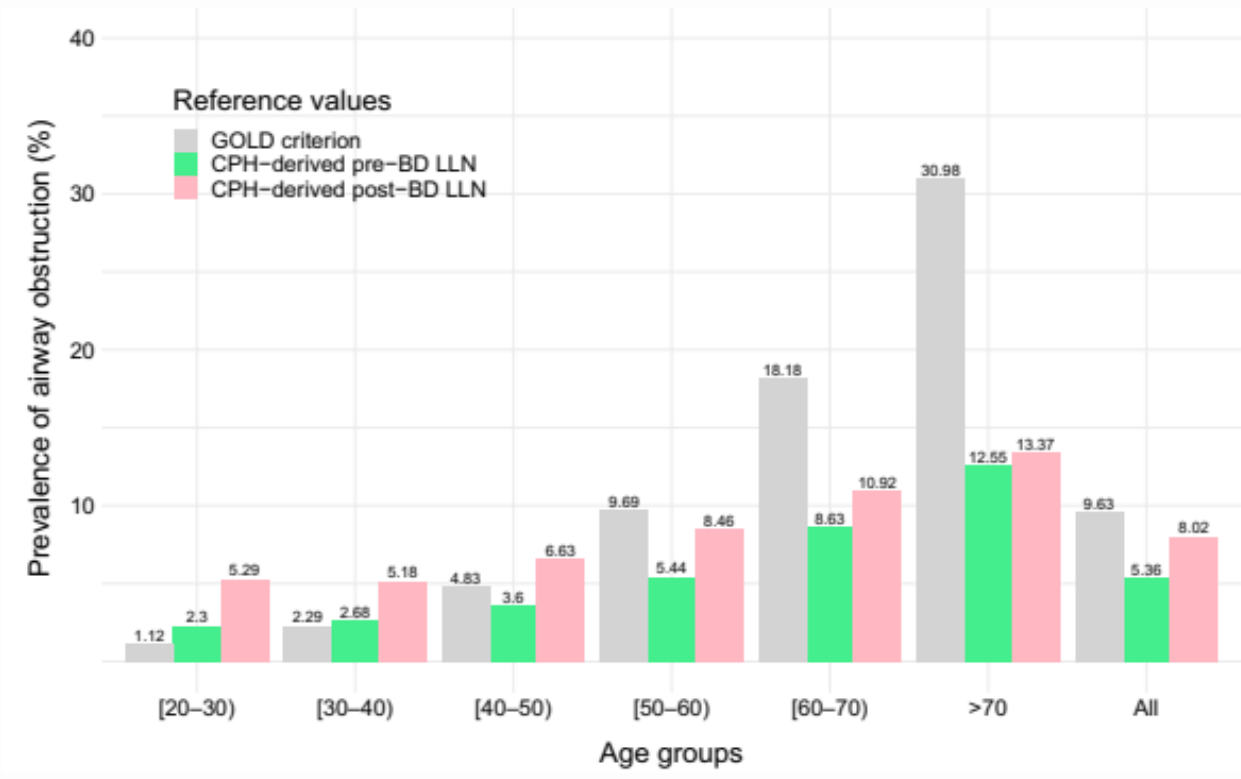
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Impact of Using Pre- and Postbronchodilator Spirometry Reference Values in a Chinese Population

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Implications of Global Lung Function Initiative Spirometry Reference Equations in Northeast Asian Patients With COPD

Joon Young Choi, MD, PhD; Chang-Hoon Lee, MD, PhD; Hyonsoo Joo, MD, PhD; Yun Su Sim, MD, PhD;

한국인의 정상 폐활량 예측치

¹서울대학교 보건대학원, ²산업안전보건연구원
최정근¹, 백도명¹, 이정오²

Normal Predictive Values of Spirometry in Korean Population

Jung Keun Choi¹, Domyung Paek¹, Jeoung Oh Lee²

Table 7. The selected variables of the FEV₁ from the lower AIC and American Thoracic Society applied to linear regression analysis

	Model	r ²
Male	-3.4132 - 0.0002484 * A ² + 0.04578 * H [†]	0.5897
	-3.1461 - 0.0002546 * A ² + 0.04262 * H + 0.004072 * W [†]	0.5926
	-3.0055 - 0.0217147 * A + 0.04593 * H	0.5930
Female	-2.4114 - 0.0001920 * A ² + 0.03558 * H	0.4683
	-2.3656 - 0.0001952 * A ² + 0.03473 * H + 0.001629 * W	0.4691
	-2.1183 - 0.0165358 * A + 0.03582 * H	0.4624

Table 10. The selected variables of the FEV₁/FVC% from the lower AIC applied to linear regression analysis

	Model	r ²
Male	119.9004 - 0.3902 * A + - 0.1268 * H [†]	0.4301
	97.2818 - 0.3611 * A	0.4189
	104.6884 - 0.3641 * A - 0.10693 * W [†]	0.4396
Female	97.8567 - 0.2800 * A - 0.01564 * H	0.2573
	95.3280 - 0.2781 * A	0.2583
	100.9014 - 0.2662 * A - 0.1057 * W	0.2771

- KOCOSS
- 3yrs follow-up
- Choi's(GOLD)

vs.

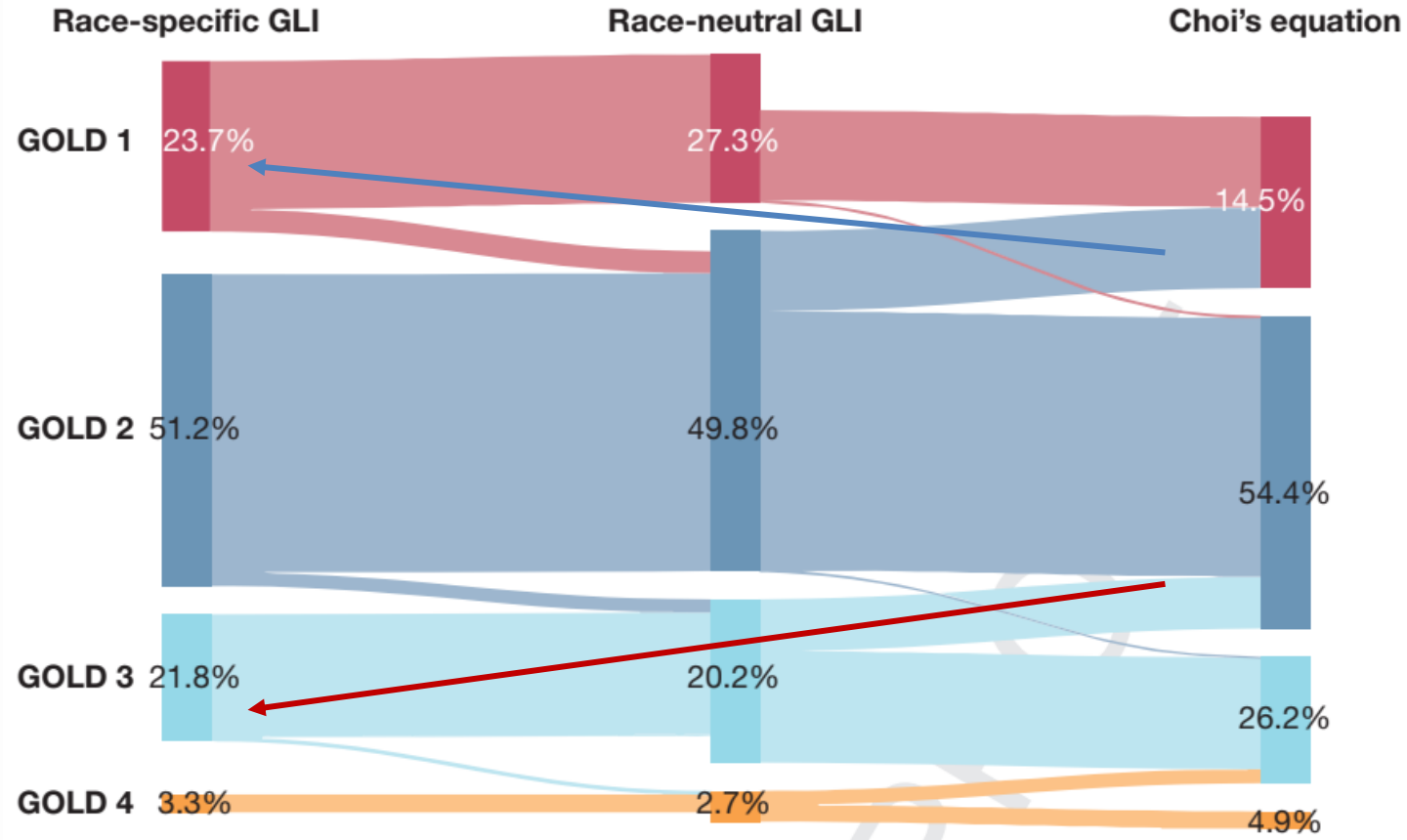
GLI 2012

vs.

GLI global

Implications of Global Lung Function Initiative Spirometry Reference Equations in Northeast Asian Patients With COPD

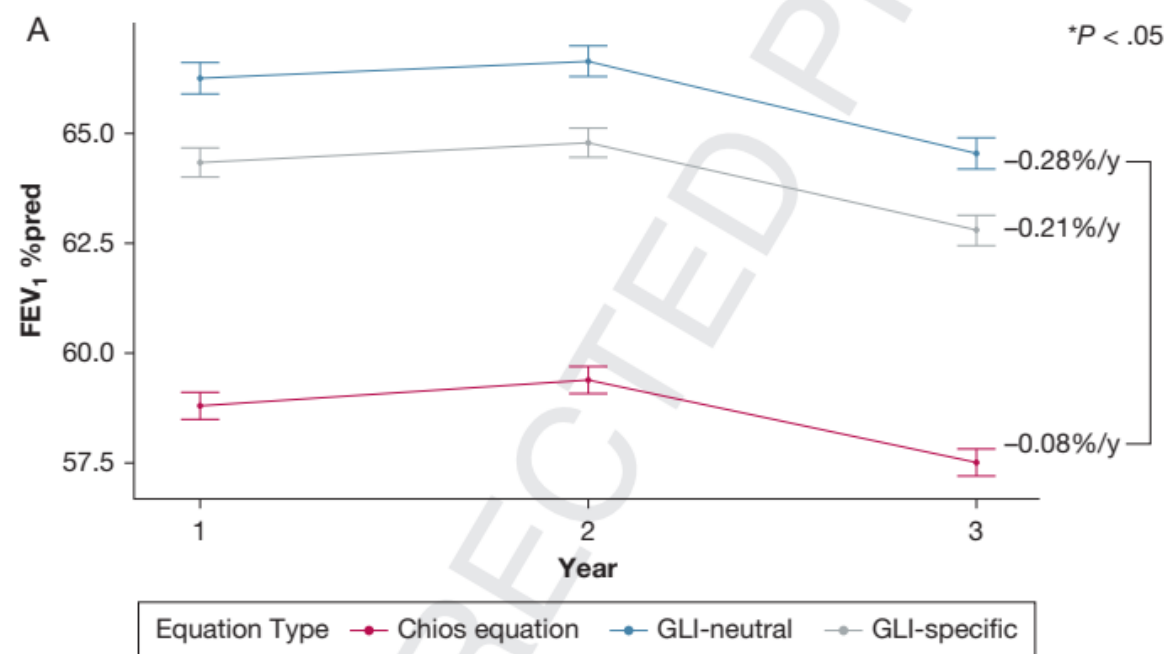
Joon Young Choi, MD, PhD; Chang-Hoon Lee, MD, PhD; Hyonsoo Joo, MD, PhD; Yun Su Sim, MD, PhD;



Implications of Global Lung Function Initiative Spirometry Reference Equations in Northeast Asian Patients With COPD

Joon Young Choi, MD, PhD; Chang-Hoon Lee, MD, PhD; Hyonsoo Joo, MD, PhD; Yun Su Sim, MD, PhD;

Variables	Race-Specific 2012 GLI Equations			Race-Neutral 2022 GLI Equations			Choi's Equations		
	IRR	95% CI	P Value	IRR	95% CI	P Value	IRR	95% CI	P Value
Moderate-to-severe exacerbation	0.97	0.97-0.98	< .001	0.97	0.97-0.98	< .001	0.97	0.96-0.97	< .001
Severe exacerbation	0.95	0.94-0.96	< .001	0.95	0.94-0.96	< .001	0.95	0.94-0.96	< .001

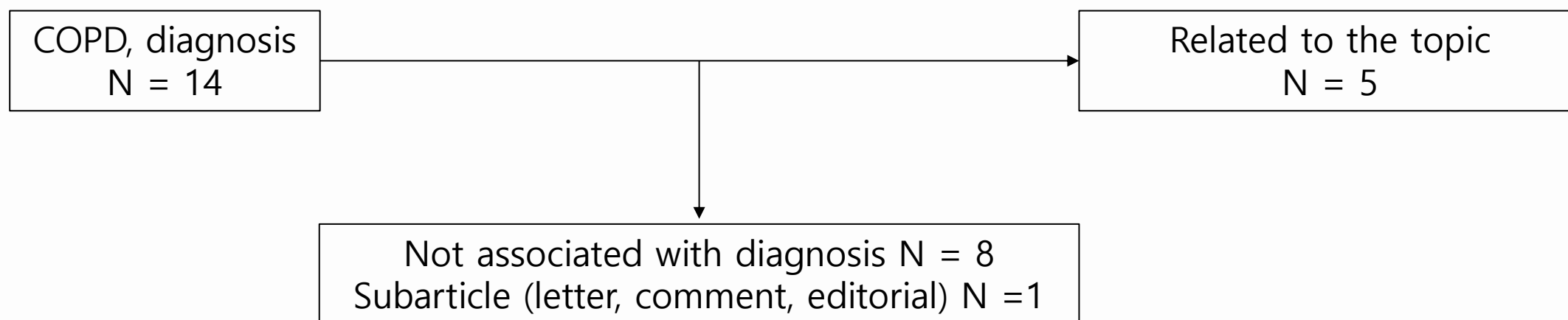




Epidemiology

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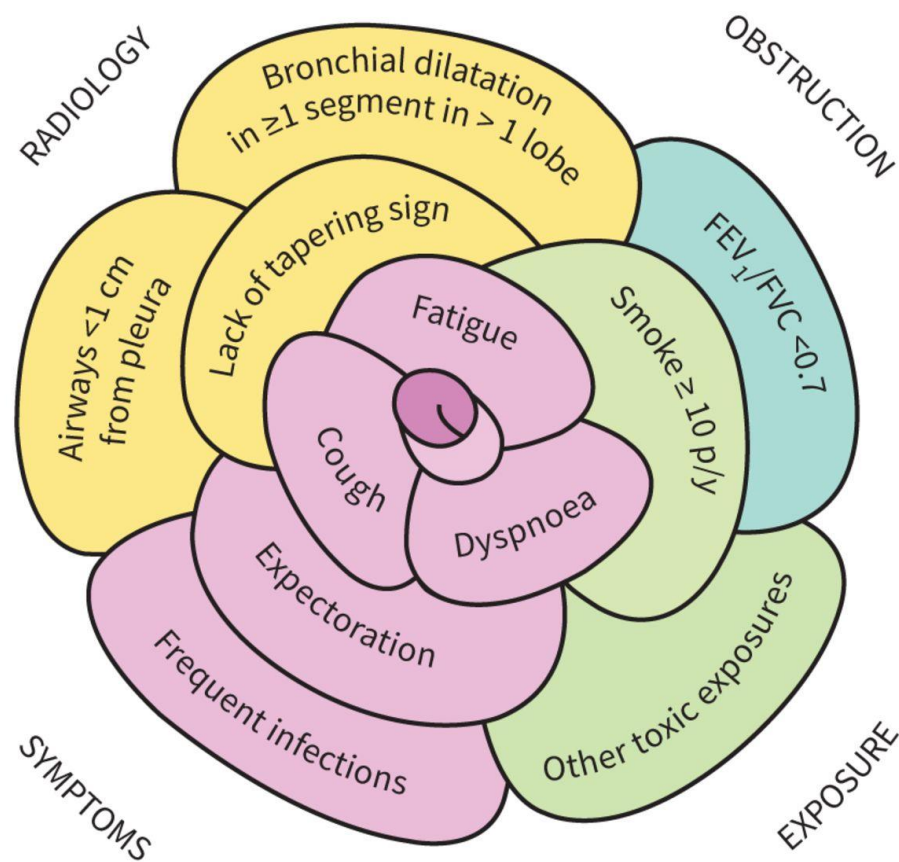


Title	Details	cited score
The Association between Bronchiectasis and Chronic Obstructive Pulmonary Disease: Data from the European Bronchiectasis Registry (EMBARC).	Am J Respir Crit Care Med. 2024 Jul 1;210(1):119-127	19
Prevalence, Diagnostic Utility and Associated Characteristics of Bronchodilator Responsiveness.	Am J Respir Crit Care Med. 2024 Feb 15;209(4):390-401	13
Cause-specific mortality in COPD subpopulations: a cohort study of 339 647 people in England.	Thorax. 2024 Feb 15;79(3):202-208	9
Does Rheumatoid Arthritis Increase the Risk of COPD?: A Nationwide Retrospective Cohort Study.	Chest. 2024 Jun;165(6):1362-1371	5
Increased Burden of Pertussis Among Adolescents and Adults With Asthma or COPD in the United States, 2007 to 2019.	Chest. 2024 Jun;165(6):1352-1361	1

The Association between Bronchiectasis and Chronic Obstructive Pulmonary Disease

Data from the European Bronchiectasis Registry (EMBARC)

Eva Polverino^{1,2}, Anthony De Soyza³, Katerina Dimakou⁴, Letizia Traversi¹, Apostolos Bossios^{5,6},



- Data from the European Bronchiectasis Registry (EMBARC)
- COPD : 4,324 + bronchiectasis alone: 12,639 ; **COPD in BE 25.49%**
- Radiology, Obstruction(ratio <0.7), Symptoms, Exposure(> 10py)

The Association between Bronchiectasis and Chronic Obstructive Pulmonary Disease

Data from the European Bronchiectasis Registry (EMBARC)

Eva Polverino^{1,2}, Anthony De Soyza³, Katerina Dimakou⁴, Letizia Traversi¹, Apostolos Bossios^{5,6},

Group	<i>n</i>	Model	Mortality	Hospitalizations	Exacerbations
COPD (clinical definition only)	4,324	Unadjusted	2.66 (2.36-3.01)	2.74 (2.53-2.97)	1.46 (1.38-1.54)
		Adjusted*	1.93 (1.70-2.19)	2.41 (2.20-2.65)	1.44 (1.35-1.54)
COPD subgroups					
COPD reported and ROSE criteria met	2,130	Unadjusted	3.24 (2.78-3.79)	3.15 (2.84-3.49)	1.50 (1.39-1.61)
		Adjusted*	2.24 (1.90-2.64)	3.09 (2.70-3.53)	1.55 (1.41-1.69)
COPD reported but no ROSE criteria met	1,702	Unadjusted	2.46 (2.06-2.95)	2.55 (2.28-2.86)	1.41 (1.30-1.53)
		Adjusted*	1.82 (1.51-2.18)	2.35 (2.08-2.66)	1.40 (1.29-1.53)
No COPD reported but meets ROSE criteria	877	Unadjusted	1.69 (1.27-2.24)	1.47 (1.23-1.75)	1.13 (1.01-1.27)
		Adjusted*	1.33 (0.99-1.78)	1.46 (1.20-1.78)	1.17 (1.03-1.32)
No COPD reported and no criteria met	10,522	Unadjusted	1.00 (reference)	1.00 (reference)	1.00 (reference)
		Adjusted*	1.00 (reference)	1.00 (reference)	1.00 (reference)

- 44.4% of COPD-diagnosed patients did **not** meet ROSE criteria.
 - 7.7% of non-COPD patients **did** meet ROSE criteria.
- COPD diagnosis in bronchiectasis patients often lacks accuracy. Incorporating ROSE criteria can enhance diagnostic precision and clinical outcomes.

Prevalence, Diagnostic Utility and Associated Characteristics of Bronchodilator Responsiveness

Richard Beasley¹, Rod Hughes², Alvar Agustí³, Peter Calverley⁴, Bradley Chipps⁵, Ricardo del Olmo⁶,

- ERS/ATS 2005: change in **FEV1 or FVC >12% and >200 ml** relative to pre-BD
(Δ FEV1 or Δ FVC >12% and >200 ml)
- ERS/ATS 2021: change in **Δ FEV1 or Δ FVC >10%** relative to the
corresponding percent predicted
- 6,788 patients from NOVELTY, a prospective cohort study in primary and secondary care in 18 countries

Prevalence, Diagnostic Utility and Associated Characteristics of Bronchodilator Responsiveness

Richard Beasley¹, Rod Hughes², Alvar Agusti³, Peter Calverley⁴, Bradley Chipps⁵, Ricardo del Olmo⁶,

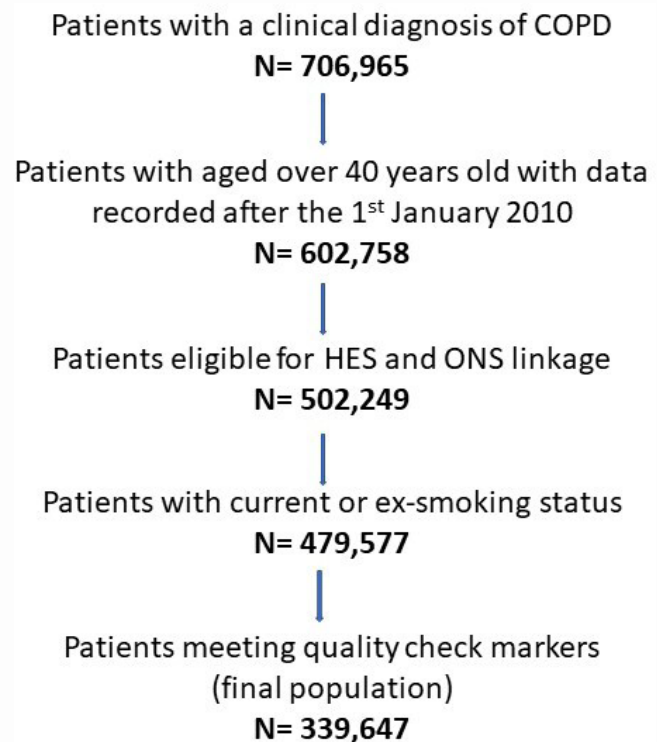
BDR Definition	Asthma and COPD			Asthma vs. COPD	
	Asthma (n = 3,519)	(n = 833)	COPD (n = 2,436)	AUC (95% CI)	Sensitivity, Specificity
ΔFEV_1 or $\Delta FVC \geq 12\%$ and ≥ 200 ml	631/3,196 (19.7%)	224/757 (29.6%)	552/2,239 (24.7%)	0.597 (0.572, 0.622)	0.55, 0.30
$\Delta FEV_1 \geq 12\%$ and ≥ 200 ml	548/3,229 (17.0%)	179/760 (23.6%)	317/2,242 (14.1%)	0.659 (0.629, 0.690)	0.58, 0.21
$\Delta FVC \geq 12\%$ and ≥ 200 ml	298/3,228 (9.2%)	143/758 (18.9%)	409/2,256 (18.1%)	0.592 (0.562, 0.622)	0.42, 0.43
$\Delta FEV_1 \geq 15\%$ and ≥ 400 ml	228/3,229 (7.1%)	42/760 (5.5%)	52/2,242 (2.3%)	0.727 (0.652, 0.803)	0.80, 0.07
$\Delta FEV_1 > 10\%$ pred	482/3,176 (15.2%)	114/750 (15.2%)	177/2,207 (8.0%)	0.571 (0.555, 0.586)	0.15, 0.92
$\Delta FVC > 10\%$ pred	279/3,175 (8.8%)	130/748 (17.4%)	326/2,221 (14.7%)	0.578 (0.562, 0.593)	0.09, 0.86
ΔFEV_1 or $\Delta FVC > 10\%$ pred	569/3,143 (18.1%)	174/747 (23.3%)	396/2,204 (18.0%)	0.505 (0.490, 0.521)	0.18, 0.82
High-likelihood asthma or COPD (1)	Asthma HL (n = 1,820)		COPD HL (n = 1,260)	AUC (95% CI)	Sensitivity, Specificity
ΔFEV_1 or $\Delta FVC \geq 12\%$ and ≥ 200 ml	351/1,658 (21.2%)		338/1,222 (27.7%)	0.619 (0.586, 0.652)	0.54, 0.26
$\Delta FEV_1 \geq 12\%$ and ≥ 200 ml	313/1,681 (18.6%)		176/1,223 (14.4%)	0.703 (0.664, 0.742)	0.56, 0.17
$\Delta FVC \geq 12\%$ and ≥ 200 ml	153/1,676 (9.1%)		260/1,227 (21.2%)	0.602 (0.562, 0.642)	0.42, 0.40
$\Delta FEV_1 \geq 15\%$ and ≥ 400 ml	148/1,681 (8.8%)		24/1,223 (2.0%)	0.765 (0.673, 0.857)	0.80, 0.04
$\Delta FEV_1 > 10\%$ pred	275/1,652 (16.6%)		89/1,203 (7.4%)	0.592 (0.572, 0.613)	0.16, 0.93
$\Delta FVC > 10\%$ pred	134/1,647 (8.1%)		210/1,207 (17.4%)	0.614 (0.593, 0.635)	0.08, 0.83
ΔFEV_1 or $\Delta FVC > 10\%$ pred	315/1,629 (19.3%)		242/1,202 (20.1%)	0.508 (0.487, 0.530)	0.19, 0.80

18-25% of COPD patients have BDR response



Original research

Cause-specific mortality in COPD subpopulations: a cohort study of 339 647 people in England

Hannah Whittaker,¹ Kieran J Rothnie,² Jennifer K Quint ¹**Table 2** Baseline characteristics for COPD population (n=3 39 647)

Baseline characteristic	n (%) or mean (SD)
Age	
Mean (SD)	67 (11.7)
Gender	
Men	180 236 (53.1)
Women	159 411 (46.9)
Smoking status	
Ex-smoker	179 129 (52.7)
Current smoker	160 518 (46.3)
MI	25 206 (7.4)
HF	23 753 (7.0)
Stroke	83 975 (24.7)
Depression	90,93 (26.8)
Anxiety	76 676 (22.6)
GORD	54 445 (16.0)
Lung cancer	3683 (1.1)
BMI	
Underweight	12 573 (3.7)
Normal	95 486 (28.1)
Overweight	98 704 (29.1)
Obese	89 123 (26.2)
Missing	43 761 (12.9)
Hypertension	147 031 (43.3)
Diabetes	52 604 (15.5)
Current asthma	121 046 (35.6)

- People with COPD alive between 1 January 2010 and 1 January 2020
- 339,647 patients with COPD.
- Mean follow-up: 5.5 years (SD: 3.6 years).

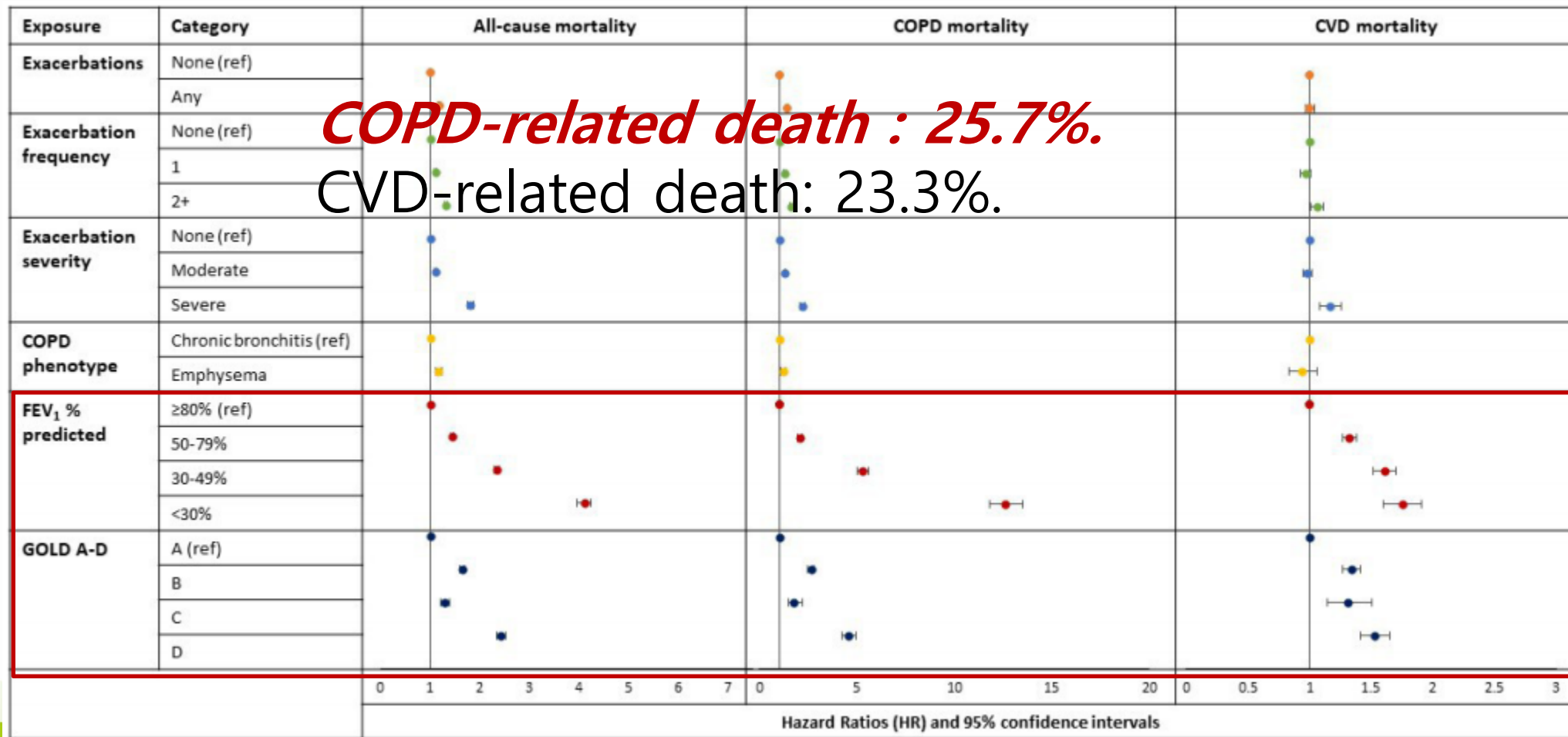


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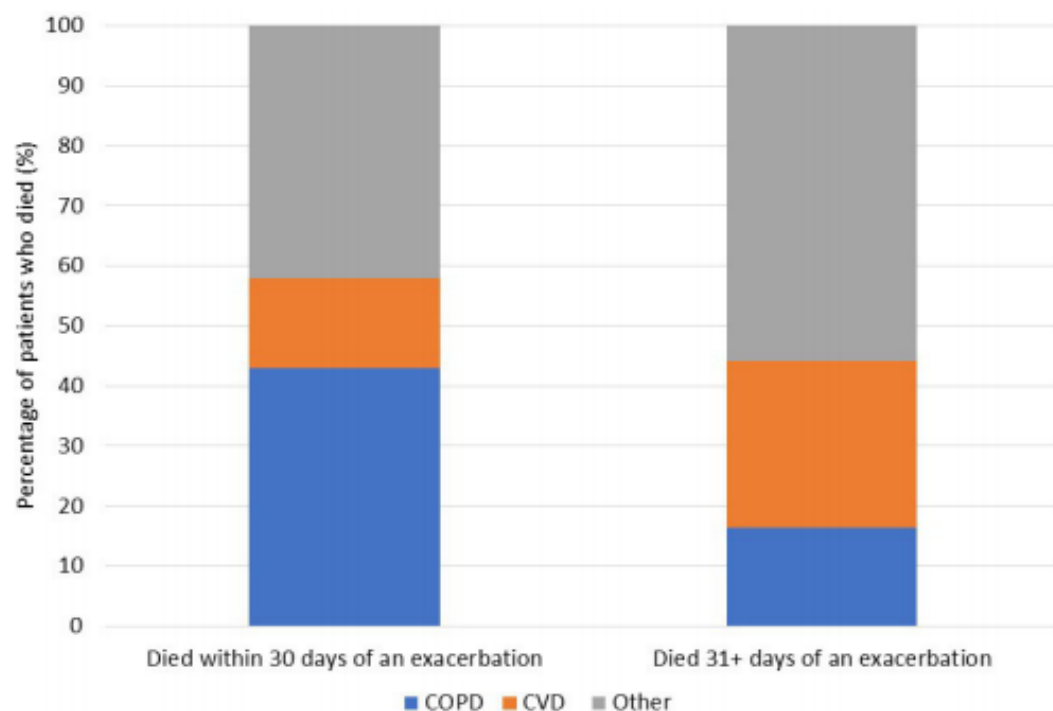
COPD-related death : 25.7%.
CVD-related death: 23.3%.





Original research

Cause-specific mortality in COPD subpopulations: a cohort study of 339 647 people in England

Hannah Whittaker,¹ Kieran J Rothnie,² Jennifer K Quint ¹

•Impact of Exacerbations:

- Any exacerbation: Increased all-cause (HR: 1.18) and COPD-related mortality (HR: 1.42)
- Severe exacerbations: Associated with all-cause (HR: 1.81), COPD (HR: 2.17), and CVD mortality (HR: 1.16).

•Timing of Deaths:

- 43.1% of deaths within 30 days of exacerbations were COPD-related.
- Patients with lower FEV1% predicted were at higher risk of COPD-related death within 30 days.

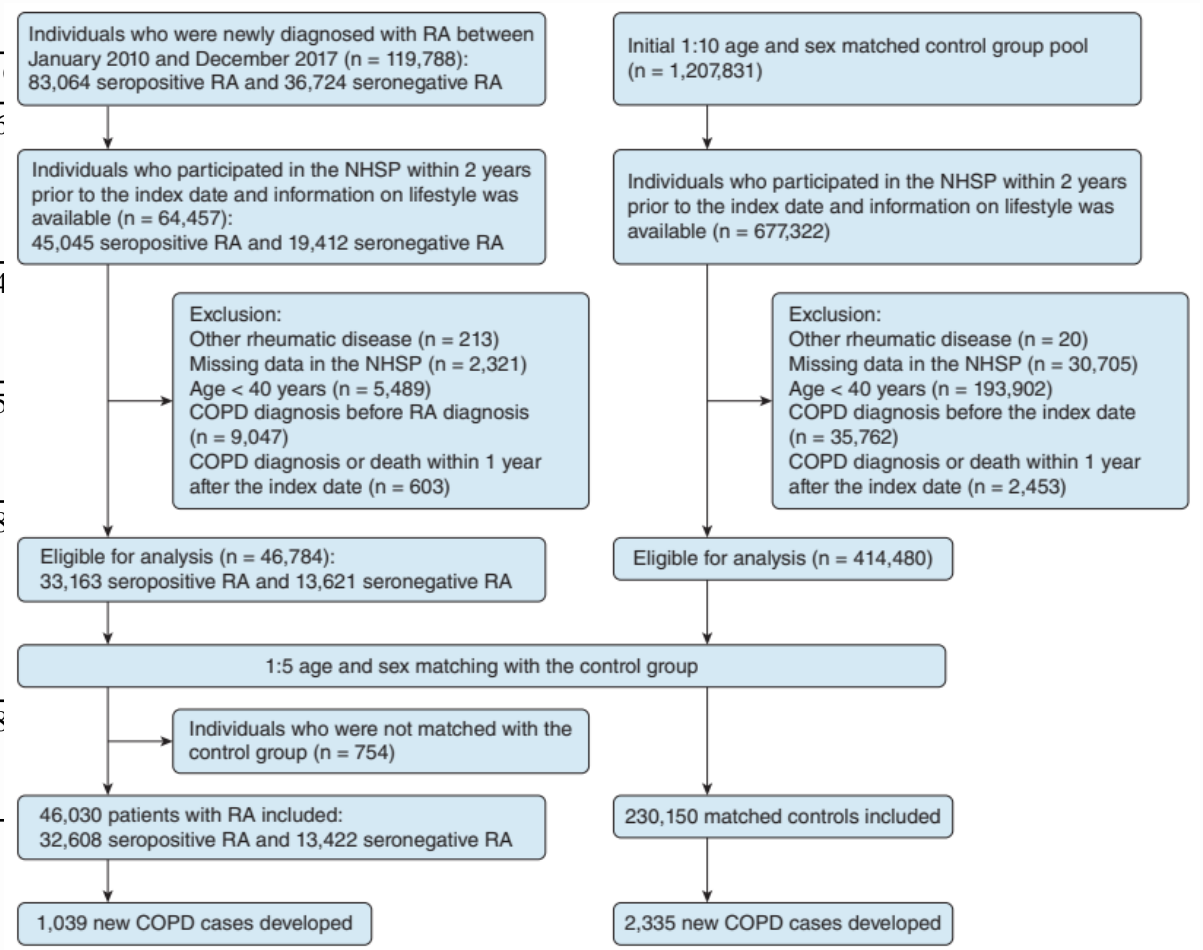
Does Rheumatoid Arthritis Increase the Risk of COPD?

A Nationwide Retrospective Cohort Study

Chiwook Chung, MD; Hyungjin Kim, MD, PhD; Kyungdo Han, PhD; Jinhyoung Jung, PhD; Yeonghee Eun, MD, PhD;

Check for updates

Author	Year	Region	Sample size	Study period	RA criteria	COPD criteria	Risk of
Sparks JA	2017	US	RA 843 Control 8399	1976–2014	ACR 1987 or ACR/ELAR 2010 criteria of RA	Self-report	aHR 1.6 95% CI
Mcguire K	2017	Canada	RA 24625 Control 25396	1996–2010	ICD code	ICD code and hospitalization	aHR 1.4 95% CI
Nannini C	2013	US	RA 594 Control 596	1955–2006	ACR 1987 criteria of RA	Spirometry and physician diagnosis	aHR 1.5 95% CI
Ursum J	2013	Netherlands	RA 3356 Control 6708	2001–2010	ICPC code	ICPC code	aHR 1.8 95% CI
Shen TC	2014	Taiwan	RA 28725 Control 114900	1998–2010	ICD code	ICD code	aHR 1.8 95% CI

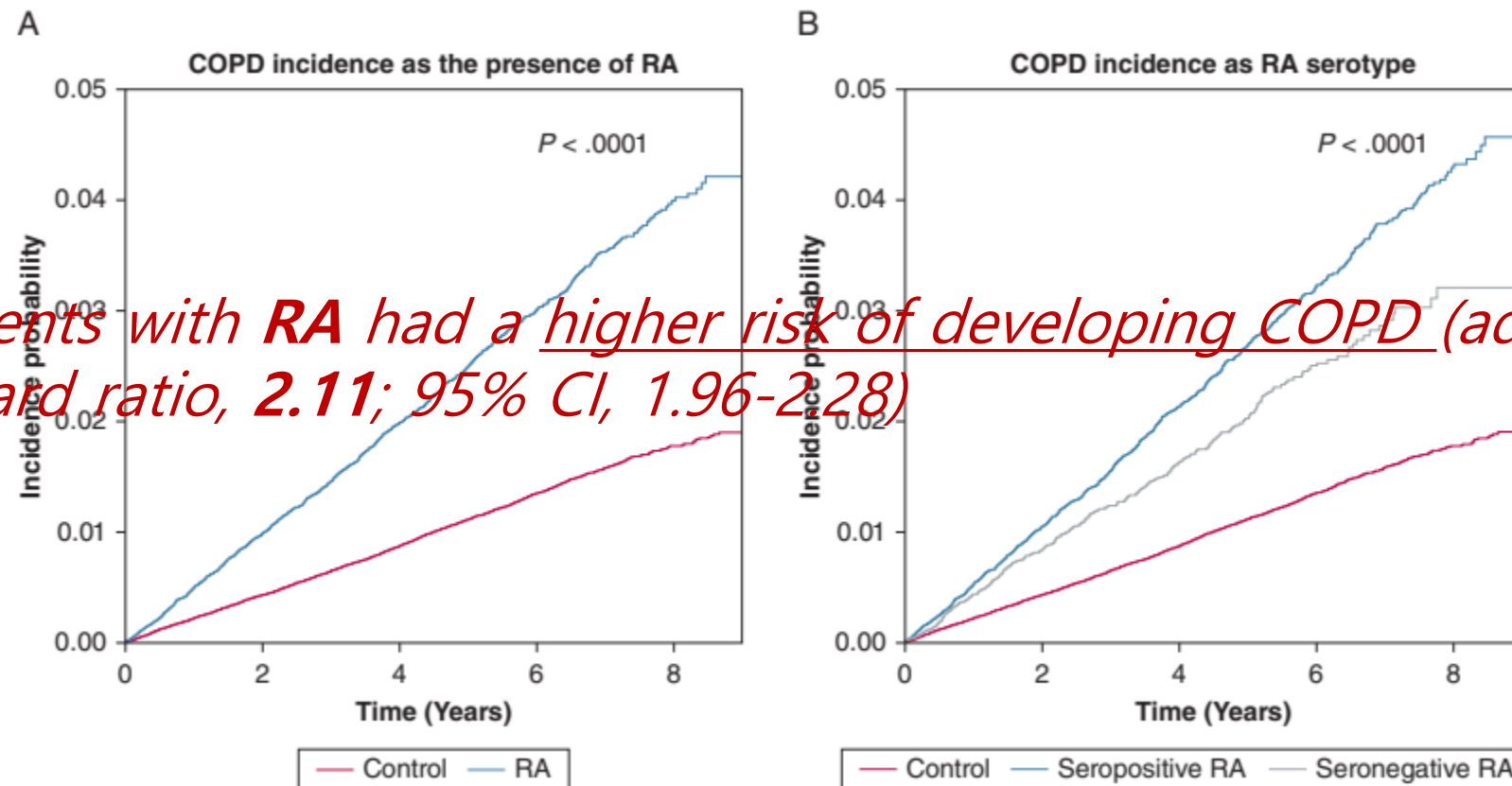


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Patients with RA had a higher risk of developing COPD (adjusted hazard ratio, 2.11; 95% CI, 1.96-2.28)

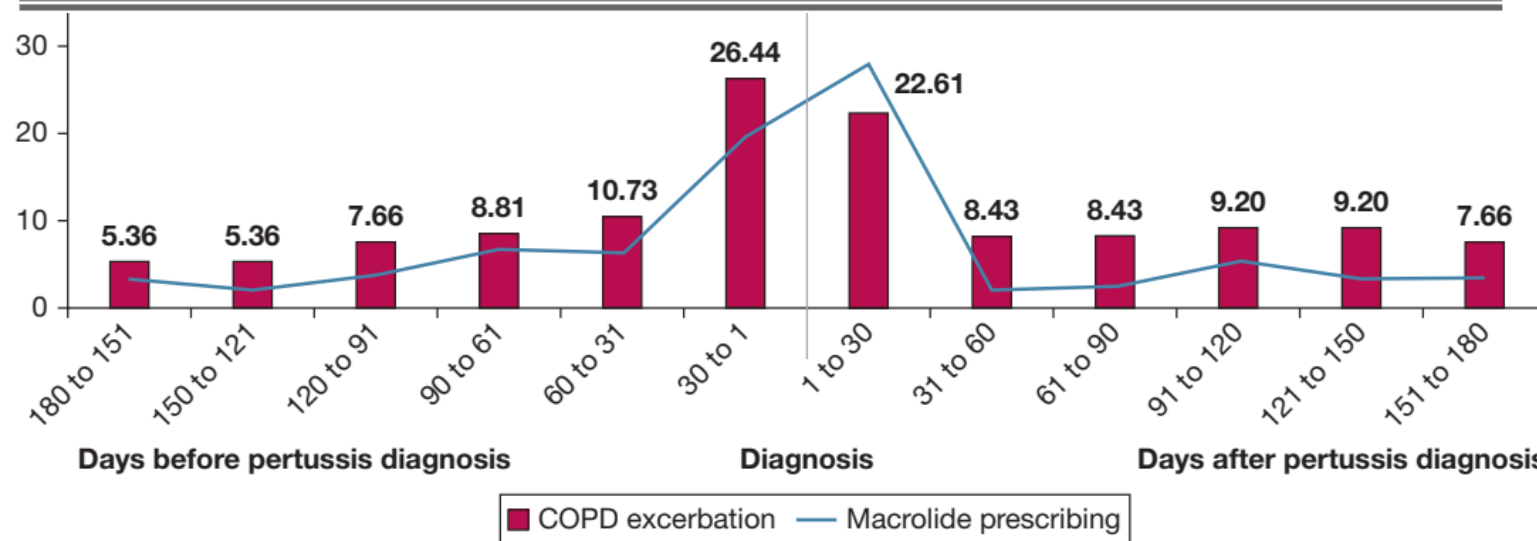
Increased Burden of Pertussis Among Adolescents and Adults With Asthma or COPD in the United States, 2007 to 2019



Sarah Naeger, PhD; Vitali Pool, MD; and Denis Macina, MPH

- Observational, retrospective study included individuals aged ≥ 10 years from an administrative health claims system between 2007 and 2019.

Cohort	Follow-up Time (Person-Years)	No. of Cases	IR Per 100,000 Person-Years (95% CI)	RR vs General Population (95% CI)	P Value
COPD cohort	2,471,570	84	3.40 (2.67 to 4.13)	2.82 (2.14 to 3.72)^a	< .01
10-17 y of age	2,290	0	0.00 (0.00 to 0.00)
18-44 y of age	44,480	3	6.74 (-0.89 to 14.38)	4.06 (0.82 to 20.12) ^b	.09
45-64 y of age	623,828	23	3.69 (2.18 to 5.19)	4.36 (2.41 to 7.87) ^a	< .01
≥ 65 y of age	1,800,973	58	3.22 (2.39 to 4.05)	2.46 (1.79 to 3.40) ^a	< .01



Summary

1. GOLD 2025

Importance of GII application, case finding strategy

2. Diagnosis

GLI application, validation, early diagnostic tool(QCT, questionnaire+PEF)

3. Epidemiology

25% of BRE, 18-25% BDR +, COPD-related death : 25.7%. RR 2.11 in RA, pertussis



THANK YOU
for your
ATTENTION!