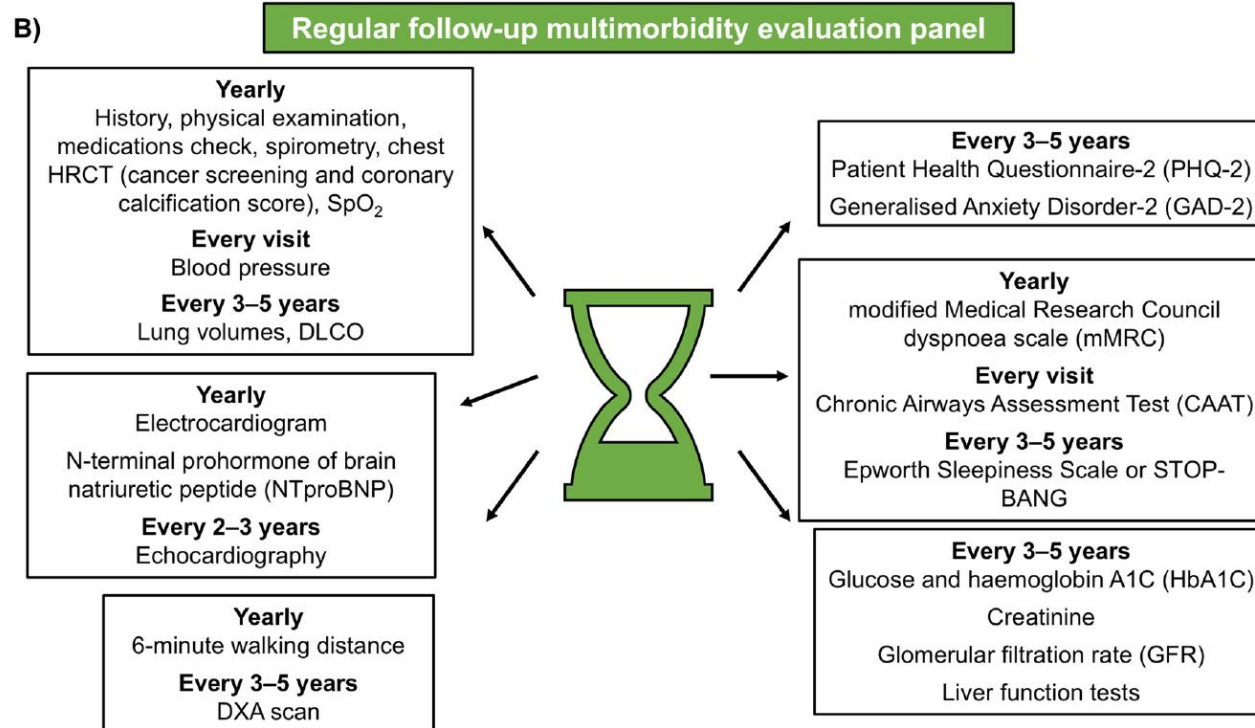
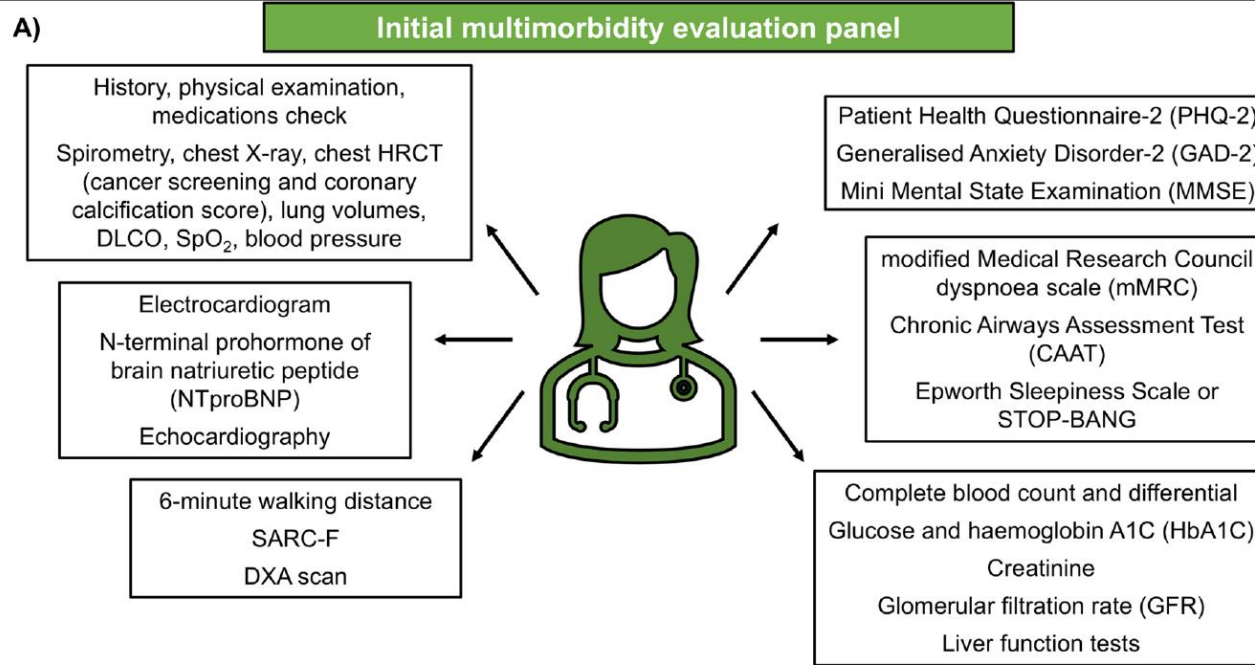

COPD Korea: Year in review 2025

Comorbidities in COPD

Hye Young Hong, MD

Division of Pulmonology and Critical Medicine,
Department of Internal Medicine, Yonsei University College of Medicine

GOLD 202



ital cluster
sion and anxiety
ive impairment

Respiratory cluster
Lung cancer
Asthma
Sleep disordered breathing
Interstitial lung disease
Bronchiectasis

Multiple organs loss of tissue (MOLT) cluster
Osteoporosis
Sarcopenia
Renal failure
Anaemia

ndependently impact outcomes.

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: [www.elsevier.com](http://www.elsevier.com/locate/ejme)

Original Article

A person-centred clinical approach to the multimorbidity evaluation panel in GOLD 2025

Bartolome R. Celli^{a,*,1}, Leonardo M. Fabbri^{b,1}, Abebaw M. Y. Nathaniel M. Hawkins^c, Gerard J. Criner^d, Jessica Bon^e, M. Christine R. Jenkins^f, Leonardo Pantoni^{g,1}, Alberto Papi^{h,m}, Sanjay Sethi^o, Daiana Stolz^p, Alvar Agustí^{q,r,s,t,2}, Don D. Sin

GOLD 2026 report



Original Article

A person-centred clinical approach to the multimorbid patient with COPD

Bartolome R. Celli^{a,*,1}, Leonardo M. Fabbri^{b,1}, Abebaw M. Yohannes^{c,d},
Nathaniel M. Hawkins^e, Gerard J. Criner^f, Jessica Bon^g, Marc Humbert^{h,i},
Christine R. Jenkins^j, Leonardo Pantoni^{k,l}, Alberto Papi^{b,m}, Jennifer K. Quintⁿ,
Sanjay Sethi^o, Daiana Stolz^p, Alvar Agusti^{q,r,s,t,2}, Don D. Sin^{u,v,2}

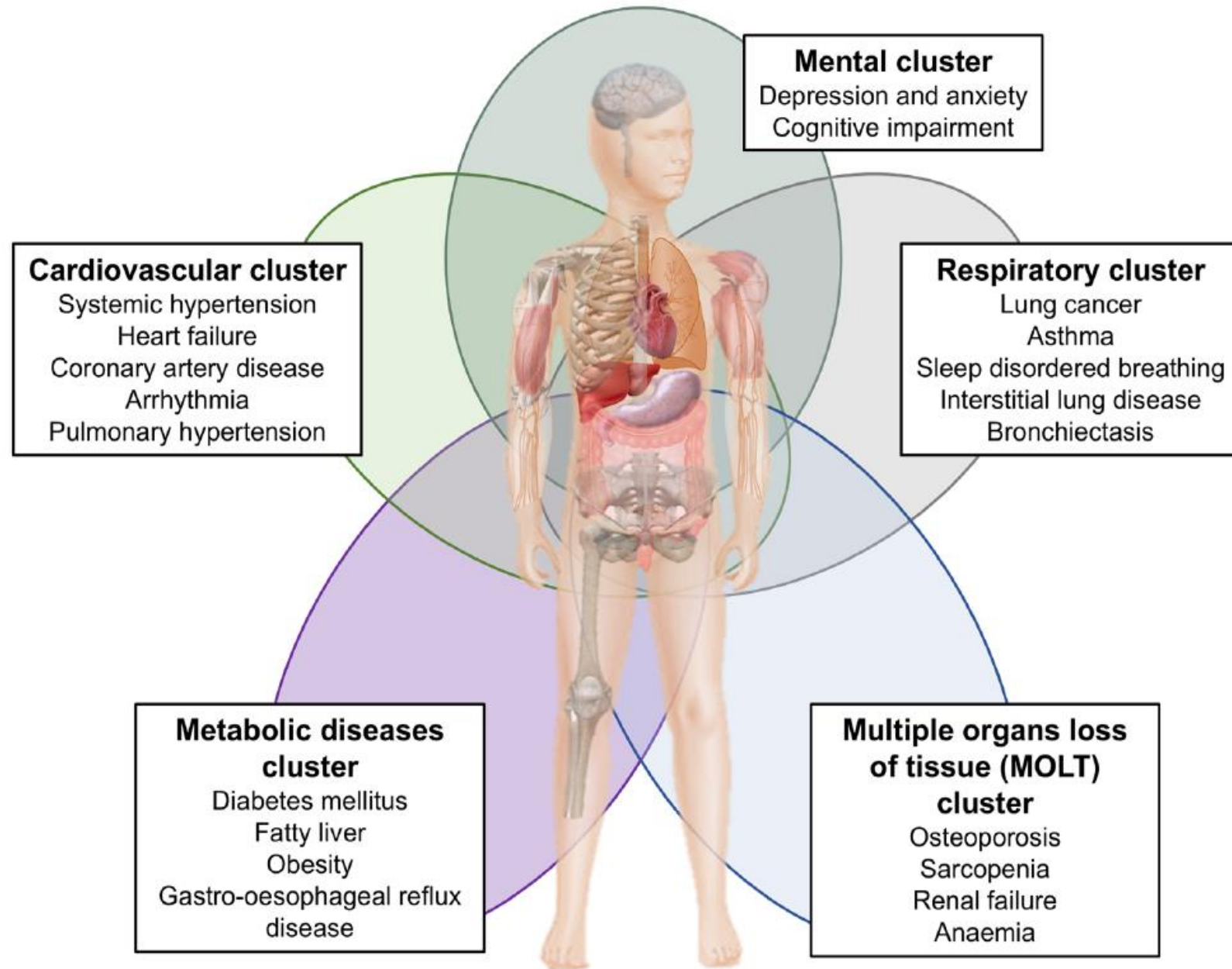


Fig. 2. Morbidity clusters frequently present in patients with COPD that independently impact outcomes.



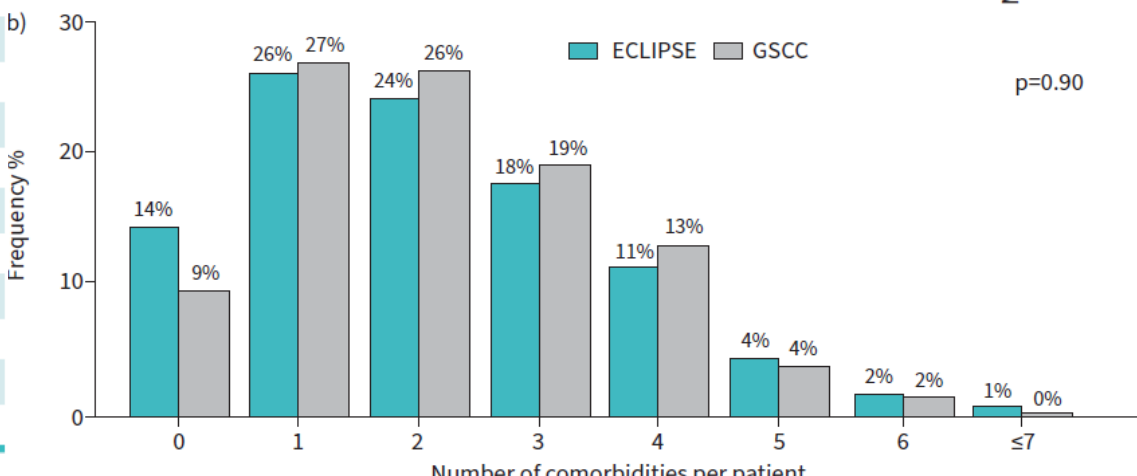
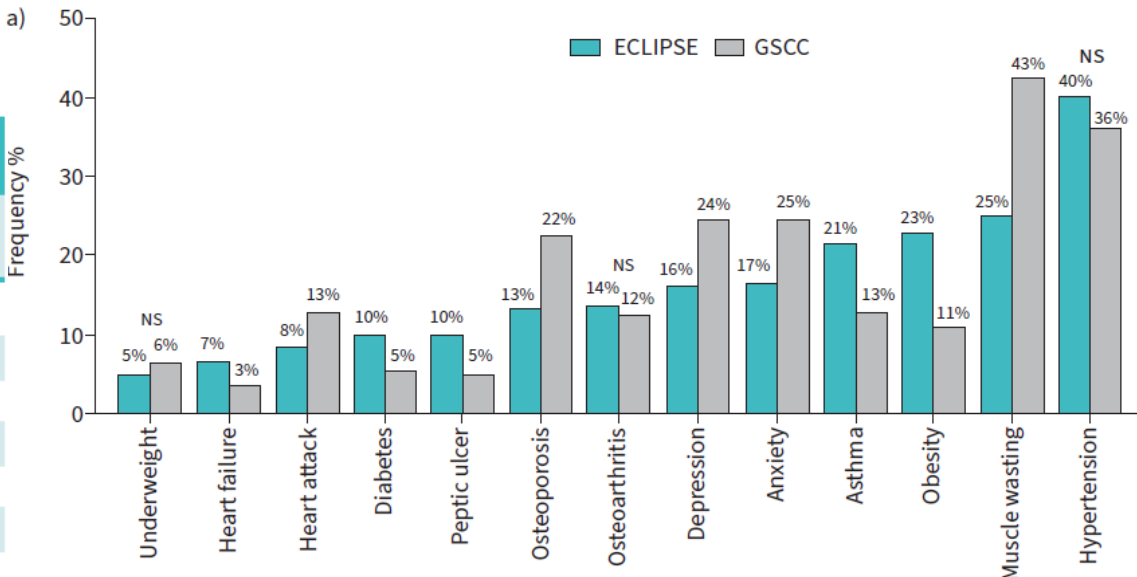
Comorbidity profiles in chronic obstructive pulmonary disease: a multicohort study

Line Egerod , Else A.M.D. ter Haar , Morten A. Karsdal, Diana J. Leeming, Carmel B. Nanthakumar, Julie C. Yates, Dirk-Jan Slebos , Simon D. Pouwels , Jorine E. Hartman  and Jannie M.B. Sand

- **Aim:** Identify **comorbidity-based patient clusters** may improve patient-centered care
 - ✓ Apply an identical **machine-learning clustering** approach across two large COPD cohorts
 - ✓ To determine whether **comorbidity patterns are reproducible** across independent populations
- ECLIPSE (N=2054): GOLD A,B,E distribution
- Groningen Severe COPD Cohort (GSCC, N=776): predominantly severe COPD (GOLD E)
 - ✓ Patients aged 40–75 years, Post-BD FEV₁ < 80% predicted, Current or former smokers
- 13 comorbidities included
 - ✓ muscle wasting, osteoporosis, obesity, diabetes, anxiety, depression, heart failure, etc.

TABLE 1 Baseline patient characteristics of the two cohorts

Clinical characteristics	ECLIPSE	GSCC	p-value
Patients n	2054	776	
Age years	63.3±7.1	61.4±6.9	<0.001
Male sex	1337 (65.1)	266 (34.3)	<0.001
BMI kg·m ⁻²	26.5±5.7	24.4±4.3	<0.001
FFMI kg·m ⁻²	17.7±3.4	15.6±2.0	<0.001
Current smoker	746 (36.3)	15 (1.9)	<0.001
Pack-years	48.7±27.1	41.4±18.1	<0.001
FEV ₁ % predicted	43.7±14.9	29.6±10.0	<0.001
FEV ₁ /FVC ratio	0.45±0.1	0.31±0.07	<0.001
mMRC score	1.66±1.1	2.63±0.63	<0.001
SGRQ-C total score	49.7±20.4	58.9±13.2	<0.001
GOLD stage			
A	805 (40.0)	2 (0.3)	<0.001
B	765 (38.0)	301 (40.8)	
E	443 (22.0)	434 (58.9)	
AECOPD [#]	0.78±0.98	2.3±2.1	<0.001
Emphysema (−950 HU)	17.7±12.3	36.4±8.24	<0.001



≥ 1 more comorbidities: ECLIPSE 86%, GSCC 91%

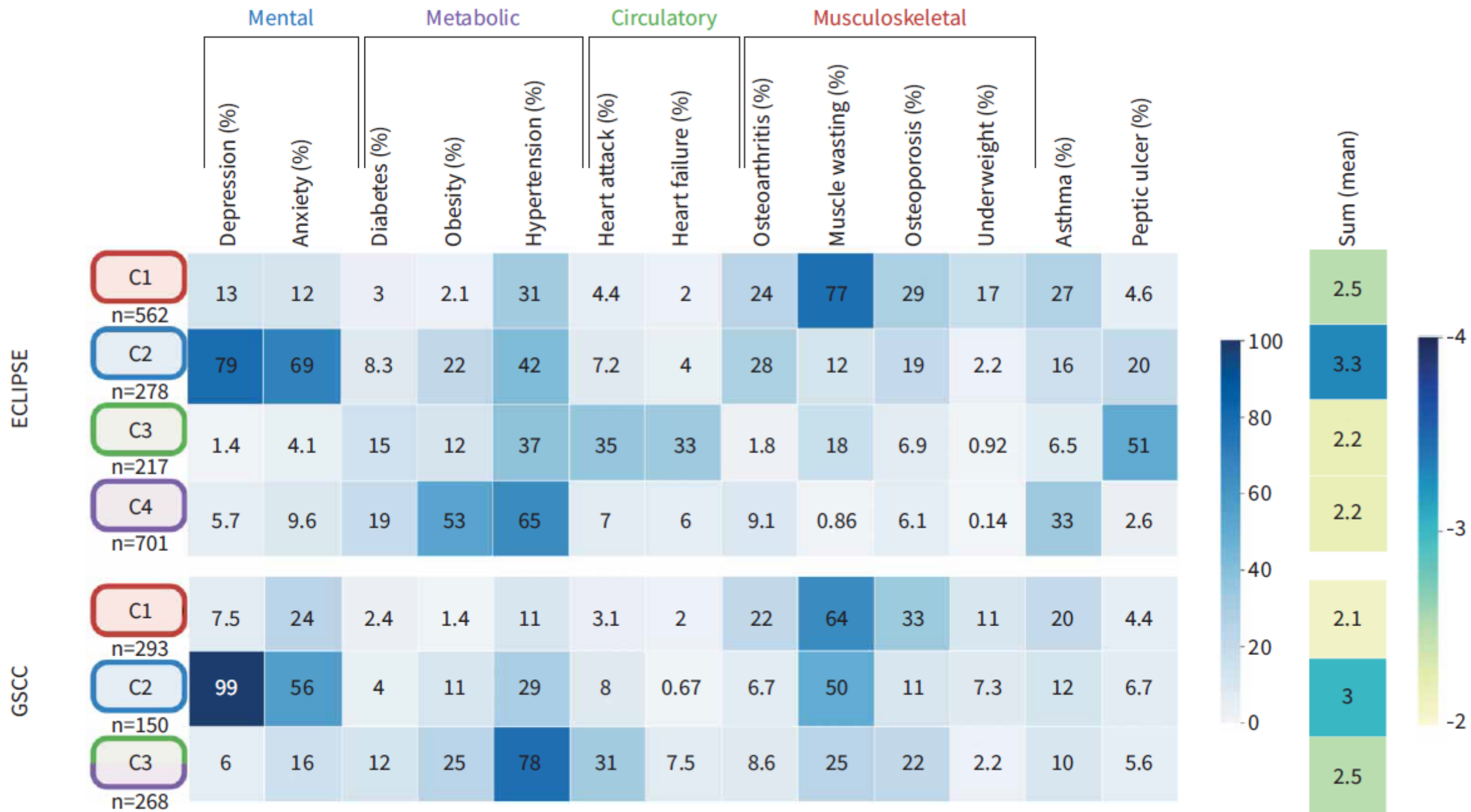
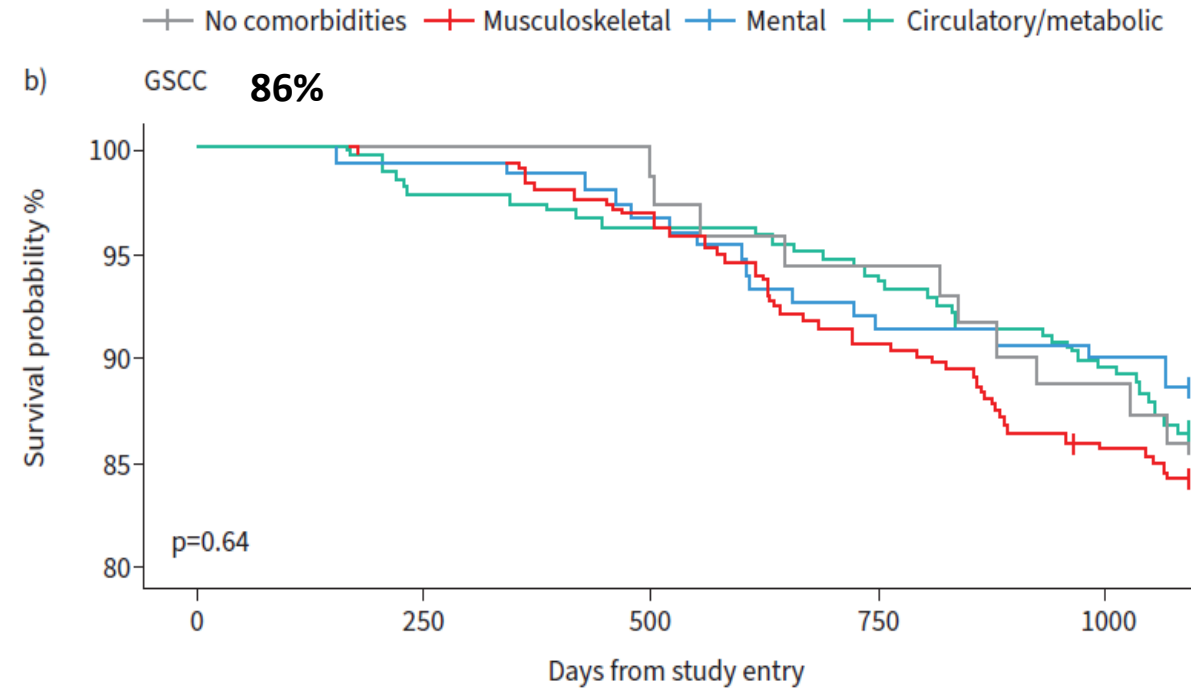
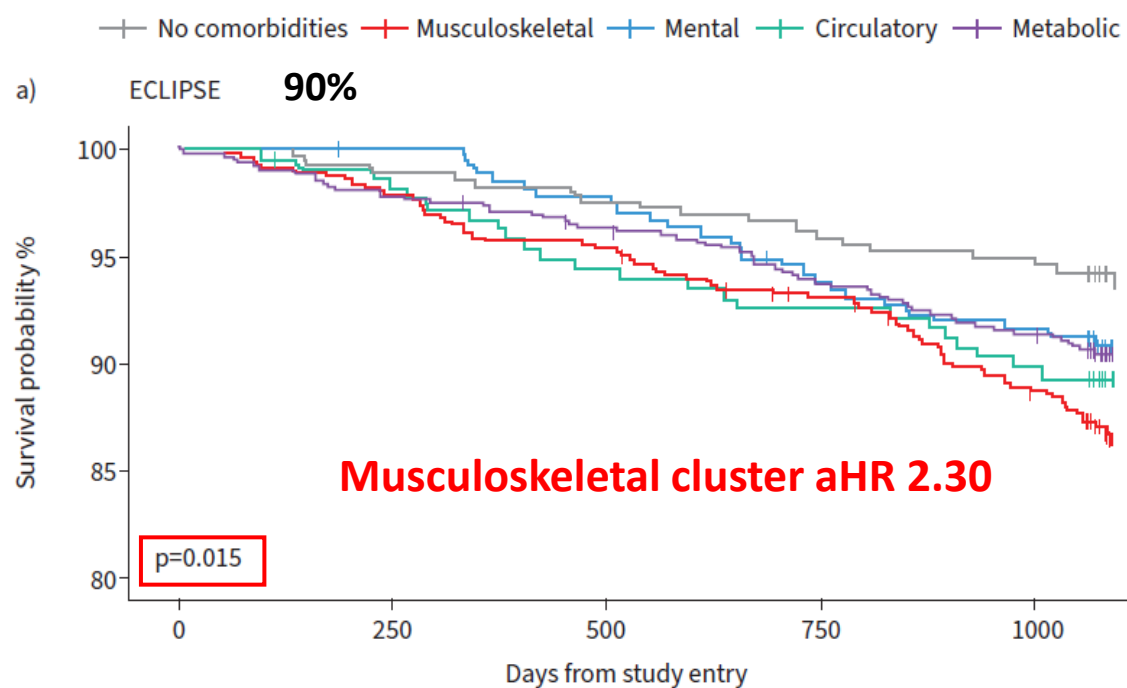


TABLE 2 Clinical characteristics of the patients in the four clusters identified in ECLIPSE

	Reference: No comorbidities	C1: Musculoskeletal	C2: Mental	C3: Circulatory	C4: Metabolic	p-value
Patients, n	296	562	278	217	701	
Age years	62.6±7.3	63.5±7.1	61.7±7.0 [#]	64.5±6.7 [¶]	63.9±7.0 [¶]	<0.001
Male sex	246 (83.1) [¶]	240 (42.7) [#]	151 (54.3) [#]	179 (82.5) [¶]	521 (74.3) [¶]	<0.001
BMI kg·m ⁻²	25.3±2.5 [#]	22.3±4.2 [#]	26.7±5.0	26.1±4.4	30.5±5.6 [¶]	<0.001
FFMI kg·m ⁻²	18.3±1.9 [¶]	14.4±2.6 [#]	17.8±2.9	18.3±3.0 [¶]	19.9±2.9 [¶]	<0.001
Current smoker	118 (39.9)	238 (42.3) [¶]	114 (41.0)	76 (35.0)	200 (28.5) [#]	<0.001
Pack-years	48.8±26.4	45.2±23.7 [#]	54.9±28.9 [¶]	46.8±28.0	49.5±28.6	<0.001
FEV ₁ % predicted	45.3±14.5 [¶]	40.6±14.5 [#]	42.3±14.9	45.2±15.8	45.5±14.5 [¶]	<0.001
FEV ₁ /FVC ratio	0.4±0.1	0.4±0.1 [#]	0.4±0.1	0.5±0.1 [¶]	0.5±0.1 [¶]	<0.001
mMRC score	1.4±1.0 [#]	1.7±1.1	1.9±1.1 [¶]	1.7±1.0	1.7±1.0	<0.001
SGRQ-C score						
Activity	54.4±25.2 [#]	66.0±24.4 [¶]	72.6±22.5 [¶]	61.3±25.2	62.5±25.6	<0.001
Impact	32.2±22.2 [#]	37.7±21.6	44.9±20.8 [¶]	38.0±21.0	38.3±22.4	<0.001
Symptoms	58.1±21.9	59.8±21.2	64.2±21.3 [¶]	59.5±21.5	59.8±22.3	0.012
Total	43.5±20.7 [#]	50.2±19.6	56.7±18.5 [¶]	48.9±19.9	49.3±20.8	<0.001
GOLD stage						
A	149 (51.2) [¶]	213 (38.7)	90 (33.1) [#]	83 (38.6)	270 (39.5)	0.001
B	90 (30.9) [#]	205 (37.2)	107 (39.3)	88 (40.9)	275 (40.2)	
E	52 (17.9) [#]	113 (24.1)	75 (27.6) [¶]	44 (20.5)	139 (20.3)	
AECOPD ⁺	0.6±0.9 [#]	0.9±1.0 [¶]	0.9±1.1 [¶]	0.8±1.0	0.7±1.0 [#]	0.002
Emphysema (−950 HU)	16.7±12.1	21.6±13.8 [¶]	19.1±12.5	16.4±11.5	14.7±10.1 [#]	<0.001



	Number at risk (number of events)				
	0	250	500	750	1000
No comorbidities	296 (0)	292 (3)	288 (7)	282 (12)	278 (16)
Musculoskeletal	562 (0)	550 (12)	536 (26)	519 (39)	492 (63)
Mental	278 (0)	277 (0)	270 (6)	258 (17)	252 (23)
Circulatory	217 (0)	212 (4)	204 (12)	200 (16)	194 (22)
Metabolic	701 (0)	686 (15)	674 (25)	655 (43)	638 (60)

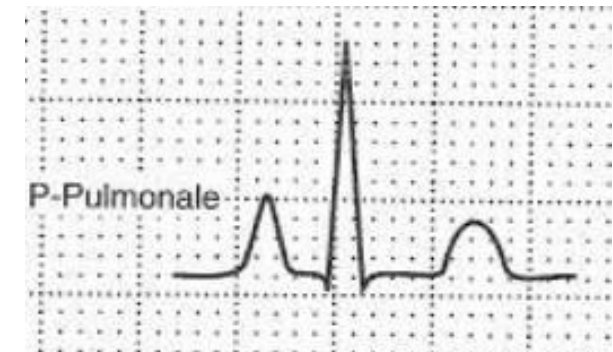
	Number at risk (number of events)				
	0	250	500	750	1000
No comorbidities	71 (0)	71 (0)	70 (1)	67 (4)	63 (8)
Musculoskeletal	292 (0)	290 (2)	283 (9)	265 (27)	249 (42)
Mental	150 (0)	149 (1)	145 (5)	137 (13)	135 (15)
Circulatory/metabolic	267 (0)	261 (6)	257 (10)	251 (16)	239 (28)

- 2 real-world COPD cohort having different levels of disease severity, similar comorbidity clusters were identified
- Different comorbidity cluster showed meaningful differences in patient characteristics and symptom burden

ECG-based risk factors for adverse cardiopulmonary events and treatment outcomes in COPD

R. Chad Wade¹, Fernando J. Martinez², Gerard J. Criner³, Lee Tombs⁴, David A. Lipson^{5,6}, David M.G. Halpin⁷, MeiLan K. Han⁸, Dave Singh⁹, Robert A. Wise¹⁰, Ravi Kalhan¹¹ and Mark T. Dransfield¹

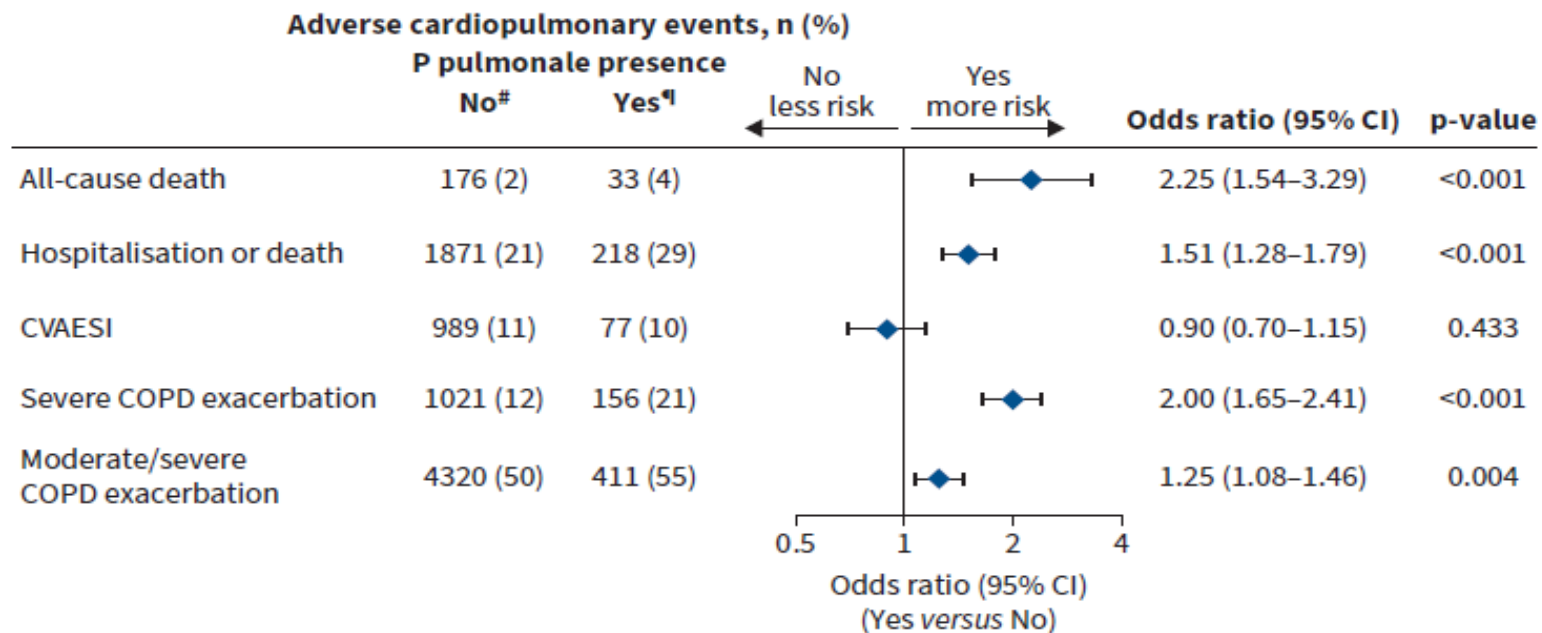
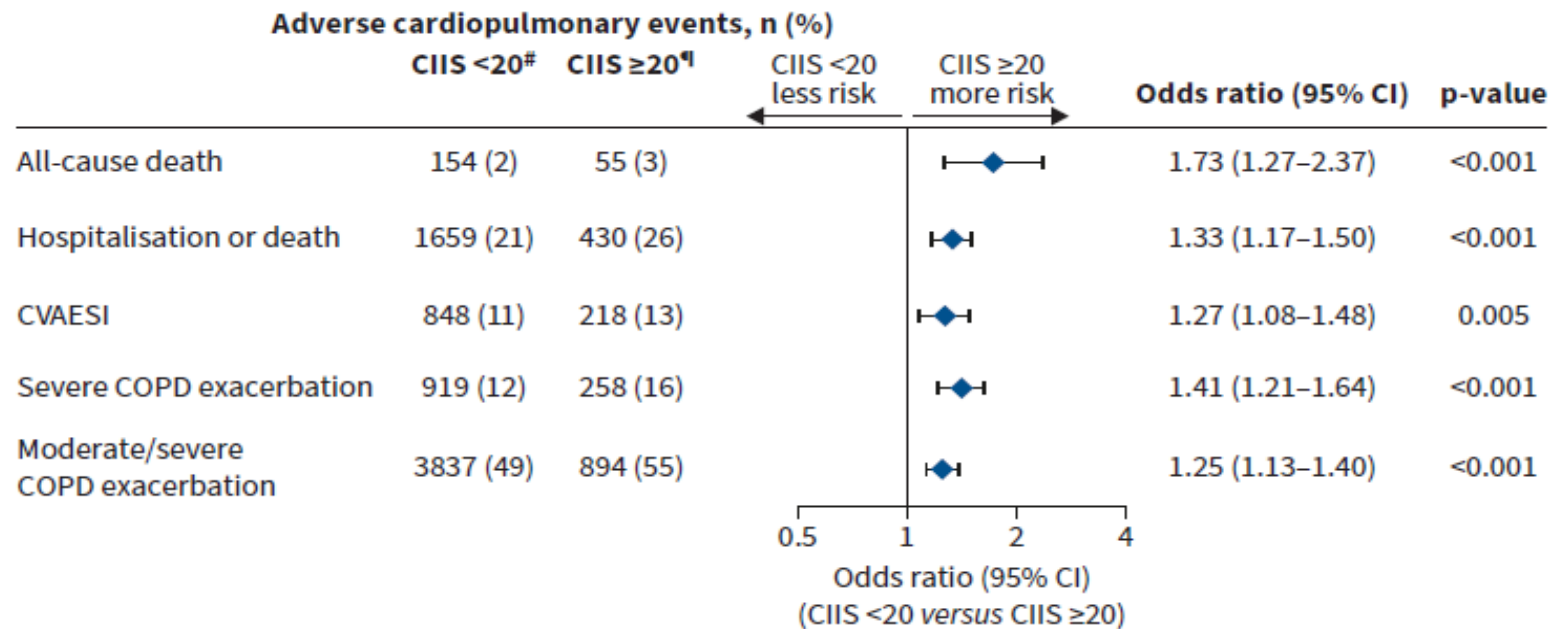
- Post-hoc analysis of IMPACT study
- **Aim:** CIIS \geq 20 or the presence of P pulmonale - Adverse cardiopulmonary events
- **Cardiac infarction injury score (CIIS):** ECG-based composite score
 - ✓ Quantify the extent of myocardial injury
 - ✓ Q-wave, ST-segment change, T-wave inversion, R-wave amplitude
- **P-pulmonale:** ECG pattern indicates Rt. atrial enlargement
 - ✓ P-wave amplitude >2.5 mm in the inferior lead
 - ✓ more severe disease physiology

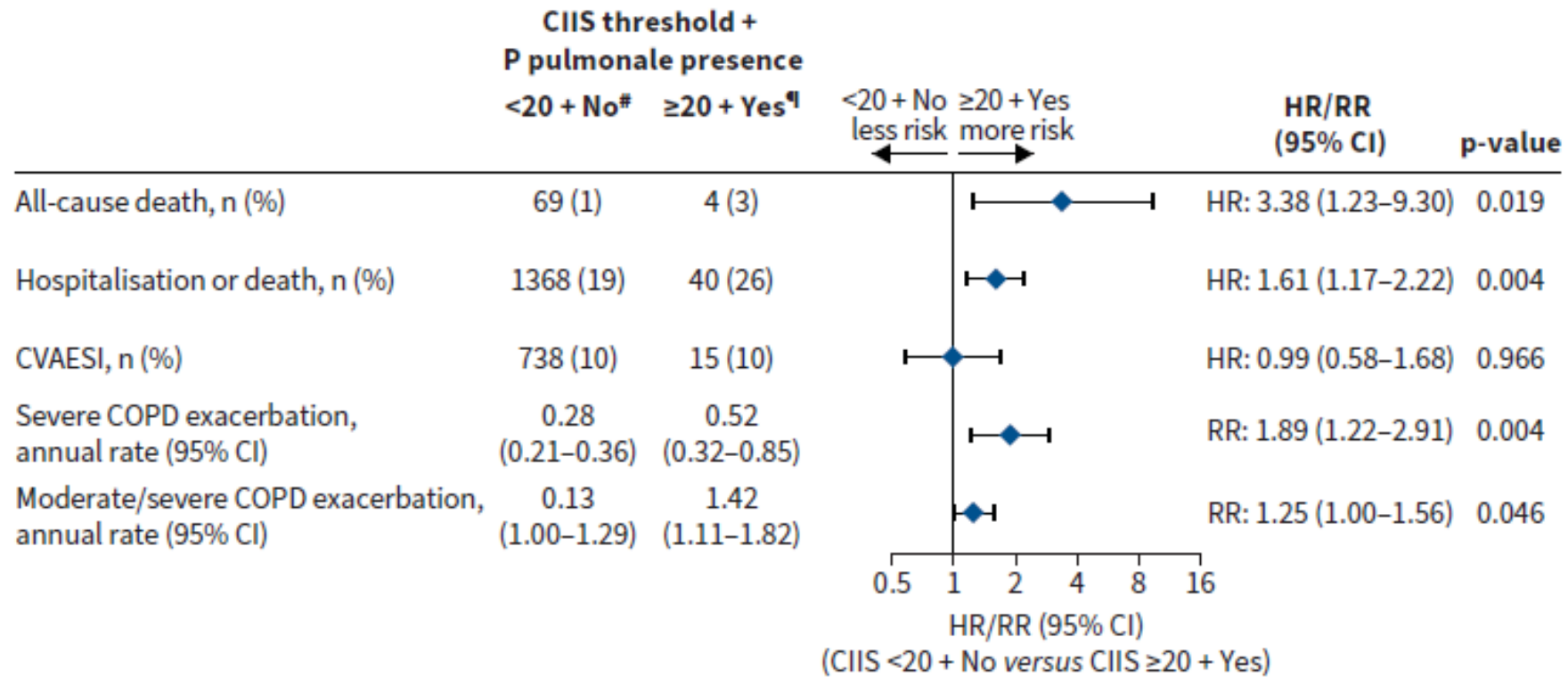


- IMPACT study (N=10355)

- Age ≥ 40
- CAT ≥ 10
- FEV₁ < 50% + moderate AE ≥ 1
- 50% \leq FEV₁ < 80% + ≥ 2 moderate or ≥ 1 severe AE
- CVD comorbidity allowed

→ N=9448





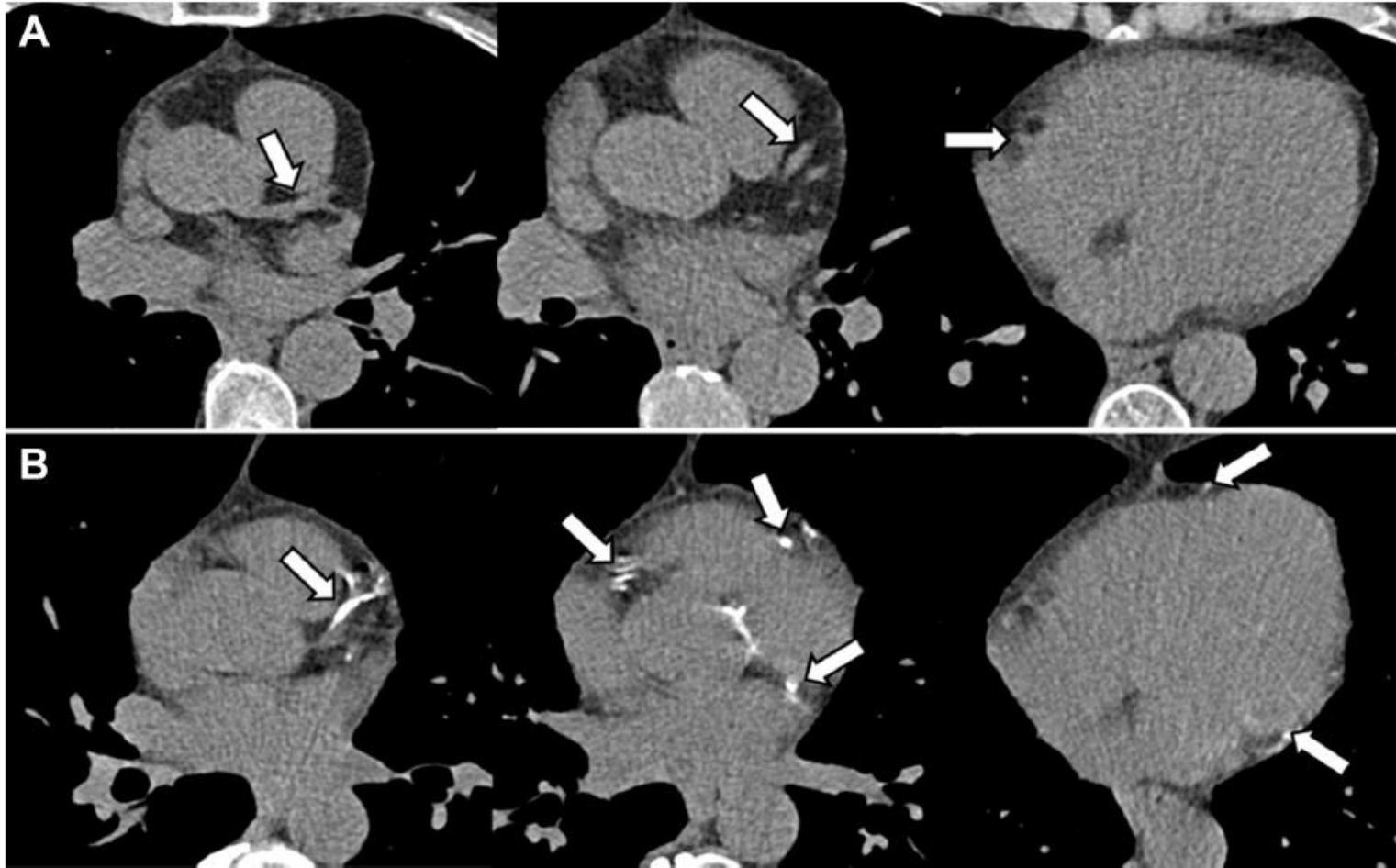
→ **CIIS and P pulmonale** can provide **valuable prognostic information** in COPD

Complementary Role of Cardiac Risk and Coronary Artery Calcium Scores

Juan P. de-Torres, MD; Ciro Casanova, MD; Jorge Zagaceta, MD; José M. Marín, MD; Carlos Cabrera, MD; Ana Ezponda, MD; Arantza Campo, MD; Ana Belén Alcaide, MD; Luis Seijo, MD; Gorra Bastarrika, MD; Victor Pinto-Plata, MD; Miguel Divo, MD; and Bartolome R. Celli, MD

- 2000 – 2011yr, 4 university hospital pulmonary clinics, >8 years of follow-up
- **COPD definition**
 - ✓ Compatible symptoms, ≥ 10 pack-years of smoking
 - ✓ Patients clinically stable for ≥ 8 weeks at baseline and on optimal COPD therapy
- **Hypothesis: cardiovascular risk scores (CVRS) + coronary artery calcium score (CACs)**
 - improve the risk evaluation for cardiovascular events in stable COPD patients
- **CVRS:** risk calculator estimating 10-year risk of MACE
 - ✓ Age, Sex, BP, cholesterol, smoking status, diabetes
 - 2 categories: <10% risk (low risk), $\geq 10\%$ risk (high risk)

- **CACS**: visual ordinal score for each of the **four coronary arteries**, total 0–12



→ no visible coronary artery calcification

→ calcification detected all coronary arteries

Group I: CVRS <10% and CACS ≤3

Group II: CVRS ≥10% and CACS ≤3

Group III: CVRS <10% and CACS >3

Group IV: CVRS ≥10% and CACS >3

TABLE 1 | Clinical and Physiologic Characteristics of Patients (N = 549)

Variable	Data
Age, y	63 (9)
Female sex	20%
Follow-up, mo	98 (62)
BMI, kg/m ²	27 (4)
Smoking history, pack-years	51 (28)
Active smoking	45%
FEV ₁ % predicted	72 (24)
FVC % predicted	97 (21)
FEV ₁ to FVC ratio	57 (13)
GOLD stage	
1	34%
2	41%
3	20%
4	5%
BODE index	1.57 (1.96)
Charlson Comorbidity Index	1.52 (1.79)
6MWD, m	467 (110)
Systolic BP, mm Hg	128 (17)
Total cholesterol, mg/dL	200 (42)
HDL cholesterol, mg/dL	53 (15)
DM	17%
Hypertension	38%
CACS	2.67 (2.51)
CACS > 3%	34
CVRS risk	11.28 (11.37)
CVRS risk at 10 y > 10%	40%
MACE	131 (24%)
MACE by GOLD stage	
1	27%
2	23%
3	17%
4	15%
Mortality	156 (28%)

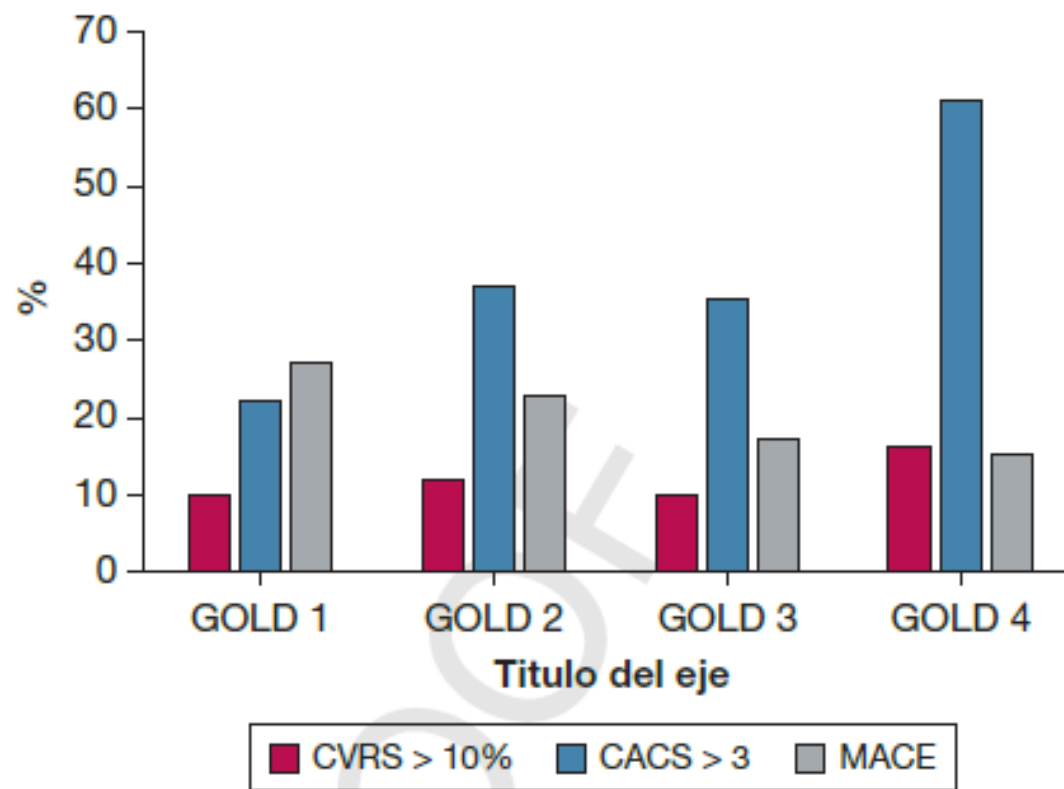
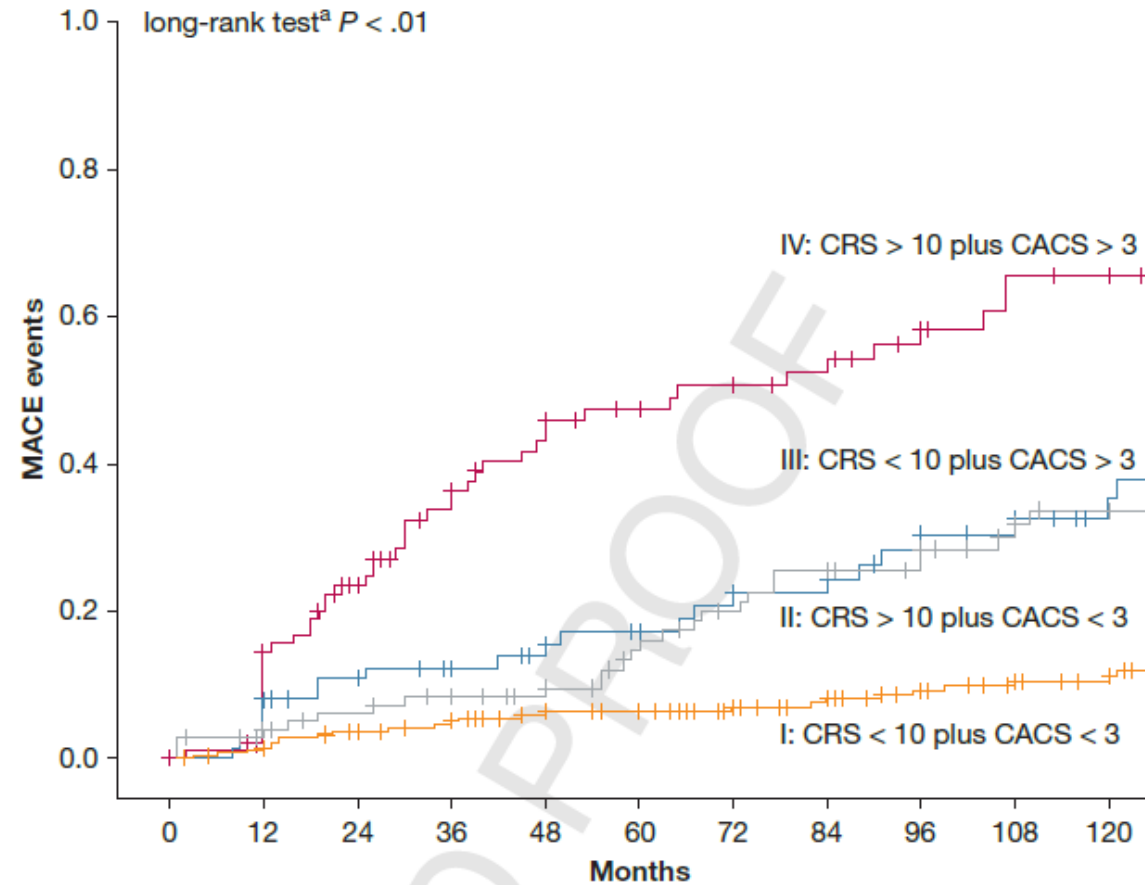


TABLE 3] Hazard Ratio and 95% CI of the Risk of a MACE in the 4 Groups

Group	B	Hazard Ratio	95% CI	P Value
IV (CACS > 3 and CVRS ≥ 10%)	2.04	7.7	4.9-11.9	< .01
III (CACS > 3 and CVRS < 10%)	1.13	3.1	1.8-5.1	< .01
II (CACS ≤ 3 and CVRS ≥ 10%)	0.95	2.6	1.6-4.2	< .01
I (CACS ≤ 3 and CVRS < 10%)		Reference		

CACS = coronary artery calcium score; CVRS = cardiovascular risk score; MACE = major adverse cardiovascular event.



Group I	270	256	244	232	220	208	185	184	172	160	148
Group II	103	91	79	67	55	43	31	19	7		
Group III	75	63	51	39	27	15	3				
Group IV	101	89	77	65	53	41	29	17	5		

Glucose-Lowering Medications and Risk of Chronic Obstructive Pulmonary Disease Exacerbations in Patients With Type 2 Diabetes

Avik Ray, MD, MS; Julie M. Paik, MD, ScD, MPH; Deborah J. Wexler, MD, MSc; Sushama K. Sreedhara, MBBS, MSPH; Katsiaryna Bykov, PharmD, ScD; William B. Feldman, MD, DPhil, MPH; Elisabetta Patorno, MD, DrPH

- **Type 2 diabetes (T2DM) + COPD**
 - ✓ Longer hospital stays, higher risk of respiratory failure, sepsis, increased medical expenses
- **Aim:** Compare the risk of moderate/severe exacerbation in T2DM + COPD
 - ✓ SGLT2i vs DPP4i, GLP-1RA vs DPP4i, SGLT2i vs GLP-1RA
- 3 large U.S. administrative claims databases
- Inclusion criteria
 - ✓ Age \geq 40 years
 - ✓ Type 2 diabetes
 - ✓ COPD: \geq 2 outpatient visits or \geq 1 hospitalization for COPD in the prior year
 - ✓ New initiation of one of the compared drug classes
- **Primary outcome:** first moderate or severe COPD exacerbation

Table 1. Selected Baseline Characteristics of Patients in the 1:1 PS-Matched Cohorts

Characteristic	1:1 PS-matched cohorts, No. (%)								
	SGLT-2i vs DPP-4i			GLP-1RA vs DPP-4i			SGLT-2i vs GLP-1RA		
	SGLT-2i (n = 27 991)	DPP-4i (n = 27 991)	Mean ASD	GLP-1RA (n = 32 107)	DPP-4i (n = 32 107)	Mean ASD	SGLT-2i (n = 36 218)	GLP-1RA (n = 36 218)	Mean ASD
Age, mean (SD), y	70.75 (8.62)	70.69 (8.79)	0.007	70.40 (8.49)	70.40 (8.18)	0.001	69.75 (8.72)	69.73 (8.68)	0.003
Sex									
Female	13 767 (49.2)	13 847 (49.5)	0.006	17 622 (54.9)	17 620 (54.9)	0.001	18 807 (51.9)	18 854 (52.1)	0.003
Race and ethnicity ^a									
Asian	280 (1.0)	300 (1.1)		225 (0.7)	321 (1.0)		398 (1.1)	326 (0.9)	
Black	2687 (9.6)	3107 (11.1)		3082 (9.6)	3789 (11.8)		3875 (10.7)	3694 (10.2)	
Hispanic	868 (3.1)	1026 (3.7)	0.061	899 (2.8)	1060 (3.3)	0.089	1304 (3.6)	1195 (3.3)	0.045
White	18 418 (65.8)	18 138 (64.8)		22 090 (68.8)	21 062 (65.6)		23 397 (64.6)	24 121 (66.6)	
Other/unknown/missing ^b	5738 (20.5)	5420 (19.4)		5811 (18.1)	5875 (18.3)		7244 (20.0)	6882 (19.1)	
Baseline HbA _{1c} level, mean (SD), % ^{a,c}	7.87 (1.78)	7.97 (1.76)	0.020	8.1 (1.8)	8.1 (1.8)	0.002	8.0 (1.8)	8.0 (1.8)	0.009
Baseline lung parameters									
GOLD group E ^d	3104 (11.1)	3098 (11.1)	0.001	3675 (11.4)	3660 (11.4)	0.001	3954 (10.9)	3906 (10.8)	0.004
Glucocorticoids (oral)	12 933 (46.2)	12 830 (45.8)	0.007	14 709 (45.8)	14 682 (45.7)	0.002	16 753 (46.3)	16 767 (46.3)	0.001
Pneumonia	7034 (25.1)	7015 (25.1)	0.002	8142 (25.4)	8141 (25.4)	0.001	8580 (23.7)	8633 (23.8)	0.003
Asthma (active) ^e	3547 (12.7)	3594 (12.8)	0.005	4534 (14.1)	4476 (13.9)	0.005	4725 (13.0)	4762 (13.1)	0.003
Pulmonary hypertension	2763 (9.9)	2821 (10.1)	0.007	2965 (9.2)	3025 (9.4)	0.006	3438 (9.5)	3547 (9.8)	0.010
Pulmonary embolism	1472 (5.3)	1437 (5.1)	0.006	1796 (5.6)	1830 (5.7)	0.005	1990 (5.5)	1989 (5.5)	0.001
Obstructive sleep apnea or CPAP/BiPAP	8103 (28.9)	8141 (29.1)	0.002	9835 (30.6)	9836 (30.6)	0.001	12537 (34.6)	12530 (34.6)	0.001
Dual therapy ^f	12700 (45.4)	12754 (45.6)	0.002	14702 (45.8)	14817 (46.1)	0.007	16767 (46.3)	16723 (46.2)	0.002
Triple therapy ^g	1607 (5.7)	1632 (5.8)	0.001	1715 (5.3)	1766 (5.5)	0.007	2704 (7.5)	2728 (7.5)	0.003

Table 2. First Chronic Obstructive Pulmonary Disease Exacerbation in the 1:1 Propensity Score-Matched Cohorts




Parameters	SGLT-2i vs DPP-4i		GLP-1RA vs DPP-4i		SGLT-2i vs GLP-1RA	
	SGLT-2i (n = 27 991)	DPP-4i (n = 27 991)	GLP-1RA (n = 32 107)	DPP-4i (n = 32 107)	SGLT-2i (n = 36 218)	GLP-1RA (n = 36 218)
Moderate or severe exacerbation						
No. of events	1886	2334	2365	2829	2363	2525
Follow-up time, median (IQR), d	145 (61 to 335)	147 (62 to 336)	142 (63 to 339)	156 (66 to 355)	141 (61 to 316)	139 (65 to 314)
IR/100 PYs	9.26	11.44	9.89	11.49	9.47	10.00
IRD/100 PYs (95% CI)	-2.20 (-2.83 to -1.58)		-1.60 (-2.18 to -1.02)		-0.55 (-1.09 to -0.01)	
HR (95% CI)	0.81 (0.76 to 0.86)		0.86 (0.81 to 0.91)		0.94 (0.89 to 1.00)	
Severe exacerbation						
No. of events	842	1201	1195	1510	1025	1121
Follow-up time, median (IQR), d	150 (67 to 354)	155 (69 to 356)	147 (69 to 356)	164 (73 to 377)	147 (67 to 329)	144 (70 to 331)
IR/100 PYs	3.95	5.61	4.79	5.84	3.94	4.24
IRD/100 PYs (95% CI)	-1.42					
HR (95% CI)	0.71 (0.66 to 0.76)					

SGLT2i: glucosuria effect, fluid reduction, systemic inflammation, EPO production
 GLP-1 RA: reduced bronchial hyperresponsiveness (IL-13, IL-33 pathway)

- SGLT2i and GLP-1 RA both reduce COPD exacerbations compared with DPP-4i
- SGLT2i and GLP-1 RA are similar to each other, with only minimal differences

ORIGINAL ARTICLE **OPEN ACCESS**

Respiratory Muscle Strength as a Predictor of Exacerbations in Patients With Chronic Obstructive Pulmonary Disease

Yuichiro Furukawa^{1,2}  | Atsushi Miyamoto²  | Kazuhisa Asai² | Masaya Tsutsumi² | Kaho Hirai² | Takahiro Ueda² | Erika Toyokura^{1,2} | Misako Nishimura² | Kanako Sato² | Kazuhiro Yamada²  | Tetsuya Watanabe² | Tomoya Kawaguchi²

- **Aim:** Whether **respiratory muscle strength predicts moderate**
- Retrospective cohort study from a university hospital, from June 2
- Respiratory muscle function
 - ✓ Maximal inspiratory pressure (P_Imax), Maximal expiratory pressure (P_Emax), %P_Imax
 - ✓ Respiratory muscle weakness (RMW): %P_Imax < 70%
- Systemic muscle function
 - ✓ Handgrip strength (HGS)
 - ✓ Skeletal muscle mass index (SMI)
- **Primary outcome:** moderate–severe COPD exacerbation within 1 year



TABLE 1 | Patients' characteristics according to respiratory muscle strength.

Variables	All patients	Patients without RMW	Patients with RMW	p value
	(n = 208)	(n = 108)	(n = 100)	
Male	180 (86.5%)	94 (87.0%)	86 (86.0%)	0.988
Age (year)	72.0 (66.0–77.0)	71.0 (65.0–77.0)	72.5 (66.8–76.3)	0.984
BMI (kg/m ²)	22.7 (19.8–24.5)	23.0 (20.7–24.9)	21.7 (18.7–24.4)	0.024*
Smoking status (pack-year)	48.0 (32.8–78.0)	45.0 (30.0–75.3)	50.0 (38.2–80.0)	0.582
Inhaled corticosteroid use	53 (25.5%)	29 (26.9%)	24 (24.0%)	0.750
Oral corticosteroid use	2 (1.0%)	2 (1.9%)	0 (0.0%)	0.498
Comorbidity				
Dyslipidemia	41 (19.7%)	22 (20.4%)	19 (19.0%)	0.941
Chronic kidney disease	24 (11.5%)	13 (12.0%)	11 (11.0%)	0.987
Cerebrovascular disease	13 (6.3%)	8 (7.4%)	5 (5.0%)	0.667
Osteoporosis	11 (5.3%)	4 (3.7%)	7 (7.0%)	0.360
mMRC 0/1/2/3/4	58 (27.9%) /71 (34.1%) /46 (22.1%) /25 (12.0%) /8 (3.8%)	36 (33.3%) /43 (39.8%) /20 (18.5%) /7 (6.5%) /2 (1.9%)	22 (22.0%) /28 (28.0%) /25 (26.0%) /18 (18.0%) /6 (6.0%)	0.007*
6MWD (m)	420.0 (370.0–480.0)	445.0 (390.0–496.3)	400.0 (337.5–450.0)	<0.001*
%FEV ₁ (%)	72.3 (54.1–89.0)	78.3 (61.6–91.0)	67.1 (47.7–85.9)	0.001*
PImax (cmH ₂ O)	52.1 (34.3–67.1)	67.0 (56.0–83.8)	33.7 (26.3–42.2)	<0.001*
PEmax (cmH ₂ O)	63.8 (48.7–82.3)	70.2 (56.5–87.0)	59.9 (41.4–75.0)	<0.001*
HGS (kgf)	31.0 (25.0–36.0)	32.0 (26.0–37.0)	30.0 (23.8–36.0)	0.267
SMI (kg/m ²)	7.8 (7.0–8.5)	7.9 (7.2–8.5)	7.7 (6.8–8.3)	0.210
Sarcopenia	21 (10.1%)	5 (4.6%)	16 (16.0%)	0.010*

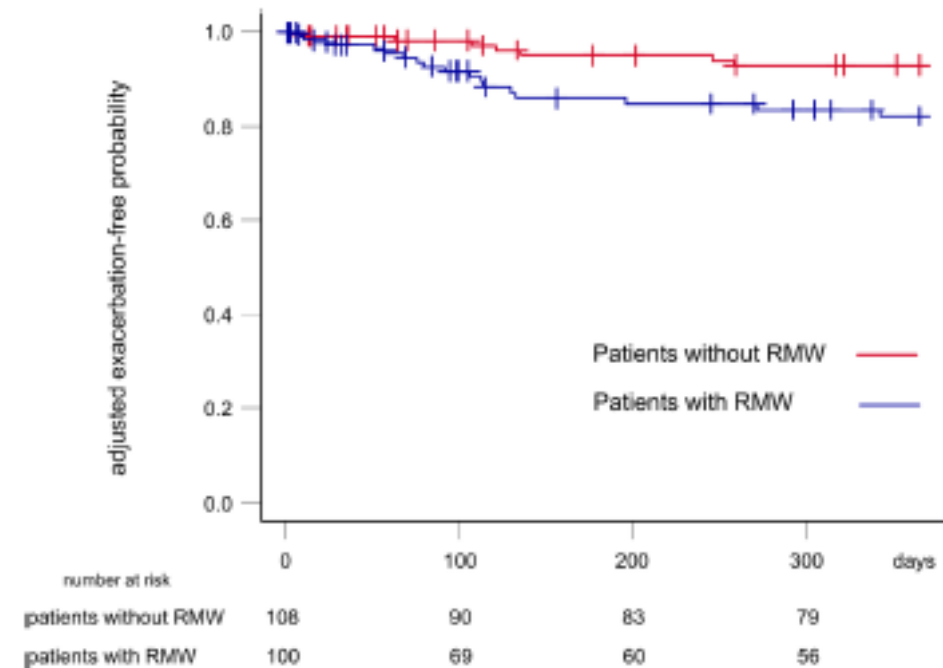
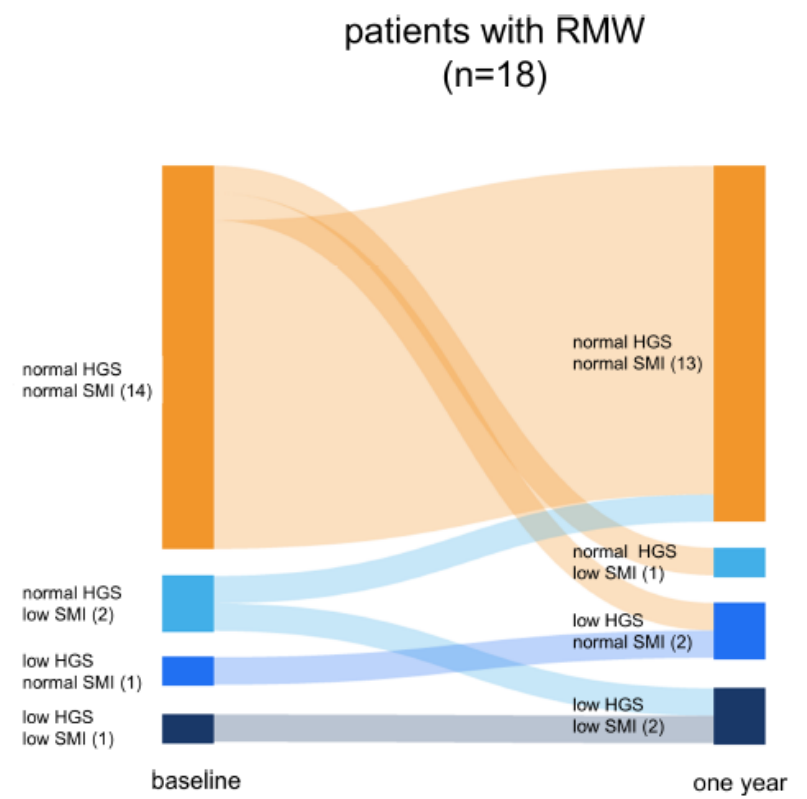
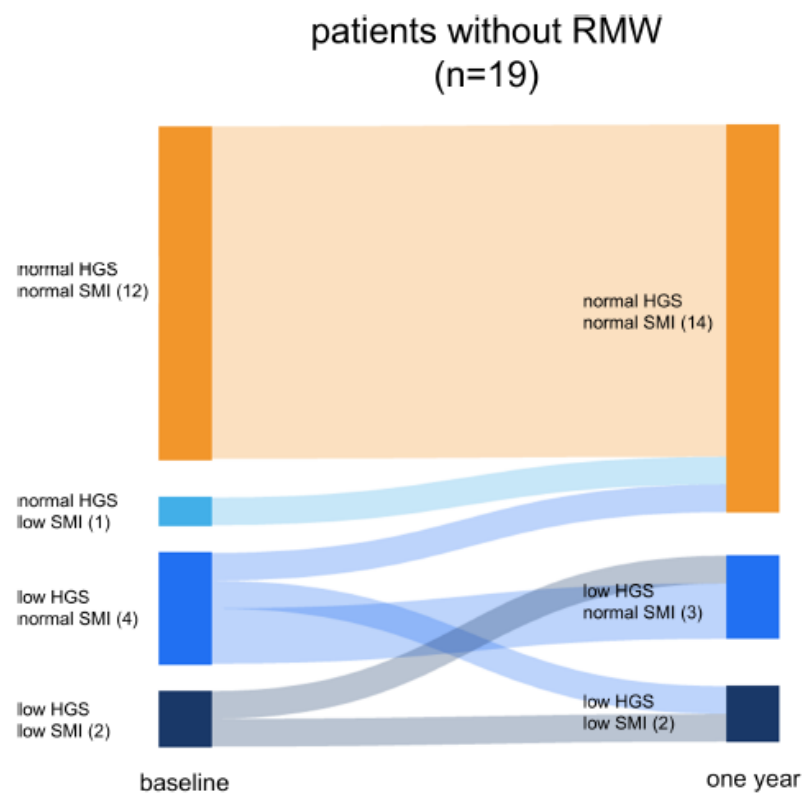
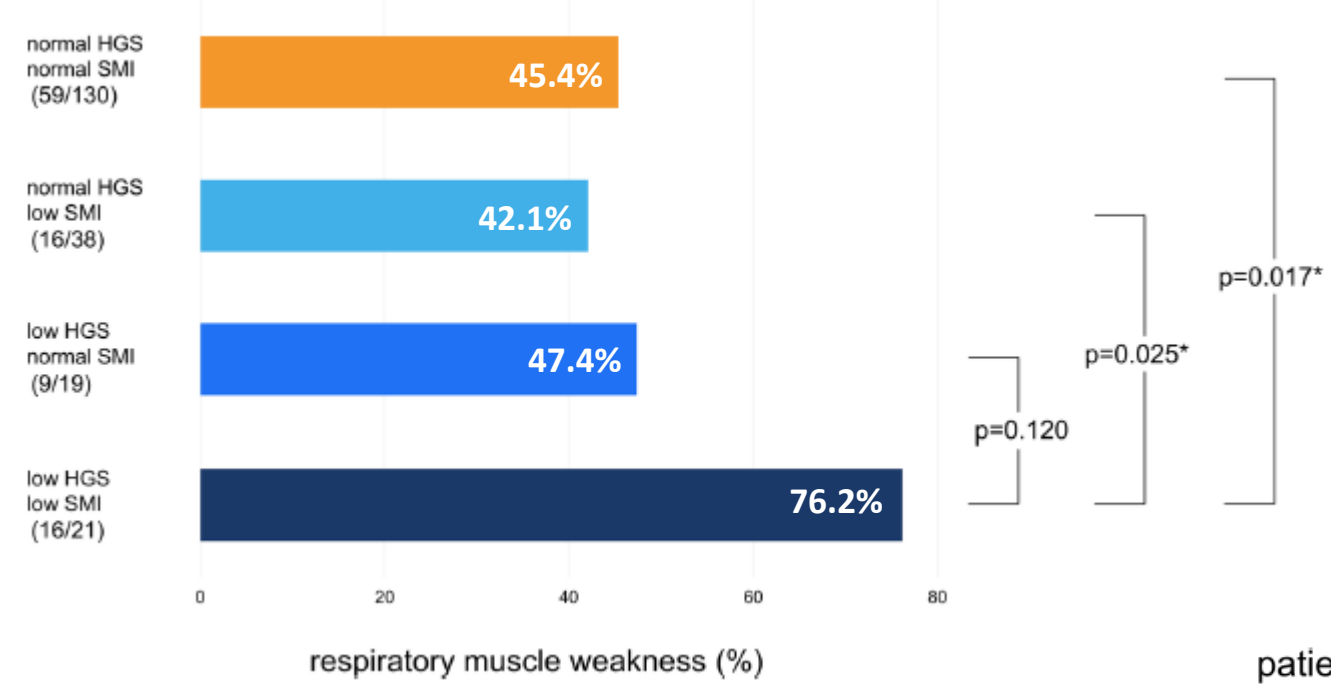
**FIGURE 1** | Kaplan–Meier curve for exacerbation-free probability

TABLE 2 | Cox regression model of COPD exacerbation risk for %PImax adjusted by sex, age, %FEV₁, HGS, and SMI.

Covariates	Adjusted HR (95% CI)	p value
%PImax (per 1 SD increase)	0.521 (0.317–0.856)	0.010*
Female (vs. male)	2.59 (0.718–9.31)	0.146
Age (per 1 year increase)	0.968 (0.918–1.02)	0.213
%FEV ₁ (per 1% increase)	0.992 (0.976–1.01)	0.299
HGS (per 1 kgf increase)	0.990 (0.930–1.05)	0.751
SMI (per 1 kg/m ² increase)	0.935 (0.666–1.31)	0.696

TABLE 3 | Cox regression model of COPD exacerbation risk for %PImax adjusted by sex, age, %FEV₁, HGS, SMI, and exacerbation history in the previous year.

Covariates	Adjusted HR (95% CI)	p value
%PImax (per 1 SD increase)	0.407 (0.202–0.820)	0.012*
Female (vs. male)	1.28 (0.217–7.52)	0.786
Age (per 1 year increase)	0.955 (0.889–1.03)	0.210
%FEV ₁ (per 1% increase)	0.989 (0.970–1.01)	0.266
HGS (per 1 kgf increase)	1.02 (0.957–1.09)	0.509
SMI (per 1 kg/m ² increase)	0.885 (0.508–1.54)	0.666
Exacerbation history (vs. no exacerbation)	5.04 (1.57–16.2)	0.007*



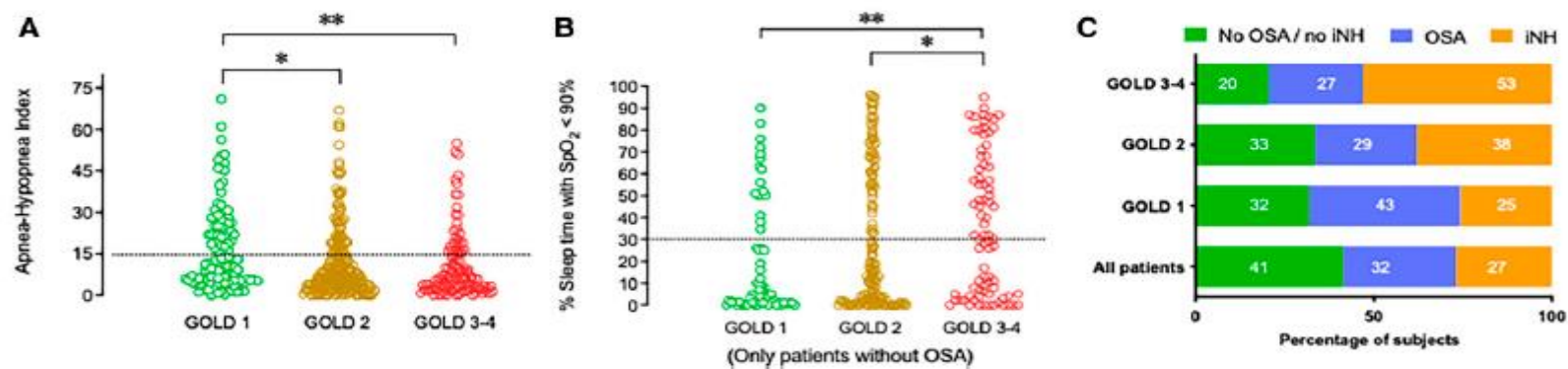
Sleep-disordered Breathing in Patients with Chronic Obstructive Pulmonary Disease: Prevalence and Outcomes

Jose M. Marin^{1,2}, Joan B. Soriano^{2,3}, Marta Marin-Oto⁴, Juan P. De-Torres⁴, Luis M. Seijo⁵, Carlos Cabrera⁶, Ingrid Solanes⁷, Cristina Martinez⁸, Nuria Toledo-Pons⁹, Nuria Feu¹⁰, Carlos Amado¹¹, Laura Vigil¹², Bartolome R. Celli¹³, and Ciro Casanova¹⁴; for the CHAIN Cohort

- **Overlap syndrome (OVS): COPD + Obstructive sleep apnea (OSA)**
- **Hypothesis:** OVS increases mortality and exacerbation risk
- Spanish multicenter CHAIN COPD cohort
 - ✓ At year-2 visit (2012–2014), all patients undergo home sleep apnea testing
 - ✓ OSA: AHI \geq 15 events/hour (moderate–severe)
 - ✓ Isolated nocturnal hypoxemia (iNH): In patients without OSA, T90 > 30%
- **Primary outcome:** all-cause mortality
- **Secondary outcome:** moderate to severe AE

Table 1. Demographic and clinical characteristics of patients with COPD (N=428) at baseline according to OSA and nocturnal hypoxemia

Variable	No OSA, No iNH	OSA	iNH
No. of patients	177 (41%)	136 (32%)	115 (27%)
Male sex	130 (73%)	113 (83%)	91 (80%)
Age, yr	65.0 ± 8.6	67.9 ± 7.9*	67.6 ± 7.7*
Smoking history			
Pack-years	55.5 (40–60)	54.1 (40–64)	56.6 (45–69)
Current smoker	64 (36%)	47 (35%)	42 (37%)
Chronic bronchitis	102 (58%)	83 (61%)	64 (56%)
Body mass index, kg/m ²	26.4 (23.5–29.1)	29.7 (26.6–32.8) [†]	27.5 (24.4–30.2) [†]
Post BD FEV ₁ , % predicted	65.7 (50–79)	67.1 (52–84)	59.0 (42–73) ^{†§}
GOLD stage			
1	49 (43%)	49 (42%)	17 (15%)
2	90 (44%)	58 (29%)	55 (27%)
3/4	38 (35%)	29 (26%)	43 (39%)
D _{LCO} , % predicted	72 (54–89)	76 (59–95)	61 (48–85) [†]
Resting O ₂ saturation, %	95 (94–96)	95 (93–96)	94 (92–95) ^{§†}
6MWD, m	492 (420–540)	444 (372–499) [§]	446 (380–512) [*]
mMRC dyspnea score	2.01 ± 0.80	2.24 ± 0.93	2.48 ± 0.99
CAT score	10 (6–13)	9 (6–14)	11 (6–1)
Prior year exacerbation history			
Total exacerbation rate	0.36 (0.27–0.44)	0.44 (0.38–0.48)	0.43 (0.36–0.53)
≥1 severe exacerbation	26 (15%)	34 (25%) [*]	25 (22%)
ESS score	5 (3–8)	7 (5–10) [*]	5 (3–7) [†]
Respiratory treatment			
LABA + LAMA	38 (21%)	23 (17%)	19 (16%)
LABA + LAMA + ICS	80 (45%)	65 (48%)	59 (51%)
CASIS score	36 (30–40)	34 (30–40)	34 (30–38)
FOSQ total score	9.6 (8.2–1.08)	9.5 (7.7–11)	9.4 (8.0–10.5)
AHI, events/h	5 (2–8)	25 (16–37) [†]	4 (2–8) [†]
ODI, events/h	3 (1–6)	19 (11–32) [†]	3 (1–7) [†]
T90, %	3 (1–11)	41 (14–81) [†]	60 (46–72) ^{††}
Prevalent comorbidities			
Arterial hypertension	61 (34%)	58 (43%)	45 (39%)
Diabetes	21 (12%)	26 (19%)	17 (15%)
Hyperlipidemia	43 (24%)	34 (25%)	27 (23%)
Coronary artery disease	18 (10%)	19 (14%)	10 (9%)



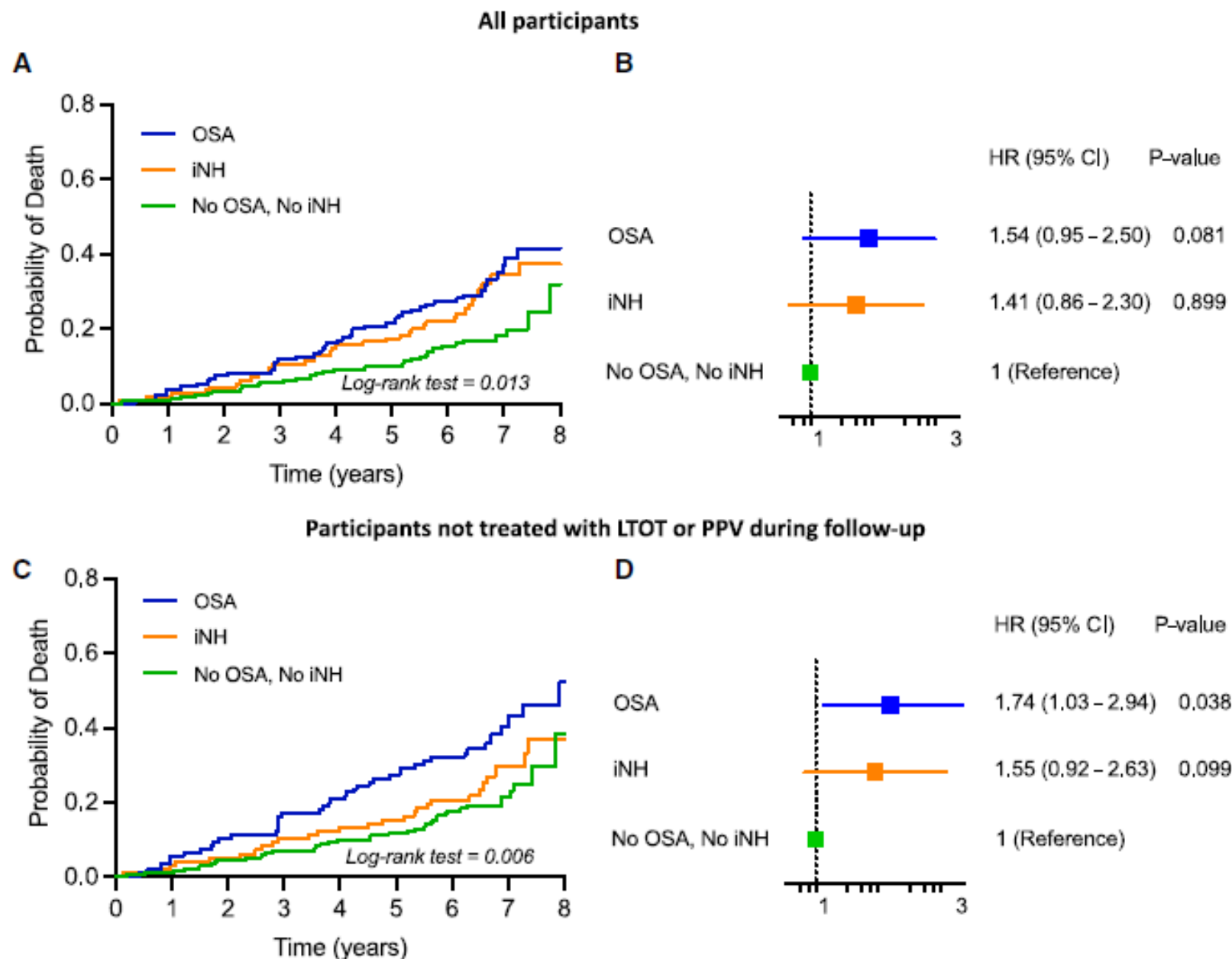


Figure 3. All-cause mortality in the CHAIN Sleep-Disordered Breathing (SDB) substudy. (A) Kaplan-Meier survival curves by categories of SDB in all

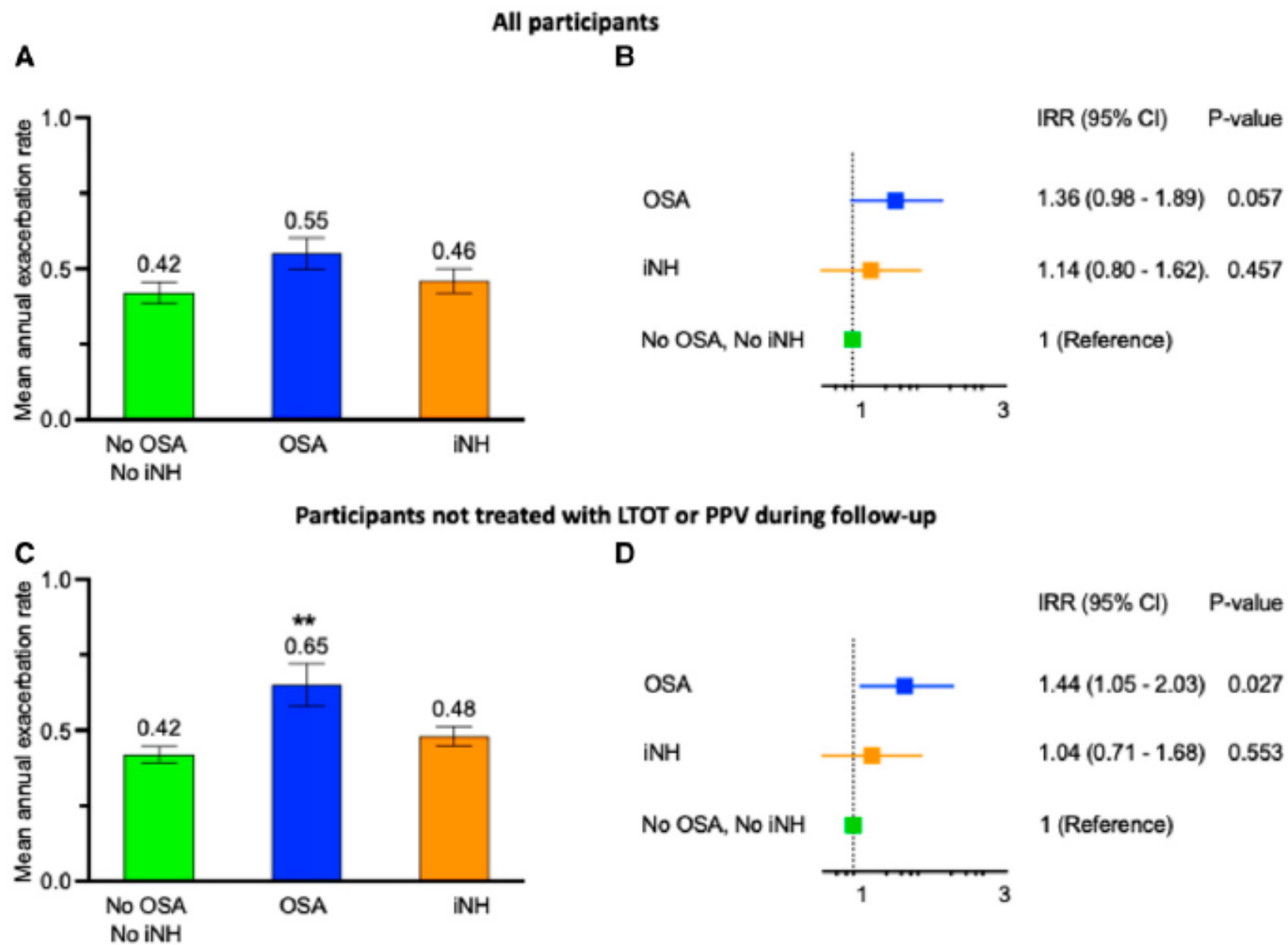


Figure 4. Moderate to severe chronic obstructive pulmonary disease (COPD) exacerbations in the studied groups. (A), Mean annual

Lung Cancer Risk in Preserved Ratio Impaired Spirometry and Airway Obstruction

A UK Biobank Study

Joon Young Choi, MD, PhD; Chin Kook Rhee, MD, PhD, FATS, FAPSR; and Jongin Lee, MD, PhD

- **Aim:** Longitudinal incidence of lung cancer risk in PRISm (normal spirometry, COPD)
- UK Biobank prospective cohort (267,222 pts)
- 40-69yr, No history of cancer at baseline, median of 13 years follow-up
- Spirometry-based groups:
 - ✓ Normal spirometry ($FEV_1/FVC \geq 0.70$, $FEV_1 \geq 80\%$)
 - ✓ PRISm ($FEV_1/FVC \geq 0.70$, $FEV_1 < 80\%$)
 - ✓ Mild COPD ($FEV_1/FVC < 0.70$, $FEV_1 \geq 80\%$)
 - ✓ Moderate–severe COPD ($FEV_1/FVC < 0.70$, $FEV_1 < 80\%$)
- **Primary outcome:** Incidence of lung cancer (national cancer registry)

TABLE 1] Baseline Characteristics of Participants According to Spirometry-Defined Lung Function Categories

Variable	74% Normal Lung Function (n = 197,833)	10.6% PRISm (n = 28,409)	7.3% Mild COPD (n = 19,542)	8% Moderate to Severe COPD (n = 21,438)	P Value					
Age, y	55.6 (8.0)	56.1 (8.0)	58.6 (7.5)	59.1 (7.4)	< .001					
Age group, y					< .001					
40s	51,787 (26.2)	6,845 (24.1%)	2,964 (15.2%)	2,861 (13.3%)						
50s	70,504 (35.6%)	10,013 (35.2%)	5,966 (30.5%)	6,262 (29.2%)						
60s	75,542 (38.2%)	11,551 (40.7%)	10,612 (54.3%)	12,315 (57.4%)						
Sex					< .001					
Male	84,207 (42.6%)	12,154 (42.8%)	10,925 (55.9%)	11,938 (55.7%)						
Female	113,626 (57.4%)	16,255 (57.2%)	8,617 (44.1%)	9,500 (44.3%)						
Townsend deprivation score					< .001					
Low	77,796 (39.3%)	9,786 (34.4%)	7,400 (37.9%)	6,795 (31.7%)						
Moderate	72,031 (36.4%)	10,060 (35.4%)	7,030 (36.0%)	7,327 (34.2%)						
High	48,006 (24.3%)	8,563 (30.1%)	5,112 (26.2%)	7,316 (34.1%)						
Alcohol consumption					< .001					
Never	5,572 (2.8%)	1,034 (3.6%)	546 (2.8%)	632 (2.9%)						
Previous	5,598 (2.8%)	1,230 (4.3%)	575 (2.9%)	968 (4.5%)						
Current	186,554 (94.3%)	26,114 (91.9%)	18,406 (94.2%)	19,815 (92.4%)						
Smoking status					< .001					
Never	112,582 (56.9%)	14,375 (50.6%)	9,025 (46.2%)	7,488 (34.9%)						
Previous	69,539 (35.2%)	10,461 (36.8%)	7,736 (39.6%)	8,775 (40.9%)						
Current	15,712 (7.9%)	3,573 (12.6%)	2,781 (14.2%)	5,175 (24.1%)						
Smoking history, pack-y					< .001					
0	112,582 (56.9%)	14,375 (50.6%)	9,025 (46.2%)	7,488 (34.9%)						
0-10	16,759 (8.5%)	1,871 (6.6%)	1,621 (8.3%)	1,295 (6.0%)						
10-20	16,552 (8.4%)	2,462 (8.7%)	1,806 (9.2%)	2,042 (9.5%)						
20-30	10,585 (5.4%)	2,203 (7.8%)	1,527 (7.8%)	2,086 (9.7%)						
≥ 30	10,958 (5.5%)	3,633 (12.8%)	2,503 (12.8%)	5,738 (26.8%)						
No response	30,397 (15.4%)	3,865 (13.6%)	3,060 (15.7%)	2,789 (13.0%)						
					BMI					
					Normal	67,461 (34.1%)	6,621 (23.3%)	8,844 (45.3%)	7,070 (33.0%)	< .001
					Underweight	308 (0.2%)	53 (0.2%)	58 (0.3%)	123 (0.6%)	
					Overweight	86,024 (43.5%)	11,093 (39.0%)	8,162 (41.8%)	8,916 (41.6%)	
					Obese	43,917 (22.2%)	10,599 (37.3%)	2,467 (12.6%)	5,307 (24.8%)	
					Lung cancer diagnosis					< .001
					No	196,991 (99.6%)	28,136 (99.0%)	19,288 (98.7%)	20,749 (96.8%)	
					Yes	842 (0.4%)	273 (1.0%)	254 (1.3%)	689 (3.2%)	
					Death					< .001
					No	186,797 (94.4%)	25,674 (90.4%)	17,836 (91.3%)	17,778 (82.9%)	
					Yes	11,036 (5.6%)	2,735 (9.6%)	1,706 (8.7%)	3,660 (17.1%)	
					FEV ₁ , %	98.88 (11.46)	72.45 (7.17)	92.21 (9.52)	65.37 (11.74)	< .001
					FVC, %	100.38 (11.63)	75.44 (8.08)	108.10 (11.71)	81.91 (12.42)	< .001
					FEV ₁ to FVC ratio	77.79 (3.89)	75.84 (3.78)	66.81 (3.01)	62.42 (6.91)	< .001
					FEV ₁ , L	3.02 (0.70)	2.20 (0.52)	2.89 (0.64)	2.02 (0.58)	< .001
					FVC, L	3.89 (0.90)	2.91 (0.70)	4.33 (0.98)	3.23 (0.86)	< .001

TABLE 2] Lung Cancer Risk Estimates by Spirometry-Defined Groups: Survival and Competing Risk Analyses

Variable	Cox Proportional Hazards Model, HR (95% CI)		Fine-Gray Competing Risk Model, sHR (95% CI)	
	Crude	Multivariate	Crude	Multivariate
Spirometry findings				
Normal	Reference	Reference	Reference	Reference
PRISm	2.294 (2.001-2.629)	1.586 (1.380-1.823)	2.256 (1.968-2.586)	1.553 (1.351-1.786)
Mild COPD	3.124 (2.715-3.595)	1.745 (1.511-2.015)	3.093 (2.688-3.558)	1.754 (1.521-2.023)
Moderate to severe COPD	8.038 (7.268-8.889)	2.918 (2.618-3.253)	7.693 (6.956-8.508)	2.798 (2.506-3.125)
Age, y				
Every 1		1.088 (1.080-1.096)		1.083 (1.076-1.091)
Sex				
Male		Reference		Reference
Female		1.224 (1.119-1.338)		1.277 (1.168-1.396)
Alcohol				
Never		Reference		Reference
Previous		1.185 (0.865-1.621)		1.154 (0.842-1.583)
Current		0.931 (0.713-1.214)		0.950 (0.726-1.241)
Townsend deprivation index				
Low		Reference		Reference
Moderate		1.066 (0.951-1.196)		1.057 (0.942-1.185)
High		1.499 (1.343-1.673)		1.469 (1.314-1.641)
Smoking duration, pack-y				
0		Reference		Reference
0-10		2.964 (2.374-3.702)		2.956 (2.368-3.689)
10-20		4.713 (3.915-5.673)		4.681 (3.891-5.631)
20-30		8.156 (6.867-9.687)		8.068 (6.803-9.567)
≥ 30		14.747 (12.716-17.101)		14.258 (12.309-16.516)
No response		2.757 (2.293-3.314)		2.744 (2.285-3.294)
BMI				
Normal		Reference		Reference
Underweight		1.118 (0.578-2.162)		1.028 (0.526-2.007)
Overweight		0.912 (0.822-1.011)		0.927 (0.835-1.028)
Obese		0.780 (0.691-0.880)		0.783 (0.693-0.883)

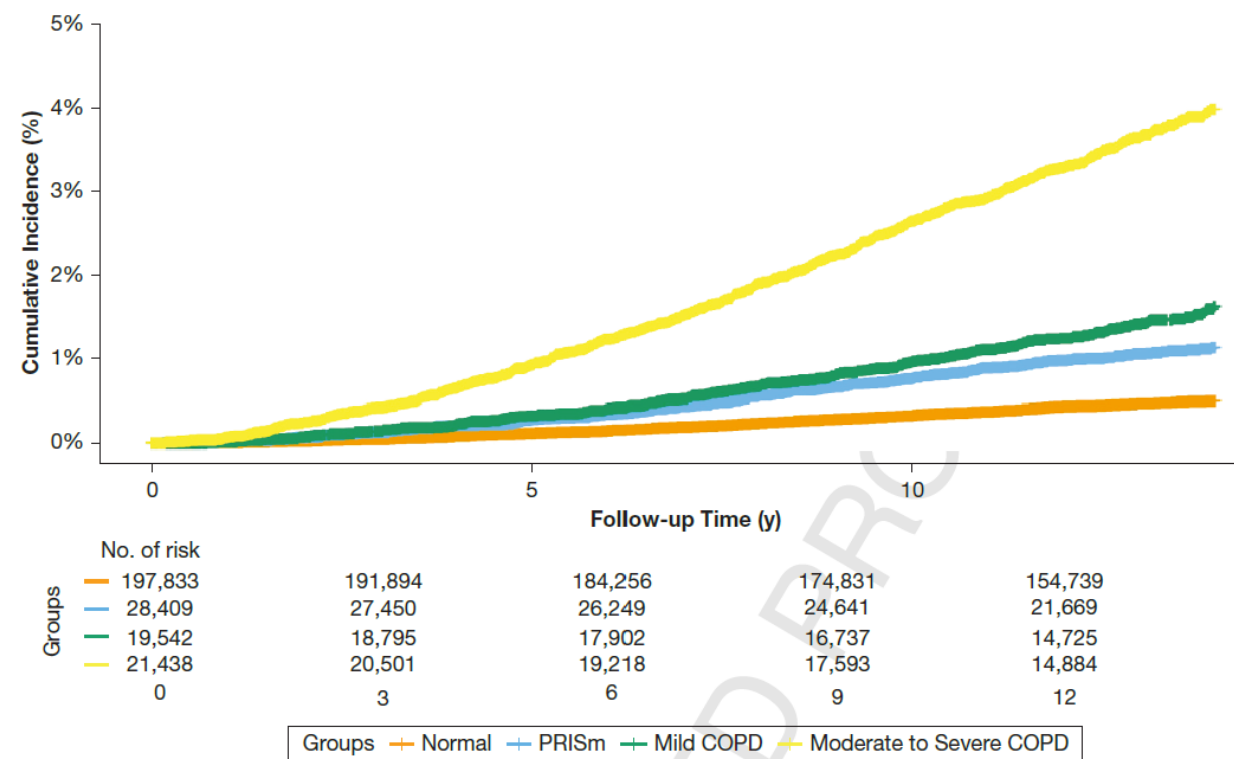


Figure 2 – Graph showing cumulative incidence of lung cancer by spirometry-defined lung function categories over 13 years of follow-up.

Summary

- GOLD 2026 emphasizes **multimorbidity assessment** as a core part of COPD management
- **Comorbidity-based clusters** have distinct clinical characteristics
- **ECG** and **coronary calcium scoring** may predict MACE in COPD patients
- SGLT2i and GLP-1RA are associated with reduced COPD AE in DM with COPD
- **Reduced respiratory muscle strength** is a powerful marker of worse COPD outcomes
- **Untreated sleep-breathing problems** are a major independent predictor of COPD mortality
- **PRISm** carries a significantly **elevated risk of lung cancer**

Thank you for your attention

Severance

