

Multi-Morbidity in Chronic Obstructive Pulmonary Disease Across Three Geographic Regions of a Large Integrated Healthcare Organization

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GOLD: Global Initiative for Chronic Obstructive Lung Disease

- Definition of COPD:
 - Respiratory disease characterized by *persistent* airflow limitation that is typically *progressive and disabling* and associated with an enhanced *chronic inflammatory response* in the airways and the lung to noxious particles or gasses
- COPD is common, preventable, *treatable, and partially reversible*
- Exacerbations and comorbidities contribute to the overall severity in individual patients

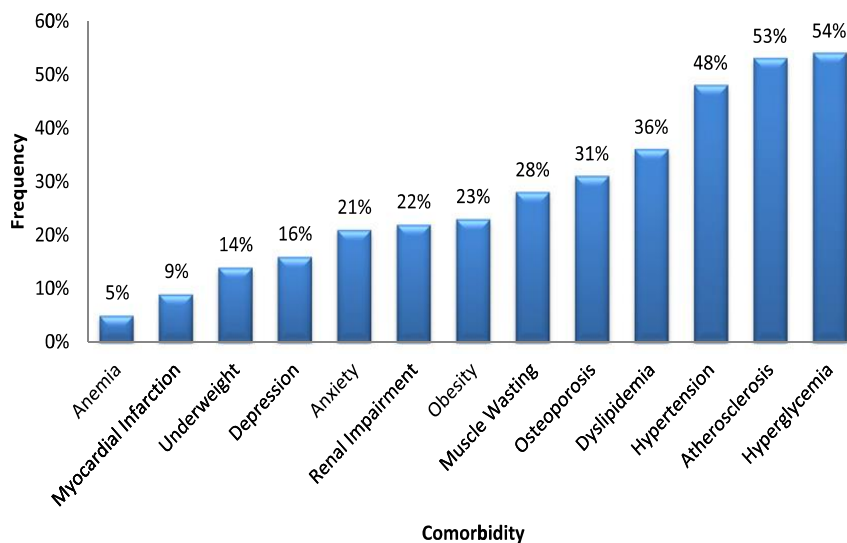
GOLD Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. 2015.

THE STAGGERING STATISTICS OF COPD



COPD is the **only** leading cause of death that remains on the rise.

Prevalence of Comorbidities



Vanfleteren et al. AJRCCM 2012

COPD Patient-Powered Research Network – PCORnet enterprise with PORTAL CDRN pilot collaborative

The COPD Patient-Powered Research Network

- The COPD Foundation is one of the original 18 organizations awarded money from the Patient Centered Outcomes Research Institute (PCORI) to create a Patient-Powered Research Network (PPRN)
- Community of COPD patients coming together to share information about their health and participate in research.
- Governed by a majority led patient Board working directly with researchers
- PORTAL was one of the CDRNs (Kaiser regions +) with opportunity for collaborative pilot PCORI projects



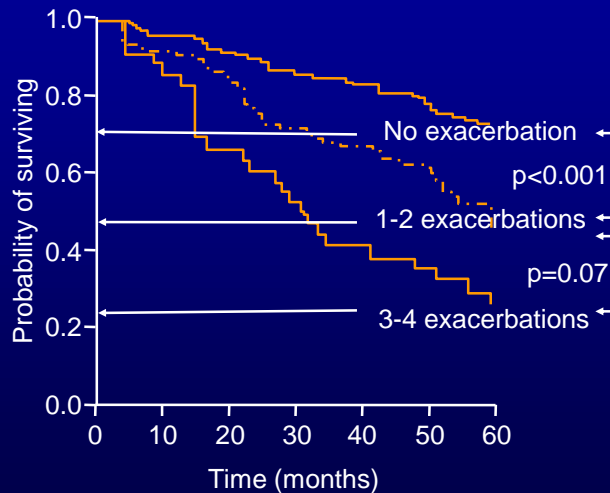
Morbidity and Mortality are related to severe exacerbations

- Average inpatient mortality rate for AECOPD is 6.7% increasing to 15.6% in the post discharged period ¹
- 25% are dead in a year ^{2,3}

Hoogendoorn M. ERJ 2011 p508. ² Lykkegaard J Resp Med 2012. ³ Groenewegen KH Chest 2003.

Effects of Repeated Exacerbations on Survival in COPD

Prospective study
Cohort of 304 males
Exacerbations requiring hospital treatment during the year
Follow-up over 5 years



Soler-Cataluña JJ et al. *Thorax* 2005;64:925-31

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Background

- Previous studies in limited geographic datasets have reported that over 50% of COPD patients have at least 4 or more comorbidities
- Predictive models to predict subsequent risk of acute exacerbation AE are poor
- Most very limited by lack of comprehensive medical record data
- We aimed to identify comorbidity profiles in a community-based sample of patients with COPD from a large integrated health care system across three US geographic regions.

Methods

- Retrospective cohort study in 3 regions
- COPD diagnosis between 2011 and 2015 with at least one inhaler used
- Socio-demographic, clinical and health care utilization data were obtained from electronic records.
- Latent class analysis (LCA) to identify comorbidity profiles

- We included specific comorbid conditions from the Charlson Comorbidity Index (CCI) and accounted for variation in underlying prevalence of different comorbidities across study sites.
- Population-based sample of 91,453 patients

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• Results - 91,453 COPD patients (2011 and 2015)

- Mean age was 71 years, 55% were females
- 23% were non-white and 80% were former or current smokers

- LCA identified four distinct co-morbidity profiles with progressively higher Charlson Comorbidity Index (CCI) scores:
 - low morbidity (61%, 1.9 ± 1.4)
 - metabolic-renal (21%, 4.7 ± 1.8)
 - cardiovascular (12%, 4.6 ± 1.9)
 - multi-morbidity (7%, 7.5 ± 1.7)

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Baseline Characteristics of Adults with COPD					Total n=91,453
	Multimorbidity Class 1 (n=6,013; 7%)	Cardiovascular Disease Class 2 (n=10,662; 12%)	Metabolic-Renal Class 3 (n=19,242; 21%)	Low Morbidity Class 4 (n=55,536; 61%)	
Age	75 (9)	75 (10)	74 (9)	68 (11)	71 (11)
40-49	31 (1%)	115 (1%)	205 (1%)	2301 (4%)	2652 (3%)
50-59	262 (4%)	729 (7%)	1305 (7%)	9051 (16%)	11347 (12%)
60-69	1154 (19%)	2204 (21%)	4350 (23%)	17995 (32%)	25703 (28%)
70-79	2459 (41%)	3887 (36%)	7687 (40%)	17789 (32%)	31822 (35%)
80+	2107 (35%)	3727 (35%)	5695 (30%)	8400 (15%)	19929 (22%)
Women	2707 (45%)	5232 (49%)	10509 (55%)	31515 (57%)	49963 (55%)
Smoking Status					
Never	1124 (19%)	1926 (18%)	3796 (20%)	10489 (19%)	17335 (19%)
Former	4076 (68%)	6972 (65%)	12105 (63%)	30747 (55%)	53900 (59%)
Current	543 (9%)	1255 (12%)	2639 (14%)	11328 (20%)	15765 (17%)
Missing	270 (4%)	509 (5%)	702 (4%)	2972 (5%)	4453 (5%)
Sites/Regions					
1	2942 (49%)	5187 (49%)	9054 (47%)	27808 (50%)	44991 (49%)
2	340 (6%)	897 (8%)	1299 (7%)	4363 (8%)	6899 (8%)
3	2731 (45%)	4578 (43%)	8889 (46%)	23365 (42%)	39563 (43%)

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Long-acting beta-agonists (LABA)	1804 (30%)	3639 (34%)	5960 (31%)	18095 (33%)	29498 (32%)
Long-acting anticholinergic (LAMA)	1697 (28%)	3443 (32%)	4940 (26%)	14410 (26%)	24490 (27%)
Inhaled corticosteroids (ICS)	1874 (31%)	3766 (35%)	6179 (32%)	18850 (34%)	30669 (34%)
LAMA & ICS	823 (14%)	1846 (17%)	2463 (13%)	7555 (14%)	12687 (14%)
LABA & ICS	1753 (29%)	3524 (33%)	5765 (30%)	17481 (31%)	28523 (31%)
Long-term systemic corticosteroids	92 (2%)	170 (2%)	219 (1%)	431 (1%)	912 (1%)
Oxygen use	1874 (31%)	2675 (25%)	2746 (14%)	5918 (11%)	13213 (14%)
Comorbidities					
Charlson comorbidity index	7.5 (1.72)	4.6 (1.94)	4.7 (1.75)	1.9 (1.43)	3.2 (2.34)
Quartile 1 (0-1)	0 (0%)	59 (1%)	25 (0%)	24271 (44%)	24355 (27%)
Quartile 2 (2)	0 (0%)	780 (7%)	512 (3%)	19198 (35%)	20490 (22%)
Quartile 3 (3-4)	18 (0%)	4955 (46%)	9728 (51%)	10215 (18%)	24916 (27%)
Quartile 4 (>4)	5995 (100%)	4868 (46%)	8977 (47%)	1852 (3%)	21692 (24%)

Baseline Characteristics of Adults with COPD

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Charlson comorbidity index	7.5 (1.72)	4.6 (1.94)	4.7 (1.75)	1.9 (1.43)	3.2 (2.34)
Myocardial infarction	3270 (54%)	3723 (35%)	361 (2%)	1787 (3%)	9141 (10%)
Congestive heart failure	4973 (83%)	7248 (68%)	550 (3%)	0 (0%)	12771 (14%)
Peripheral vascular disease	5124 (85%)	7910 (74%)	12488 (65%)	23991 (43%)	49513 (54%)
Cerebrovascular disease	1797 (30%)	2332 (22%)	2050 (11%)	2883 (5%)	9062 (10%)
Dementia	232 (4%)	529 (5%)	178 (1%)	200 (0%)	1139 (1%)
Rheumatic disease	371 (6%)	836 (8%)	1010 (5%)	2137 (4%)	4354 (5%)
Peptic ulcer disease	157 (3%)	275 (3%)	163 (1%)	304 (1%)	899 (1%)
Mild liver disease	518 (9%)	1001 (9%)	1355 (7%)	3392 (6%)	6266 (7%)
Diabetes without chronic complication	0 (0%)	2630 (25%)	0 (0%)	7522 (14%)	10152 (11%)
Diabetes with chronic complication	4976 (83%)	0 (0%)	11003 (57%)	0 (0%)	15979 (17%)
Hemiplegia or paraplegia	154 (3%)	568 (5%)	108 (1%)	0 (0%)	830 (1%)
Renal disease	5409 (90%)	3355 (31%)	13884 (72%)	462 (1%)	23110 (25%)
Any malignancy (lymphomas, leukemias etc)	415 (7%)	1038 (10%)	1398 (7%)	2857 (5%)	5708 (6%)
Moderate or severe liver disease	76 (1%)	80 (1%)	119 (1%)	179 (0%)	454 (0%)
Metastatic solid tumor	114 (2%)	261 (2%)	334 (2%)	725 (1%)	1434 (2%)
Other, non Charlson morbidities					
Depression	2033 (34%)	3114 (29%)	5190 (27%)	12068 (22%)	22405 (24%)
Anxiety	1188 (20%)	2098 (20%)	3129 (16%)	8817 (16%)	15232 (17%)
Chronic pain	1653 (27%)	2455 (23%)	4234 (22%)	9227 (17%)	17569 (19%)

Results – Summary / Subsequent Utilization

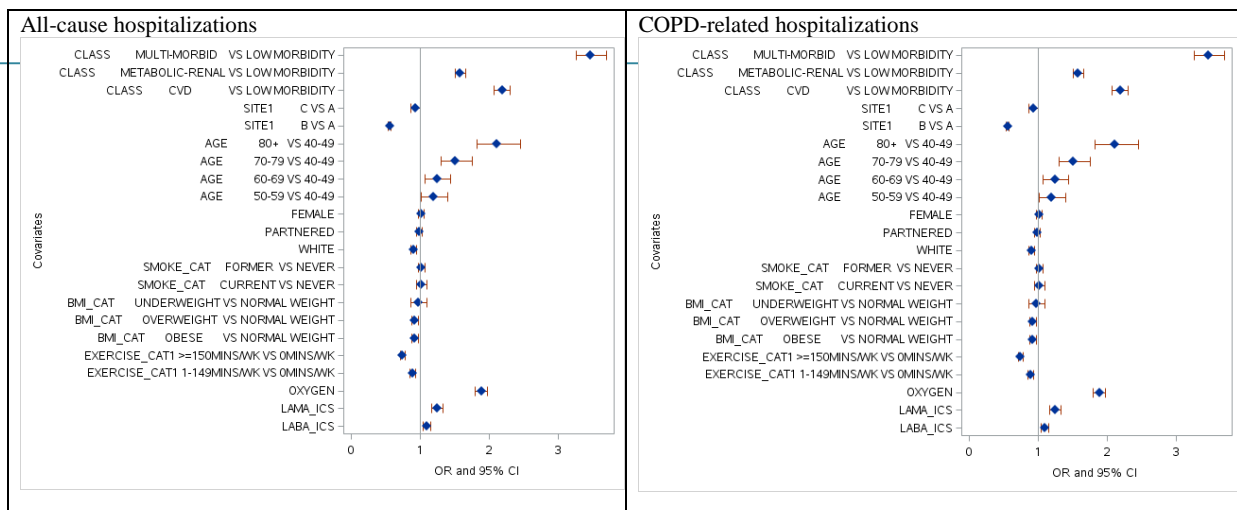
- Patients with a low morbidity profile tended to be younger (68 vs. 74 years, $p < 0.001$), were current smokers (20% vs. 13%, $p < 0.001$), and more physically active (51% engaged in at least some moderate activity in a week vs. 40%, $p < 0.001$) compared to patients in the higher morbidity profiles.
- FEV1% predicted obtained from a subsample of patients was not different across the morbidity profiles (68% \pm 21%, low morbidity to 64% \pm 19%, multi-morbidity).
- There was a trend in increasing use of acute care (hospitalizations, observational stays, and emergency department visits) with increasing class-average CCI ($p < 0.001$) in the year of cohort identification

AE & Acute Utilization of Adults with COPD

	Multimorbidity Class 1 (n=6,013; 7%)	Cardiovascular Disease Class 2 (n=10,662; 12%)	Metabolic-Renal Class 3 (n=19,242; 21%)	Low Morbidity Class 4 (n=55,536; 61%)	Total n=91,453
Health Care Utilization (Oct 2014-Sept 2015)					
All Cause (≥1)					
Hospitalizations	2763 (46%)	3876 (36%)	3241 (17%)	5733 (10%)	15613 (17%)
Observational stays	1077 (18%)	1301 (12%)	1101 (6%)	1748 (3%)	5227 (6%)
Emergency department visits	3439 (57%)	5210 (49%)	6503 (34%)	14207 (26%)	29359 (32%)
Skilled nursing facility stays	699 (12%)	857 (8%)	628 (3%)	715 (1%)	2899 (3%)
Primary care visits	8.2 (9.18)	6.7 (7.28)	5.8 (6.48)	4.4 (5.88)	5.2 (6.55)
Specialty care visits	11.9 (13.86)	9.3 (11.11)	8.7 (11.69)	6.5 (10.73)	7.7 (11.32)
COPD-related acute care encounters (≥1)					
Hospitalizations	417 (7%)	678 (6%)	476 (2%)	892 (2%)	2463 (3%)
Observational stays	114 (2%)	197 (2%)	139 (1%)	363 (1%)	813 (1%)
Emergency department visits	435 (7%)	664 (6%)	680 (4%)	1726 (3%)	3505 (4%)

Results

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Conclusions

- Our four co-morbidity clusters in COPD patients resonate with previous studies
- Previous psychological profile was not seen (CCI not include mental health)
- The distribution across clusters suggest that earlier studies using limited samples may overestimate the burden of co-morbidities in community settings

- We demonstrated independence of the multimorbidity profiles to airflow obstruction though spirometry data was limited to half of the sample

- Subsequent work will examine downstream health care utilization patterns across these four co-morbidity profiles

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Thank You

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