



Improving Health Outcomes in COPD: Hospital-based Strategies for Optimizing Maintenance Therapy and Promoting Patient Self-management



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Faculty Disclosures

- Consultant: AstraZeneca, Circassia, GlaxoSmithKline, Sunovion Pharmaceuticals, Third Pole, Verona
- Royalty: UpToDate
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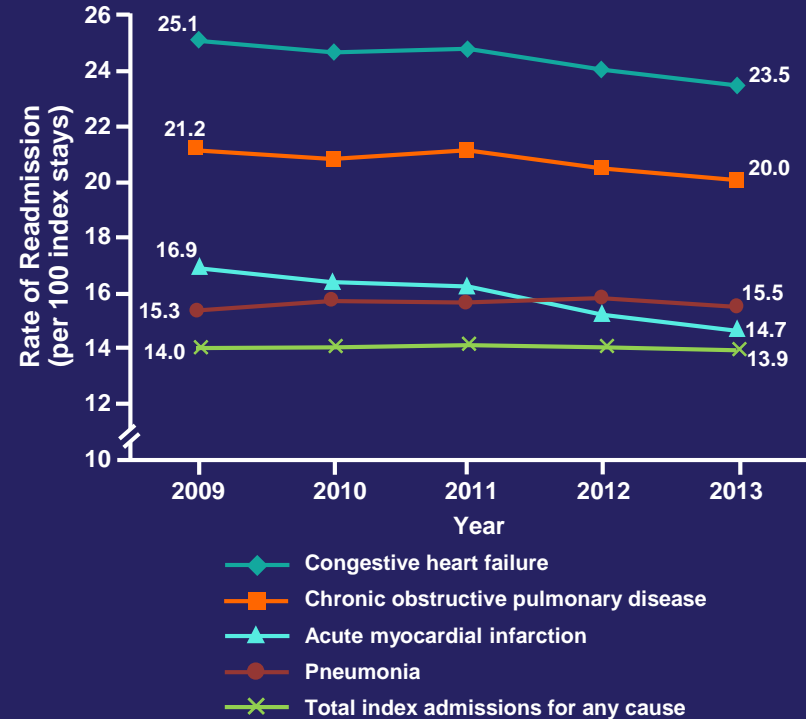
Learning Objectives

- Utilize long-term treatment strategies to reduce hospital readmissions for COPD exacerbations
- Review the clinical evidence regarding the efficacy and safety of long-acting maintenance regimens for COPD
- Select medication delivery devices for patients with COPD based upon individual physical and cognitive characteristics
- Outline a transitional care plan that promotes patient self-management to reduce the risk for future exacerbations and hospital readmissions

COPD in the Hospital Setting

In-hospital Burden of COPD

- 1.1 million COPD-related ED visits
- 660,000 discharges with a primary diagnosis of COPD
- 20% all-cause 30-day readmission rate among patients with an index hospitalization for COPD
- In-hospital mortality:
 - 2.5% for exacerbation-related admissions
 - Up to 28% for patients requiring mechanical ventilation



ED, emergency department.

Re-Hospitalization In COPD

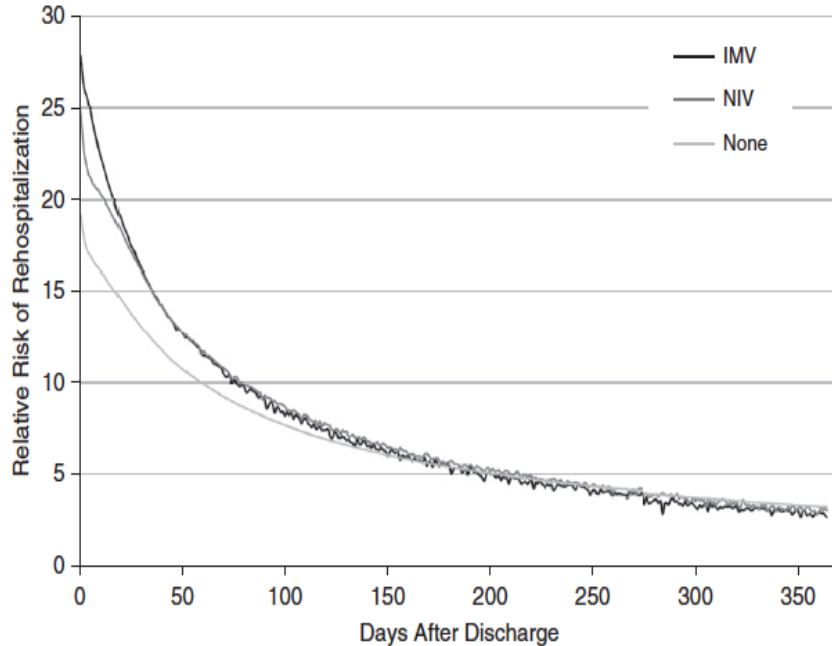
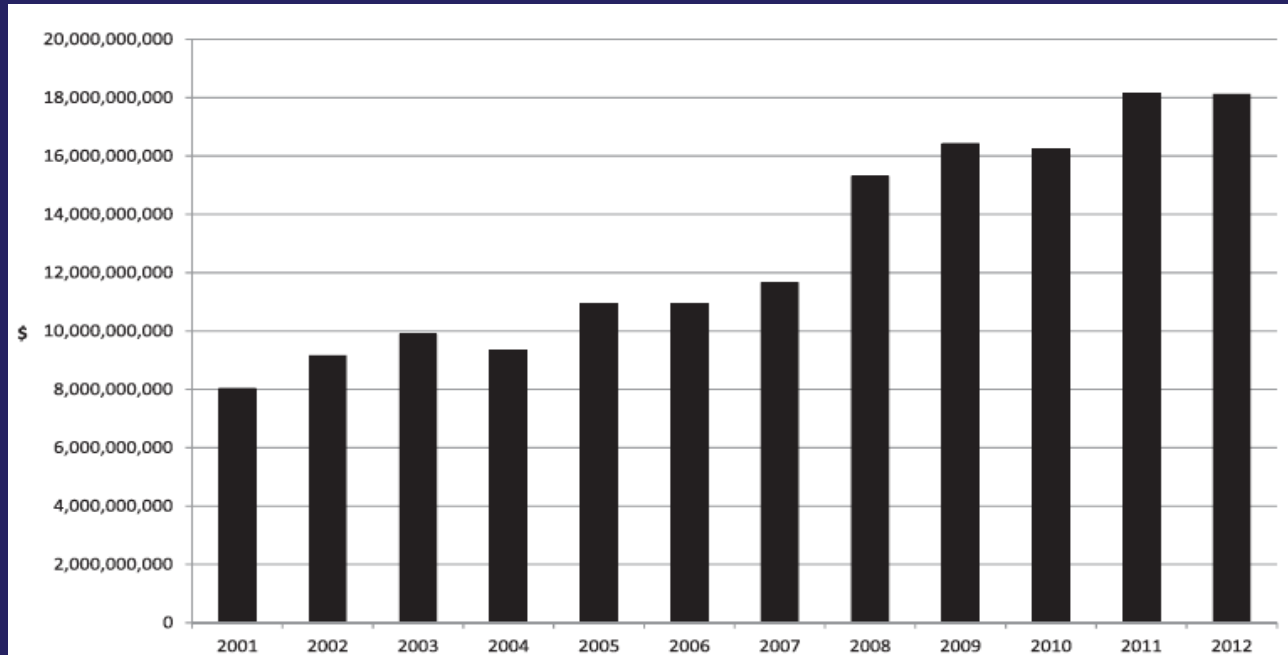


Figure 3. Age-sex-race-adjusted relative risk of readmission in the first year after hospitalization for chronic obstructive pulmonary disease. IMV = invasive mechanical ventilation; NIV = noninvasive ventilation.

2,340,637 Medicare discharges.

64.2% readmitted within one year after discharge.

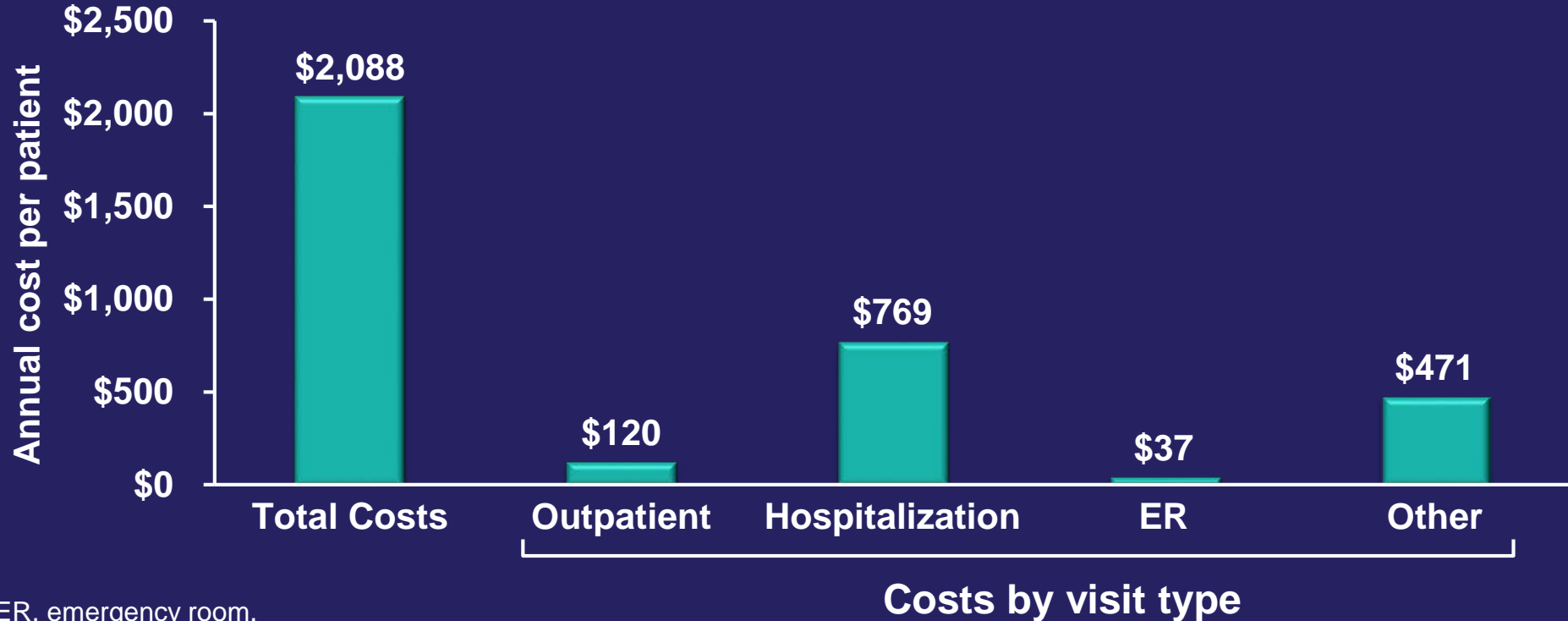
COPD Hospitalization Charges 2001-2012



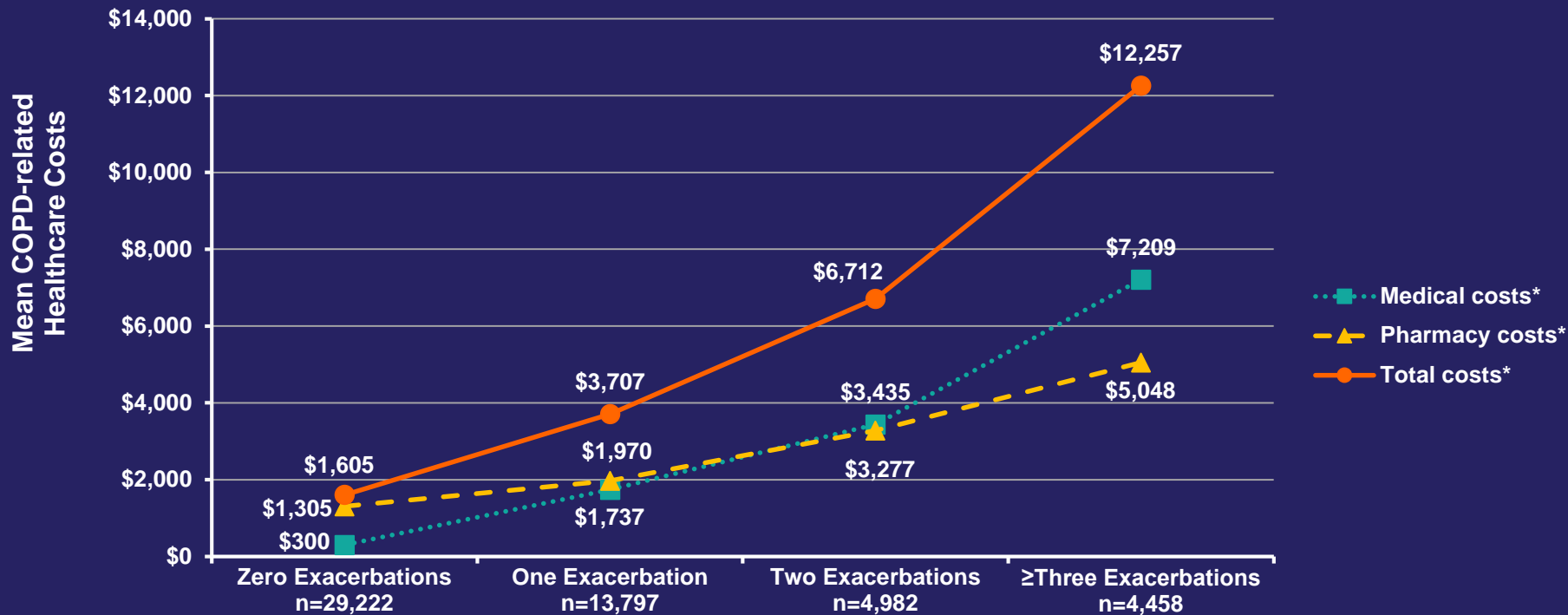
Increase number of hospitalizations and ED visits for COPD.

No significant change in USA age-adjusted hospitalization rate.

COPD-related Healthcare Costs



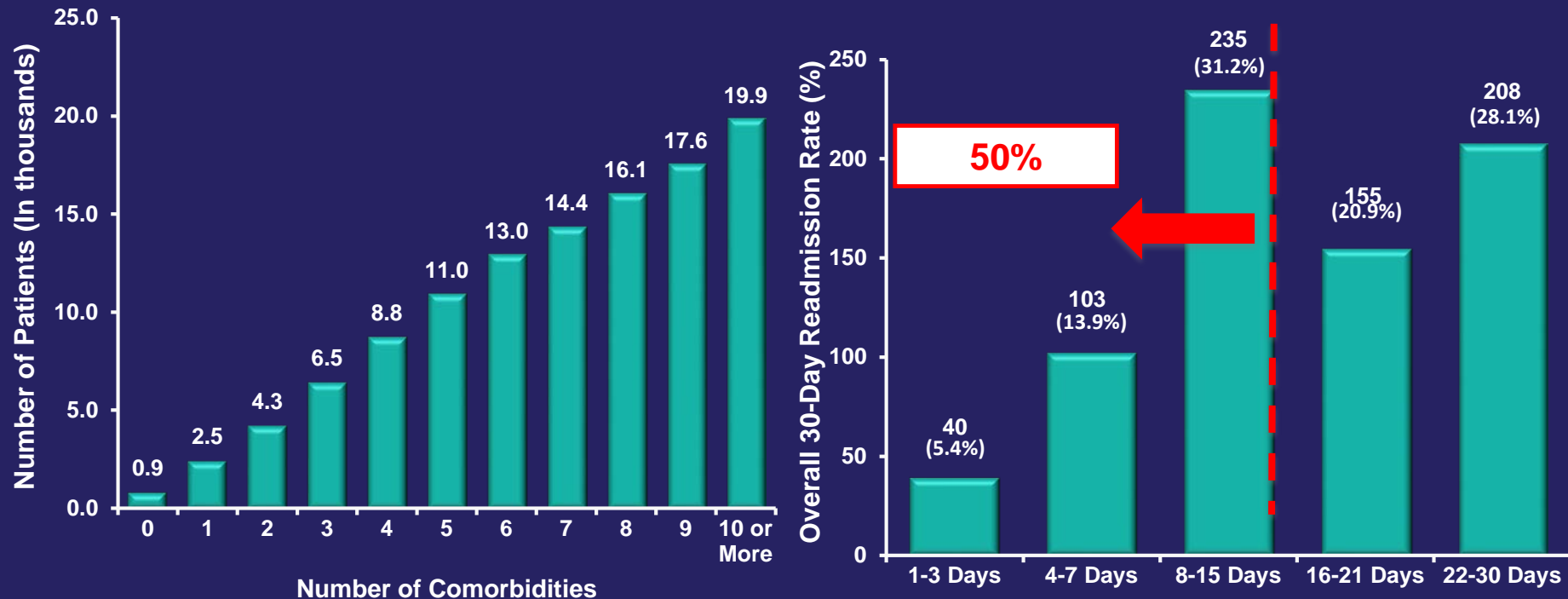
COPD-related Healthcare Costs Increase with Greater Exacerbation Frequency



*Statistically significant ($P < .001$) trend.

Dhamane AD, et al. *Int J COPD*. 2015;10:2609-18.

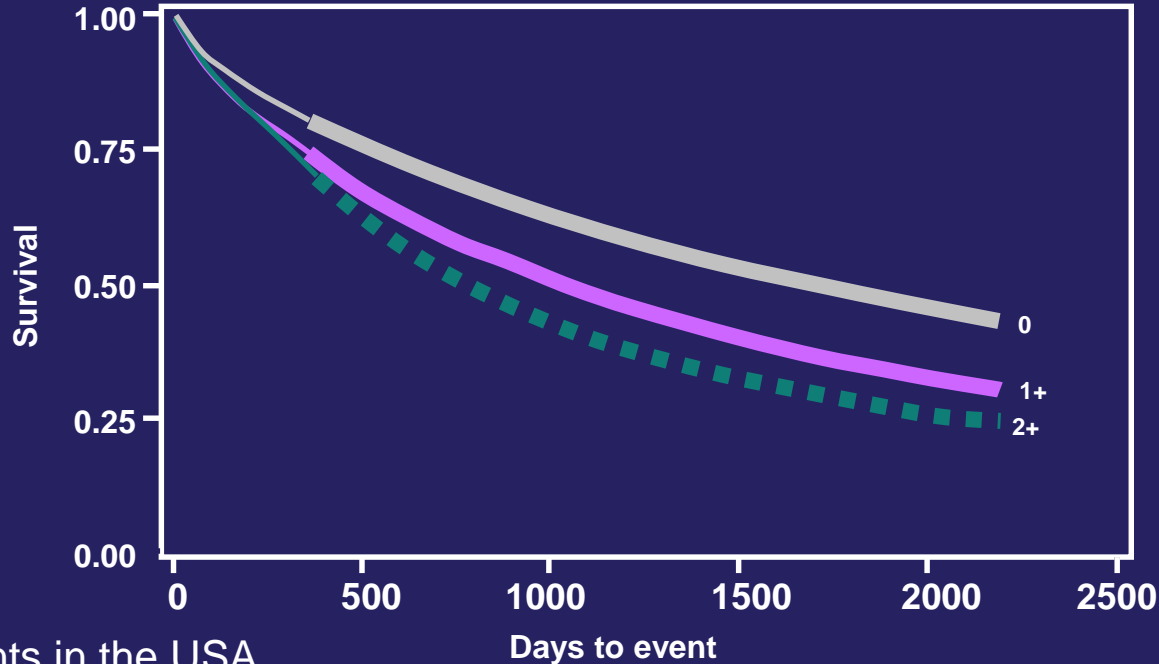
Impact of Comorbidities and Outpatient Follow-up on Readmission Risk



Factors Associated With Increased Risk of Early Readmission After an Acute Exacerbation

- Black race
- Comorbidities
 - Congestive heart failure
 - Frailty
 - Other medical conditions (eg, chronic renal insufficiency, diabetes)
 - Psychiatric, including depression, anxiety, psychosis, alcohol and drug use
 - Risk of readmission is increased with increasing number of comorbidities
- Discharge to post-acute care
- Dual eligibility for Medicare and Medicaid
- Elevated serum arterial blood carbon dioxide level
- Low body mass index
- Longer length of stay
- Male sex

Mortality After Hospitalization In COPD



51,353 VA patients in the USA.

Increasing mortality with additional hospitalizations.

Life Expectancy And Mortality After COPD Hospitalization

	1 Year	5 Years	Median Survival
Risk of Death	21%	55%	4.2 years

	1 Year	5 Years	Mean Length of Stay
Risk of Re-hospitalization	25%	44%	6.5 days

Management of an Acute Exacerbation

Assessment of an Exacerbation

- Assess severity of symptoms
- Chest radiograph
- Blood gases and/or
O₂ saturation

Initial Treatment of an Acute Exacerbation

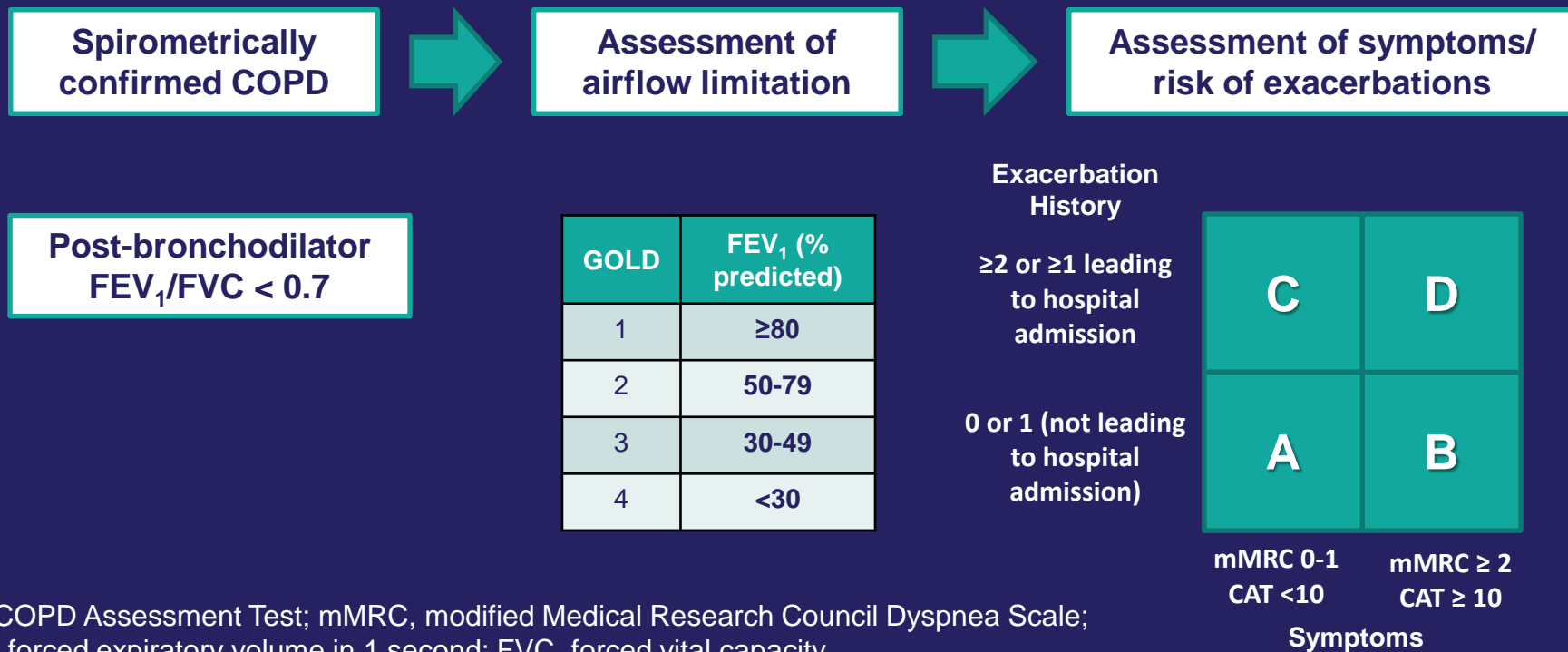
- Bronchodilator therapy
 - Increase doses / frequency of SABA therapy
 - Combine SABAs with anticholinergics
 - Use spacers or air-driven nebulizers
- Corticosteroids
- Antibiotics
- Oxygen therapy
- Noninvasive ventilation / Invasive mechanical ventilation

Criteria for Hospital Admission

- Clinical assessment
 - Symptoms
 - Severity (as determined by spirometry)
 - Risk of exacerbations
 - Comorbidities
- Response to therapy
- Post-discharge environment

Assessment of COPD Severity and Exacerbation Risk

The Redefined ABCD Assessment Tool



CAT, COPD Assessment Test; mMRC, modified Medical Research Council Dyspnea Scale; FEV_1 , forced expiratory volume in 1 second; FVC, forced vital capacity.

The Redefined ABCD Assessment Tool

Exacerbation History

Assess
1 – symptoms
and
2 - risk of
exacerbations

**≥2 or ≥1 leading to
hospital admission**

**0 or 1 (not leading to
hospital
admission)**

C

D

A

B

**mMRC 0-1
CAT <10**

**mMRC ≥ 2
CAT ≥ 10**

Symptoms

CAT, COPD Assessment Test; mMRC, modified Medical Research Council Dyspnea Scale; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity. Vestbo J, et al. GOLD 2018 Update. Available at <http://goldcopd.org>.

A Lack of Spirometry is Associated with Inaccurate Estimation of COPD Severity

Assessment of Severity	Patients (%)
Physician < Spirometry	41
Physician = Spirometry	30
Physician > Spirometry	29

Spirometry resulted in a change in treatment in ~33% of patients.

mMRC Questionnaire

PLEASE TICK THE BOX THAT APPLIES TO YOU

mMRC Grade 0	I only get breathless with strenuous exercise.	<input type="checkbox"/>
mMRC Grade 1	I get short of breath when hurrying on the level or walking up a slight hill.	<input type="checkbox"/>
mMRC Grade 2	I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level.	<input type="checkbox"/>
mMRC Grade 3	I stop for breath after walking about 100 meters or after a few minutes on the level.	<input type="checkbox"/>
mMRC Grade 4	I am too breathless to leave the house or I am breathless when dressing or undressing.	<input type="checkbox"/>



COPD Assessment Test (CAT™)

CAT™ ASSESSMENT

For each item below, place a mark (x) in the box that best describes you currently.
Be sure to only select one response for each question.

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

Reference: Jones et al. ERJ 2009; 34 (3); 648-54.

TOTAL SCORE:

FIGURE 2.3

Long-term Maintenance Therapy

Medication Selection

Approved Long-acting Bronchodilator Monotherapies

	Agent	Delivery
LABA	Arformoterol	Nebulizer
	Formoterol	Nebulizer
		DPI
	Indacaterol	DPI
	Olodaterol	SMI
	Salmeterol	DPI
LAMA	Aclidinium	DPI
	Tiotropium	DPI, IS
	Umeclidinium	DPI
	Glycopyrronium	DPI, Nebulizer

LABA, long-acting beta₂-agonist; LAMA, long-acting muscarinic antagonist; DPI, dry powder inhaler; IS, inhalation spray; SMI, slow mist inhaler.

Vestbo J, et al. GOLD 2018 Update. Available at <http://goldcopd.org>.

Approved Fixed-dose Combination Therapies

Combination	Agent	Delivery
LABA/LAMA	Vilanterol + umeclidinium	DPI
	Olodaterol + tiotropium	SMI
	Indacaterol + glycopyrrolate	DPI
	Formoterol + glycopyrrolate	MDI
LABA/ICS	Formoterol + budesonide	MDI
	Salmeterol + fluticasone	DPI
	Vilanterol + fluticasone	DPI
	Formoterol + mometasone*	MDI
LABA / LAMA / ICS	Fluticasone furoate + vilanterol + umeclidinium	DPI

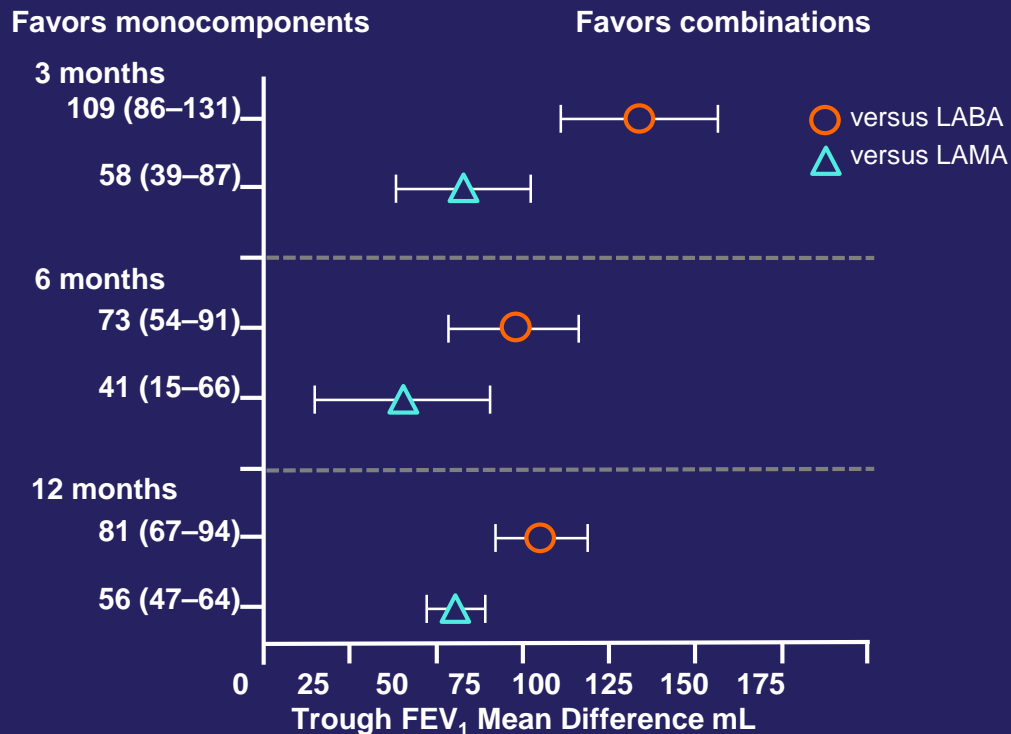
*Off-label use. Not indicated for the treatment of patients with COPD. ICS, inhaled corticosteroid; MDI, metered dose inhaler.

Vestbo J, et al. GOLD 2018 Update. Available at <http://goldcopd.org>.

Emerging Therapies

Type	Agent	Delivery
LAMA	Revefenacin	Nebulizer
LABA/LAMA	Aclidinium + formoterol	DPI
LABA/LAMA/ICS	Glycopyrronium + formoterol + budesonide	MDI
	Glycopyrronium + formoterol + beclomethasone	MDI

LABA/LAMA Combined Bronchodilator Therapy vs Monotherapy



- Meta analysis of 14 studies
- N=20,329 patients
- LABA/LAMA combinations were more effective vs monocomponents at 3, 6, and 12 months of treatment
 - Improvements in trough FEV₁
 - Transition dyspnea index
 - SGRQ scores

Effect of Combined Therapy with LABA/LAMA vs LABA/ICS on Lung Function

A

Study or Subgroup

Ind/Gly (110/50 µg od) vs Sal/FP (50/500 µg bid)

Vogelmeier et al³⁴

Wedzicha et al³⁶

Zhong et al³⁵

Umec/Vi (62.5/25 µg od) vs Sal/FP (50/250 or 500 µg bid)

Donohue et al (DB2114930)³⁷

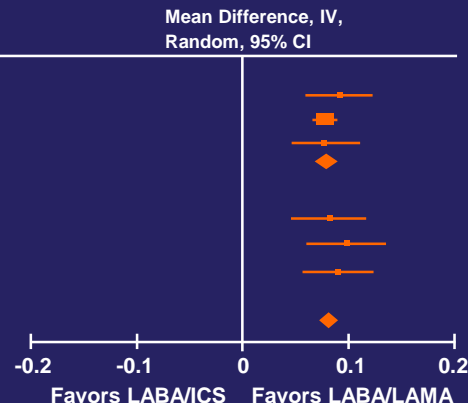
Donohue et al (DB2114951)³⁷

Singh et al³⁸

Total (95% CI)

Heterogeneity: $\tau^2=0.00$, $\chi^2=1.82$, $df=5$ ($P=.87$), $I^2=0\%$

Test for overall effect: $Z=17.30$ ($P<.0001$)



B

Study or Subgroup

Ind/Gly (110/50 µg od) vs Sal/FP (50/500 µg bid)

Vogelmeier et al³⁴

Wedzicha et al³⁶

Zhong et al³⁵

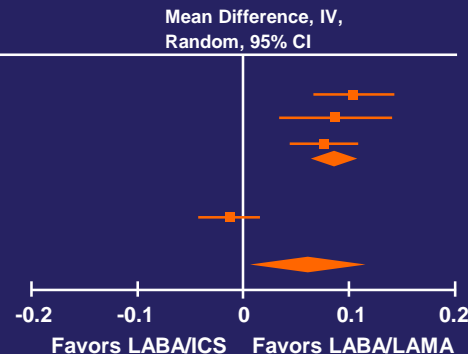
AcLi/For (400/12 µg bid) vs Sal/FP (50/500 µg bid)

Vogelmeier et al³⁹

Total (95% CI)

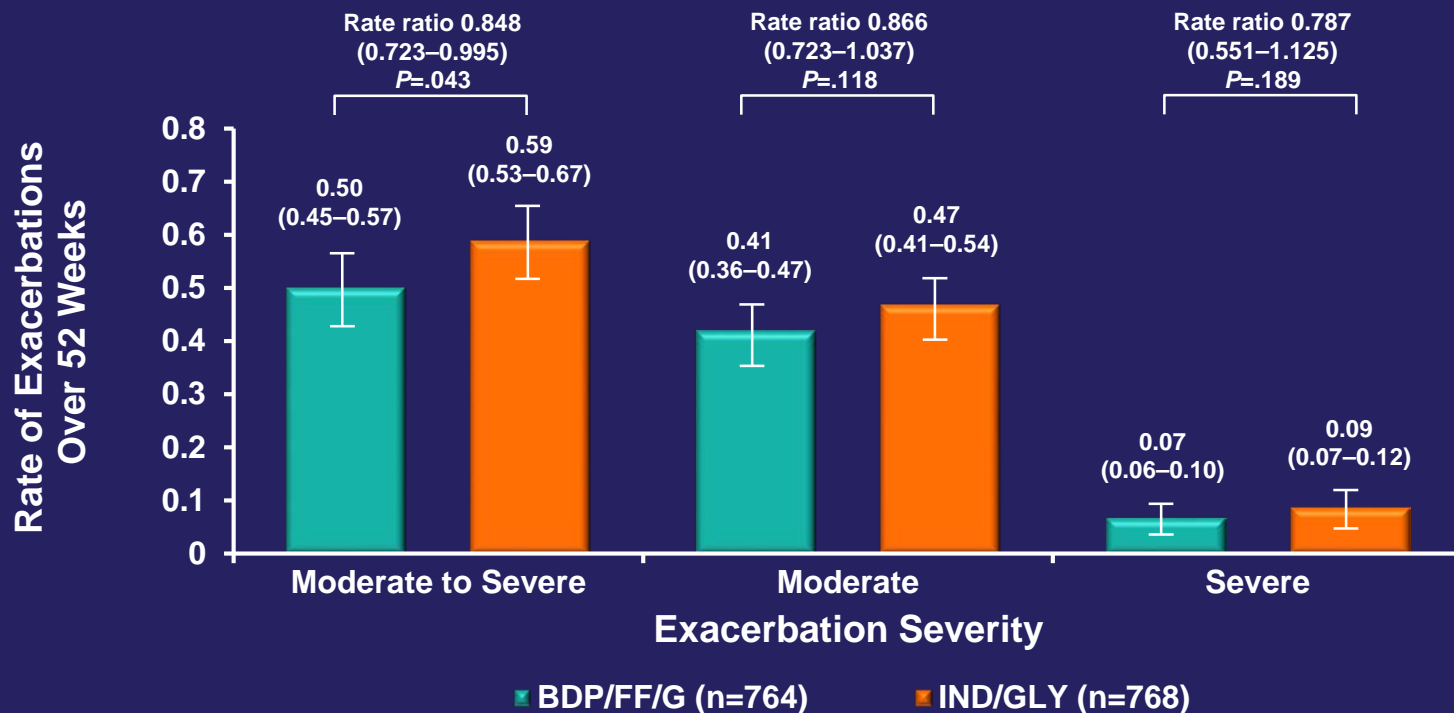
Heterogeneity: $\tau^2=0.00$, $\chi^2=30.20$, $df=3$ ($P<.0001$), $I^2=90\%$

Test for overall effect: $Z=2.09$ ($P=.04$)



Ind, indacaterol;
Gly, glycopyrronium;
Sal, salmeterol;
FP, fluticasone propionate;
bid, bidaily;
Umec, umeclidinium;
Vi, vilanterol;
AcLi, acclidinium;
For, formoterol.

Extrafine Inhaled Triple Therapy Reduces Exacerbations vs Dual Bronchodilator Therapy



BDP/FF/G, beclometasone dipropionate, formoterol fumarate, and glycopyrronium; IND/GLY, indacaterol plus glycopyrronium.
Papi A, et al. *Lancet*. 2018;391:1076-1084.

Treatment of stable COPD

INITIAL PHARMACOLOGICAL TREATMENT

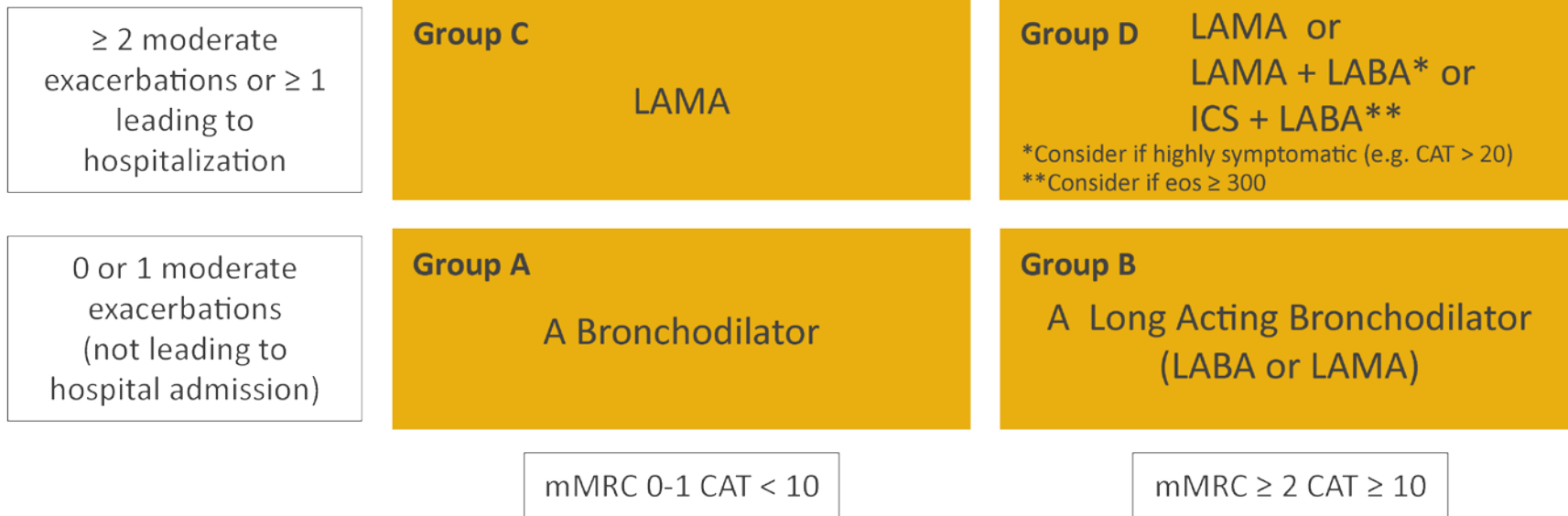


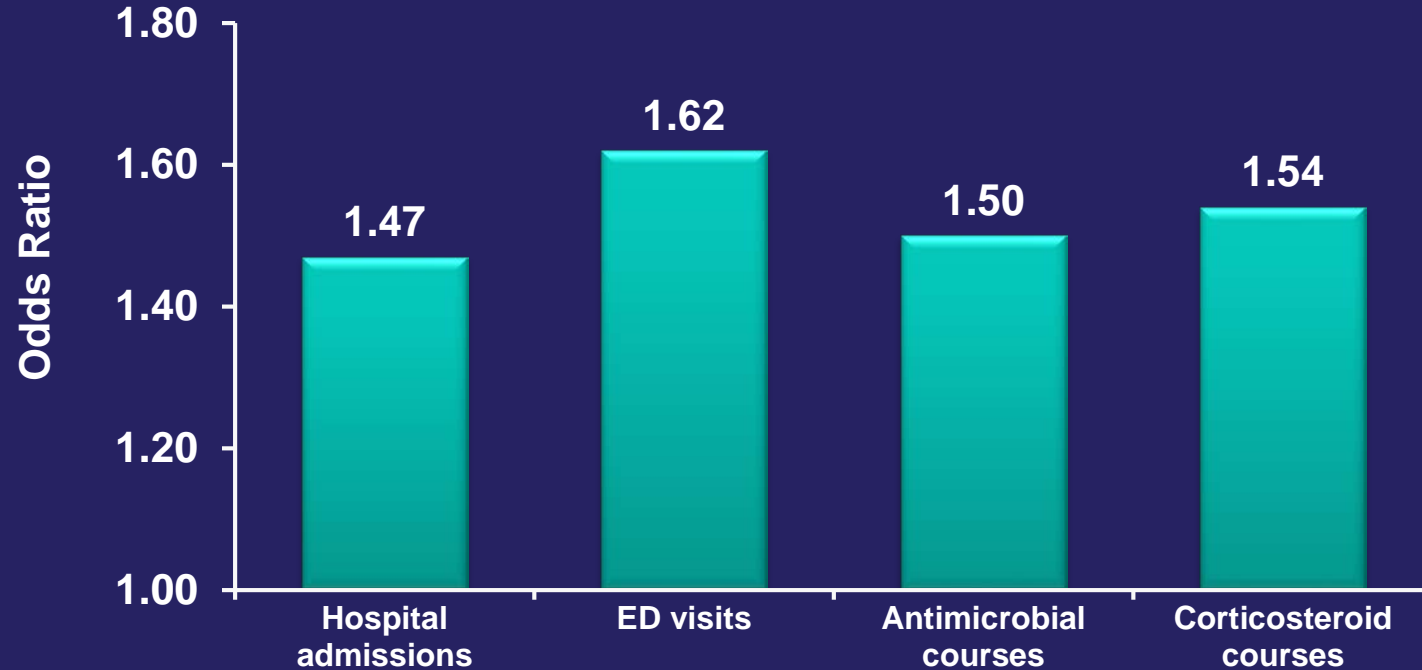
FIGURE 4.1

Definition of abbreviations: eos: blood eosinophil count in cells per microliter; mMRC: modified Medical Research Council dyspnea questionnaire; CAT™: COPD Assessment Test™.

Long-term Maintenance Therapy

Appropriate Delivery Device Selection

Association Between Critical Inhaler Errors* and Healthcare Utilization



*Data includes asthma and COPD patient populations.

Dekhuijzen PNR, et al. *Patient Prefer Adherence*. 2016;10:1561-1572; Melani AS, et al. *Respir Med*. 2011;105(6):930-938.

Assessments to Aid in Device Selection

Cognitive

- Any test for higher level cognitive function
 - Failure indicates MDI or DPI may be inappropriate

Physical

- Validated teach-back methods for specific devices
- Check for inspiratory flow (eg, In-Check DIAL)



Overcoming Cognitive and Physical Limitations

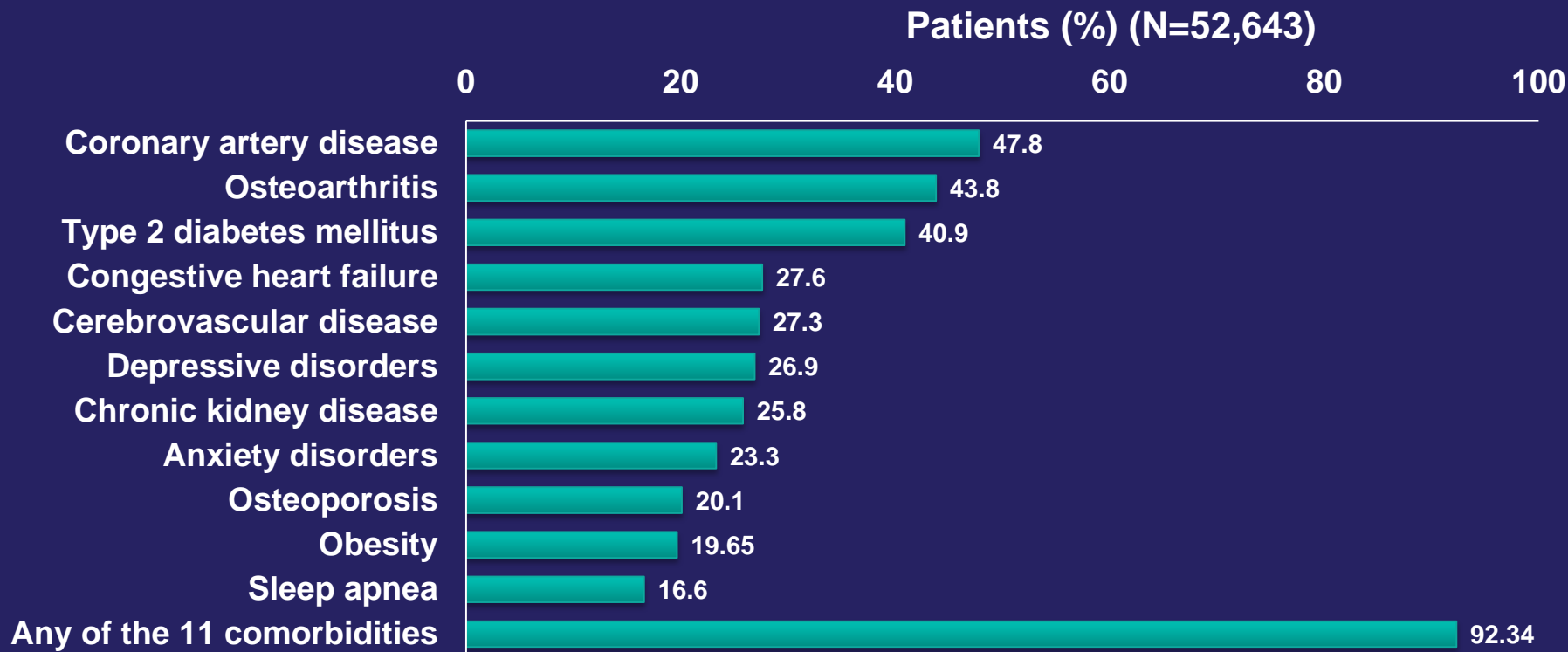
Limitation		Potential Strategy
Physical	<ul style="list-style-type: none"> • Unable to generate adequate PIFR 	SMI, nebulizer
	<ul style="list-style-type: none"> • Impaired manual dexterity (eg, arthritis, Parkinsonism, or stroke) 	Nebulizer
	<ul style="list-style-type: none"> • Pain or weakness from neuromuscular disease (eg, multiple sclerosis) 	Nebulizer
Cognitive	<ul style="list-style-type: none"> • Unable to coordinate breathing with device requirements 	Spacer, SMI, nebulizer
	<ul style="list-style-type: none"> • Unable to remember instructions for device actuation (eg, Alzheimer's disease, altered consciousness) 	Device with fewer steps, nebulizer
	<ul style="list-style-type: none"> • Unable to keep track of doses 	Device with a dose counter

PIFR; peak inspiratory flow rate. Wise RA, et al. *Chronic Obstr Pulm Dis*. 2017;4(1):13. Dhand R, et al. *COPD*. 2012;9(1):58-72; Nobles J, et al. *Consult Pharm*. 2014;29(11):753-756.

Opportunities to Improve Long-term COPD Care

Consideration of Comorbidities

Prevalence of Comorbidities Among Patients with COPD



Cardiovascular Disease in COPD

- Patients with COPD are at increased risk for CVD
- Approximately one-third of all deaths in those with COPD are due to CVD causes
- Prognosis following a MI is substantively worse in those with concomitant COPD
- Optimal management of patients diagnosed with both conditions remains a topic of debate

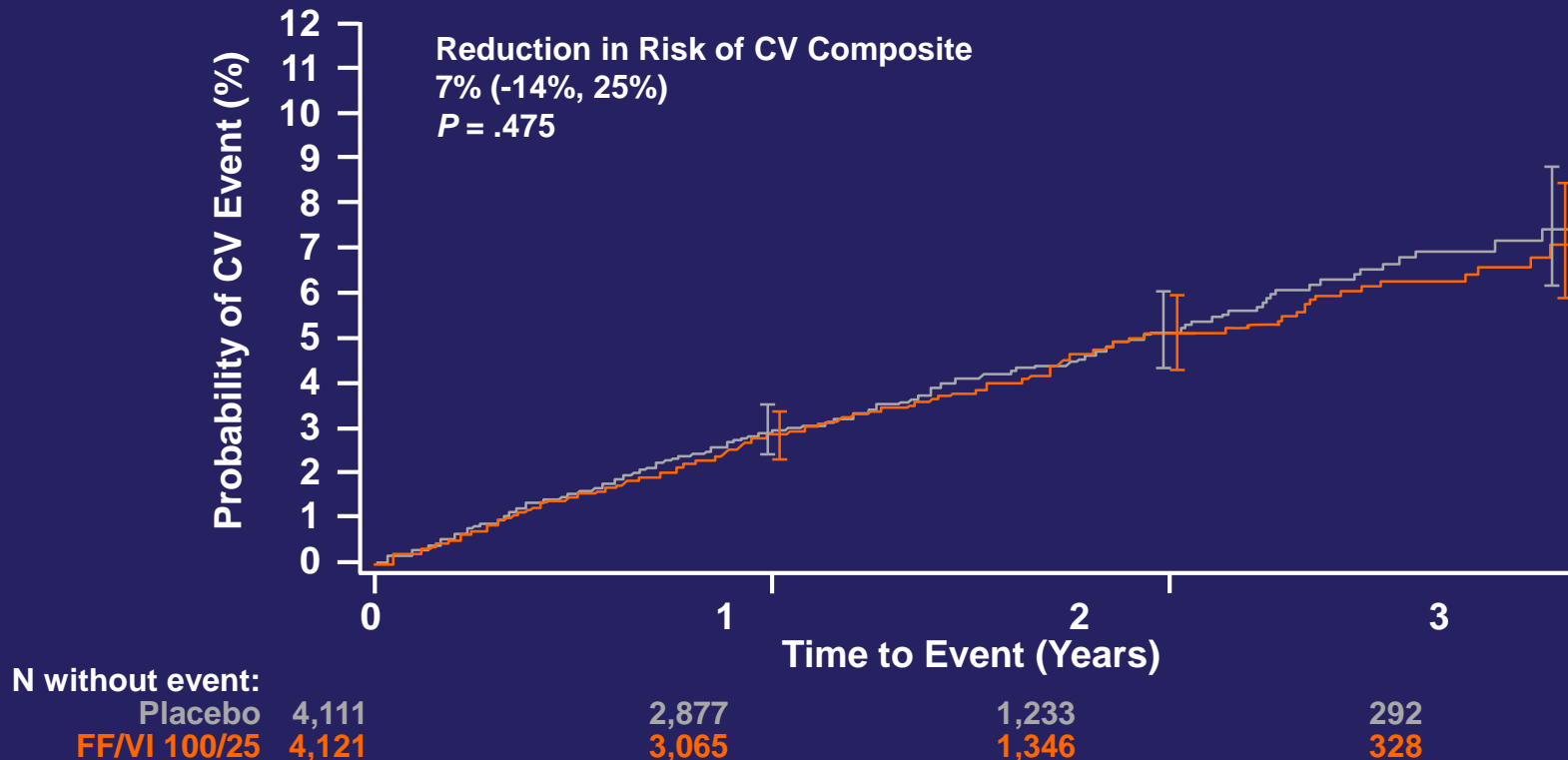
Risk for Hospitalization and Mortality Due to Cardiovascular Causes in COPD

	COPD Patients (n = 11,493)	Matched Controls (n = 22,986)
	Event / 1000 Person- Years	Event / 1000 Person- Years
Total Costs		
Cause of hospitalization		
Arrhythmia	16.44	8.18
Angina	6.02	2.34
Acute myocardial infarction	10.86	6.56
Congestive heart failure	31.96	6.10
Stroke	12.44	9.77
Pulmonary embolism	1.72	0.31
Any cardiovascular	109.50	44.66
Any hospitalization	598.36	221.23

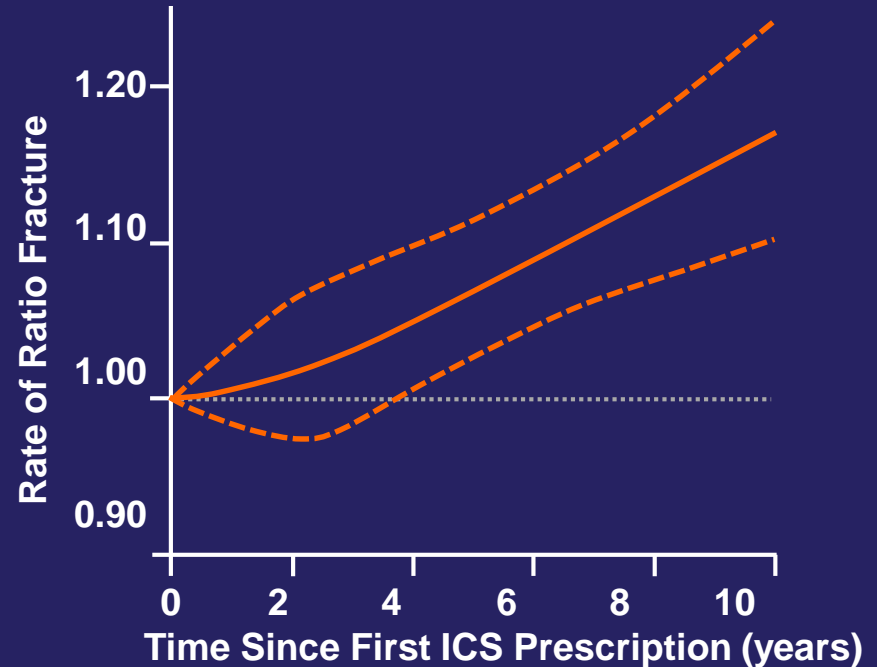
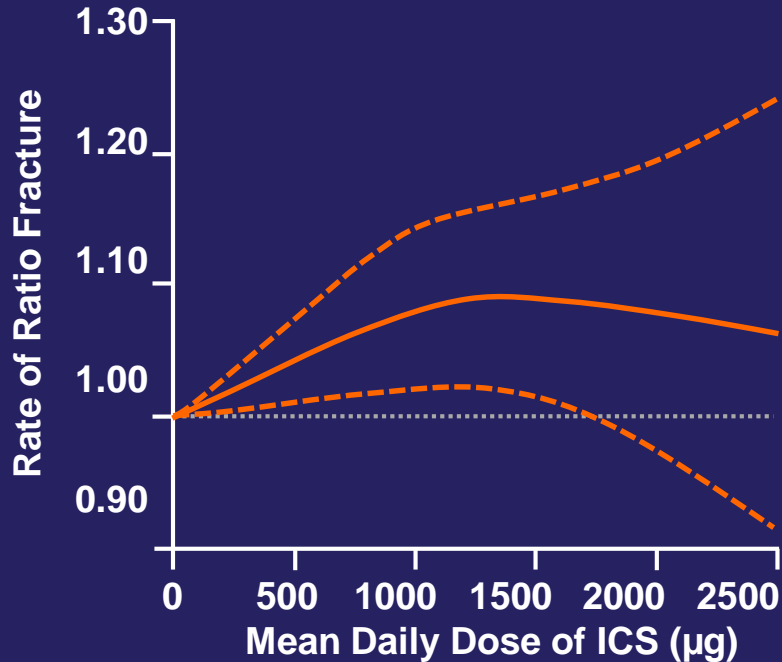
Risk for Hospitalization and Mortality Due to Cardiovascular Causes in COPD

	COPD Patients (n=11,493)	Matched Controls (n= 22,986)
	Event/1000 Person- Years	Event/1000 Person- Years
Underlying case of death		
Arrhythmia	1.94	0.69
Acute myocardial infarction	5.89	3.90
Congestive heart failure	4.10	1.00
Stroke	4.17	3.37
Pulmonary embolism	0.33	0.15
Any cardiovascular mortality	31.89	15.39
Any mortality	106.58	37.79

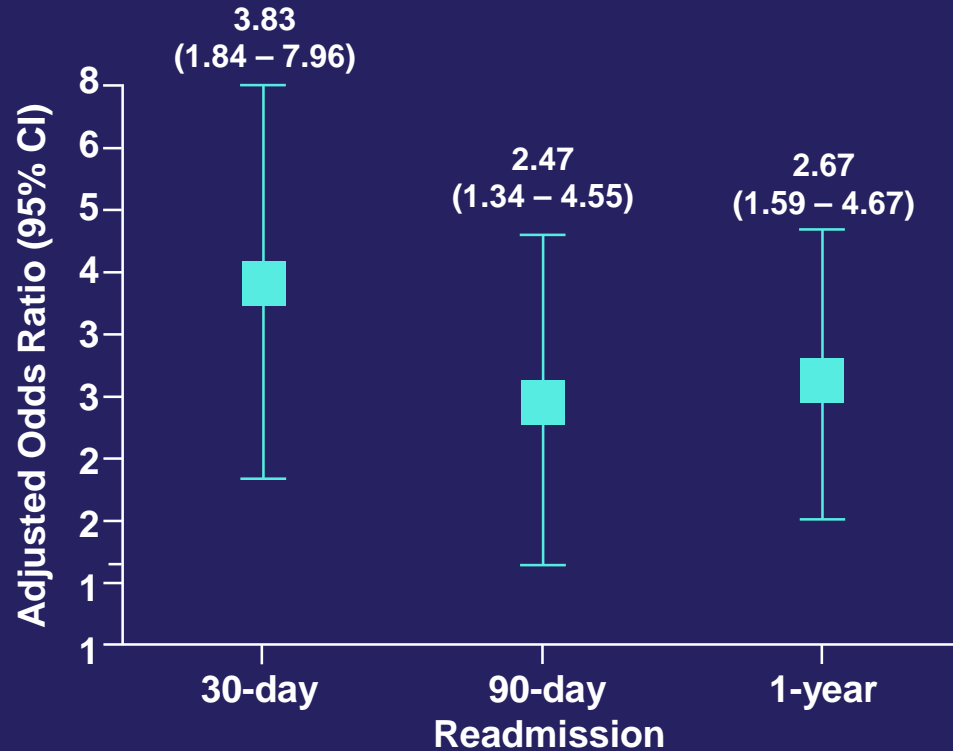
Combined LABA and ICS Therapy Pose No Excess CV Risk



Impact of Long-term High-dose ICS Use on the Risk of Fractures in Patients with COPD



Depression Is Associated with Readmission for Acute Exacerbation



Opportunities to Improve Long-term COPD Care

Patient Discharge and Follow-up

Crucial Issues to Address Prior to Discharge

Pharmacotherapy

- Individualized maintenance therapy
- Medication/device training

Patient/Caregiver Education

- Expectations
- Adherence
- Nonpharmacologic intervention
 - Smoking cessation
 - PR program
 - Vaccinations

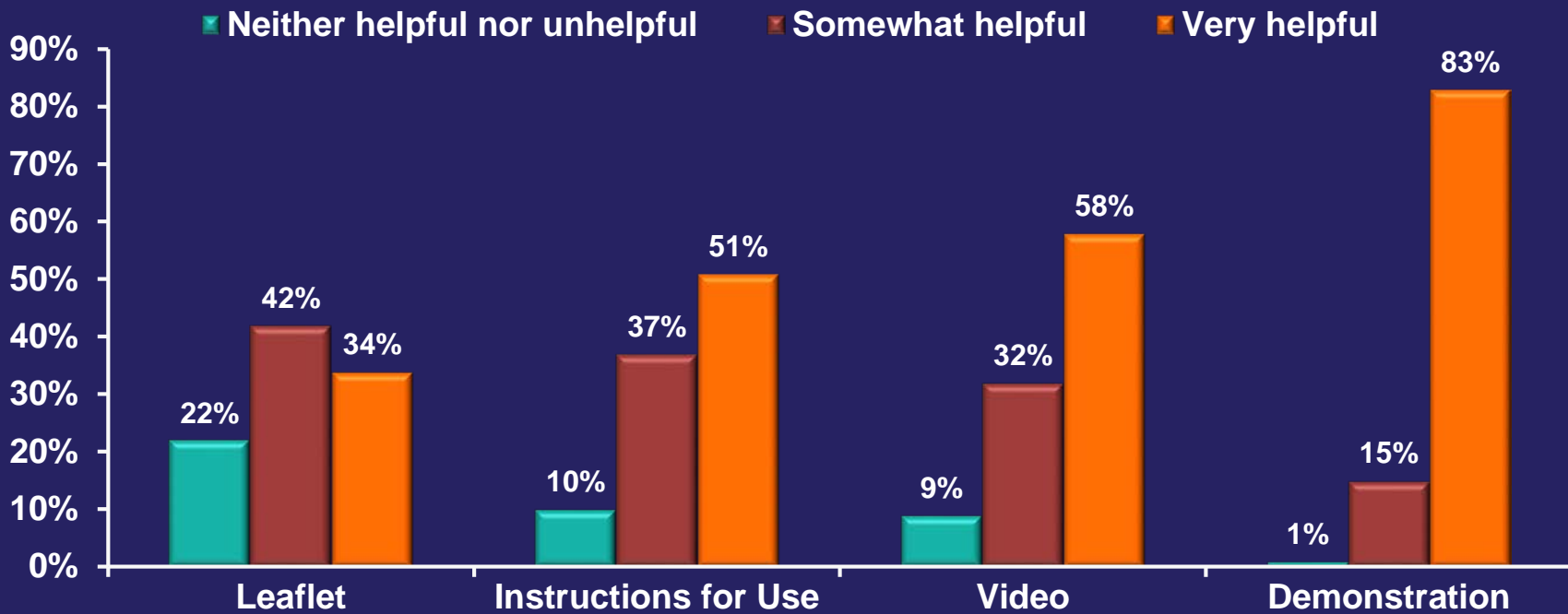
Referral & Follow-up

- Schedule:
 - Home care visit and/or transition care team call
 - PCP appointment
- Ensure information transfer from ED to community HCPs

HCP, healthcare provider; PCP, primary care provider; PR, pulmonary rehabilitation.

Vestbo J, et al. GOLD 2018 Update. Available at <http://goldcopd.org>.

Patient Preferences for Using Different Training Methods



Promoting Patient Self-management

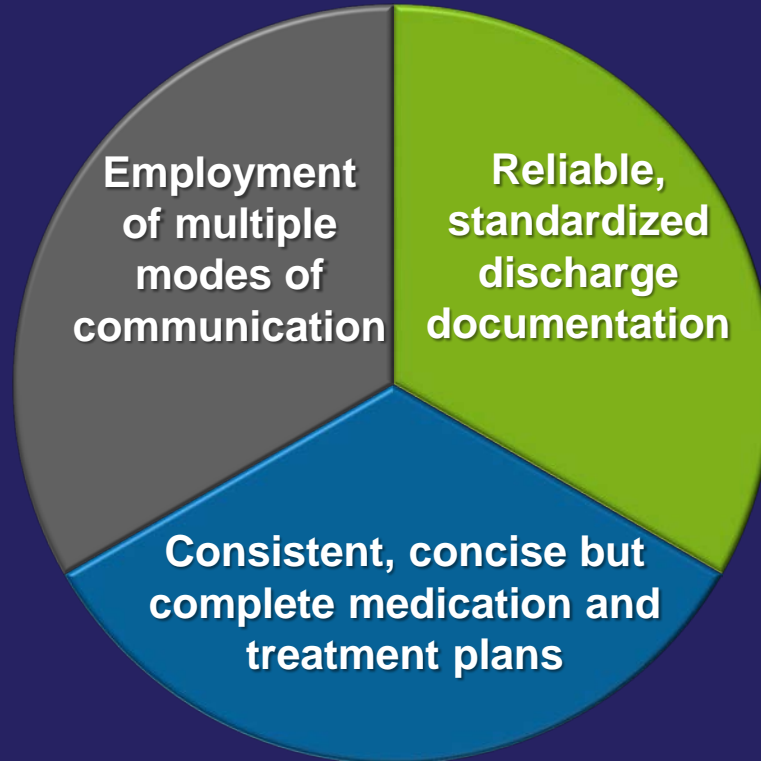
Key Topics of Interviewed Patients



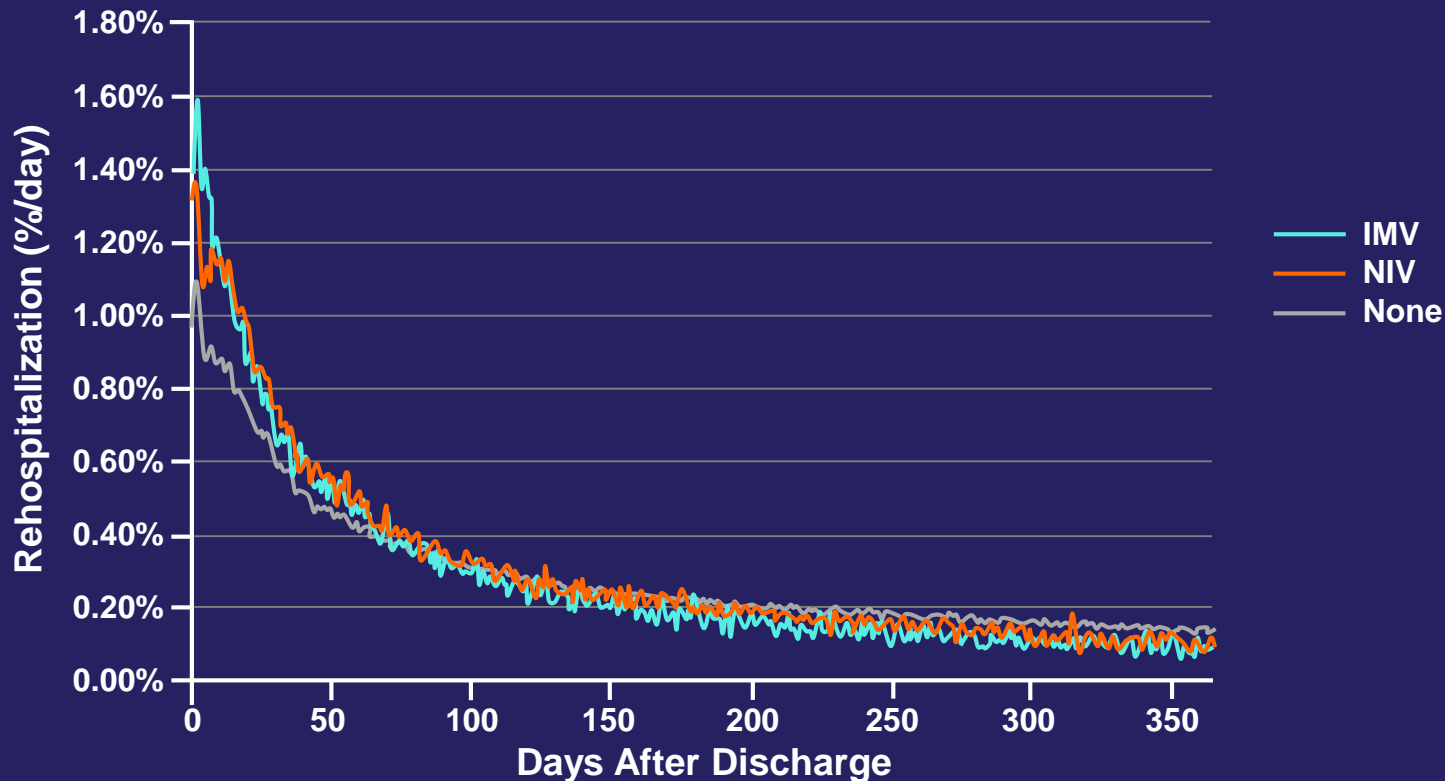
Key Topics of Interviewed HCPs



Improving Communication Between Inpatient and Outpatient HCPs



Prolonged Risk for Readmission Following Hospitalization for COPD



Follow-up After Hospitalization for an Exacerbation Improves Patient Outcomes

- An outpatient visit within 1 month after admission resulted in fewer ED visits (14%) and 30-day readmissions (9%)¹
- Not attending primary care follow-up within 4 weeks was associated with a 10-fold greater likelihood of 30-day readmission²
- Not attending a follow-up visit within 30 days was associated with an increased risk of rehospitalization within 90 days of discharge³

1. Sharma G, et al. *Arch Intern Med.* 2010;170(18):1664-1670; 2. Misky GJ, et al. *J Hosp Med.* 2010;5(7):392-397;

3. Gavish R, et al. *Chest.* 2015;148(2):375-381.

Follow-up Assessment Recommendations

72 Hours (Call)

- Health status
- Medications
- Clinician appointments & lab tests
- Home services coordination
- Action plan

1 to 4 Weeks (Visit)

- Ability to cope in usual environment
- Treatment regimen
- Inhaler technique
- Need for long-term O₂
- Capacity for physical activity & ADLs
- Symptoms (CAT/mMRC)
- Comorbidities

12 to 16 Weeks (Visit)

- Same as at 1 to 4 weeks
- Spirometry (FEV₁)



Cochrane Review Conclusions

Pulmonary rehabilitation following COPD exacerbations:

- Exercise and health status improve – high quality evidence of benefit
- Readmissions and mortality – Heterogeneity of effect with both positive and negative studies
- PR programs differ widely – components, duration



**NO SERIOUS ADVERSE EVENTS
REPORTED!!!**

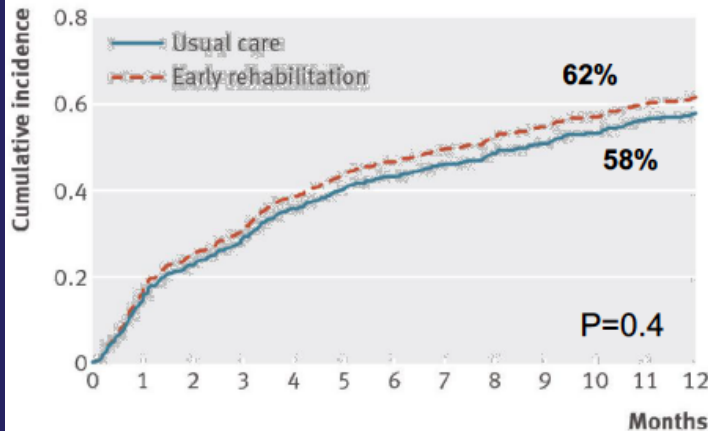
Effects of early PR in COPD exacerbation

RCT. n=389 subjects with exacerbation of CRD (not only COPD)

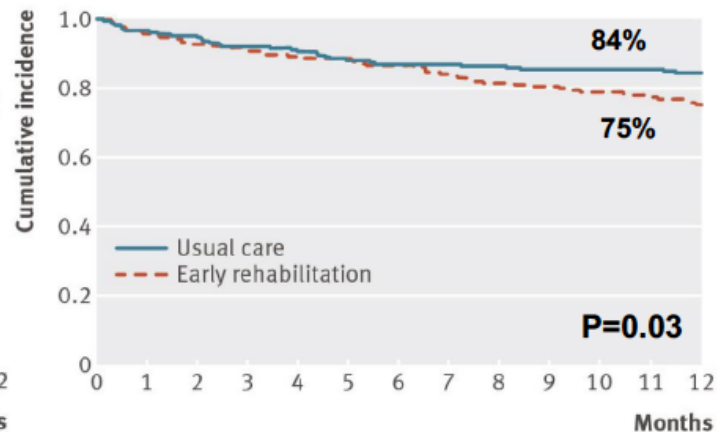
Inpatient (48h): aerobic, resistance and NMES training; self-management and education (median 5 days)

After discharge: unsupervised home-based programme supported by telephone consultations (motivational interview techniques). Total: 6 weeks

Hospital readmission



Survival



- **Why Do Patients Decline Pulmonary Rehabilitation?** ^{1,2}
 - Too sick; fear COPD / comorbidities would worsen
 - Not sick enough, lack of relevance
 - Other obligations, interruption of daily routine
 - Lack of information / referral
 - Transportation problems, location of PR
 - Financial burden
- **Why Do Patients Accept Pulmonary Rehabilitation?** ^{3,4}
 - Build confidence, learn to live/cope with limitations
 - Gain support and encouragement from professionals
 - Gain tangible results
 - 11-fold increased likelihood of uptake if patients have a spouse/resident caregiver ⁵



Hypothesis:
Pulmonary rehabilitation after a
hospitalization for COPD improves
hospital-free survival

The PROPEL Study PR Intervention

- Intensive pulmonary rehab phase
 - 12 weeks; center and home sessions 5 days/week
 - Physical therapy evaluation / exercise
- Respiratory Health Coach
 - Education and motivation
- Maintenance Program
 - 9 months



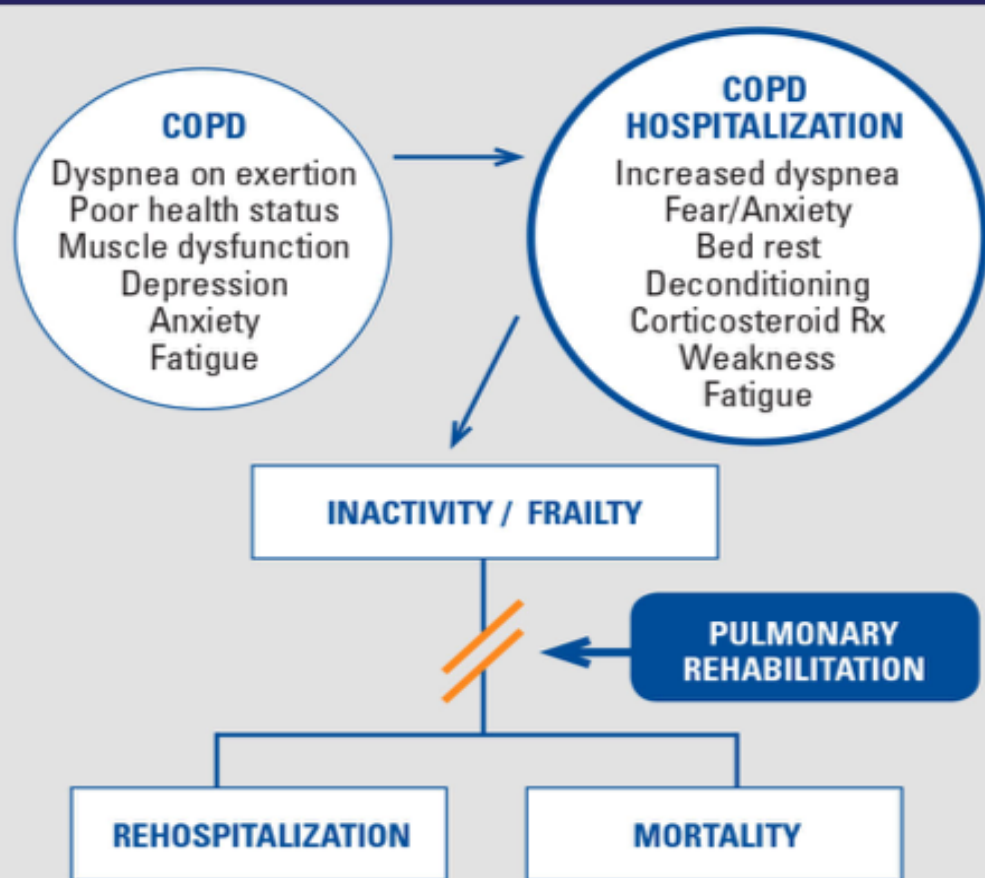


Figure 1. Role of pulmonary rehabilitation in improving hospital-free survival.

Case Evaluations

Case Evaluation #1: Patient Description

A 74-year-old man with COPD (GOLD B) presents to the ED for an exacerbation. His current medications include a SABA (prn) and a LAMA maintenance therapy. He is short of breath, has a wet cough, trouble walking across the room, and chest tightness. Physical exam reveals wheezing and decreased breath sounds. Although he reports having “pretty good control” over his symptoms in general, his son believes that his father has had at least two mild exacerbations that he has managed on his own at home during the past 3 months.



Case Evaluation #1: Question 1

Which of the following validated clinical tools would you use to evaluate the patient's symptom burden?

- A. CAT**
- B. mMRC**
- C. SGRQ**



Case Evaluation #1: Question 2

After confirming the patient's ability to use his inhaler device and adherence to treatment, what type of alteration to the patient's current regimen would you recommend?

- A. No alteration
- B. Addition of a LABA**
- C. Addition of roflumilast

Case Evaluation #2: Patient Description

A 70-year-old woman with an established COPD diagnosis (GOLD C) is hospitalized for an acute exacerbation for the second time within two months. Since her initial diagnosis 7 years ago, the patient has typically exhibited good symptom control with treatment. She reports that she has recently been experiencing symptoms of memory loss, as well as poor vision and worsening osteoarthritis. She also relates a diminished ability to engage in her usual activities of late. Her current maintenance therapy regimen includes a LAMA, LABA, and SABA (prn).



Case Evaluation #2: Question 1

What is your next step in management once you have treated the exacerbation and the patient is stabilized?

- A. Addition of an ICS to her treatment regimen
- B. Evaluation of her device technique**
- C. Evaluation of her home care environment

Case Evaluation #2 Cont'd

Further evaluation reveals that the patient has been having difficulty using her prescribed devices because of pain and stiffness in her hands. Additionally, she confides that she often has difficulty keeping track of whether she has taken all of her medications. You prescribe a fixed-dose combination therapy that is delivered with a device she appears able to use more easily.



Case Evaluation #2: Question 2

What type of instruction would you offer to ensure that the patient is able to use her device correctly?

- A. Instructional written materials
- B. Instructional video
- C. Physical demonstration



Case Evaluation #2: Question 3

During what time frame would you recommend that the patient attend a follow-up visit?

- A. Within 3 days
- B. Within 4 weeks**
- C. Within 8 weeks

Summary

- Exacerbations of COPD represent a significant health and economic burden in the hospital setting
- In-hospital care provides an important opportunity to assess COPD severity, symptom burden, and risk for exacerbations, as well as re-evaluate the efficacy of a patient's current treatment
- Individualized discharge plans and follow-up care that address behavioral, physical, and environmental barriers to effective COPD management are essential for preventing hospital readmissions



Clinical Pearls

- Following an acute exacerbation, confirm the diagnosis of COPD and assess disease severity and risk for future exacerbations using clinical assessments and spirometry
- Reevaluate maintenance therapy regimens and make adjustments to insure that treatment is adequately individualized to meet the physiological and behavioral characteristics of the patient
- Provide patients with education that includes device training, and addresses therapeutic expectations, medication adherence, and nonpharmacologic interventions
- Schedule follow-up that consists of a home care visit or a call from the transition care team, and an appointment with a PCP

Thank You!