Management of Chronic Respiratory Illnesses

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Objectives

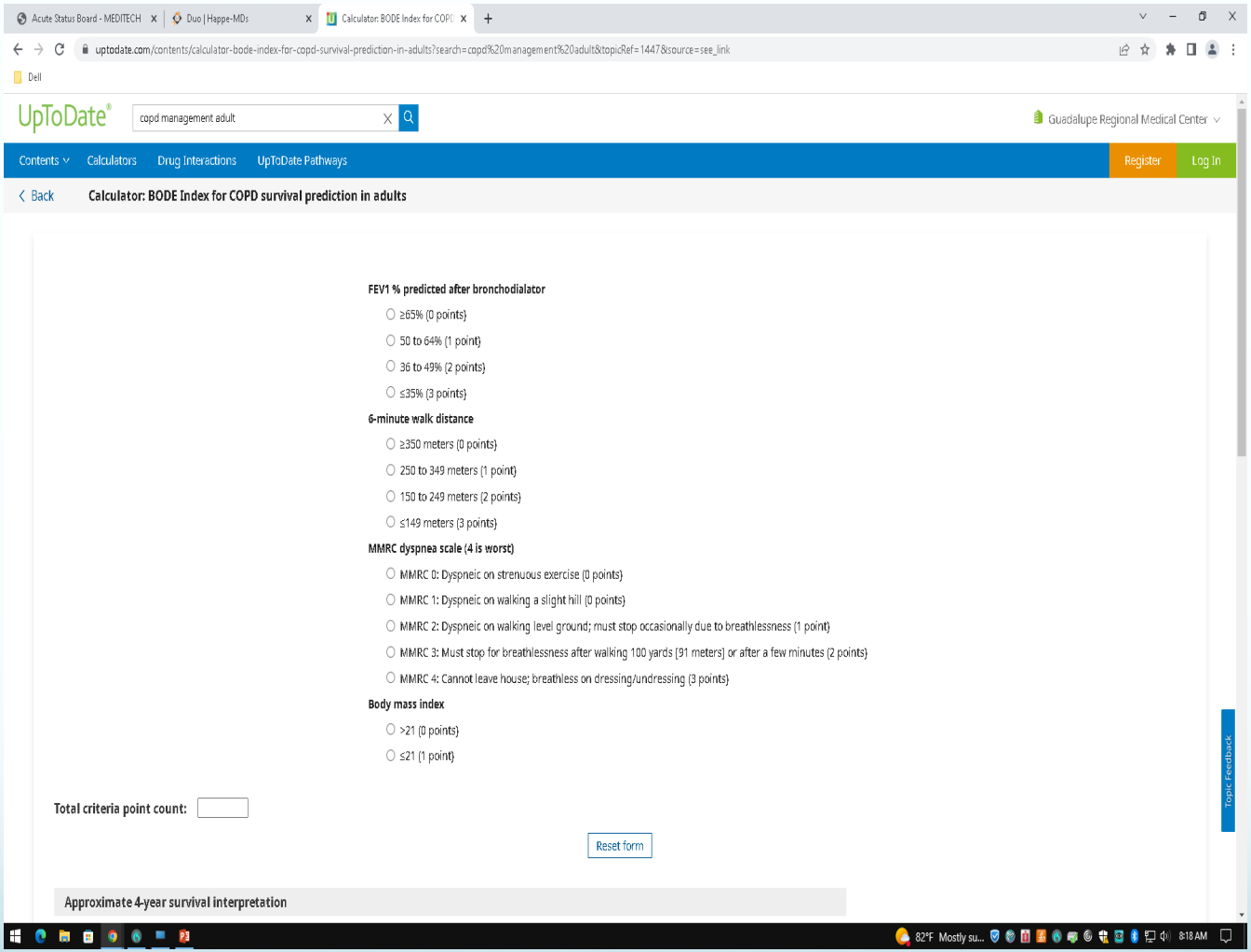
- Diagnosis and management of asthma and COPD
- Non-pharmacologic management of chronic respiratory illnesses
- Benefits of pulmonary rehab

Key indicators of COPD

- Dyspnea
  - Progressive
  - Worse with exercise
  - Persistent
- Chronic Cough
  - May be intermittent and may be non-productive
- Chronic Sputum
  - Any pattern of sputum production
- Exposures
  - Tobacco smoke
  - Exposure to home cooking or home heating fuels
  - Occupational dusts/chemicals

	Pre-Bronch			Post-Bronch		
	Actual	Pred	%Pred	Actual	%Pred	%Chng
---- SPIROMETRY ----						
FVC (L)	1.82	2.99	60	1.89	63	+3
FEV1 (L)	1.17	2.30	51	1.26	55	+7
FEV1/FVC (%)	64	78	82	67	85	+3
FEF 25% (L/sec)	1.86	4.90	37	2.09	42	+12
FEF 75% (L/sec)	0.29	0.46	62	0.35	77	+22
FEF 25-75% (L/sec)	0.67	1.88	35	0.81	42	+21
FEF Max (L/sec)	3.71	5.80	63	4.07	70	+9
FIVC (L)	1.72			1.71		+0
FIF Max (L/sec)	2.83			3.38		+19
---- LUNG VOLUMES --						
SVC (L)	1.66	2.99	55			
IC (L)	1.31	2.09	62			
ERV (L)	0.25	1.05	24			
FRC (N2) (L)	3.06	3.08	99			
RV (N2) (L)	2.70	2.33	116			
TLC (N2) (L)	4.36	5.35	81			
RV/TLC (N2) (%)	62	44	139			
Washout Time (min)	2.24					
---- DIFFUSION ----						
DLCOunc (ml/min/mmHg	11.68	26.95	43			
DLCOcor (ml/min/mmHg		26.95				
DL/VA (ml/min/mmHg/L	3.52	5.03	69			
VA (L)	3.32	5.35	62			

Penicillins



https://www.ncbi.nlm.nih.gov/pubmed/14999112

Management of stable COPD: Initiation of therapy based on the GOLD ABCD assessment of symptoms and risk of exacerbation*

Groups	Symptoms	Risk	Suggested treatment
All			▪ Avoidance of risk factor(s), such as smoking ▪ Annual influenza vaccination ▪ Pneumococcal vaccination ▪ Regular physical activity ▪ Regular review/correction of inhaler technique ▪ Long-term oxygen therapy if chronic hypoxemia ▪ Pulmonary rehabilitation
A	**Less symptomatic** Mild or infrequent symptoms (ie, breathless with strenuous exercise or when hurrying on level ground or walking up a slight hill)¶ or CAT <10Δ	**Low risk** 0 or 1 exacerbations in the past year without associated hospitalization	Short-acting bronchodilator (SABA, SAMA, or combination of SABA-SAMA), as needed.
B	**More symptomatic** Moderate to severe symptoms (ie, patient has to walk more slowly than others of same age due to breathlessness, has to stop to catch breath when walking on level ground at own pace, or has more severe breathlessness)¶ or CAT ≥10Δ	**Low risk** 0 or 1 exacerbations in the past year without associated hospitalization	Regular treatment with a long-acting bronchodilator, either LAMA or LABA, based on patient preference. Short-acting bronchodilator (usually SABA) for symptom relief as needed.
C	**Less symptomatic** Mild or infrequent symptoms (ie, breathless with strenuous exercise or when hurrying on level ground or walking up a slight hill)¶ or CAT <10Δ	**High risk** ≥2 exacerbations per year with one or more leading to hospitalization	Regular treatment with a LAMA; SABA available for symptom relief as needed.
D	**More symptomatic** Moderate to severe symptoms (ie, patient has to walk slower than others of same age due to breathlessness, has to stop to catch breath when walking on level ground at own pace, or has more severe breathlessness)¶ or CAT ≥10Δ	**High risk** ≥2 exacerbations per year with one or more leading to hospitalization	Regular treatment with LAMA **or**, if severe breathlessness (eg, CAT >20), combination LABA plus LAMA. Combination glucocorticoid-LABA inhaler may be preferred, if features of asthma/COPD overlap. SABA available for symptom relief as needed.

Patients must be taught how and when to use their treatments, and treatment choices are adjusted based on patient responses. Medications being prescribed for other conditions should be reviewed. Refer to UpToDate topic on the diagnosis of COPD for further information about mMRC and CAT.

COPD: chronic obstructive pulmonary disease; GOLD: Global Initiative for Chronic Obstructive Lung Disease; CAT: COPD Assessment Test; SABA: short-acting beta agonist; SAMA: short-acting muscarinic antagonist; LAMA: long-acting muscarinic antagonist (anticholinergic); LABA: long-acting beta agonist; mMRC: Modified Medical Research Council; FEV_1: forced expiratory volume in one second; FVC: forced vital capacity.

* All patients with COPD have a reduced FEV_1/FVC ratio that is <0.70% predicted or <5th percentile lower limit of normal. The severity of airflow limitation is determined by the FEV_1.

¶ Symptom severity based on: Modified Medical Research Council (mMRC) Dyspnea scale.

Δ COPD Assessment Test (CAT): http://www.catestonline.org (Accessed on July 9, 2019).

Adapted from: Global Initiative for Chronic Obstructive Pulmonary Disease: Global Strategy for the Diagnosis, Management, and Prevention of COPD, 2019 (Accessed June 18, 2019).

Additional data from:

1. *Fletcher CM, Elmes PC, Fairbairn MB, et al. The significance of respiratory symptoms and the diagnosis of chronic bronchitis in a working population. Br Med J 1959; 2:257.*
2. *Dodd JW, Hogg L, Nolan J, et al. The COPD assessment test (CAT): response to pulmonary rehabilitation. A multicentre, prospective study. Thorax 2011; 66:425.*
3. *Dodd JW, Marns PL, Clark AL, Ingram KA, Fowler RP, Canavan JL, et al. The COPD Assessment Test (CAT): short- and medium-term response to pulmonary rehabilitation. Copd 2012; 9:390.*
4. *Jones PW, Harding G, Berry P, Wiklund I, Chen WH, Kline Leidy N. Development and first validation of the COPD Assessment Test. Eur Respir J 2009; 34:648.*
5. *http://www.catestonline.org*

Usual doses of single agent long-acting beta agonists* for COPD

Agent	Brand name	Dosing
Arformoterol	Brovana (United States)	Solution for nebulization: Inhale contents of 1 vial (15 mcg/2 mL) twice daily via standard jet nebulizer¶
Formoterol[Δ]	Perforomist (United States)	Solution for nebulization: Inhale contents of 1 vial (20 mcg/2 mL) twice daily via standard jet nebulizer¶
	Foradil (Canada)	DPI:◇ Inhale contents of 1 capsule (12 mcg/capsule) twice daily§
	Oxeze Turbuhaler (Canada: 6 mcg/inhalation and 12 mcg/inhalation)¥	DPI: 1 to 2 inhalations (12 to 24 mcg total dose) twice daily
Indacaterol‡	Arcapta Neohaler†	DPI:◇ Inhale contents of 1 capsule (75 mcg/capsule) once daily
	Onbrez Breezhaler (Canada)	DPI:◇ Inhale contents of 1 capsule (75 mcg/capsule) once daily
Olodaterol	Striverdi Respimat (United States)	SMI: 2 inhalations (2.5 mcg/actuation) once daily
Salmeterol	Serevent Diskus (United States/Canada)	DPI:◇ 1 inhalation (50 mcg/actuation) twice daily

COPD: chronic obstructive pulmonary disease; DPI: dry powder inhaler; SMI: soft mist inhaler.

* Vilanterol is not available as a single agent. Refer to relevant clinical topics and Lexicomp drug monographs included within UpToDate for information about combination inhalers containing vilanterol with a long-acting muscarinic antagonist and/or inhaled glucocorticoid.

¶ Data about mixing nebulized medications are limited; refer to the UpToDate topic on delivery of inhaled medications, table on mixing nebulized medications, and Lexicomp drug information monographs included within UpToDate.

Δ Formoterol is not available as a single agent inhaler in the United States. Refer to relevant clinical topics and Lexicomp drug monographs included within UpToDate for information about combination inhalers containing formoterol with a long-acting muscarinic antagonist and/or inhaled glucocorticoid.

◇ DPIs contain lactose and may contain milk protein, which may put patients with milk protein allergy at risk.

§ According to Canadian labelling, the formoterol dose can be increased to 2 capsules (24 mcg/dose) inhaled twice daily (maximum dose 48 mcg/day), if needed for symptom control.

¥ Oxeze Turbuhaler has been approval in Canada for use in asthma but not COPD.

‡ In countries outside the United States and Canada, indacaterol doses of 150 or 300 mcg/day have been approved and are available.

† Arcapta Neohaler is no longer available in the United States, but may be available elsewhere.

Usual doses of single agent long-acting muscarinic antagonists (anticholinergic) for COPD

Agent	Brand name	Dosing
Aclidinium	Tudorza Pressair (United States)	DPI:* 1 inhalation (400 mcg/actuation) twice daily
	Tudorza Genuair (Canada)	
Glycopyrrolate (known as glycopyrronium in Canada and Europe)¶	Seebri Breezhaler (Canada)	DPI:* Inhale contents of 1 capsule (50 mcg/capsuleΔ) once daily
	Lonhala Magnair (United States)	Solution for nebulization: Inhale contents of 1 vial (25 mcg/1 mL) twice daily via specialized Magnair device
Tiotropium¶	Spiriva HandiHaler (United States), Spiriva (Canada)	DPI:* Inhale contents of 1 capsule (18 mcg/capsule) once daily
	Spiriva Respimat (United States, Canada)	SMI:◇ 2 inhalations (2.5 mcg/actuation) once daily
Umeclidinium	Incruse Ellipta (United States, Canada)	DPI:* 1 inhalation (62.5 mcg/actuation) once daily
Revefenacin§	Yupelri (United States)	Solution for nebulization: Inhale contents of 1 vial (175 mcg/3 mL) once daily via standard jet nebulizer¥

COPD: chronic obstructive pulmonary disease; DPI: dry powder inhaler; SMI: soft mist inhaler.

* DPIs contain lactose and may contain milk protein, which may put patients with milk protein allergy at risk.

¶ Use in patients with moderate to severe renal dysfunction should be based on consideration of expected benefits compared with potential risk of reduced clearance; patients should be monitored for anticholinergic adverse effects.

Δ Glycopyrrolate (United States name) is called glycopyrronium in other countries. The dose of glycopyrrolate (glycopyrronium) is expressed variably, depending upon the country. In the United States, the glycopyrrolate (glycopyrronium) dose is expressed as the amount of bromide salt delivered from the mouthpiece. In Canada, the does is expressed as the amount of glycopyrronium base per capsule.

◇ Tiotropium SMI is available as multiple strengths (ie, 1.25 mcg/actuation and 2.5 mcg/actuation). For COPD, the 2.5 mcg/actuation preparation should be used.

§ Revefenacin use is not recommended in patients with hepatic impairment.

¥ Do not dilute or mix with other medications.

Combination long-acting muscarinic antagonist/long-acting beta agonist inhalers for COPD

Agents	Brand names	Dosing
Combination long-acting muscarinic antagonist/long-acting beta agonist inhalers		
Aclidinium 400 mcg/formoterol 12 mcg	Duaklir Genuair (Canada) Duaklir Pressair (United States)	1 inhalation twice daily; DPI
Glycopyrrolate 50 mcg/indacaterol 110 mcg*	Ultibro Breezhaler (Canada)	1 capsule (inhalation only), once daily; DPI
Glycopyrrolate 9 mcg/formoterol 4.8 mcg	Bevespi Aerosphere (United States)	2 inhalations twice daily; pMDI
Tiotropium 2.5 mcg/olodaterol 2.5 mcg per actuation	Stiolto Respimat (United States) Inspiolto Respimat (Canada)	2 inhalations once daily; SMI
Umeclidinium 62.5 mcg/vilanterol 25 mcg	Anoro Ellipta (United States and Canada)	1 inhalation once daily; DPI
Triple combination glucocorticoid/long-acting muscarinic antagonist/long-acting beta agonist inhaler		
Fluticasone furoate 100 mcg/umeclidinium 62.5 mcg/vilanterol 25 mcg	Trelegy Ellipta (United States)	1 inhalation once daily; DPI
Budesonide 160 mcg/glycopyrrolate 9 mcg/4.8 mcg formoterol	Breztri Aerosphere (United States and Canada)	2 inhalations twice daily; MDI

Strength shown following each ingredient in the combination is for one inhalation or puff as listed in the United States approved prescribing information or Canada product monograph.

DPI: dry powder inhaler; pMDI: pressurized metered dose inhaler; SMI: soft mist inhaler.

* Glycopyrrolate 15.6 mcg/indacaterol 27.5 mcg (Utibron Neohaler), although approved by the US Food and Drug Administration, is not available in the United States.

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Tbco Prod: Never Smoked Yrs Smk: Pks/Day: Yrs Quit:

Medications:

Pre Test Comments:

Post Test Comments: Bronchodilated with Albuterol. Pt had difficult time with test due to cough.

	Pre-Bronch			Post-Bronch		
	Actual	Pred	%Pred	Actual	%Pred	%Chng
---- SPIROMETRY ----						
FVC (L)	2.26	4.62	48	2.67	57	+18
FEV1 (L)	2.01	3.70	54	2.40	64	+19
FEV1/FVC (%)	89	80	110	90	111	+1
FEF 25% (L/sec)	3.59	8.21	43	3.95	48	+10
FEF 75% (L/sec)	1.31	1.28	102	1.97	153	+50
FEF 25-75% (L/sec)	2.15	3.58	60	3.17	88	+47
FEF Max (L/sec)	3.59	9.39	38	4.47	47	+24
FIVC (L)	2.00			2.47		+23
FIF Max (L/sec)	2.00			2.43		+21
---- LUNG VOLUMES ----						
SVC (L)	2.55	4.62	55			
IC (L)	1.98	3.06	64			
ERV (L)	0.13	1.53	8			
FRC (N2) (L)	2.43	3.15	77			
RV (N2) (L)	1.87	1.77	105			
TLC (N2) (L)	4.42	6.34	69			
RV/TLC (N2) (%)	42	28	151			
Washout Time (min)	1.38					
---- DIFFUSION ----						
DLCOunc (ml/min/mmHg)	28.98	28.30	102			
DLCOcor (ml/min/mmHg)		28.30				
DL/VA (ml/min/mmHg/L)	6.19	4.46	138			
VA (L)	4.68	6.34	73			

Asthma

- **Intermittent** — Intermittent asthma is characterized by the following features in adults and adolescents
  - Daytime asthma symptoms occurring two or fewer days per week
  - Two or fewer nocturnal awakenings per month
  - Use of short-acting beta agonists (SABAs) to relieve symptoms two or fewer days per week
  - No interference with normal activities between exacerbations
  - FEV_1 measurements between exacerbations that are consistently within the normal range (ie, ≥80 percent of predicted)
  - FEV_1/FVC ratio between exacerbations that is normal (based on age-adjusted values)
  - One or no exacerbations requiring oral glucocorticoids per year

Asthma

- **Mild persistent** — Mild persistent asthma is characterized by the following:
  - Symptoms more than twice weekly (although less than daily)
  - Approximately three to four nocturnal awakenings per month due to asthma (but fewer than every week)
  - Use of SABAs to relieve symptoms more than two days out of the week (but not daily)
  - Minor interference with normal activities
  - FEV_1 measurements within normal range (≥80 percent of predicted)

- **Moderate persistent**
  - Daily symptoms of asthma
  - Nocturnal awakenings as often as once per week
  - Daily need for SABAs for symptom relief
  - Some limitation in normal activity
  - FEV_1 ≥60 and <80 percent of predicted and FEV_1/FVC below normal

Approaches to asthma controller therapy in adolescents and adults

National Asthma Education and Prevention Program: Expert Panel Working Group (NAEPP 2020)		Global Initiative for Asthma (GINA)	
Asthma symptoms/lung function	**Therapy***	**Asthma symptoms**	**Therapy**
Intermittent asthma/step 1		**Step 1**	
▪ Daytime symptoms ≤2 days/week ▪ Nocturnal awakenings ≤2/month ▪ Normal FEV_1 ▪ Exacerbations ≤1/year	▪ SABA, as needed	▪ Infrequent asthma symptoms (eg, <2 times/week)	▪ Low-dose ICS with rapid onset LABA (eg, budesonide-formoterol combination MDI 160 mcg-4.5 mcg/inhalation or DPI 200 mcg-6 mcg/inhalation) 1 inhalation, as needed **or** ▪ Low-dose ICS whenever SABA used
Mild persistent asthma/step 2		**Step 2**	
▪ Daytime symptoms >2 but <7 days/week ▪ Nocturnal awakenings 3 to 4 nights/month ▪ Minor interference with activities ▪ FEV_1 within the normal range ▪ Exacerbations ≥2/year	▪ Low-dose ICS daily with SABA as needed **or** ▪ Low-dose ICS **plus** SABA, concomitantly administered, as needed **Alternative option(s)** ▪ Daily LTRA* **and** SABA as needed	▪ Asthma symptoms or need for reliever inhaler ≥2 times/week	▪ Low-dose ICS daily, with SABA as needed (preferred) **or** ▪ Low dose ICS-formoterol as needed (preferred) **Other options** ▪ Low-dose ICS plus SABA, concomitantly administered, as needed **or** (less preferred) ▪ LTRA daily and SABA as needed
Moderate persistent asthma/step 3		**Step 3**	
▪ Daily symptoms ▪ Nocturnal awakenings >1/week ▪ Daily need for SABA ▪ Some activity limitation ▪ FEV_1 60 to 80% predicted ▪ Exacerbations ≥2/year	▪ Combination low-dose ICS-formoterol daily **and** 1 to 2 inhalations as needed up to 12 inhalations/day (preferred option) **Alternative option(s)** ▪ Medium-dose ICS daily **and** SABA as needed **or** ▪ Low-dose ICS-LABA combination daily **or** low-dose ICS **plus** LTRA daily **and** SABA as needed **or** ▪ Low-dose ICS daily plus zileuton and SABA as needed*	▪ Troublesome asthma symptoms most days, nocturnal awakening due to asthma ≥1 time/month, risk factors for exacerbations¶	▪ Low-dose ICS-LABA as maintenance and reliever therapy (ie, budesonide-formoterol) (preferred) **or** ▪ Low-dose ICS-LABA combination daily, with SABA as needed **Other options** ▪ Medium-dose ICS daily, with SABA as needed **or** ▪ Low-dose ICS plus LTRA daily, with SABA as needed
Severe persistent asthma/steps 4 to 6		**Steps 4 to 5**	
▪ Symptoms all day ▪ Nocturnal awakenings nightly ▪ Need for SABA several times/day ▪ Extreme limitation in activity ▪ FEV_1 <60% predicted ▪ Exacerbations ≥2/year	**Step 4:** ▪ Combination medium dose ICS-formoterol daily **and** 1 to 2 inhalations as needed to 12 inhalations/day (preferred option) **Alternative option(s)** ▪ Medium-dose ICS-LABA daily or medium-dose ICS **plus** LAMA daily **and** SABA as needed **or** ▪ Medium-dose ICS daily plus LTRA **or** zileuton **and** SABA as needed*	▪ Severely uncontrolled asthma with ≥3 of the following: daytime asthma symptoms >2 times/week; nocturnal awakening due to asthma; reliever needed for symptoms >2 times/week, or activity limitation due to asthma **or** ▪ An acute exacerbation	**Step 4:** ▪ Medium-dose ICS-LABA daily and SABA as needed **Other options** ▪ High-dose ICS daily – May need short course of oral glucocorticoids ▪ Possible add-on tiotropium, LTRA
	Step 5: ▪ Medium to high-dose ICS-LABA **plus** LAMA daily **and** SABA as needed (preferred) **Alternative option(s)** ▪ Medium-high dose ICS-LABA daily or high-dose ICS + LTRA* daily and SABA as needed ▪ Possible addition of asthma biologics△		**Step 5:** ▪ High-dose ICS-LABA daily and SABA as needed (preferred) ▪ Assess for possible add-on therapy (eg, tiotropium, zileuton, anti-IgE, anti-IL-5, anti-IL-5R, anti-IL-4R) **Other options** ▪ Oral glucocorticoids titrated to optimize asthma control and minimize adverse effects
	Step 6: ▪ High-dose ICS-LABA daily; consider LAMA as substitute for LABA or as add-on therapy if not done previously◇ ▪ Oral glucocorticoids, titrated to optimize asthma control and minimize adverse effects ▪ Possible addition of asthma biologics△		

Initial therapies are noted above. A higher level of initial therapy, sometimes with concurrent use of oral glucocorticoids, may be chosen if the patient presents with an acute exacerbation. Treatment may be stepped down if asthma is well controlled for at least 3 months, or stepped up 1 or 2 steps if asthma is not well controlled or is very poorly controlled. At follow-up visits, check adherence, inhaler technique, environmental factors, and comorbid conditions. Subcutaneous immunotherapy is suggested as an adjunct to standard pharmacotherapy in individuals who have demonstrated allergy to the included allergens and whose asthma is well-controlled whenever immunotherapy is administered. Consult with asthma specialist if step 4 or higher is required.

FEV_1: forced expiratory volume in one second; SABA: short-acting beta agonist; ICS: inhaled corticosteroid (glucocorticoid); LABA: long-acting beta agonist; MDI: metered dose inhaler; DPI: dry powder inhaler; LTRA: leukotriene receptor antagonist; IgE: immunoglobulin E; IL: interleukin.

* Theophylline and cromolyn are not included in the table even though they were included in NAEPP-EPR 3 (2007) and theophylline is included in NAEPP (2020). These agents are rarely used now, due to availability of more effective options.

¶ Risk factors for exacerbations include: smoking, allergen exposure if sensitized, previous intubation or intensive care unit stay for asthma, low FEV_1 (especially <60% predicted), obesity, food allergy, chronic rhinosinusitis, and poor adherence/inhaler technique.

△ Asthma biologics include anti-immunoglobulin E, anti-interleukin (IL)-5, anti-IL-5R, and anti-IL-4R (anti-IL-4/IL-13). Refer to UpToDate graphic on our approach to selection of biologic agents for add-on therapy for severe asthma in adolescents and adults.

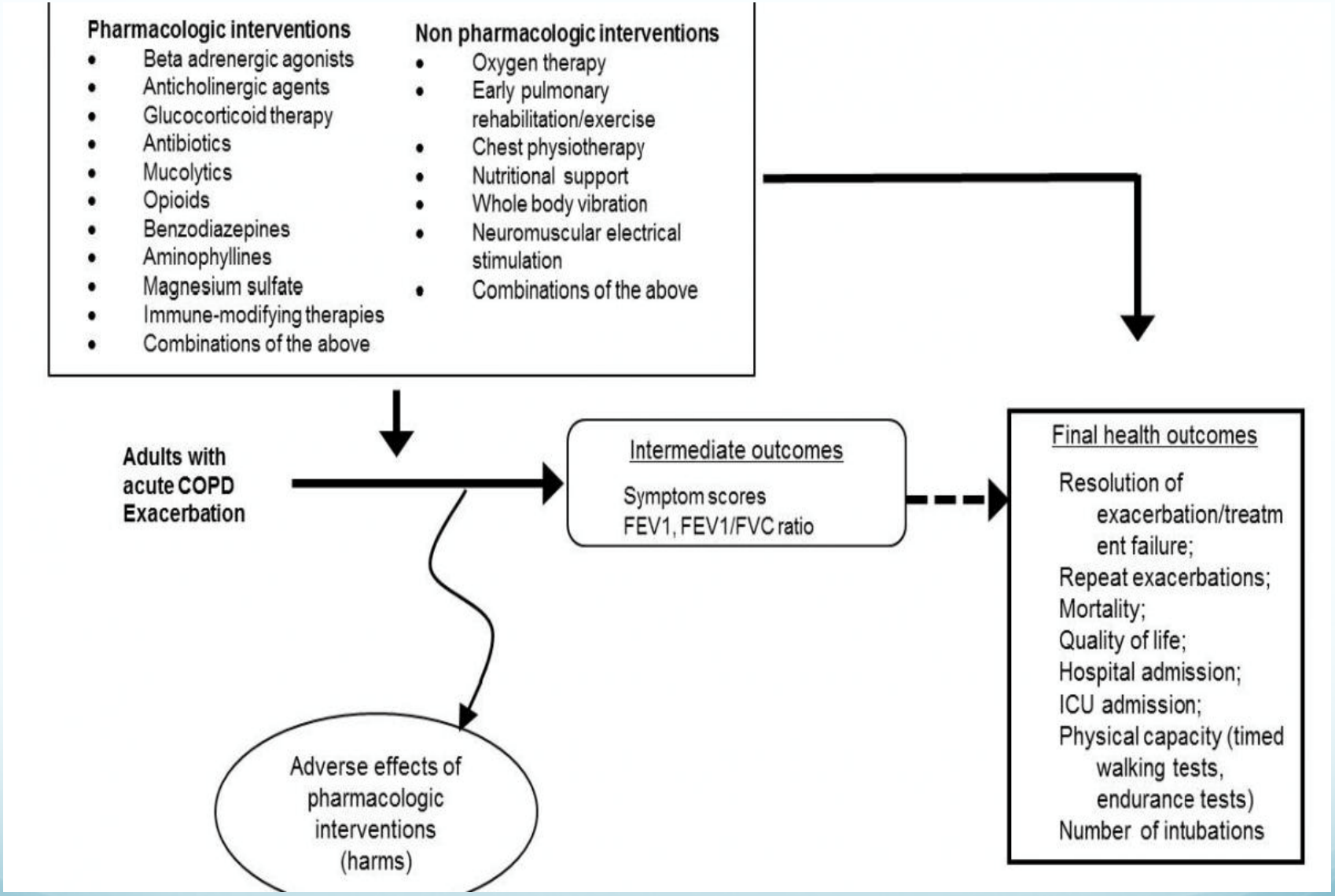
◇ The NAEPP 2020 Focused Updates included LAMA therapy in step 5 but not step 6; however, a trial of add-on LAMA therapy is reasonable, if not previously assessed.

References:

1. *National Asthma Education and Prevention Program: Expert panel report III: Guidelines for the diagnosis and management of asthma. Bethesda, MD: National Heart, Lung, and Blood Institute, 2007. (NIH publication no. 08-4051).* https://www.nhlbi.nih.gov/health-topics/guidelines-for-diagnosis-management-of-asthma.
2. *2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group. J Allergy Clin Immunol 2020;146:1217-70.* https://www.nhlbi.nih.gov/health-topics/asthma-management-guidelines-2020-updates.
3. *Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA).* www.ginasthma.org.

Omalizumab

- Six years of age and older.
- Moderate-to-severe persistent asthma
- Asthma symptoms that are inadequately controlled with inhaled glucocorticoids
- A total serum IgE level between 30 and 700 (1300 for children 6 to 11 years old) international units/mL.
- Skin testing or in vitro testing for allergen-specific IgE to an allergen that is present year-round (a perennial allergen), such as house dust mites, animal danders, cockroaches, or molds.



Pharmacologic and Non-pharmacologic Therapies in Adult Patients with Acute Exacerbation of COPD: A Systematic Review. From www.ahrq.gov

Non-Pharmacologic Therapy

- Smoking cessation
  - The Lung Health Study demonstrated that participants with mild to moderate COPD who stopped smoking experienced an improvement in FEV1 in the year after quitting.
  - Regardless of severity of lung disease, has been shown to have a mortality benefit, secondary to the reduction in cardiovascular and lung cancer mortality

The Lung Health Study. Am J Respir Crit Care Med. 2000;161((2 pt 2)):381–92.

Tashkin DP, Murray RP. Smoking cessation in chronic obstructive pulmonary disease. Respir Med. 2009;103(7):963–74.

Smoking Cessation

- Reduction in the amount of cigarettes smoked per day or intermittent quitting did not achieve the same rate of decline in FEV1 achieved in those with complete and sustained cessation, unless the percent reduction was very marked (>85%).
- Nicotine replacement therapy is indicated for ambulatory patients with COPD despite the presence of CVD.

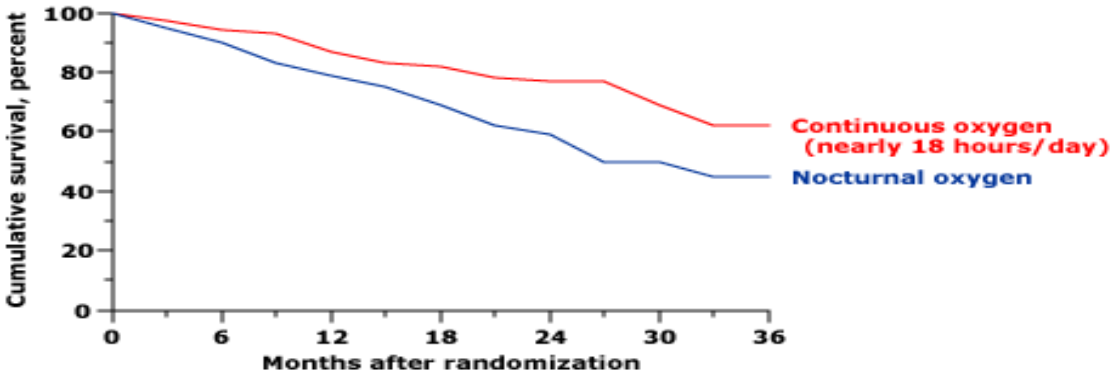
Vaccination

- Annual vaccination against influenza is indicated for patients with COPD and/or CVD.
- Vaccination against pneumococcus should be offered to individuals with COPD

Oxygen Therapy

- Current indications for continuous long-term oxygen therapy include:
  - PaO_2 ≤55 mmHg or SpO_2 ≤88 percent during rest
  - PaO_2 between 56 to 59 mmHg (SpO_2 of 89 percent) combined with evidence of cor pulmonale, right heart failure, or erythrocytosis (hematocrit >56 percent)
  - PaO_2 >60 mmHg or SpO_2 >90 percent with "compelling medical justification"; including significant coronary heart disease or active cardiac ischemia

Survival benefit of continuous long-term oxygen therapy in COPD



The Nocturnal Oxygen Therapy Trial randomly assigned 203 patients with chronic obstructive pulmonary disease complicated by hypoxemia to treatment with nearly continuous oxygen therapy (red line) or nocturnal oxygen alone (blue line). Continuous oxygen therapy was associated with a significant survival benefit (p = 0.01).

Redrawn from Nocturnal Oxygen Trial Therapy Group, Ann Intern Med 1980; 93:391.

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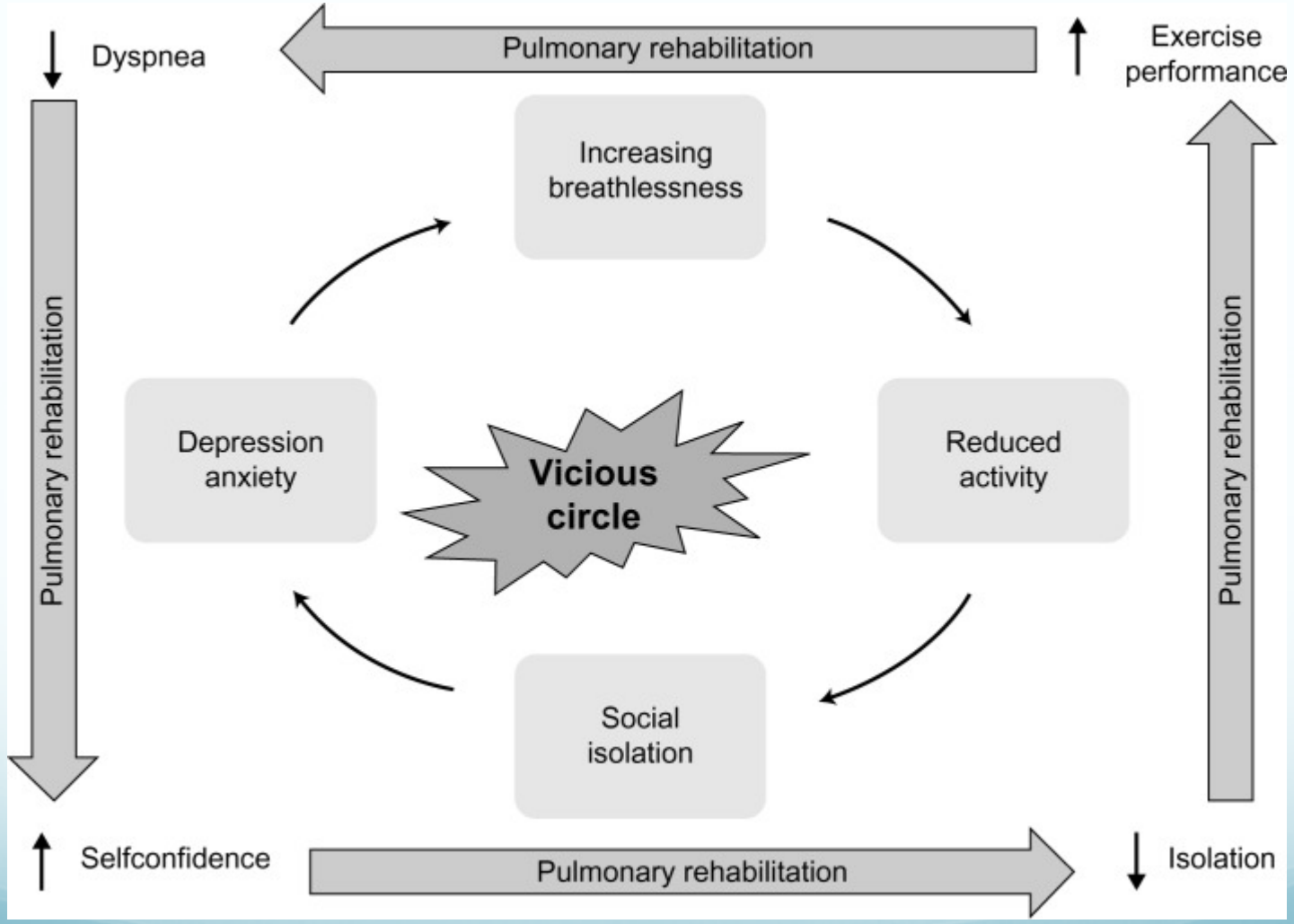
Chronic Non-Invasive Ventilation

- Significant benefit in patients with COPD who also have OSA, OHS or chronic hypercapnic respiratory failure,.



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3869834/

Pulmonary Rehabilitation

- PR is a well-proven structured and multidisciplinary treatment approach including patient assessment, physical training and peripheral muscle strengthening, occupational therapy, education of the patient, smoking cessation intervention, nutritional intervention, and psychosocial support.

Pulmonary Rehab Indications

- COPD
- COVID 19
- Lung Cancer
- Asthma
- Bronchiectasis
- Interstitial lung diseases
- Chest wall disorders
- Pulmonary hypertension.
- Lung transplantation.

Pulmonary rehab

- **Exercise training**
- **Endurance training**
- **Lower extremity exercise**
- **Upper extremity exercise**
- **Resistance/strength training**

Additional Benefits

- **Smoking cessation**
- **Long term oxygen therapy (LTOT)**
- **Nutritional counseling and weight management**
- **Proper use of medications**
- **Health preservation**

Main Outcomes

- Improvement in exercise performance,
- Improvement in dyspnea,
- Improvement in health related quality of life
- Psychosocial benefits,
- Cost effectiveness,
- Reduced health care utilization, and
- Improved survival

Pulmonary Rehab Mortality Benefit

- Retrospective cohort study of 197,376 Medicare beneficiaries hospitalized for COPD found that initiation of pulmonary rehabilitation within 90 days of discharge was associated with a reduction in all-cause mortality at one year.
- A subsequent randomized trial of 150 patients found greater benefit in exercise capacity, but not in overall one year mortality in patients enrolled within two weeks after discharge or the same rehabilitation program initiated two months after discharge.

JAMA. 2020;323(18):1813 ERJ Open Res. 2020;6(1) Epub 2020 Feb 17.