# Summary of COPD Care Model in Adults

## Definitions

Global Initiative for Chronic Obstructive Lung Disease (GOLD): "**COPD**, a common preventable and treatable disease, is characterized by *persistent airflow limitation* that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases. Persistent airflow limitation is confirmed by spirometry showing post-bronchodilator $FEV_1/FVC < 0.70$. Acute exacerbations COPD (AECOPD) and comorbidities contribute to the overall severity in individual patients."

Affects ≈ 7% US population and is 3rd ranked cause of death. Total cost in US estimated at $60 billion.

Symptoms include: dyspnea, chronic cough and chronic sputum production.

**Exacerbations** are acute events characterized by worsening of respiratory symptoms beyond normal variation and leading to change in medication.

**Chronic bronchitis:** cough and sputum production for at least 3 months in each of 2 consecutive years; other causes chronic cough excluded, may or may not be associated with persistent airflow limitation.

**Emphysema:** pathology term describing destruction of the alveoli; can also be found with normal lung function.

**Asthma:** chronic airway inflammation with variable expiratory airflow limitation; symptoms of wheeze, cough, chest tightness, SOB.

## Risk Factors for the Development of COPD

Tobacco smoking is the most common risk factor (80% in US).

Indoor and outdoor air pollution (including burning of biomass for cooking or heating) and occupational exposure to dusts and chemicals also contribute to COPD. This also includes exposure to second-hand smoke.

Risk is thought to be due to the total life-time burden of inhaled particles: amount and duration.

Genetic factors also play a role. Alpha-1 antitrypsin deficiency is the most severe example.

Impaired lung growth during gestation and childhood has potential to increase an individual's risk.

Asthma and bronchial hyperactivity may be risk factor for development COPD. Asthma and COPD may overlap.

### Risk Factor Modification

- **Tobacco:** smoking cessation cornerstone of all therapies. Only evidence based intervention that improves COPD prognosis and may prevent AECOPD. If never smoker, encourage continued avoidance. If abstinent, offer continued support. If current smoker:
  - Ask (about smoking)
  - Advise (about health effects)
  - Assess(willingness to quit)
  - Assist (with strategies)
  - Arrange (follow up)

Nicotine replacement therapy (gum, inhaler, nasal spray, sublingual, lozenge, patch) with pharmacotherapy increases long term abstinence.

## Diagnosis of COPD: H & P

Diagnosis of COPD made by presence of symptoms compatible with COPD, history of exposure to triggers and confirmed by spirometry as well as absence of alternative explanation for symptoms and airflow limitation.

**History:** Consider clinical DX in patient (typically > 40 YO) with:

- Dyspnea: progressive, worse with exercise, persistent. In sedentary individual, may present as fatigue (avoidance of activities causing exertional dyspnea).
- Chronic cough: often worse in AM; may be intermittent and non-productive.
- Sputum production: any pattern.
- History of exposure to inhaled particulates (commonly tobacco).
- May have family history of COPD.

### Physical Exam:

- May be normal or show prolonged expiration.
- As progresses: hyperinflation, decreased breath sounds, wheezes, crackles, and/or distant heart sounds. May develop increased AP diameter of (barrel) chest.
- End stage: may adopt tripod posture, accessory muscle use, pursed lip breathing, cyanosis, asterixis, enlarged liver, yellow staining of fingers, muscle wasting, weight loss.
- Clubbing not common in COPD; usually due to lung CA, interstitial lung disease or bronchiectasis.

## Diagnosis of COPD: Evaluation

### Laboratory

- No lab test diagnostic, but may be used to evaluate other causes of dyspnea.
  - CBC, TSH, chemistries.
  - BNP to evaluate for HF.
- Consider testing for alpha-1-antitrypsin deficiency; especially in younger patient, non- or minimal-smoker, family history emphysema, or CXR with basilar emphysema.

### Pulmonary Function Tests

- Spirometry: persistent airflow limitation, as indicated by post-bronchodilator $FEV_1/FVC$ ratio, is required to make the diagnosis of COPD. Post-bronchodilator % predicted $FEV_1$ determines severity of airflow limitation.
- Other PFT tests may be beneficial in specific cases.

### Pulse Oximetry and ABG

- Pulse ox easy to perform. ABG needed if hypoxic, depressed level consciousness, acute exacerbation, assessment of hypercapnia.

### Imaging Studies

- **CXR:** poor sensitivity for detecting COPD. Useful to exclude alternative Dx or when change in Sx suggests complication.
- **CT:** not needed for routine Dx. Usually performed to evaluate complication of COPD, alternative Dx considered, or prior to lung volume reduction surgery.

### Differential Diagnosis

See table 1.

From the *Global Strategy for the Diagnosis, Management and Prevention of COPD*, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2015. Available from: http://www.goldcopd.org/.

## Staging of COPD

**Assess Symptoms:** validated questionnaires such as COPD Assessment Test (CAT) [CAT score < 10 = less symptoms] http://www.catestonline.org/ or Clinical COPD Questionnaire (CCQ) http://www.ccq.nl/

Modified British Medical Research Council (mMRC) only provides assessment of breathlessness [mMRC score < 1 = less symptoms]

**Assess Degree of Airflow Limitation (spirometry)** post-bronchodilator $FEV_1/FVC < 0.70$. Note: may be poor correlation between $FEV_1$ and symptoms. Perform annually.

| GOLD | Desc | $FEV_1$ (% predicted) |
|---|---|---|
| 1 | Mild | $FEV_1 \geq 80\%$ p. |
| 2 | Mod | $50\% \leq FEV_1 < 80\%$ p. |
| 3 | Severe | $30\% \leq FEV_1 < 50\%$ p. |
| 4 | Very Severe | $FEV_1 < 30\%$ p |

**Assess Risk of Exacerbation** Best predictor of frequent (≥ 2) exacerbation (high risk) is history of previous exacerbation.

**Assess Comorbidities:** CV, osteoporosis, depression / anxiety, skeletal muscle dysfunction, metabolic syndrome, lung CA, others. May affect morbidity and mortality.

**Gold system** combines symptoms, history of exacerbations and $FEV_1$ to guide therapy.

| Group | Risk (exac) | Sx | Gold ($FEV_1$) |
|---|---|---|---|
| A | Low | Less | 1 - 2 |
| B | Low | More | 1 - 2 |
| C | High | Less | 3 - 4 |
| D | High | More | 3 - 4 |

## Treatment for Stable COPD

See table 2.

**Goals:**

- **Reduce Symptoms:** relieve symptoms, improve exercise tolerance, improve health and quality of life (QOL).
- **Reduce Risk:** prevent progression, prevent and treat exacerbations, reduce mortality, while minimizing SE treatment.

### Non-Specific

- **Smoking cessation**: essential! Minimize other pollutant / occupational exposure.
- **Regular exercise:** benefit all; may mitigate lung function decline.

### Pharmacological Agents

See table 3. Choice of medication depends on severity of symptoms and response. Combining classes may improve efficacy and decrease risk of side effects as opposed to increasing dose of single agent.

**Bronchodilators**

- Inhaled is preferred route. Hand held (metered dose MDI, soft mist SMI, dry powder DPI) and nebulized. Proper technique important.
- Used to reduce symptoms; Long acting forms reduce frequency and severity of exacerbations, improve health status, QOL, and exercise tolerance. Does not alter disease processes.
- Two main classes: beta 2 agonist (BA) and anti-cholinergic (muscarinic antagonists (MA)).
- Two main duration of actions: short and long acting (SA, LA).
- Commonly referred to as SABA, SAMA, LABA, LAMA.
- LA preferred for maintenance.
- SA preferred as rescue.

## Treatment of Stable COPD, Continued

**Bronchodilators -cont.**

- Oral theophylline not preferred due to toxicity.
- SE: May be increased risk arrhythmia with initiating LABA in pt. with history of arrhythmia or HF.
- 2 large studies did not confirm CV risk from LAMA or from SMI (Respimat).

**Dual Therapy**

LAMA / LABA appears effective.

**Combined Therapy**

- ICS / LABA:
  - Patients with $FEV_1 < 60\%$ predicted, frequent exacerbations, or asthmatic component benefit from regular treatment with ICS used in combination with LABA (ISC NOT for mono-therapy).
  - ICS associated with increased risk pneumonia.

**Triple Therapy**

- ICS/LABA + LAMA appears to provide additional benefits, (not extensively studied).

**Phospodiesterase-4 inhibitors**

- Adjunctive Roflumilast reduces exacerbations in Gold 3 or 4 patients with chronic bronchitis and with history of frequent exacerbations.

### Vaccination

- **Influenza:** annual.
- **Pneumococcus:** PCV13 (1 dose) and PPSV23: once as adult, and repeated at age 65: see CDC guidelines on timing.

## Treatment of Stable COPD, Continued

### Generally Not Recommended

- Oral Corticosteroids: not for long term treatment.
- Alpha-1 Antitrypsin: use only if deficiency present.
- Antibiotics: debate over benefit of daily prophylaxis in patient with severe, frequent exaccerbation: risk vs. benefit.
- Mucolytic Agents: overall benefit small, thiol derivatives may help if viscous sputum.
- Antitussives.

### Other Treatments

- **Pulmonary Rehabilitation**
  - Improves exercise capacity, QOL and survival; ↓'s dyspnea, hospitalizations and mortality.
- **Oxygen Therapy**
  - Improves mortality and QOL, if significant hypoxia at rest.
  - $PaO_2 <$ 55mmHg or $SaO_2 \leq$ 88%, with or without hypercapnia confirmed twice over 3 week period; or
  - $PaO_2$: 55 - 60 mmHg or $SaO_2$ of 88%, with evidence pulmonary HTN, HF, or polycythemia.
- **Non-Invasive Ventilatory Support**
  - Subset with pronounced daytime hypercapnia.
  - May improve survival, but not QOL.
- **Surgical Treatment**
  - Lung volume reduction in select patients with predominant upper lobe emphysema and low exercise capacity.
- **Palliative, end-of-life and hospice care**
  - Need frank discussion of patient wishes.
  - Narcotics decrease dyspnea.

## Management of Exacerbation: Assessment

AECOPD may be mild to severe (leading to ↓ lung function, respiratory failure and death).

Respiratory infections (viral or bacterial) appear to be most common cause (70%).

### Assessment

- **H&P:**
  - History: Sx change from baseline, constitutional Sx, chest pain or pressure, edema. Evaluate for comorbid conditions, alternative diagnosis, smoking, and medication compliance / use.
  - Physical: wheezing, cyanosis, tachypnea, accessory muscle use, change in mental status.
- **Pulse Oximetry**
- **ABG -** concern respiratory acidosis or need for ventilatory support. $PaO_2$ < 60 mmHg with or without $PaCO_2$ > 50 mmHg indicates respiratory failure.
- **CXR** useful in excluding alternative diagnoses (e.g. HF, pneumothorax or pneumonia).
- **ECG** may aid in diagnosis of coexisting CV problems.
- **Lab** CBC, chemistry, other based on Hx (BNP, troponins, D-dimer)
- Spirometry is NOT recommended during an exacerbation due to difficulty performing test.
- Sputum gram stain and culture NOT routinely collected. May be helpful if highly suspicious of bacterial infection (especially Pseudomonas) or poor response to initial ABx.
- Viral testing (culture, serology, or PCR) may be beneficial, especially for influenza.

## Management of Exacerbation: Treatment

**Oxygen:** titrated to target saturation of 88 - 92% or $PaO_2$ of 60 - 70 mmHg. Concern for hypercapnia.

**Bronchodilators- acute:** SAMA (+/- SABA). May be hand-held for more mild exacerbations. If prefer nebulized, use air-driven or limit $O_2$-driven duration.

**Systemic Corticosteroids:** shorten recovery time, improve lung function ($FEV_1$) and hypoxemia; reduce early relapse. 40mg prednisone PO x 5d for outpatient management (GOLD). Higher dose and longer duration (14 d) may be required for hospitalized pt.

**Antibiotics:** give to patients with moderate to severe illness with ↑sputum purulence and ↑ dyspnea and / or ↑ sputum volume; H. Flu, M. catarrhalis, and Strep. pneumoniae likely pathogens. Pseudomonas can occur in pt. with frequent Abx (4x/yr), hospitalization within 90d, previous Pseudomonas, systemic corticosteroid use, or severe COPD. Consider long-term macrolide if ≥ 1 severe AECOPD/yr despite optimal maintenance therapy.

**Antivirals** for influenza

**Adjunct therapy:**

- Anti-smoking counseling.
- Case management, written action plan and educational reinforcement (medication techniques, written action plan, $O_2$ therapy, recognizing complications, minimizing dyspnea, end-of-life decisions).
- Manage comorbidities.
- Nutritional support (protein calorie malnutrition in severe COPD).
- Thrombosis prophylaxis for hospitalized pt.
- Pulmonary rehab within 4 weeks of AECOPD may prevent COPD rehospitalization.

## Management of Exacerbation: Hospitalization

### Indications for Hospitalization

- Marked ↑ intensity symptoms or change mental status.
- Severe underlying COPD.
- Failure to respond to initial medical management.
- Acute or acute-on-chronic respiratory acidosis.
- Serious comorbidities.
- Frequent exacerbations.
- Older age.
- Inability to eat or sleep.
- Insufficient home support.

### Mechanical Ventilation

- **Noninvasive Positive Pressure Ventilation (NPPV)**
  - Indications: severe exacerbation not requiring emergent intubation and without contraindications (cardiac or respiratory arrest, inability to clear secretions, high aspiration risk, impaired consciousness).
  - Nasal mask, face mask, nasal plugs, helmet.
  - Common modes: assist control, pressure support, CPAP, BPAP, proportional assist ventilation.
- **Invasive Ventilation**
  - Indications: severe respiratory distress, failure to oxygenate or ventilate after failed or contraindication to non-invasive ventilation.
  - BAP-65 (elevated **B**UN, **A**ltered mental status, **P**ulse > 109, age > **65)** predicts risk of intubation.
  - Common modes: assist control, synchronized intermittent mandatory ventilation (with or without pressure support).

## Common Comorbidities and Predictors of Poor Outcome

### Common Comorbidities

COPD coexists with other diseases, often through shared risk factors (smoking) or systemic inflammation.

- **Cardiovascular disease:** IHD, stroke, PVD, HF, HTN, AFib. Cardioselective beta-blockers are not contraindicated and benefit outweighs risk.
- **Lung CA:** most frequent cause of death in patients with mild COPD.
- **Serious infections:** pneumonia and sepsis.
- **Other:** DM, GERD, malnutrition, osteoporosis, renal insufficiency, anxiety / depression, impaired cognitive function can contribute to overall poor health status and prognosis and can be impacted by disease process and treatments.

### Predictors of Poor Outcome

**BODE Index:** Predicts risk of death and hospitalization

- **B**MI: ↓ BMI →↑ mortality
- **O**bstruction ($FEV_1$)
- **D**yspnea: mMRC
- **E**xercise: 6 min walk distance

**Other factors:**

- Histamine-induced airway hyper-responsiveness
- Co-existing cardiac disease or other significant comorbidities including lung CA
- Chronic hypercapnia
- Older age
- Pseudomonas aeruginosa in sputum
- Hospitalization for exacerbation (50% 5 yr mortality rate)

Prevention of Acute Exacerbations of COPD: American College of Chest Physicians and Canadian Thoracic Society Guidelines. Chest. 2015; 147(4):894-942.

**Table 1: Differential Diagnosis of COPD**

| Diagnosis | Age Onset | Signs and Symptoms | Other |
|---|---|---|---|
| **COPD** | Mid-life | Slowly progress: Sx initially may be AM, but progresses to anytime | Tobacco or other exposure<br>Persistent airflow limitation |
| **Asthma** | Child | Vary day to day; Sx worse night and early AM | Allergies, family history<br>Variable obstructive airflow limitation<br>May coexist with COPD |
| **CHF** | Mid-life | Baseline symptoms and exacerbations | CXR: pulmonary edema<br>Restrictive pattern of airflow limitation |
| **Chronic Bronchitis** | Mid-life | Chronic cough x 3 mo in 2 successive years | Tobacco exposure<br>Do not have persistent airflow limitation |
| **Bronchiectasis** | Mid-life | Large volume purulent sputum | Associated with chronic or recurrent infection<br>Clubbing of digits<br>CT: thick bronchial wall, bronchial dilatation |
| **Central Airway Stenosis** | Mid-life | Slowly progressive dyspnea | Caused by benign or malignant processes<br>Monophonic wheeze or stridor may be present<br>Bronchoscopy gold standard for Dx |
| **TB** | Any age | Constitutional Sx | Calcified granulomata<br>Microbiology to confirm |
| **Bronchiolitis obliterans** | Mid-life | Dry cough, SOB, fatigue, wheezing | May have history of: rheumatoid lung or inflammatory bowel disease, acute fume exposure, lung or bone marrow transplantation<br>Non-smoker<br>CT: mosaic ground glass, bronchial dilatation |
| **Diffuse pan-bronchiolitis** | Asian male | Most have chronic sinusitis | Non-smoker<br>HRCT: diffuse small centrilobular nodular and linear opacities |
| **Lung Cancer** | Mid-life | Cough, hemoptysis; may have dyspnea, chest pain | Consider in current or former smoker with new onset cough or hemoptysis |
| **Sarcoidosis** | Young adults | Cough, dyspnea, chest pain, fever, weight loss | Diffuse interstitial lung disease, multisystem granulomas, bilateral hilar adenopathy |
| **Other causes chronic cough** | Medications (ACE), chronic sinusitis or rhinitis, GERD, chronic aspiration, other | | |

**Table 2: Treatment Strategies Stable COPD (GOLD)**

| Group | Risk* & Symptoms^ | Spirometry Classification | Non Pharmacological Treatment | First Choice† | Alternative Choice† |
|---|---|---|---|---|---|
| A | Low Risk / Less Symptoms | Gold 1-2 | •Smoking cessation / exposure avoidance<br>•Physical activity<br>•Vaccination | SABA prn or SAMA prn | LABA or LAMA or SABA + SAMA |
| B | Low Risk / More Symptoms | Gold 1-2 | •Smoking cessation / exposure avoidance<br>•Physical activity<br>•Vaccination<br>•Pulmonary Rehabilitation<br>•Oxygen Therapy (if hypoxic) | LABA or LAMA | LABA + LAMA |
| C | High Risk / Less Symptoms | Gold 3-4 | | ICS + LABA or LAMA | LABA + LAMA, or<br>LABA + PDE-4 inhibitor, or<br>LAMA + PDE-4 inhibitor |
| D | High Risk / More Symptoms | Gold 3-4 | | ICS + LABA and/or LAMA | ICS + LABA + LAMA, or<br>ICS + LABA + PDE-4 inhibitor, or<br>LABA + LAMA, or<br>LAMA + PDE-4 inhibitor<br>ICS + LABA and/or LAMA + low dose theophylline at HS |

*Risk of exacerbation: Low ≤1 / yr; High ≥2/yr ^Symptoms (measured by CAT): Less: score < 10; More: score ≥10

**†SABA and/or SAMA can be used PRN in any group for relief of acute symptoms.**

**No medication currently available alters the natural history of COPD.**

| Table 3* Common Medications | | | | | |
|---|---|---|---|---|---|
| | **Generic** | **Brand** | **Form** | **Frequency** | **Class SE** |
| **SABA** | | | | | Resting sinus tachycardia, ?cardiac arrhythmia, somatic tremor, hypokalemia |
| | Albuterol | Proair, Proventil, Ventolin | Neb, MDI | Q4 – 6 hr PRN | |
| | Levalbuterol | Xopenex | Neb, MDI | Q6 – 8 hr PRN | |
| **SAMA** | | | | | Dryness of mouth, ?prostate symptoms, acute glaucoma (direct contact with eye – neb tx), narrow angle glaucoma worsening |
| | Ipratropium | Atrovent | Neb, MDI | QID PRN | |
| **SAMA/SABA** | | | | | |
| | Ipratropium/ albuterol | Combivent, Duoneb | Neb, SMI, MDI | Q4-6 hr PRN | |
| **LABA** | | | | | As for SABA |
| | Arformoterol | Brovana | Neb | BID | |
| | Formoterol | Perforomist (neb) Foradil (DPI) | Neb, DPI, MDI | BID | |
| | Indacaterol | Arcapta | DPI | QD | |
| | Olodaterol | Striverdi | SMI | QD | |
| | Salmeterol | Seravent | DPI, MDI | BID | |
| | Vilanterol | (only available in combination with ICS or LAMA) | | | |
| **LAMA** | | | | | As for SAMA |
| | Aclidinium | Tudorza | DPI | BID | |
| | Tiotropium | Spiriva | DPI, SMI | QD | |
| | Umeclidinium | (only available in combination with LABA) | | | |
| **LAMA / LABA** | | | | | |
| | Umeclidinium/Vilanterol | Anoro | DPI | QD | |
| **ICS / LABA** | | | | | |
| | Budesonide/ Formoterol | Symbicort | MDI, DPI | BID | |
| | Fluticasone/ Salmeterol | Advair | DPI, MDI | BID | |
| | Fluticasone/ Vilanterol | Breo Ellipta | DPI | QD | |
| | Monetasone/ Formoterol | Dulera | MDI | BID | |
| **ISC (NOT for use without LABA)** | | | | | Increased risk pneumonia, thrush, hoarse voice, skin bruising, ?decrease bone density |
| | Beclamethasone | QVar | Neb, MDI, DPI | BID | |
| | Budesonide | Pulmicort | Neb, DPI | BID | |
| | Fluticasone | Flovent | DPI, MDI | BID | |
| | Mometasone | Asmanex | DPI, MDI | QD - BID | |
| **PDE4 Inhibitor** | Indication: moderate to severe COPD with chronic bronchitis and ≥ 1 AECOPD previous year (Chest 2015) | | | | Nausea, ↓ appetite, abdominal pain, diarrhea, sleep disturbance, headache |
| | Roflumilast | Daliresp | PO | QD | |
| **Methylxanthine** | Indication: slow-release form may be considered add on to maximum oral maintenance therapy to prevent frequent AECOPD (Chest, 2015) | | | | Narrow therapeutic window. GI, CNS stimulation, arrhythmias, seizures |
| | Theophylline | Theo-24, Theochron | PO | QD - BID | |
| **Mucolytic** | Indication: moderate to severe COPD with ≥ 2 AECOPD previous 2 years (Chest, 2015) | | | | |
| | N-acetylecysteine | | PO | | |
| ***Please review full prescribing information** | | | | | |

**Asthma COPD Overlap Syndrome (ACOS)**

Outcomes are often worse than for asthma or COPD alone.
**Characterized** by persistent airflow limitation with features associated with both asthma and COPD.
- Historical features: Age of onset, pattern of respiratory symptoms, exposure history, family history, time course, exacerbations.
- Diagnostic features: CXR, sputum analysis; spirometry will show fixed airflow obstruction.

**Treatment** backbone as for COPD: avoidance of triggers (tobacco smoke), regular exercise or pulmonary rehabilitation, vaccinations, treatment of comorbidities.
Medication therapy should include ICS – as proven effect in preventing morbidity and mortality in asthma in combination with LABA (neither as monotherapy). Dosages and other medical therapy depend on severity.
Referral to specialist, especially with diagnostic uncertainty, due to worse outcomes.

# Management AECOPD

Increased symptoms requiring change in medications (dyspnea, sputum volume, and/or sputum purulence)
- Assess severity of exacerbation and determine site of care
- Consider etiology and comorbidities (pneumonia, HF, PE, other)

Once stable, reinforce education including mechanisms of disease, triggers (including avoidance of tobacco smoke), medication (dose, schedule, technique), signs of exacerbation, advance directives.

**Mild Exacerbation: (outpatient)**
- Symptomatic bronchodilator therapy: increase dose and/ or frequency, may combine SABA with SAMA, proper technique
- No systemic corticosteroids
- No antibiotics
- Re-evaluate

**Antibiotic** (depends on local resistance patterns and risk^)

Without risk factors*
- Azithromycin, 2nd or 3rd generation cephalosporin, doxycycline, trimethoprim/sulfamethoxazole

With risk factors*
- Amoxicillin/clavulanic acid, levofloxacin

At risk for Pseudomonas**
- Levofloxacin, ciprofloxacin

^Consider long-term macrolide if ≥ 1 severe AECOPD/yr despite optimal maintenance therapy; resistance is concern.

*Risk Factors: age > 65, $FEV_1$ < 50% predicted, ≥3 exac/yr, comorbidities

**Risk for Pseudomonas: recent hospitalization, frequent ABx (4/yr), severe exacerbations, isolation of P. aeruginosa during previous hospitalization or colonization

**Moderate to Severe Exacerbation:**
- Assess severity of symptoms, pulse ox. (ABG if indicated), CXR, other testing as indicated
- Determine site of care: outpatient with close follow-up, hospital or ICU

**Outpatient**
- Bronchodilators – increase dose and/or frequency, may combine SABA with SAMA, use spacers with MDIs or air-driven nebulizers (pt. preference)
- Oral corticosteroids (short course)
- ABX if increased mucopurulent sputum, sputum volume and dyspnea or other signs of bacterial infection
- Evaluate for home oxygen
- Closely monitor for worsening condition

**Differential Diagnosis**
- Pneumonia
- Heart Failure
- Pneumothorax
- Pleural effusion
- Pulmonary embolism
- Cardiac arrhythmia

**Inpatient**
- Bronchodilators – increase dose and/or frequency, combine SABA and SAMA, use spacers with MDIs or air-driven nebulizers (pt. preference)
- Supplemental oxygen: monitor ABG
- Oral or IV corticosteroids
- ABX if increased mucopurulent sputum / signs of bacterial infection or require mechanical ventilation. Consider risk of Pseudomonas and resistant organism (if recent ABX use)
- Consider non-invasive mechanical ventilation
- Support nutrition
- DVT prophylaxis
- Closely monitor
- ICU may be required if inadequate oxygenation, ventilation, hemodynamic instability, mental status change

**Discharge Criteria**
- Able to use long acting bronchodilators; use SABA no more than q4 hr
- If ambulatory prior to admission, able to walk across room
- Able to eat and sleep without frequent interruptions due to dyspnea
- Clinically stable 12 – 24 hr
- Patient and/or care givers fully understands correct medication use, including any new medications and understand warning signs of worsening symptoms
- Follow-up and home care arrangements completed as necessary (home health, home $O_2$, meals, medications, etc.)
- Co-morbidities stabilized
- Patient, family and physician confident patient can manage successfully at home

**Follow-up Care after Exacerbation**
- Consider repeat spirometry, once stable, as significant decline in lung function can occur after exacerbation.
- Reassess home environment, tobacco smoke exposure, inhaler technique and understanding of treatment.
- Consider need for oxygen and pulmonary rehabilitation, if not already done.
- Consider referral to COPD specialist for: concurrent cardiac disease or asthma, suspicion of alpha-1-antitypsin deficiency, poor response to optimal therapy, severe or frequent exacerbations.