69 yo M with 50p-y tobacco use, quit 10 yrs ago, presents with a new diagnosis of COPD. He has daily symptoms and is currently using his prn albuterol 3-4 times a day. What inhaler treatment do you NOT recommend?

1. LABA (e.g. salmeterol)
2. LAMA (e.g. tiotropium)
3. LABA-ICS (e.g. budesonide-formoterol)
4. LAMA-LABA (e.g. indacaterol-glycopyrronium)
5. ICS (e.g. mometasone)
COPD Therapy: LABA vs. LAMA

Hazard ratio, 0.83 (95% CI, 0.77–0.90)
P<0.001 by log-rank test

No. at Risk
Tiotropium 3707 3369 3136 2955 2787 2647 2561 2455 2343 2242 2169 2107 1869
Salmeterol 3669 3328 3028 2802 2605 2457 2351 2251 2137 2050 1982 1915 1657

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LAMA vs. LABA-ICS: no difference

<table>
<thead>
<tr>
<th>Variable</th>
<th>SFC 50/500 (n = 658)</th>
<th>Tiotropium (n = 665)</th>
<th>Rate Ratio*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exacerbations (mean no./yr)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCU</td>
<td>1.28</td>
<td>1.32</td>
<td>0.97</td>
<td>0.84 to 1.12</td>
</tr>
<tr>
<td>Requiring oral corticosteroids</td>
<td>0.69</td>
<td>0.85</td>
<td>0.81</td>
<td>0.67 to 0.99</td>
</tr>
<tr>
<td>Requiring antibiotics</td>
<td>0.97</td>
<td>0.82</td>
<td>1.19</td>
<td>1.02 to 1.38</td>
</tr>
</tbody>
</table>
LAMA vs. LABA-ICS: no difference

More short of breath

Less short of breath

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Wedzicha et al. AJRCCM 2007
COPD Therapy: Do ICS help?

A Moderate or Severe COPD Exacerbation

Hazard ratio, 1.06 (95% CI, 0.94–1.19)
P=0.35 by Wald’s chi-square test

No. at Risk
IGC continuation 1243 1059 927 827 763 694 646 615 581 14
IGC withdrawal 1242 1090 965 825 740 688 646 607 570 19
COPD Therapy: Do ICS help?

A Moderate or Severe COPD Exacerbation

Hazard ratio, 1.0
P = 0.35 by Wald's chi-square test

C Severe COPD Exacerbation

Hazard ratio, 1.20 (95% CI, 0.98–1.48)
P = 0.08 by Wald’s chi-square test

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COPD Therapy: LABA-LAMA vs. LABA-ICS

**B Time to First Exacerbation**

- **Salmeterol–fluticasone group**
- **Indacaterol–glycopyrronium group**

<table>
<thead>
<tr>
<th>Exacerbation Type</th>
<th>Patients at Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>1675</td>
</tr>
<tr>
<td></td>
<td>1679</td>
</tr>
<tr>
<td>Moderate or Severe</td>
<td>1675</td>
</tr>
<tr>
<td></td>
<td>1679</td>
</tr>
<tr>
<td>Severe</td>
<td>1675</td>
</tr>
<tr>
<td></td>
<td>1679</td>
</tr>
</tbody>
</table>

- Hazard ratio, Any: 0.84 (95% CI, 0.78–0.91) P<0.001
- Hazard ratio, Moderate or Severe: 0.78 (95% CI, 0.70–0.86) P<0.001
- Hazard ratio, Severe: 0.81 (95% CI, 0.66–1.00) P=0.046

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69 yo M with 50p-y tobacco use, quit 10 yrs ago, presents with a new diagnosis of COPD. He has daily symptoms and is currently using his prn albuterol 3-4 times a day. What inhaler treatment do you NOT recommend?

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2. LAMA (e.g. tiotropium)
3. LABA-ICS (e.g. budesonide-formoterol)
4. LAMA-LABA (e.g. indacaterol-glycopyrronium)
5. ICS (e.g. mometasone)
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5. ICS (e.g. mometasone)
68 yo W smoking 1ppd x 50 years was recently hospitalized for COPD exacerbation and pneumonia. You recommend which of the following to reduce her mortality risk?

1. LAMA alone (e.g. tiotropium)
2. Tobacco Cessation
3. LABA-LAMA combination (e.g. indacaterol-glycopyrronium)
4. LABA-ICS combination (e.g. salmeterol-fluticasone)
5. (Lung Cancer Screening w/ LDCT)
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5. (Lung Cancer Screening w/ LDCT)
68 yo W smoking 1ppd x 50 years was recently hospitalized for COPD exacerbation and pneumonia. You recommend which of the following to reduce her likelihood of another COPD exacerbation?

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2. Tobacco Cessation
3. LABA-LAMA combination
4. LABA-ICS combination
68 yo W smoking 1ppd x 50 years was recently hospitalized for COPD exacerbation and pneumonia. You recommend which of the following to reduce her likelihood of another COPD exacerbation?

1. LAMA alone
2. Tobacco Cessation
3. LABA-LAMA combination
4. LABA-ICS combination
COPD and oxygen: LOTT trial

• Stable COPD
• SpO₂ at rest, 89 to 93%
• OR during the 6-minute walk test, SpO₂ ≥80% for ≥5 minutes and <90% for ≥10 seconds
• Oxygen 24/7 if resting SpO₂ 89 - 93%
• Oxygen with sleep and exertion if only desat with exercise

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COPD Therapy: Supplemental Oxygen?

A Primary Outcome (Death or First Hospitalization) or First Hospitalization

Death or first hospitalization, $P=0.52$ by log-rank test
First hospitalization, $P=0.37$ by log-rank test

No. at Risk
No supplemental oxygen 370 304 232 181 139 102 76 59 43 29 21 7 1
Supplemental oxygen 368 314 243 198 158 125 86 61 44 24 13 6 1

COPD Therapy: Supplemental Oxygen?

A Primary Outcome (Death or First Hospitalization) or First Hospitalization

B Death

No. at Risk
No supplemental oxygen
Supplemental oxygen

P = 0.53 by log-rank test

Months since Randomization

Cumulative Probability

## Oxygen Related Adverse Events

<table>
<thead>
<tr>
<th>Expected, related events</th>
<th>No. of reports</th>
<th>Reports per 100 person-years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fires related to oxygen use</td>
<td>2</td>
<td>0.08</td>
</tr>
<tr>
<td>Burn from smoking around oxygen equipment</td>
<td>3</td>
<td>0.12</td>
</tr>
<tr>
<td>Burn from using oxygen equipment around open flame</td>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>Burn from liquid oxygen frost</td>
<td>4</td>
<td>0.16</td>
</tr>
<tr>
<td>Nosebleed</td>
<td>9</td>
<td>0.35</td>
</tr>
<tr>
<td>Tripping/falling over oxygen equipment</td>
<td>23*</td>
<td>0.90</td>
</tr>
</tbody>
</table>

| Total no. of expected, related events                                                   | 42             | 1.64                         |

| Total no. of patients ever using supplemental oxygen during follow-up                   | 490            |                              |
| No. (%) reporting at least 1 related adverse event                                     | 42 (8.6%)      |                              |

*Two of these events involved hospitalization: overnight hospitalization with humerus fracture and 6-day hospitalization with rib fractures.
Oxygen Related Adverse Events

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74 yo W w/ hx COPD, still smoking, comes in for routine follow up. She is on LAMA and has not been hospitalized for COPD in the past year. On exam, her SpO2 is 95%. Is she hypoxemic at rest?

1. Yes
2. No
3. I don’t know
74 yo W w/ hx COPD, still smoking, comes in for routine follow up. She is on LAMA and has not been hospitalized for COPD in the past year. On exam, her SpO2 is 95%. Is she hypoxemic at rest?

1. Yes
2. No
3. I don’t know – active tobacco use causes increased COHb, which cannot be distinguished from Oxy-hgb by SpO2 – need an ABG with co-ox.
74 yo W, w/ hx COPD, comes in for routine follow up. She is on a LAMA and has been hospitalized for COPD twice in the past year. On exam, her resting SpO2 is 90%, but she drops to 85% with exertion. What do you recommend to reduce her COPD related hospitalizations?

1. Supplemental oxygen with exertion and at night
2. Add LABA to LAMA controller regimen
3. GERD therapy
4. Chronic low dose prednisone therapy
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Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

The National Lung Screening Trial Research Team*

ABSTRACT

BACKGROUND
The aggressive and heterogeneous nature of lung cancer has thwarted efforts to reduce mortality from this cancer through the use of screening. The advent of low-dose helical computed tomography (CT) altered the landscape of lung-cancer screening, with studies indicating that low-dose CT detects many tumors at early stages. The National Lung Screening Trial (NLST) was conducted to determine whether screening with low-dose CT could reduce mortality from lung cancer.

METHODS
From August 2002 through April 2004, we enrolled 53,454 persons at high risk for lung cancer at 33 U.S. medical centers. Participants were randomly assigned to undergo three annual screenings with either low-dose CT (26,722 participants) or single-view posteroanterior chest radiography (26,732). Data were collected on cases of lung cancer and deaths from lung cancer that occurred through December 31, 2009.

The members of the writing team (who are listed in the Appendix) assume responsibility for the integrity of the article. Address reprint requests to Dr. Christine D. Berg at the Early Detection Research Group, Division of Cancer Prevention, National Cancer Institute, 6130 Executive Blvd., Suite 3112, Bethesda, MD 20892-7346, or at bergec@mail.nih.gov.

*Complete list of members of the National Lung Screening Trial research team is provided in the Supplementary Appendix, available at NEJM.org.

This article (10.1056/NEJMoa1102873) was published on June 29, 2011, at NEJM.org.
A Lung Cancer

B Death from Lung Cancer

Cumulative No. of Lung Cancers

Cumulative No. of Lung-Cancer Deaths

Years since Randomization

Chest radiography

Low-dose CT

USPSTF Recommends Lung Cancer Screening

Lung Cancer: Screening
Release Date: December 2013

Summary of Recommendation and Evidence

<table>
<thead>
<tr>
<th>Population</th>
<th>Recommendation</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults Aged 55-80, with a History of Smoking</td>
<td>The USPSTF recommends annual screening for lung cancer with low-dose computed tomography (LDCT) in adults aged 55 to 80 years who have a 30 pack-year smoking history and currently smoke or have quit within the past 15 years. Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.</td>
<td>B</td>
</tr>
</tbody>
</table>

http://www.uspreventiveservicestaskforce.org/uspstf/uspslung.htm
# USPSTF Grade recommendation

## Breast Cancer Screening

| Women, Age 50-74 Years | The USPSTF recommends biennial screening mammography for women 50-74 years. | B |

## Colorectal Cancer Screening

| Adults, beginning at age 50 years and continuing until age 75 | The USPSTF recommends screening for colorectal cancer using fecal occult blood testing, sigmoidoscopy, or colonoscopy in adults, beginning at age 50 years and continuing until age 75 years. The balance of benefit of screening outweighs harms. | A |

## Cervical Cancer Screening

| Women 21 to 65 (Pap Smear) or 30-65 (in combo with HPV testing) | The USPSTF recommends screening for cervical cancer in women age 21 to 65 years with cytology (Pap smear) every 3 years or, for women age 30 to 65 years who want to lengthen the screening interval, screening with a combination of cytology and human papillomavirus (HPV) testing every 5 years. See the Clinical Considerations for discussion of cytology method, HPV testing, and screening interval. | A |

## Prostate Cancer Screening

| Men, Screening with PSA | The U.S. Preventive Services Task Force (USPSTF) recommends against prostate-specific antigen (PSA)-based screening for prostate cancer. | D |

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Who pays?  CMS  
Center for Medicare and Medicaid Services

• Age 55-77
• 30 pack-years of smoking history
• Currently smoking or quit within 15 years
• Asymptomatic (no s/s lung cancer)
• 1:1 dedicated Shared Decision-Making Visit

ShouldIscreeen.com

Lung cancer screening decision aid

Lung Cancer Screening
SHOULD YOU DO IT?

Given your age and smoking history, you are eligible for screening according to the US Preventive Services Task Force criteria.

The chance of you developing lung cancer in the next 6 years is 24%. Talk to your doctor about the option to screen or not to screen as s/he will understand your situation best.

Compared to other people like you, there will be 49 fewer deaths out of 1000 in the next 6 years if you get screened.

ShouldIScreen.com

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JMRI Res Protoc 2014;
57 yo M active smoker w/ hx 35p-y tobacco use has had scant hemoptysis for a few months and presents for evaluation.

Which ONE option is appropriate as part of the evaluation and treatment of this patient?

• Lung cancer screening with Low Dose Chest CT
• Spirometry
• Tobacco Cessation counseling
• Positron Emission Tomography-CT (PET-CT)
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• Tobacco Cessation counseling
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38 yo M w/ asthma, poorly controlled, daily symptoms, using daily inhaled steroid and prn albuterol 3-5 times a day w/ frequent early am awakenings due to wheezing. Which do you recommend next?

1. Add LAMA (e.g. tiotropium)
2. Add ICS-LABA combination (e.g. budesonide-formoterol)
3. Add omeprazole
4. Start daily prednisone for a month and then wean as tolerated
5. Azithromycin x 5 days
Does LABA therapy increase mortality in asthma?

The Salmeterol Multicenter Asthma Research Trial (SMART): A Comparison of Usual Pharmacotherapy for Asthma or Usual Pharmacotherapy Plus Salmeterol; Chest 2006
Increased mortality in asthma with LABA?

The Salmeterol Multicenter Asthma Research Trial (SMART); Chest 2006
Does LABA-ICS increase mortality compared with ICS alone in asthma?

- 26 week prospective, double-blind, multicenter RCT
- ICS vs. LABA-ICS
- Age 12 and older; 1-4 exacerbations in prior year
- primary end point: first serious asthma-related event
  - (a composite of adjudicated death, intubation, and hospitalization)
  - as assessed in a time-to-event analysis.
- 11,693 patients randomized


A  Time to First Serious Asthma-Related Event

Hazard ratio, 1.07 (95% CI, 0.70–1.65)

Days since Randomization

Cumulative Percentage of Patients

No. at Risk

<table>
<thead>
<tr>
<th></th>
<th>Budesonide–formoterol</th>
<th>Budesonide</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5846</td>
<td>5847</td>
</tr>
<tr>
<td>30</td>
<td>5814</td>
<td>5799</td>
</tr>
<tr>
<td>60</td>
<td>5783</td>
<td>5773</td>
</tr>
<tr>
<td>90</td>
<td>5753</td>
<td>5745</td>
</tr>
<tr>
<td>120</td>
<td>5737</td>
<td>5720</td>
</tr>
<tr>
<td>150</td>
<td>5722</td>
<td>5701</td>
</tr>
<tr>
<td>180</td>
<td>5704</td>
<td>5676</td>
</tr>
<tr>
<td>210</td>
<td>44</td>
<td>33</td>
</tr>
</tbody>
</table>

A Time to First Serious Asthma-Related Event

B Time to First Asthma Exacerbation

Hazard ratio, 0.84 (95% CI, 0.74–0.94)

No. at Risk
Budesonide–formoterol 5846 5589 5406 5257 5117 5011 4863 38
Budesonide 5847 5532 5321 5116 4972 4848 4715 27
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45 yo W w/ hx asthma on ICS-LABA developed rhinorrhea, cough and wheezing x 3 days. She is missing work and is unable to sleep because of her symptoms. Her husband, and daughter also had similar symptoms a week earlier that have now resolved. What would you recommend?

1. Add LAMA (e.g. tiotropium) to her regimen
2. Azithromycin 500mg po qday x 3 days
3. Doxycycline 100mg po BID x 7 days
4. Levofloxacin 750mg po qday x 7 days
5. Add PO prednisone and increase prn albuterol
6. Oseltamivir (tamiflu) 75mg po BID x 5 days
Azithromycin for Acute Exacerbations of Asthma

4582 Patients assessed for eligibility

4383 Excluded
2044 Antibiotic treatment
660 Other
417 Underlying health condition
315 Discharged
259 Age
220 >48 Hours after presentation
191 Declined to participate
130 Unknown reason
110 No requirement for steroid treatment
30 Not English speaking
7 No asthma exacerbation

199 Randomized

97 Randomized to receive azithromycin
97 Received azithromycin as randomized

87 Symptom diary scores analyzed
96 Acute and Mini AQLQ scores analyzed
97 Pulmonary functions analyzed

102 Randomized to receive placebo
102 Received placebo as randomized

89 Symptom diary scores analyzed
100 Acute and Mini AQLQ scores analyzed
101 Pulmonary functions analyzed

Azithromycin for Acute Exacerbations of Asthma The AZALEA Randomized Clinical Trial
Azithromycin for Acute Exacerbations of Asthma

A. Acute AQLQ score

Mean Diary Score

Mean Acute AQLQ Overall Score

Day

Active
Placebo
Azithromycin for Acute Exacerbations of Asthma

A

Acute AQLQ score

B

Mini AQLQ score

Mean AQLQ Overall Score

Mean Mini AQLQ Overall Score

Visit

0

1

2

3

4

5

6

7

8

9

10


Azithromycin for Acute Exacerbations of Asthma The AZALEA Randomized Clinical Trial

Azithromycin for Acute Exacerbations of Asthma

The AZALEA Randomized Clinical Trial

Azithromycin for Acute Exacerbations of Asthma

The AZALEA Randomized Clinical Trial

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Asthma Exacerbations: Mepolizumab

Asthma and allergic disease
“TH2” inflammation type asthma

“TH2” inflammation type asthma
Anti-IL-5 therapies

• High risk severe asthma (PFT abnormalities)
• Already on therapy (ICS and LABA/controller)
  • Significant portion of patients are on oral steroids
• 2 or more exacerbations/year
• Peripheral eosinophilia (abs 300 or greater)
• Kids and adults (12-75/80’s)
Severe Eosinophilic Asthma – new treatment options

- 1,306 patients - Age 12-75
- ICS and LABA
- 2 or more exacerbations/year
- Randomized to anti-IL-5 Q4W, anti-IL-5 Q8W, and placebo;
- Stratified by blood eos 300 or greater ug/ml
- OUTCOME: annual exacerbation rate

CALIMA study investigators. Lancet 2016; 388: 2128–41

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Reduced asthma exacerbations

Reduced asthma exacerbations

Blagev 2017

CALIMA study investigators. Lancet 2016; 388: 2128–41
# Adverse Effects

<table>
<thead>
<tr>
<th></th>
<th>Placebo (n=440)</th>
<th>Benralizumab 30 mg Q4W (n=438)</th>
<th>Benralizumab 30 mg Q8W (n=428)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any adverse event</td>
<td>342 (78%)</td>
<td>322 (74%)</td>
<td>320 (75%)</td>
</tr>
<tr>
<td>Any drug-related adverse event</td>
<td>36 (8%)</td>
<td>51 (12%)</td>
<td>54 (13%)</td>
</tr>
<tr>
<td>Any adverse event leading to treatment discontinuation</td>
<td>4 (&lt;1%)</td>
<td>8 (2%)</td>
<td>10 (2%)</td>
</tr>
<tr>
<td>Any adverse event leading to death</td>
<td>0</td>
<td>2 (&lt;1%)</td>
<td>2 (&lt;1%)</td>
</tr>
<tr>
<td>Any serious adverse event</td>
<td>60 (14%)</td>
<td>45 (10%)</td>
<td>40 (9%)</td>
</tr>
<tr>
<td>Adverse event in &gt;3% of patients*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasopharyngitis</td>
<td>92 (21%)</td>
<td>90 (21%)</td>
<td>79 (18%)</td>
</tr>
<tr>
<td>Asthma</td>
<td>68 (15%)</td>
<td>61 (14%)</td>
<td>47 (11%)</td>
</tr>
<tr>
<td>Bronchitis</td>
<td>52 (12%)</td>
<td>40 (9%)</td>
<td>44 (10%)</td>
</tr>
<tr>
<td>Upper respiratory tract infection</td>
<td>41 (9%)</td>
<td>29 (7%)</td>
<td>36 (8%)</td>
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<td>54 (13%)</td>
</tr>
<tr>
<td>Any adverse event leading to treatment discontinuation</td>
<td>4 (&lt;1%)</td>
<td>8 (2%)</td>
<td>10 (2%)</td>
</tr>
<tr>
<td>Any adverse event leading to death</td>
<td>0</td>
<td>2 (&lt;1%)</td>
<td>2 (&lt;1%)</td>
</tr>
<tr>
<td>Any serious adverse event</td>
<td>60 (14%)</td>
<td>45 (10%)</td>
<td>40 (9%)</td>
</tr>
<tr>
<td>Adverse event in &gt;3% of patients*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasopharyngitis</td>
<td>92 (21%)</td>
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<td>29 (7%)</td>
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</tr>
</tbody>
</table>
### Adverse effects

<table>
<thead>
<tr>
<th>Event</th>
<th>Placebo (n=440)</th>
<th>Benralizumab 30 mg Q4W (n=438)</th>
<th>Benralizumab 30 mg Q8W (n=428)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any adverse event</td>
<td>342 (78%)</td>
<td>322 (74%)</td>
<td>320 (75%)</td>
</tr>
<tr>
<td>Any drug-related adverse event</td>
<td>36 (8%)</td>
<td>51 (12%)</td>
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Blagev 2017
43 yo M w/ hx severe asthma has been hospitalized for asthma twice in the last year. He is currently on montelukast controller with albuterol as needed, which he uses three times a day. Which of the following is the next step in asthma therapy?

1. Bronchial Thermoplasty
2. Mepolizumab (Anti-IL-5)
3. Benralizumab (Anti IL-5 Ab)
4. Omalizumab (Anti IgE)
5. Add ICS/LABA combination
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5. Add ICS/LABA combination
6. Trigger evaluation? Correct diagnosis?
Questions?
Learning objectives

1. Understand the criteria for lung cancer screening using low-dose Chest CT
2. Understand the options of using different classes of inhalers in treating COPD
3. Understand whether supplemental oxygen for COPD patients who are not hypoxemic at rest is beneficial
4. Understand the safety profile of asthma inhalers
5. Understand therapy for asthma exacerbations
6. Understand when advanced asthma therapies (new anti-IL-5 therapy) is indicated
74 yo W, w/ hx COPD, comes in for routine follow up. She is on a LAMA and has been hospitalized for COPD twice in the past year. On exam, her resting SpO2 is 90%, but she drops to 85% with exertion. What do you recommend to reduce her COPD related hospitalizations?

1. Supplemental oxygen with exertion and at night
2. Add LABA to LAMA controller regimen
3. GERD therapy
4. Chronic low dose prednisone therapy
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1. Supplemental oxygen with exertion and at night
2. Add LABA to LAMA controller regimen
3. GERD therapy
4. Chronic low dose prednisone therapy
MOC question

• Rationale:

• 1 is wrong: The LOTT Trial (NEJM 2016 http://www.nejm.org/doi/full/10.1056/NEJMoaa1604344#t=article ) shows that supplemental oxygen for moderate hypoxemia (89-93% on RA at rest) was not associated with a reduction in mortality or hospitalizations or other secondary outcomes. Whereas the studies examining inhaler therapy for COPD (esp LAMA, LABA, LABA-ICS and LAMA-LABA (NEJM 2016http://www.nejm.org/doi/full/10.1056/NEJMoaa1516385 ) all show reduction in time to first exacerbation or exacerbation frequency.


• 3 is wrong: GERD therapy is a reasonable alternative to explore – evaluating whether chronic microaspiration is a contributor to the lung disease and a cause for recurrent bronchitis or pna or exacerbation – but there are no studies showing that GERD therapy reduces COPD exacerbation frequency. In fact, a trial of PPI for asthma patients did not show a reduction in asthma symptoms (http://www.nejm.org/doi/full/10.1056/NEJMoaa0806290#t=abstract).

• 4 is wrong: Chronic low dose prednisone therapy was specifically not associated with a reduction of exacerbation frequency – thus prednisone is only recommended for COPD exacerbation treatment and not for prevention of exacerbations. In fact, it may be associated with increased mortality (http://erj.ersjournals.com/content/17/3/337).
"TH2" inflammation type asthma

Nonspecific immunosuppression:
- **Corticosteroids**
  - Corticosteroids are effective across all three diseases, but toxicity precludes widespread and long-term use

Allergens → MHC class II TCR → Dendritic cell → T_h2 cell

**IL-4-specific blockers:**
- Altrakincept (Immunex)
- Pascolizumab (GSK)

**Partial efficacy in asthma; development discontinued**

**IL-4 and IL-13-specific blockers:**
- Pitraflekina (Aerovance)
- AMG317 (Amgen)
- **Dupilumab** (Regeneron/Sanofi)

**IL-13-specific blockers:**
- Tralokinumab (AZ)
- Anrulizumab (Pfizer)
- **Lebrikizumab** (Roche)

**Dupilumab is effective across all three diseases**

Eosinophil

- Mepolizumab is effective in asthma (in subgroup with high eosinophils); effective in CSwNP; not effective in AD

**IL-5-specific blockers:**
- Mepolizumab (GSK)
- Reslizumab (Leva)
- Benralizumab (AZ)

B cell → IgE → FceRI

**IgE-specific mAbs:**
- **Omalizumab** (Novartis/Gentech)

**Mast cell → Histamine**

Antihistamines

**Omalizumab is effective in allergic asthma and asthmatics with co-morbid CSwNP; not effective in AD**