# Pulmonary Medicine

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# OBJECTIVES

Participants should gain basic knowledge of interpreting spirometry tests to diagnose asthma, COPD and other chronic lung diseases

COPD- participants should be able to diagnose, treat, and prescribe proper pharmacological medications for managing COPD patients both maintenance and exacerbations

Asthma- participants should be able to diagnose, treat and prescribe proper pharmacological medications for managing Asthma patients both maintenance and exacerbations

Participants should gain knowledge on prescribing proper pharmacological treatment for tobacco cessation

Patients should gain knowledge on interstitial lung diseases and updates related to respiratory conditions post COVID19

PULMONARY FUNCTION TESTS

PFTS

SPIROMETERY

LUNG FUNCTION TESTING

# INDICATIONS FOR PULMONARY FUNCTION TESTING

- Preoperative evaluation
- Evaluating patients with pulmonary complaints
- Assessing treatment effectiveness
- Monitoring disease progress
- Screening certain patient populations
- Research

Ferguson GT, Enright PL, Buist S, Higgins MW.; Office spirometry for lung health assessment in adults. Chest 2000 1146-1161.

Consensus statement of the National Lung Health Education Program (NLHEP)

- -input from ACCP and NHLBI

Recommended spirometry for:

- -smokers >45 years old
- -patients with pulmonary complaints
- -global health assessment

In 2016, USPSTF/AAFP recommended against screening with

spirometry for asymptomatic adults even if they smoke

# SPIROMETRY

- Most commonly ordered test
- Appropriate for most situations
- Procedure:
- -a seated patient, usually wearing noseclips, inhales maximally to Total Lung Capacity (TLC) and then exhales maximally
- -3 attempts completed to meet standards for reliability and reproducibility
- -inhaled and exhaled flow/volume measured via pneumotach and numerical and graphical printouts generated
- -bronchodilator may be given by aerosol or MDI if warranted and the testing is repeated to assess the effectiveness of the treatment

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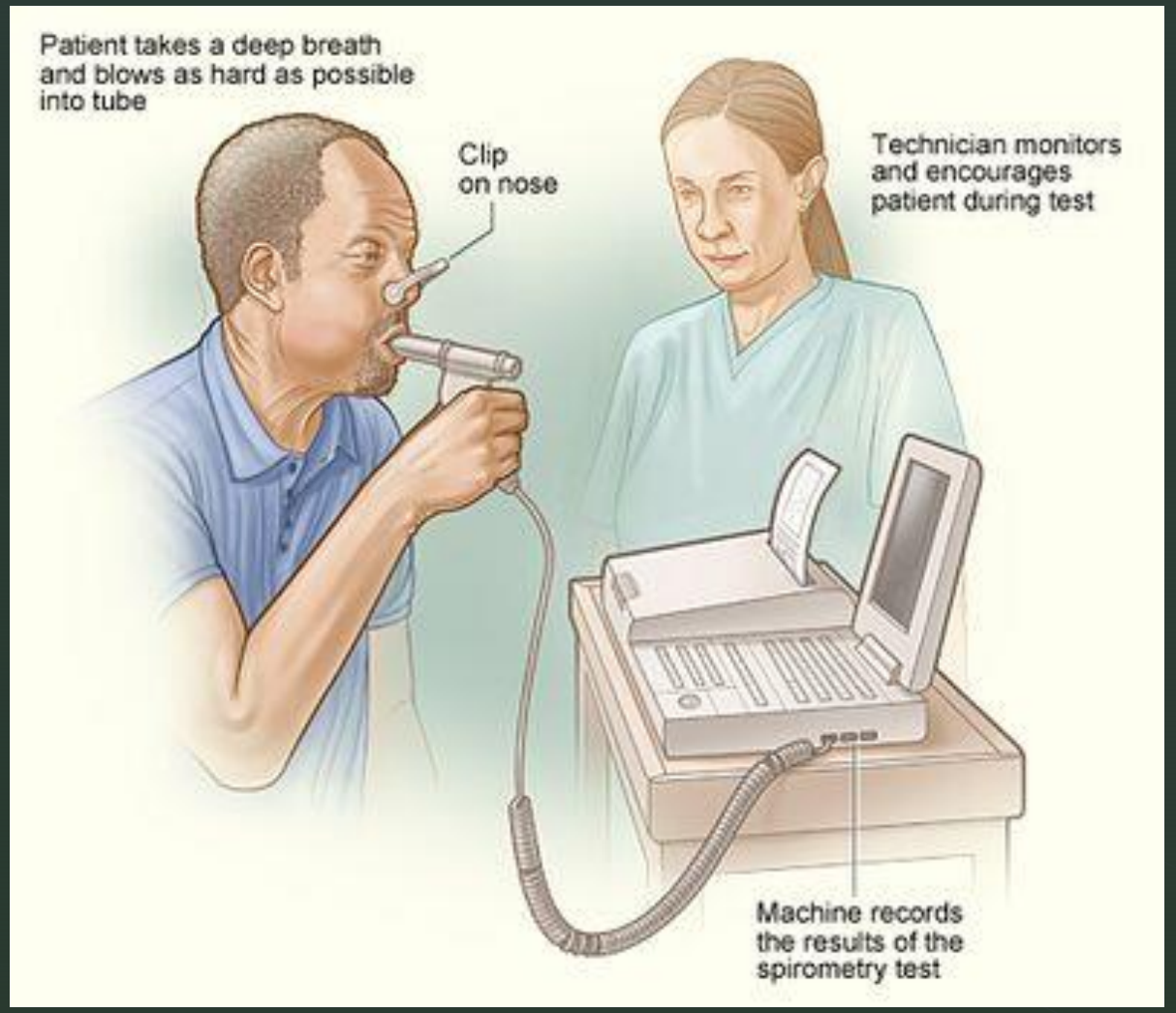
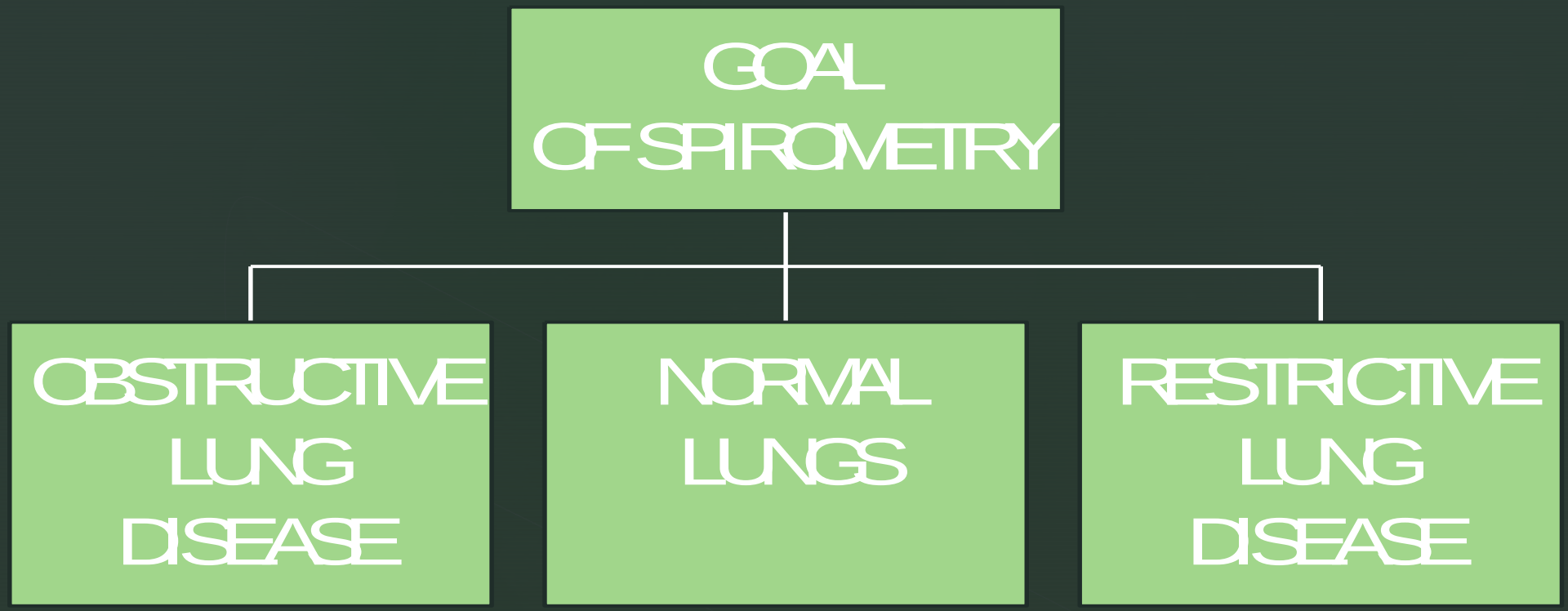

Patient takes a deep breath and blows as hard as possible into tube
Clip on nose
Technician monitors and encourages patient during test
Machine records the results of the spirometry test




… on the day of testing

# OBSTRUCTIVE LUNG DISEASE

- Decreased airflow
- Normal or increased air volume

- Chronic Obstructive Pulmonary Disease

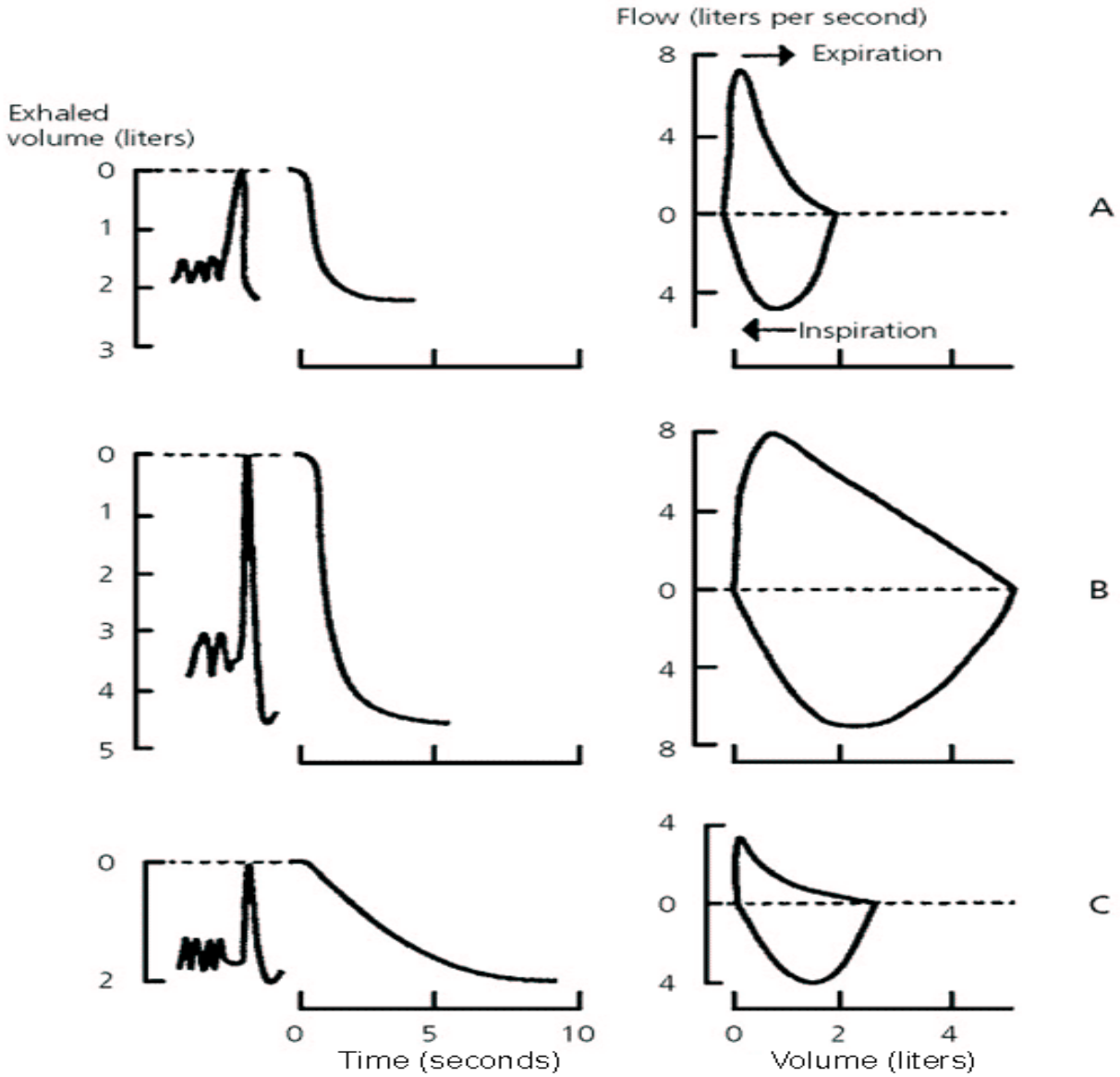
  -Emphysema

  -Chronic Bronchitis

  -Asthma

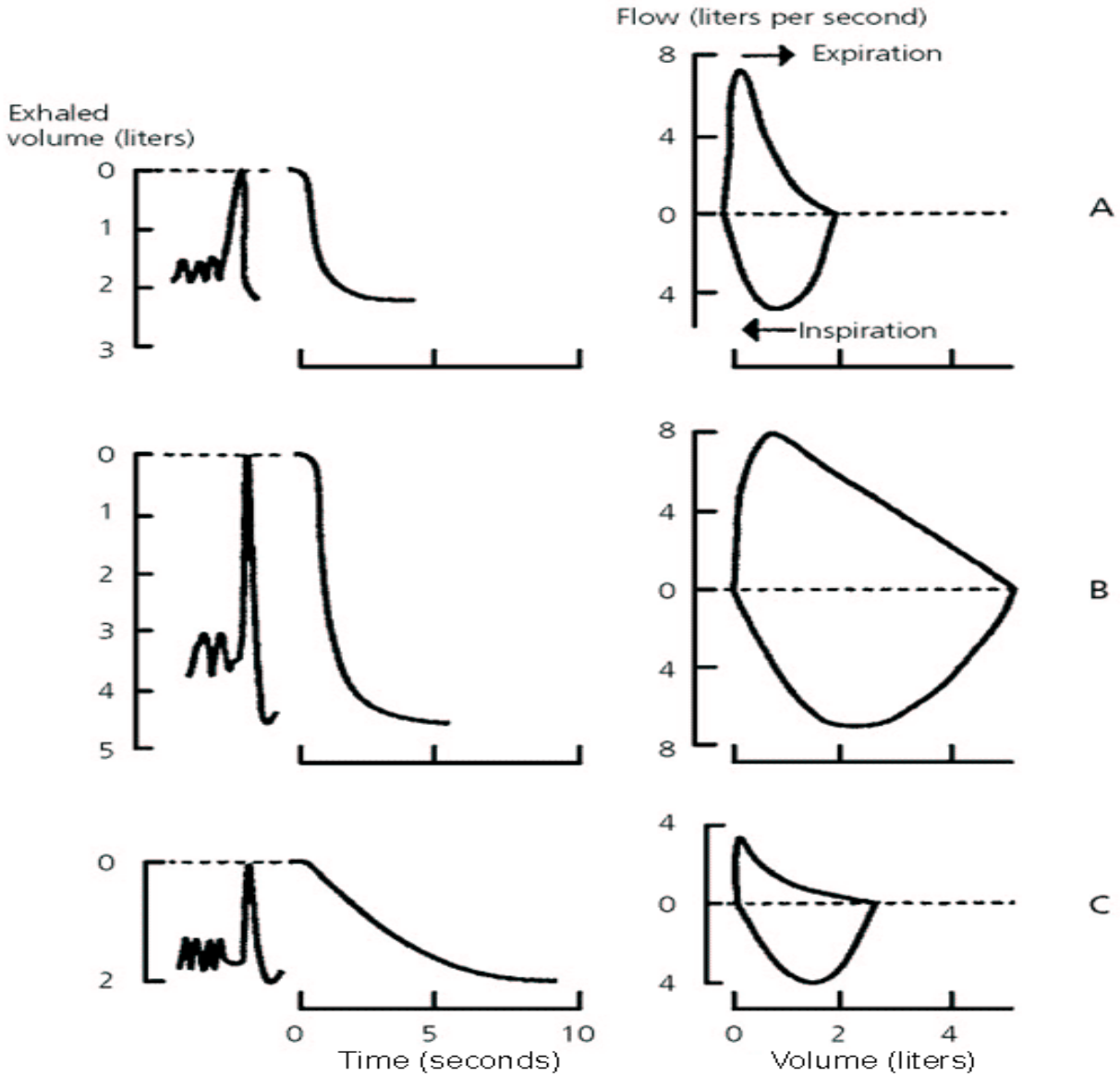
  -Bronchiectasis

  -Cystic fibrosis


Exhaled volume (liters)
0
1
2
3
Flow (liters per second)
8
Expiration
4
0
4
Inspiration
A
0
1
2
3
4
5
8
4
0
4
8
B
0
2
4
0
4
C
0
5
10
Time (seconds)
0
2
4
Volume (liters)

# RESTRICTIVE LUNG DISEASE

- Normal airflow
- Decreased air volume
- “PAINT” mnemonic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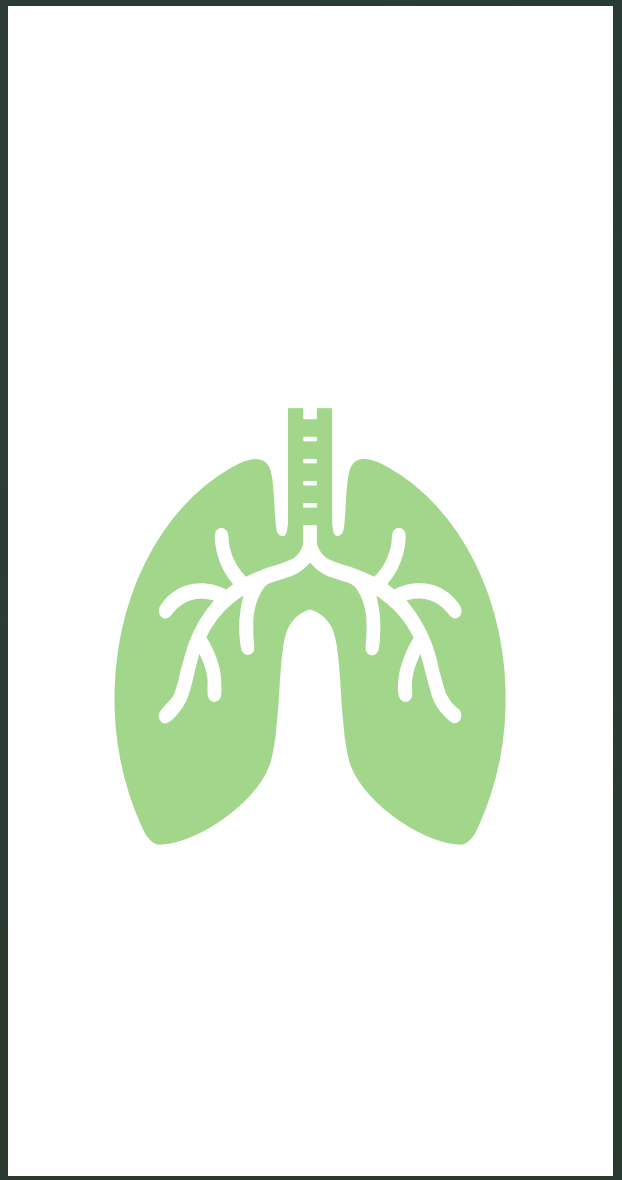


# RESTRICTIVE LUNG DISEASE "PAINT"

- **P**leural-pleural effusion/mass/thickening
- **A**lveolar-pulmonary edema, pneumonia, cancer
- **I**nterstitial-pulmonary fibrosis, sarcoidosis, silicosis pneumoconiosis etc.
- **N**euromuscular-myasthenia gravis, ALS, Guillain-Barre, diaphragmatic paralysis
- **T**horacic Cage-kyphoscoliosis, obesity

# FULL SPIROMETRY YIKES !!

| | Pred | LLN | Pre- | % | Post- | % | % chg |
|---|---|---|---|---|---|---|---|
| FVC | 3.34 | 2.59 | 1.86 | 55 | 1.83 | 55 | -1 |
| FEV 1 | 2.44 | 1.81 | 0.75 | 31 | 0.73 | 30 | -3 |
| FEV1%F | 73.81 | 64.13 | 40.36 | 55 | 39.72 | 54 | -2 |
| FEV 3 | 3.18 | 2.16 | 1.14 | 36 | 1.13 | 36 | 0 |
| FEV3%E | 92.05 | 87.41 | 61.22 | 67 | 61.71 | 67 | 1 |
| FEV6 | | | 1.47 | | 1.45 | | -1 |
| PEF | 6.63 | 4.27 | 2.62 | 40 | 2.70 | 41 | 3 |
| MEF 50 | 2.88 | 1.25 | 0.19 | 6 | 0.22 | 8 | 19 |
| FIF 50 | | | 3.14 | | 3.17 | | 1 |
| F25/75 | 1.90 | 0.61 | 0.19 | 10 | 0.18 | 10 | -3 |
| FE%FIF | ? | ? | ? | ? | ? | | |
| FET | | | 13.75 | | 14.64 | | 6 |

# FULL SPIROMETRY
# FOCUS ON THE MAIN 3

| | Pred | LLN | Pre- | % | Post- | % | % chg |
|---|---|---|---|---|---|---|---|
| FVC | 3.34 | 2.59 | 1.86 | 55 | 1.83 | 55 | -1 |
| FEV 1 | 2.44 | 1.81 | 0.75 | 31 | 0.73 | 30 | -3 |
| FEV1%F | 73.81 | 64.13 | 40.36 | 55 | 39.72 | 54 | -2 |
| FEV 3 | 3.18 | 2.16 | 1.14 | 36 | 1.13 | 36 | 0 |
| FEV3%E | 92.05 | 87.41 | 61.22 | 67 | 61.71 | 67 | 1 |
| FEV6 | | | 1.47 | | 1.45 | | -1 |
| PEF | 6.63 | 4.27 | 2.62 | 40 | 2.70 | 41 | 3 |
| MEF 50 | 2.88 | 1.25 | 0.19 | 6 | 0.22 | 8 | 19 |
| FIF 50 | | | 3.14 | | 3.17 | | 1 |
| F25/75 | 1.90 | 0.61 | 0.19 | 10 | 0.18 | 10 | -3 |
| FE%FIF | | | | | | | |
| FET | | | 13.75 | | 14.64 | | 6 |

# THE MAIN 3

**Fev1/FVC Ratio**

-The amount of air exhaled in the first second compared to the total amount of air exhaled

**Forced Vital Capacity (FVC)**

-The maximum volume of air that can be exhaled following a maximal inhalation

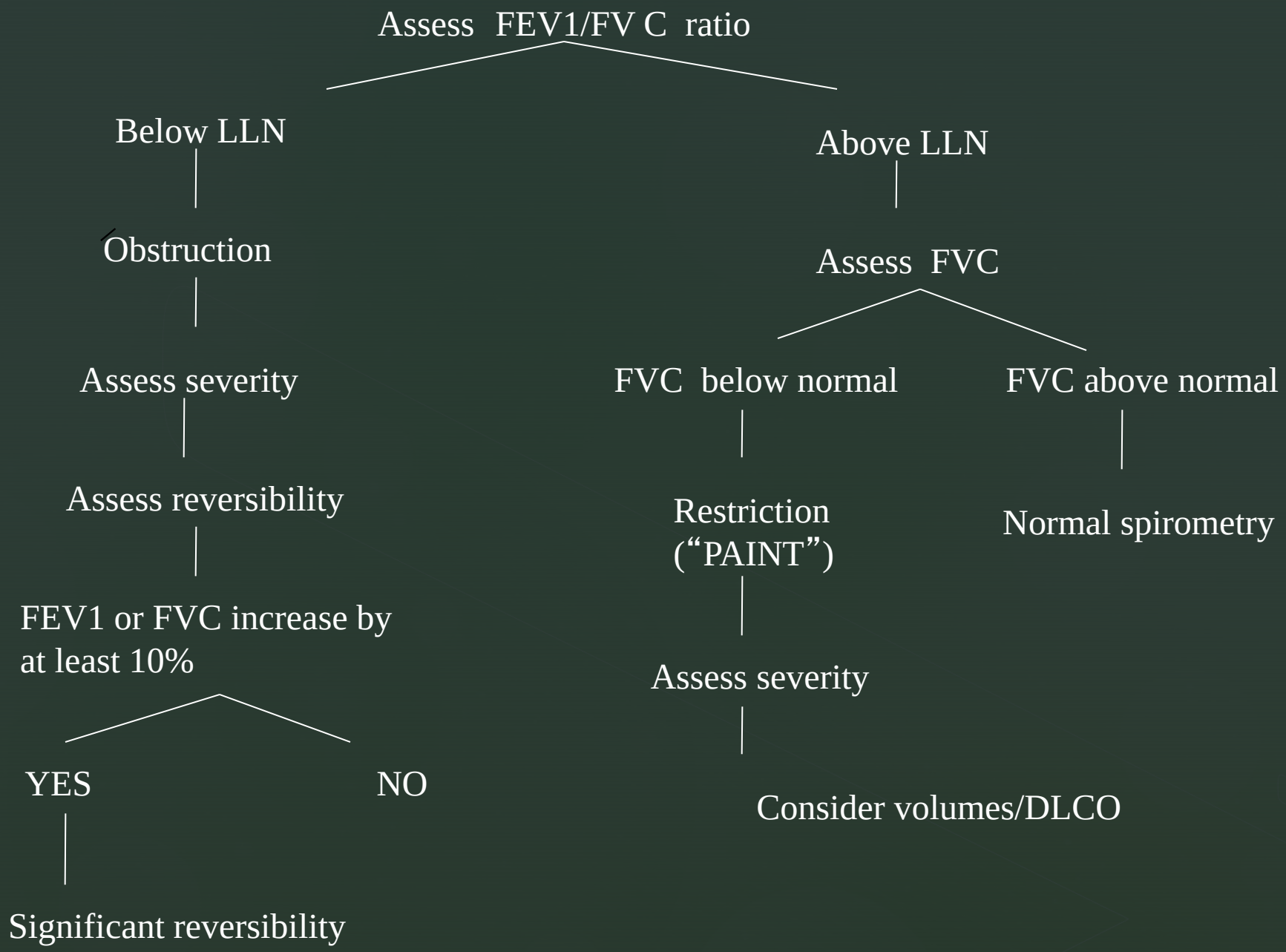
**Forced Expiratory Volume in 1 Second (Fev1)**

-The volume of air exhaled in the first second of the FVC

# AAH, THAT'S BETTER

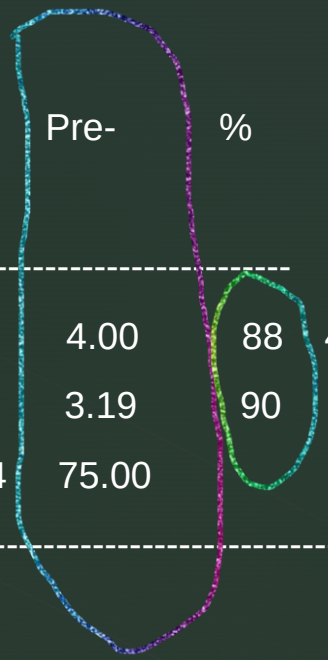
| | Pred | LLN | Pre- | % | Post- | % | % chg |
|---|---|---|---|---|---|---|---|
| FVC | 3.34 | 2.59 | 1.86 | 55 | 1.83 | 55 | -1 |
| FEV 1 | 2.44 | 1.81 | 0.75 | 31 | 0.73 | 30 | -3 |
| FEV1%F | 73.81 | 64.13 | 40.36 | | 39.72 | | |

<.70 AND LLN


Assess FEV1/FV C ratio
Below LLN
Above LLN
Obstruction
Assess FVC
Assess severity
FVC below normal
FVC above normal
Assess reversibility
Restriction
(“PAINT”)
Normal spirometry
FEV1 or FVC increase by
at least 10%
Assess severity
YES
NO
Consider volumes/DLCO
Significant reversibility

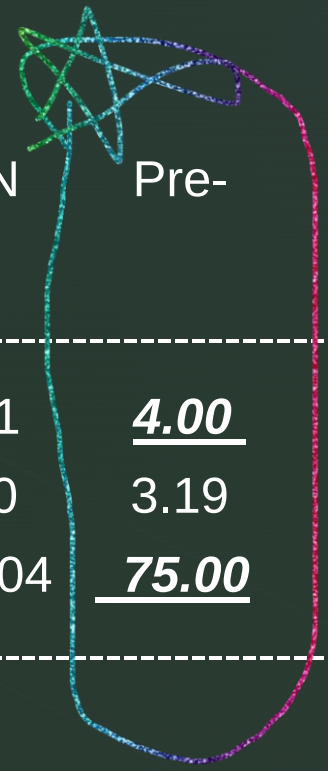
# SPIROMETRY

| | Pred | LLN | Pre- | % | Post- | % |
|---|---|---|---|---|---|---|
| FVC | 4.52 | 3.41 | 4.00 | 88 | 4.20 | 92 |
| FEV 1 | 3.54 | 2.70 | 3.19 | 90 | 3.24 | 91 |
| FEV1%F | 78.32 | 70.04 | 75.00 | | | |



- Assess FEV1/FVC ratio
- Below LLN----this reveals obstruction(or below 70%-GOLD)
- Above LLN----this can be restrictive or normal (or above 70%-GOLD)
  - Assess FVC—if normal, spirometry is normal
    ---if below normal, spirometry is restrictive

# SPIROMETRY



| | Pred | LLN | Pre- | % | Post- | % |
|---|---|---|---|---|---|---|
| FVC | 4.52 | 3.41 | ***4.00*** | 88 | | |
| FEV 1 | 3.54 | 2.70 | 3.19 | 90 | | |
| FEV1%F | 78.32 | 70.04 | ***75.00*** | | | |

- FEV1/FVC ratio is 75% which is above the LLN 70.04
- Spirometry is either normal or restrictive
- FVC is 4.00 liters, which is above LLN 3.41 liters
- This is a normal spirometry

# Spirometric Severity Classification
## (based on post-BD $FEV_1$)

| Stage | For patients with $FEV_1/FVC < 0.70$: |
|---|---|
| 1: Mild | $FEV_1$ >80% predicted |
| 2: Moderate | 50% ≤$FEV_1$ < 80% predicted |
| 3: Severe | 30% ≤ $FEV_1$ < 50% predicted |
| 4: Very Severe | $FEV_1$ < 30% predicted |

*Global initiative for chronic obstructive lung disease: www.goldcopd.com*

# SPIROMETRY

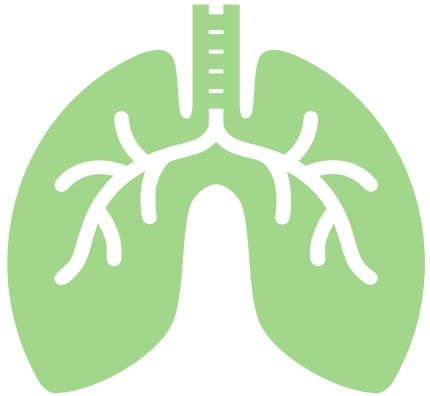
| | Pred | LLN | Pre- | % | Post- | % | %chg |
|---|---|---|---|---|---|---|---|
| FVC | 4.52 | 3.41 | 3.59 | 79 | 3.76 | 83 | 4 |
| FEV 1 | 3.54 | 2.70 | ***1.18*** | ***33*** | 1.18 | 33 | 0 |
| FEV1%F | 78.32 | 70.04 | ***32.84*** | | 31.51 | | |

- FEV1/FVC ratio is 32.84% which is below LLN 70.04%
- Spirometry is obstructive
- FEV1 is 1.18 liters which is 33% of predicted
- Spirometry is severe obstruction
- FEV1 showed no change and FVC improved 4%
- There is no significant reversibility

# SPIROMETRY

| | Pred | LLN | Pre- | % |
|---|---|---|---|---|
| FVC | 4.52 | 3.41 | ***2.60*** | ***60*** |
| FEV 1 | 3.54 | 2.70 | 2.10 | 60 |
| FEV1%F | 78.32 | 70.04 | ***80.00*** | |

- FEV1/FVC ratio 80% is above LLN 70.04%
- Spirometry is either normal or restrictive
- FVC  is 2.60 liters, below LLN 3.41 liters
- Spirometry is restrictive



# SEVERITY of RESTRICTION

- **Total Lung Capacity (TLC) (Normal range: 80 - 120% of predicted)**
- – TLC > 120 = Hyperinflation
  – TLC < 80% = Restrictive disease (ATS criteria for severity):
- – 70-80 % predicted: mild
  – 60-70% predicted: moderate
  – 50-60% predicted: moderately severe

  – ***< 50% predicted: severe***

- **• Step 5: RV/TLC ratio (Normal range: < 35% or < predicted)**
  – RV/TLC > 35% or > predicted indicates Air trapping

# OBSTRUCTION vs. RESTRICTION

## Obstruction

- decreased airflow

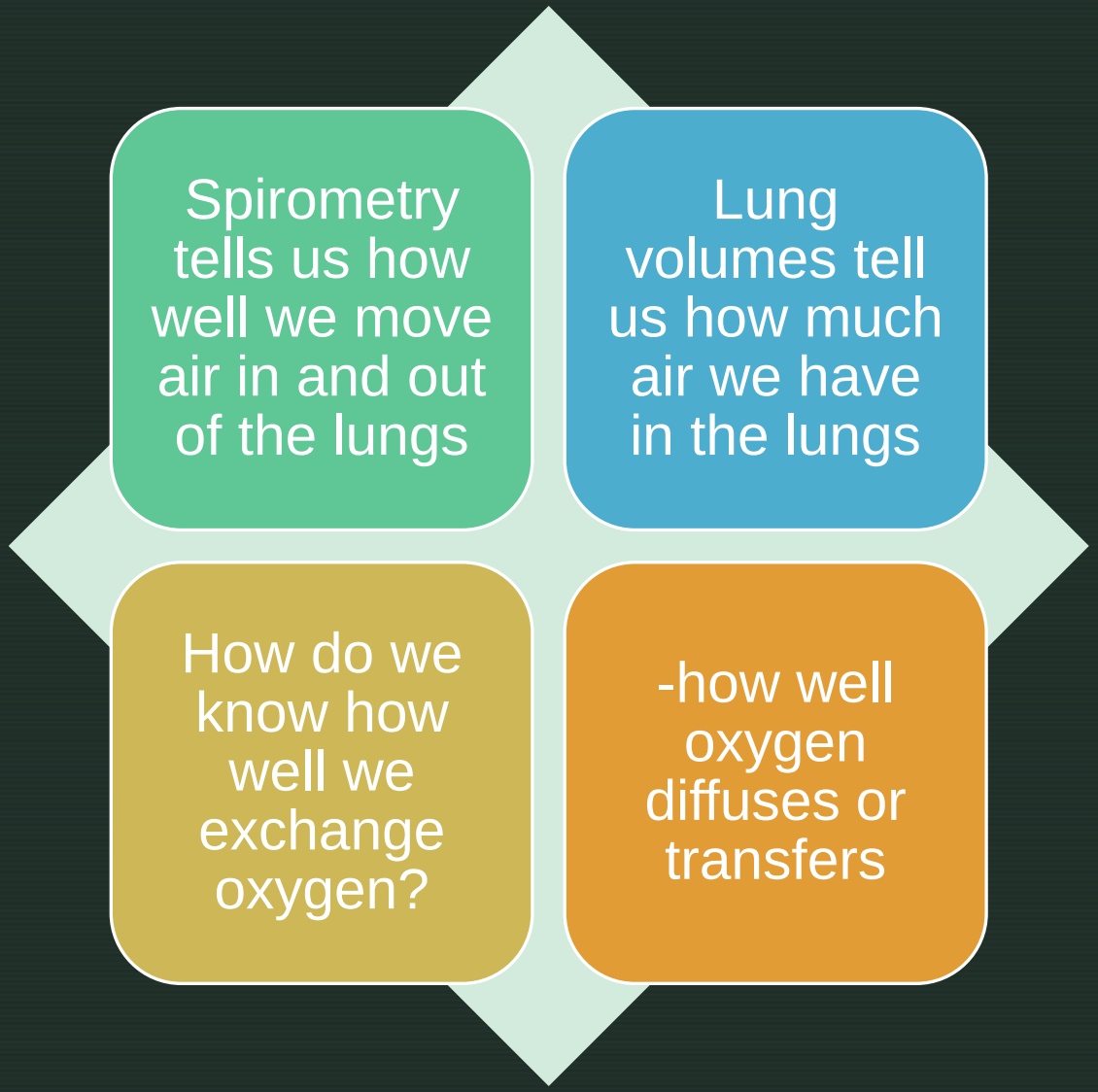
  (reduced FEV1/FVC)
- normal/increased lung volume
- normal/decreased DLCO

## Restriction

- normal airflow

  (normal FEV1/FVC)
- decreased lung volume
- normal or decreased DLCO

# DIFFUSION CAPACITY OF CARBON MONOXIDE



# DECREASED DLCO

- Emphysema- destroyed alveoli
- Fibrosis-scarring of alveoli and interstitium
- Pulmonary vascular disease
- Anemia

# NAME THAT TUNE…. I mean interpret this PFT

| | Pred | LLN | Pre- | % | Post- | % | %chg |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| FVC 5 | 4.52 | 3.41 | 4.00 | 88 | 4.20 | | 92 |
| FEV 1 6 | 3.54 | 2.70 | 1.60 | 45 | 1.70 | | 48 |
| FEV1%F | 78.32 | 70.04 | 40.00 | | 41.00 | | |
| --- | --- | --- | --- | --- | --- | --- | --- |

# PULMONARY FUNCTION

| | Pred | LLN | Pre- | % | Post- | % | %chg |
|---|---|---|---|---|---|---|---|
| FVC | 4.52 | 3.41 | 4.00 | 88 | 4.20 | 92 | 5 |
| FEV 1 | 3.54 | 2.70 | 1.60 | 45 | 1.70 | 48 | 6 |
| FEV1%F | 78.32 | 70.04 | 40.00 | | 41.00 | | |

1. Severe obstructive disease with no significant BD response
2. emphysema/COPD

   chronic bronchitis

   chronic asthma

   bronchiectasis

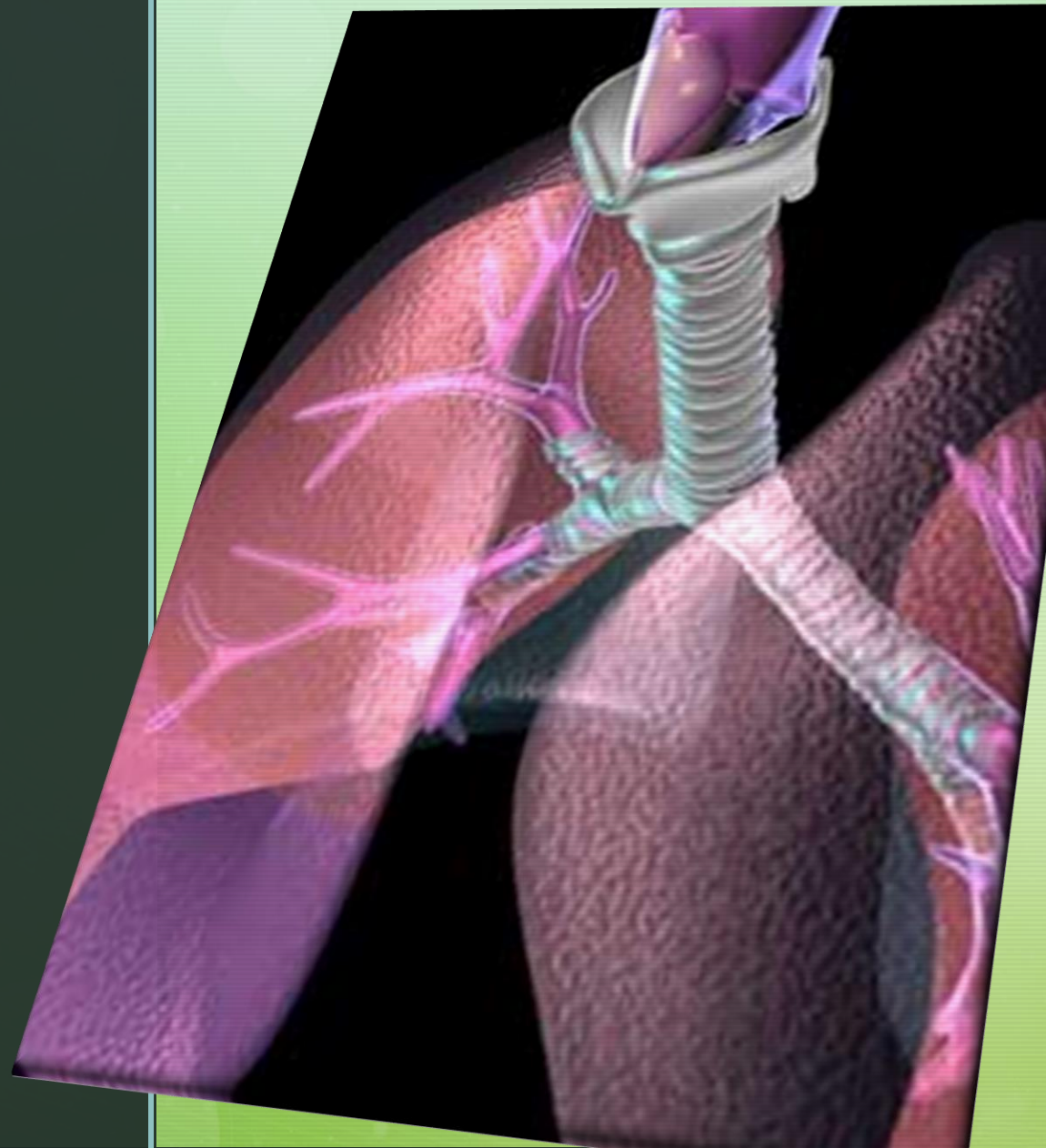
   sarcoidosis possible


THE BREATH SOUND THEY DIDN'T TEACH YOU IN SCHOOL.

# Asthma & COPD

Asthma and COPD are important and common chronic conditions, seen by primary care

> 50 million affected/underdiagnosed



# Asthma and COPD

## Asthma
Sensitizing agent

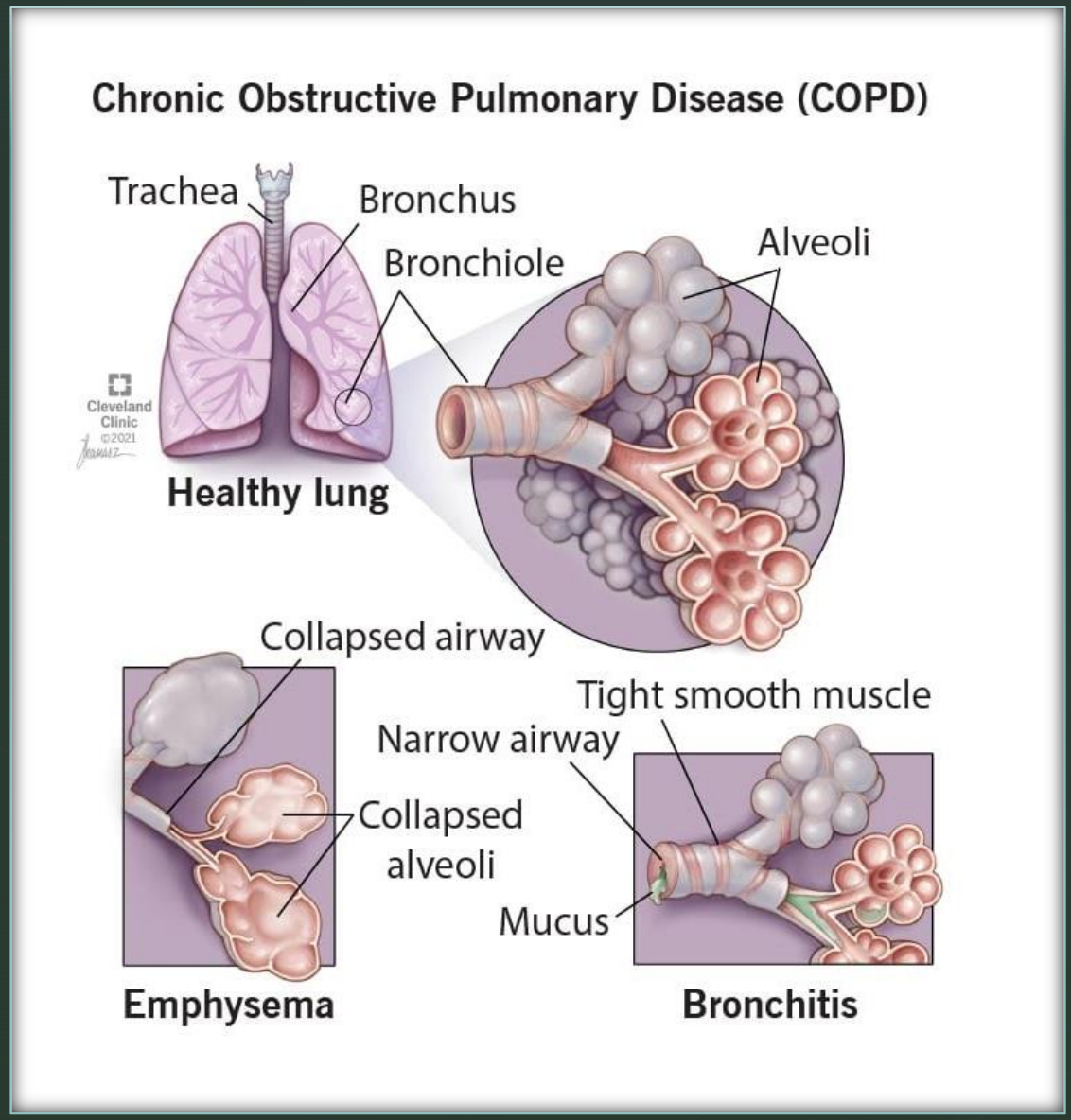
Asthmatic airway inflammation
CD4+ T lymphocytes
Eosinophils

## COPD
Noxious agent

COPD airway inflammation
CD8+ T lymphocytes
Macrophages Neutrophils

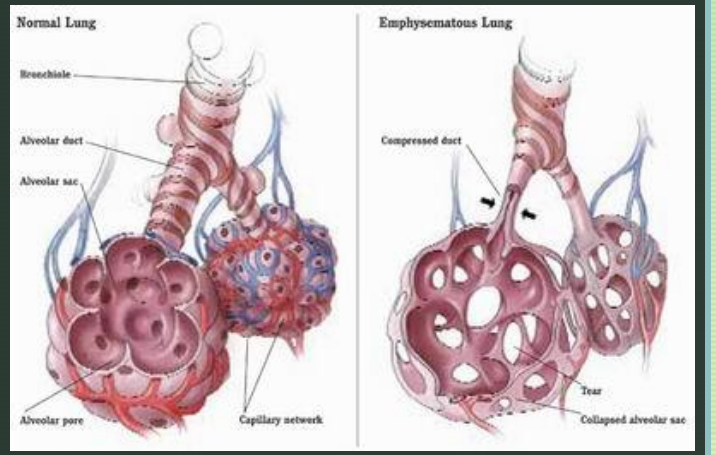
**Reversible** **Airflow Limitation** ***Irreversible***

# COPD


Chronic Obstructive Pulmonary Disease (COPD)
Trachea
Bronchus
Bronchiole
Alveoli
Cleveland Clinic ©2021
Healthy lung
Collapsed airway
Collapsed alveoli
Emphysema
Tight smooth muscle
Narrow airway
Mucus
Bronchitis

# COPD

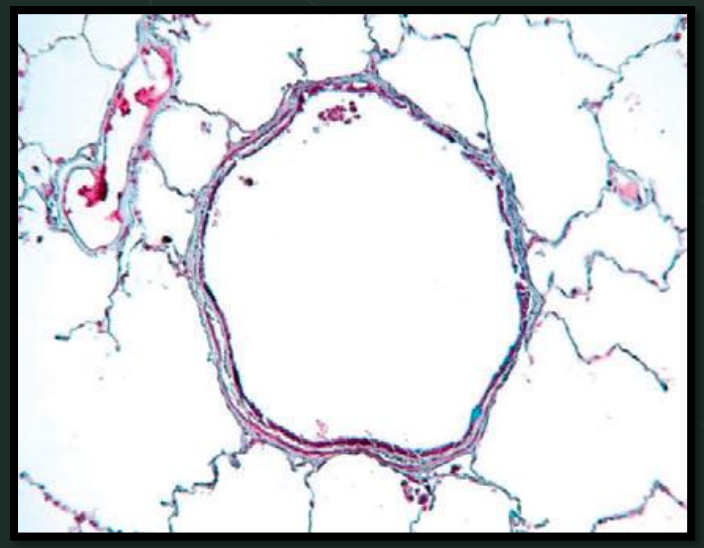
A common preventable and treatable disease, characterized by *persistent airflow limitation* that is usually progressive and associated with an *enhanced chronic inflammatory response* in the airways and the lung to noxious particles or gases.



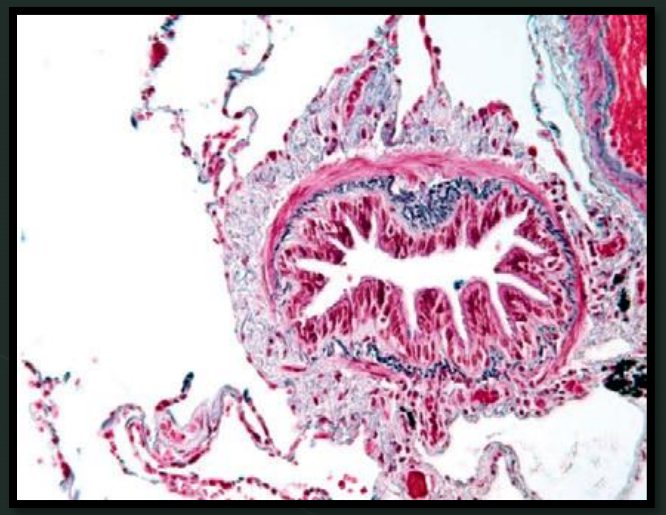

Exacerbations and comorbidities contribute to the overall severity in individual patients.

*Global initiative for chronic obstructive lung disease 2019: www.goldcopd.com*

# Airway features in a healthy individual and in patient with COPD



Normal Airway



COPD: Narrowed airways

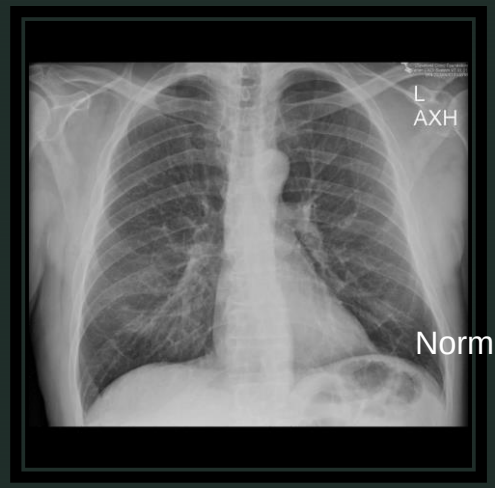
infiltration of inflammatory cells, mucosal hyperplasia and deposition of connective tissue in peribronchiolar space

*Decramer Lancet 379: 2012*

# Symptoms related to airway disease and loss of alveolar spaces

- Shortness of breath with activity
- Frequent cough
- Cough with mucus (phlegm)
- Limiting activity due to shortness of breath
- Frequent colds/nose/throat infections
- Limiting activities due to shortness of breath or tiredness.

# Diagnosis of COPD




Normal

Dyspnea, chronic cough or sputum, risk factors or family history of COPD

SPIROMETRY is required to make the diagnosis

Post bronchodilator $FEV_1/FVC$ ratio < 0.70 or < LLN

Irreversible or partially reversible airflow obstruction

CXR not useful to diagnose COPD, useful to rule out

*Exclude alternative explanation for obstructive lung disease*

COPD

# GOLD Guidelines: Composite Assessment

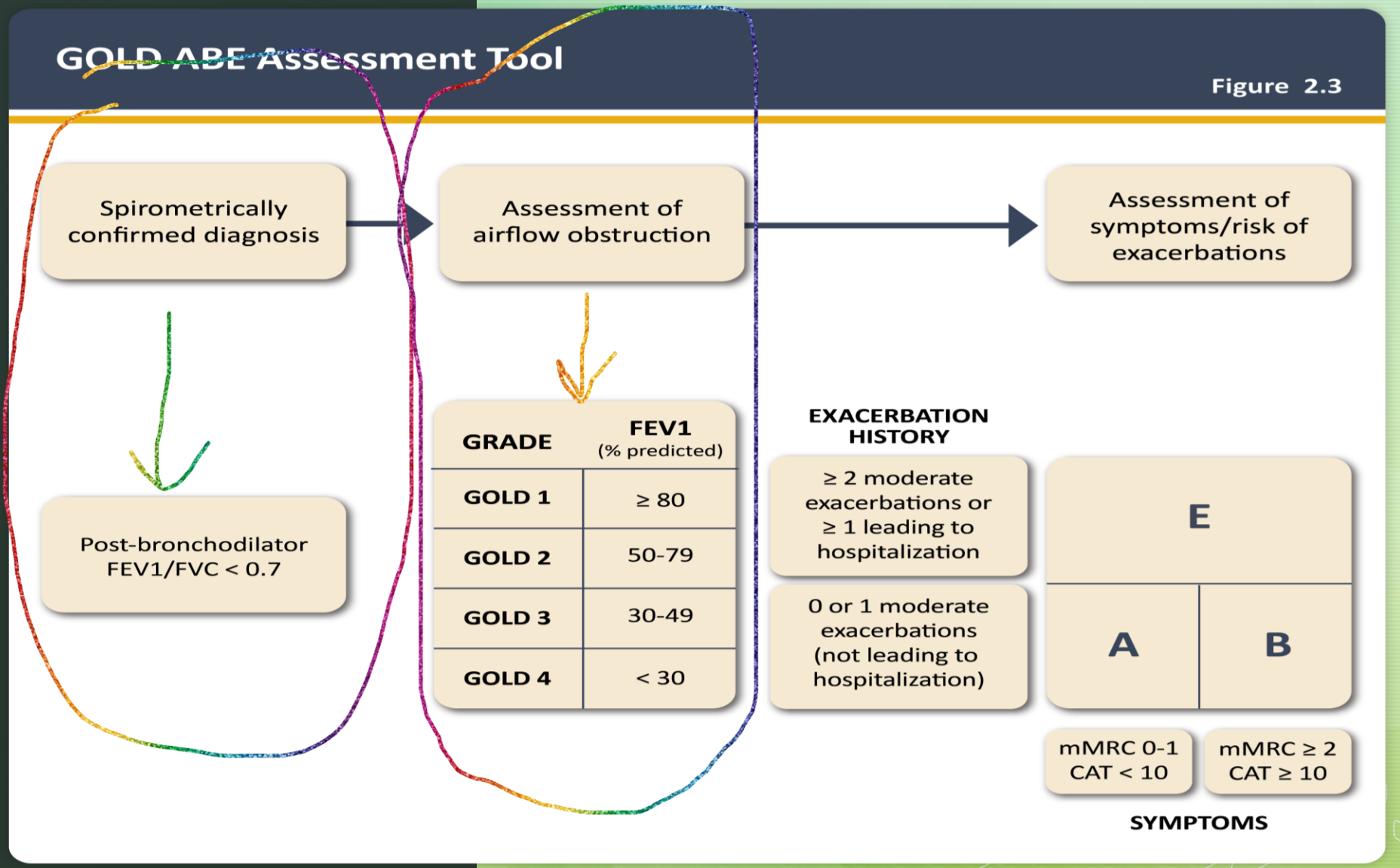
1) Determine SYMPTOM BURDEN

2) Severity of obstruction on SPIROMETRY

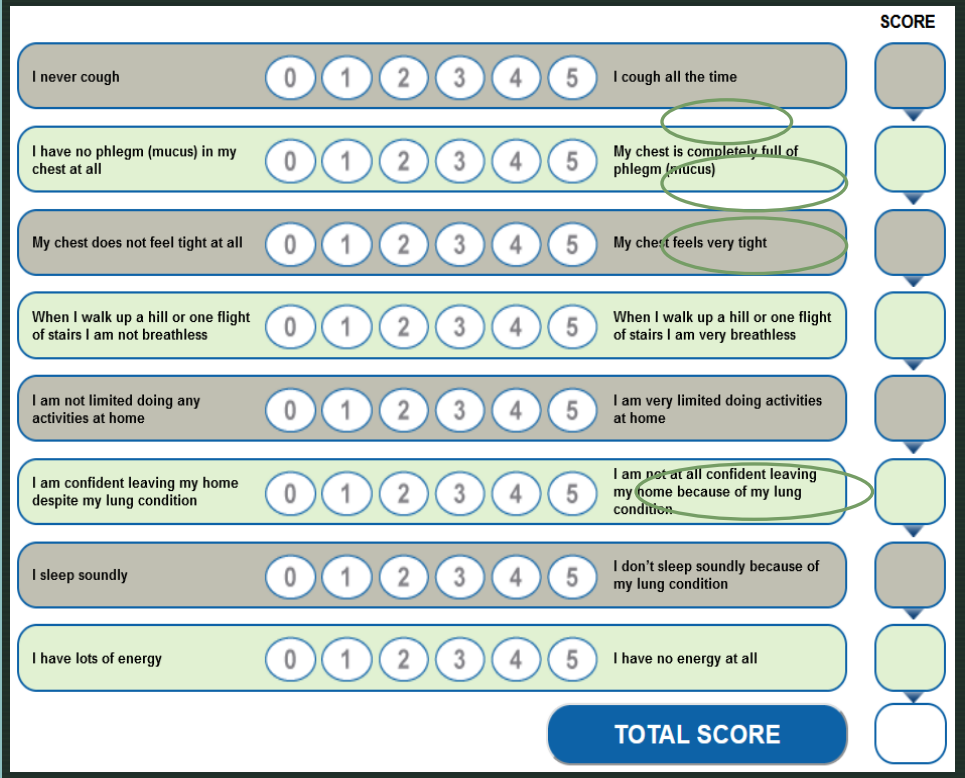
3) RISK of EXACERBATIONS

COMBINE to guide the management of COPD

# Gold Diagnostics



CAT
COPD Assessment Test



| | | |
|---|---|---|
| I never cough | 0 1 2 3 4 5 | I cough all the time |
| I have no phlegm (mucus) in my chest at all | 0 1 2 3 4 5 | My chest is completely full of phlegm (mucus) |
| My chest does not feel tight at all | 0 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 | 0 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 | 0 1 2 3 4 5 | I am very limited doing activities at home |
| I am confident leaving my home despite my lung condition | 0 1 2 3 4 5 | I am not at all confident leaving my home because of my lung condition |
| I sleep soundly | 0 1 2 3 4 5 | I don't sleep soundly because of my lung condition |
| I have lots of energy | 0 1 2 3 4 5 | I have no energy at all |
| | | TOTAL SCORE |

SCORE

## mMRC Breathlessness Scale

| Grade | Description of Breathlessness |
|---|---|
| 0 | I only get breathless with strenuous exercise |
| 1 | I get short of breath when hurrying on level ground or walking up a slight hill |
| 2 | On level ground, I walk slower than people of the same age because of breathlessness, or have to stop for breath when walking at my own pace |
| 3 | I stop for breath after walking about 100 yards or after a few minutes on level ground |
| 4 | I am too breathless to leave the house or I am breathless when dressing |

# COPD - Symptoms

# Spirometric Severity Classification
## (based on post-BD $FEV_1$)

| Stage | For patients with $FEV_1/FVC < 0.70$: |
|---|---|
| 1: Mild | $FEV_1$ >80% predicted |
| 2: Moderate | 50% ≤$FEV_1$ < 80% predicted |
| 3: Severe | 30% ≤ $FEV_1$ < 50% predicted |
| 4: Very Severe | $FEV_1$ < 30% predicted |

*Global initiative for chronic obstructive lung disease: www.goldcopd.com*

# COPD Assessment Test

| | | |
|---|---|---|
| I never cough | 0 1 2 3 4 5 | I cough all the time |
| I have no phlegm (mucus) in my chest at all | 0 1 2 3 4 5 | My chest is completely full of phlegm (mucus) |
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| When I walk up a hill or one flight of stairs I am not breathless | 0 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 | 0 1 2 3 4 5 | I am very limited doing activities at home |
| I am confident leaving my home despite my lung condition | 0 1 2 3 4 5 | I am not at all confident leaving my home because of my lung condition |
| I sleep soundly | 0 1 2 3 4 5 | I don't sleep soundly because of my lung condition |
| I have lots of energy | 0 1 2 3 4 5 | I have no energy at all |

*catestonline.org*

# Symptoms- Modified Medical Research Council (mMRC)

PLEASE TICK IN THE BOX THAT APPLIES TO YOU
(ONE BOX ONLY)

mMRC Grade 0. I only get breathless with strenuous exercise. ☐

mMRC Grade 1. I get short of breath when hurrying on the level or walking up a slight hill. ☐

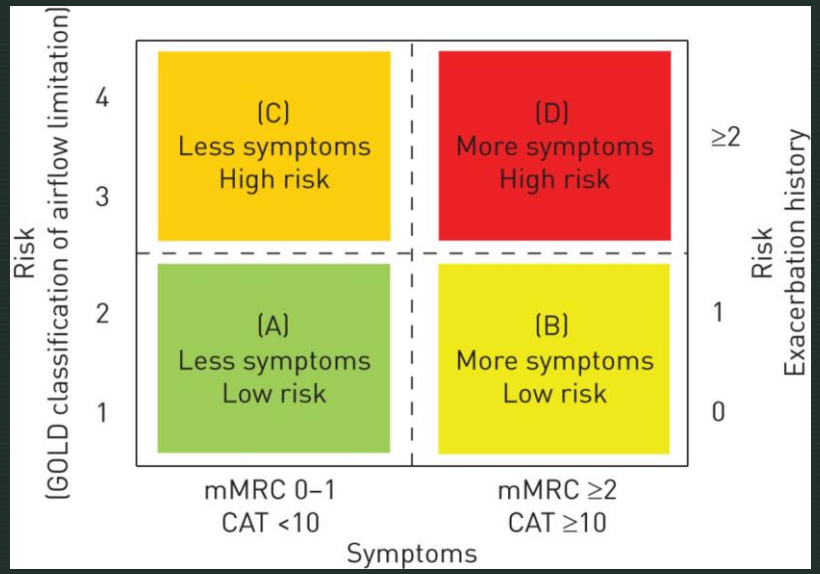
mMRC Grade 2. I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level. ☐

mMRC Grade 3. I stop for breath after walking about 100 meters or after a few minutes on the level. ☐

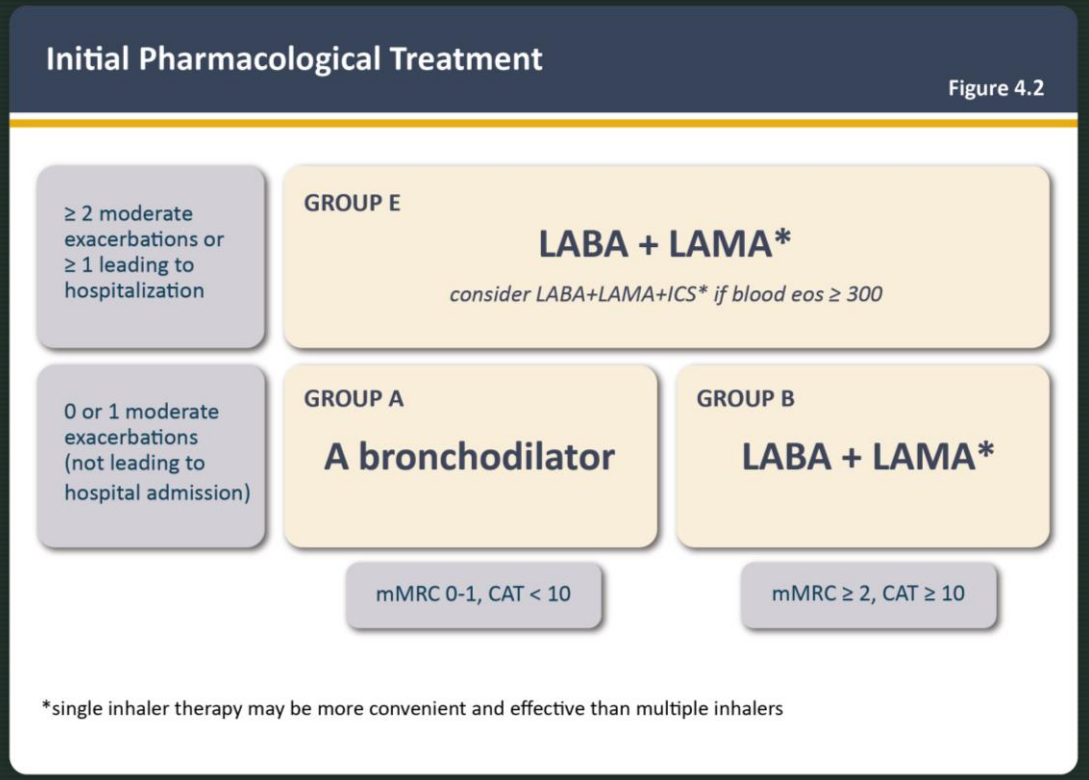
mMRC Grade 4. I am too breathless to leave the house or I am breathless when dressing or undressing. ☐

# Treatment COPD

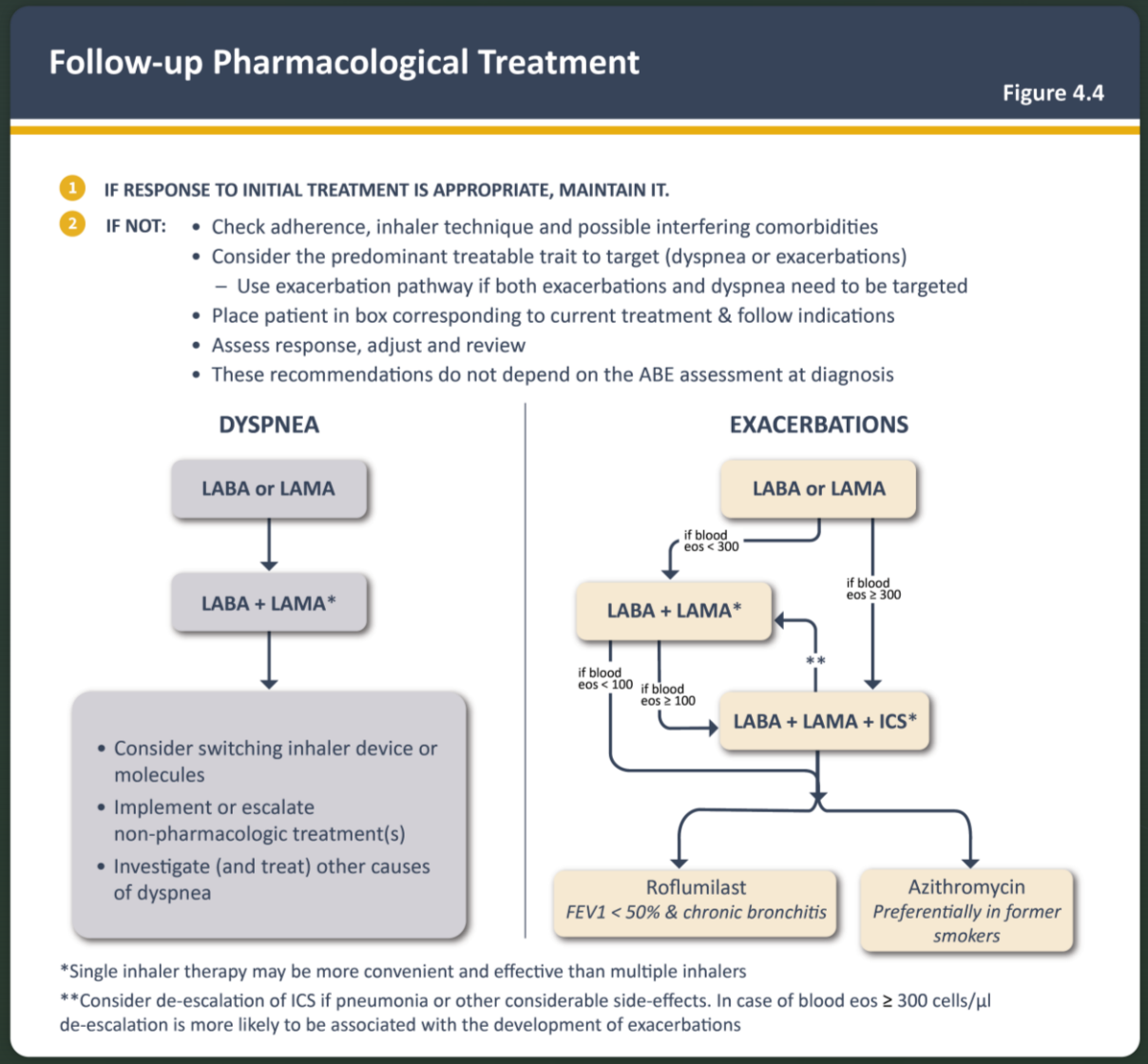
Old




2023 – Highlight importance of exacerbations



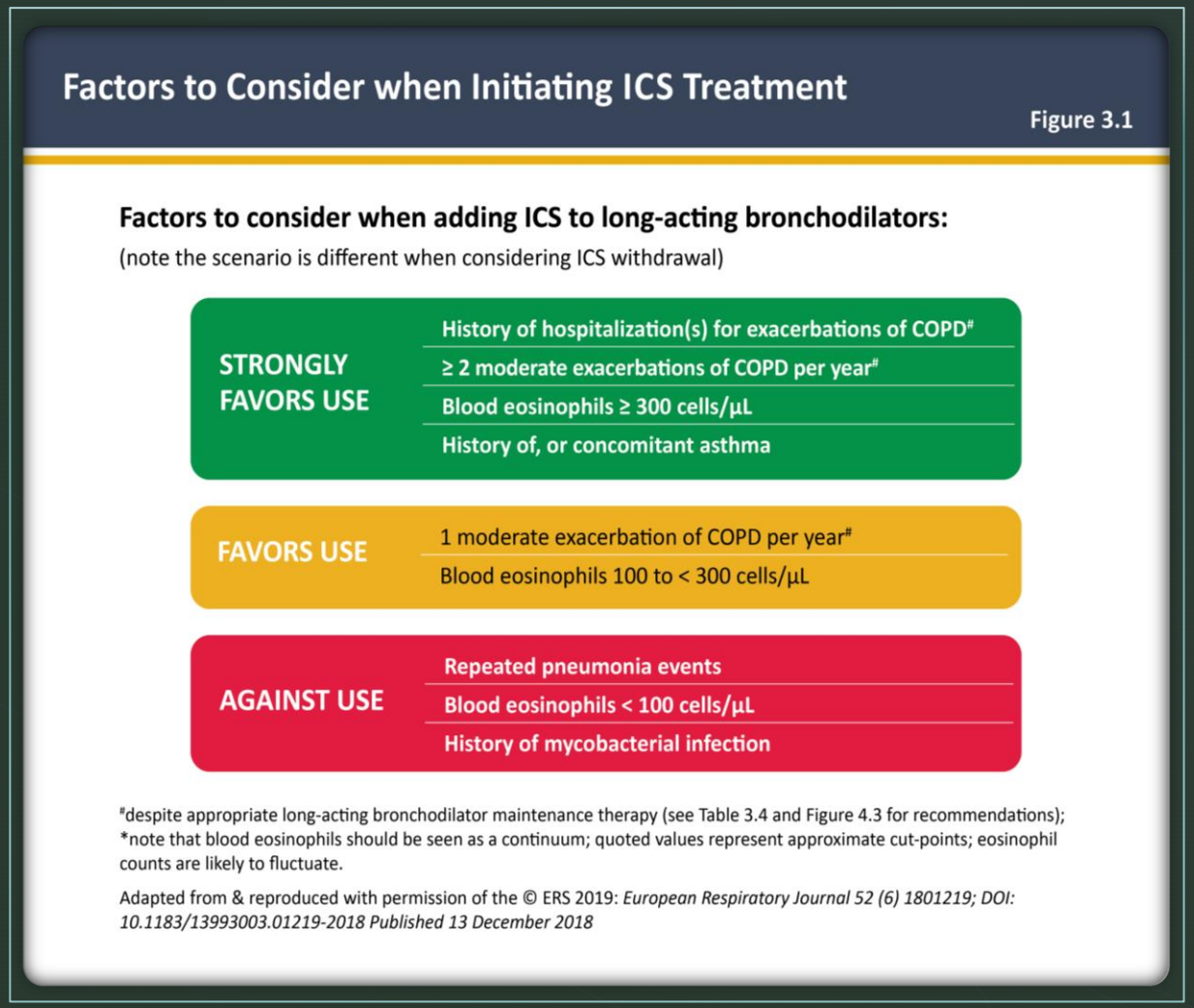
# Treatment COPD




- Many patients will be on LAMA/LABA
- The minority of patients will be on LAMA/LABA/ICS
- Few patients will be on LABA/ICS
- Blood eosinophils are an essential biomarker for COPD

# Treatment COPD Exacerbations

- Moderate exacerbation = need of oral steroids
- Severe exacerbation = hospitalized (due to respiratory failure i.e. need oxygen vs. BiPAP)



## Factors to Consider when Initiating ICS Treatment

Figure 3.1

**Factors to consider when adding ICS to long-acting bronchodilators:**

(note the scenario is different when considering ICS withdrawal)

| | |
|---|---|
| **STRONGLY FAVORS USE** | History of hospitalization(s) for exacerbations of COPD[#] |
| | ≥ 2 moderate exacerbations of COPD per year[#] |
| | Blood eosinophils ≥ 300 cells/µL |
| | History of, or concomitant asthma |
| **FAVORS USE** | 1 moderate exacerbation of COPD per year[#] |
| | Blood eosinophils 100 to < 300 cells/µL |
| **AGAINST USE** | Repeated pneumonia events |
| | Blood eosinophils < 100 cells/µL |
| | History of mycobacterial infection |

[#]despite appropriate long-acting bronchodilator maintenance therapy (see Table 3.4 and Figure 4.3 for recommendations);
*note that blood eosinophils should be seen as a continuum; quoted values represent approximate cut-points; eosinophil counts are likely to fluctuate.

# EXACERBATIONS

**Smooth muscle dysfunction**

- Bronchoconstriction
- Bronchial hyperactivity
- Hyperplasia/hypertrophy
- Inflammatory mediator release

**Airway inflammation**

- Mucosal edema
- Inflammatory cell activation
- Cellular proliferation
- Epithelial damage
- Basement membrane thickening

# Managing Exacerbations

## CAUSES/Risk Factors

- Prior exacerbations
- Infections
  - 50-80% viral
  - 45% bacterial H flu, M catarrhalis, S pneumonia
- Lower BMI, Continued smoking
- Air pollution, extremes in weather
- Certain cancers
- Heart failure, PE, arrhythmia, PTX
- (Unknown in 1/3 of cases)

## SIGNS

Change in mucus

Difficulty coughing up mucus

Cough

Shortness of breath

Wheezing

# Treatment of COPD Exacerbation

SABA or in combo with Atrovent (DUONEB)

PRN

Consider adding LABA+LAMA

Systemic Corticosteroids

Tobacco Cessation

Antimicrobial Therapy

# Respiratory Treatments

2023

Allergy & Asthma Network

AllergyAsthmaNetwork.org

800.878.4403

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CHEST FOUNDATION

DOSE INDICATOR · G = GENERIC AVAILABLE · DISEASE STATES: A = ASTHMA C = COPD

**Allergy & Asthma Network** is a national nonprofit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.

## SHORT-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **ProAir RespiClick®** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **Proventil® HFA** — 90 mcg albuterol sulfate — MDI A G
- **Ventolin® HFA** — 90 mcg albuterol sulfate — MDI A G
- **Xopenex HFA®** — 45 mcg levalbuterol tartrate — MDI A G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

- **Serevent® Diskus®** — 50 mcg salmeterol xinafoate inhalation powder — DPI A C
- **Striverdi® Respimat®** — 2.5 mcg olodaterol hydrochloride — SMI C

## INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

- **Alvesco® HFA** — 80, 160 mcg ciclesonide — MDI A
- **ArmonAir® Digihaler™** — 55, 113, 232 mcg fluticasone propionate inhalation powder — DPI A
- **Arnuity® Ellipta®** — 50, 100, 200 mcg fluticasone furoate inhalation powder — DPI A
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- **Pulmicort Flexhaler®** — 90, 180 mcg budesonide inhalation powder — DPI A
- **QVAR® Redihaler™** — 40, 80 mcg beclomethasone dipropionate — MDI A

## MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

Short-acting

- **Atrovent® HFA** — 17 mcg ipratropium bromide — MDI C

Long-acting

- **Incruse® Ellipta®** — 62.5 mcg umeclidinium inhalation powder — DPI C
- **Spiriva® HandiHaler®** — 18 mcg tiotropium bromide inhalation powder — C
- **Spiriva® Respimat®** — 1.25, 2.5 mcg tiotropium bromide — SMI A C
- **Tudorza™ Pressair™** — 400 mcg aclidinium bromide inhalation powder — DPI C

## COMBINATION MEDICATIONS

contain both short-acting beta$_2$-agonist and short-acting muscarinic antagonist

- **Combivent® Respimat®** — 20/100 mcg ipratropium bromide and albuterol — SMI C

## COMBINATION MEDICATIONS

contain both inhaled corticosteroid and long-acting beta$_2$-agonist (LABA)

- **Advair Diskus®** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol inhalation powder — DPI A C G
- **Advair® HFA** — 45/21, 115/21, 230/21 mcg fluticasone propionate and salmeterol xinafoate — MDI A G
- **AirDuo® Digihaler™** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DPI A
- **AirDuo® RespiClick®** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DPI A G
- **Breo® Ellipta®** — 100/25, 200/25 mcg fluticasone furoate and vilanterol inhalation powder — DPI A C
- **Dulera®** — 50/5, 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate — MDI A
- **Symbicort®** — 80/4.5, 160/4.5 mcg budesonide and formoterol fumarate dihydrate — MDI A C G
- **Wixela™ Inhub™** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate approved generic of Advair Diskus — DPI A C

contain both long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Anoro® Ellipta®** — 62.5/25 mcg umeclidinium and vilanterol inhalation powder — DPI C
- **Bevespi Aerosphere®** — 9/4.8 mcg glycopyrrolate and formoterol fumarate — MDI C
- **Duaklir® Pressair™** — 400, 12 mcg aclidinium bromide and formoterol fumarate — DPI C
- **Stiolto™ Respimat®** — 2.5/2.5 mcg tiotropium bromide and olodaterol — SMI C

contain inhaled corticosteroid, long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Trelegy® Ellipta®** — 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder — DPI A C
- **Breztri Aerosphere™** — 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate — MDI C

## BIOLOGICS

target cells and pathways that cause airway inflammation; delivered by injection or IV

- **Cinqair®** — reslizumab — A
- **Dupixent®** — dupilumab — A
- **Fasenra™** — benralizumab — A
- **Nucala®** — mepolizumab — A
- **Tezspire™** — tezepelumab-ekko — A
- **Xolair®** — omalizumab — A

## BRONCHIAL THERMOPLASTY

A minimally invasive procedure that uses mild heat to reduce airway smooth muscle, leading to fewer severe asthma flares, ER visits, and days lost from activities. www.btforasthma.com — A

## PDE4 INHIBITORS

ease lung inflammation and reduce exacerbations

- **Daliresp®** — 250, 500 mcg roflumilast — C

Reviewed by Dennis Williams, PharmD

Generic versions of brand name inhalers are not included on this poster. Generic inhalers may be a different color.

# INHALERS

## Short Acting Bronchodilators (SABA)

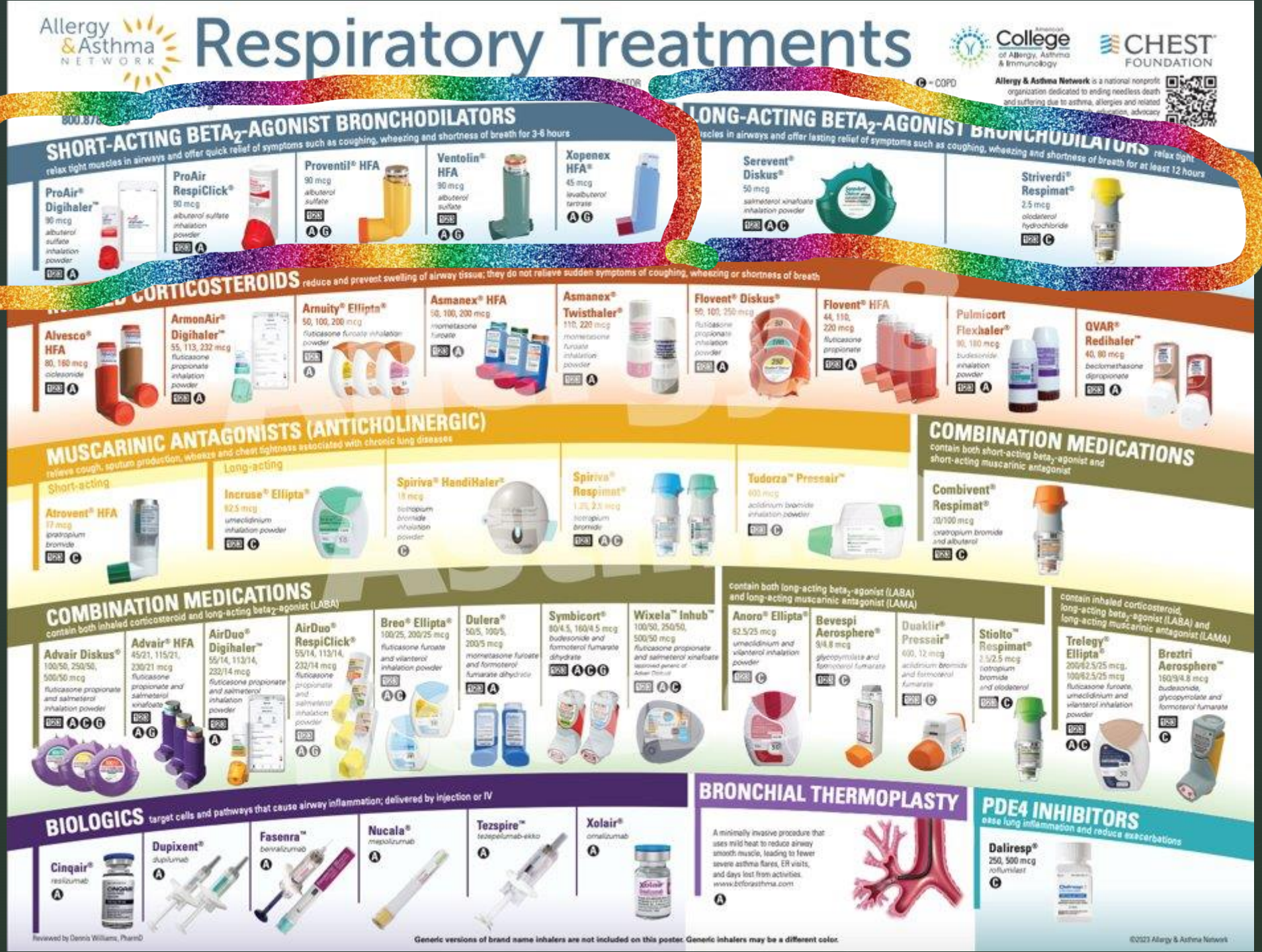
"Relievers" treat bronchospasm, fast acting

- Albuterol (ProAir ®)
- Levalbuterol (Xopenex®)

## Long-acting bronchodilators (LABA)

Prevent development of bronchospasm

- Salmeterol (Serevent Diskus®)
- Formoterol (Foradil®)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Striverdi® Respimat® 2.5 mcg olodaterol hydrochloride
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Asmanex® Twisthaler® 110, 220 mcg mometasone furoate inhalation powder
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Stiolto™ Respimat® 2.5/2.5 mcg tiotropium bromide and olodaterol
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Dupixent® dupilumab
Fasenra™ benralizumab
Nucala® mepolizumab
Tezspire™ tezepelumab-ekko
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# INHALERS

## Inhaled Corticosteroids

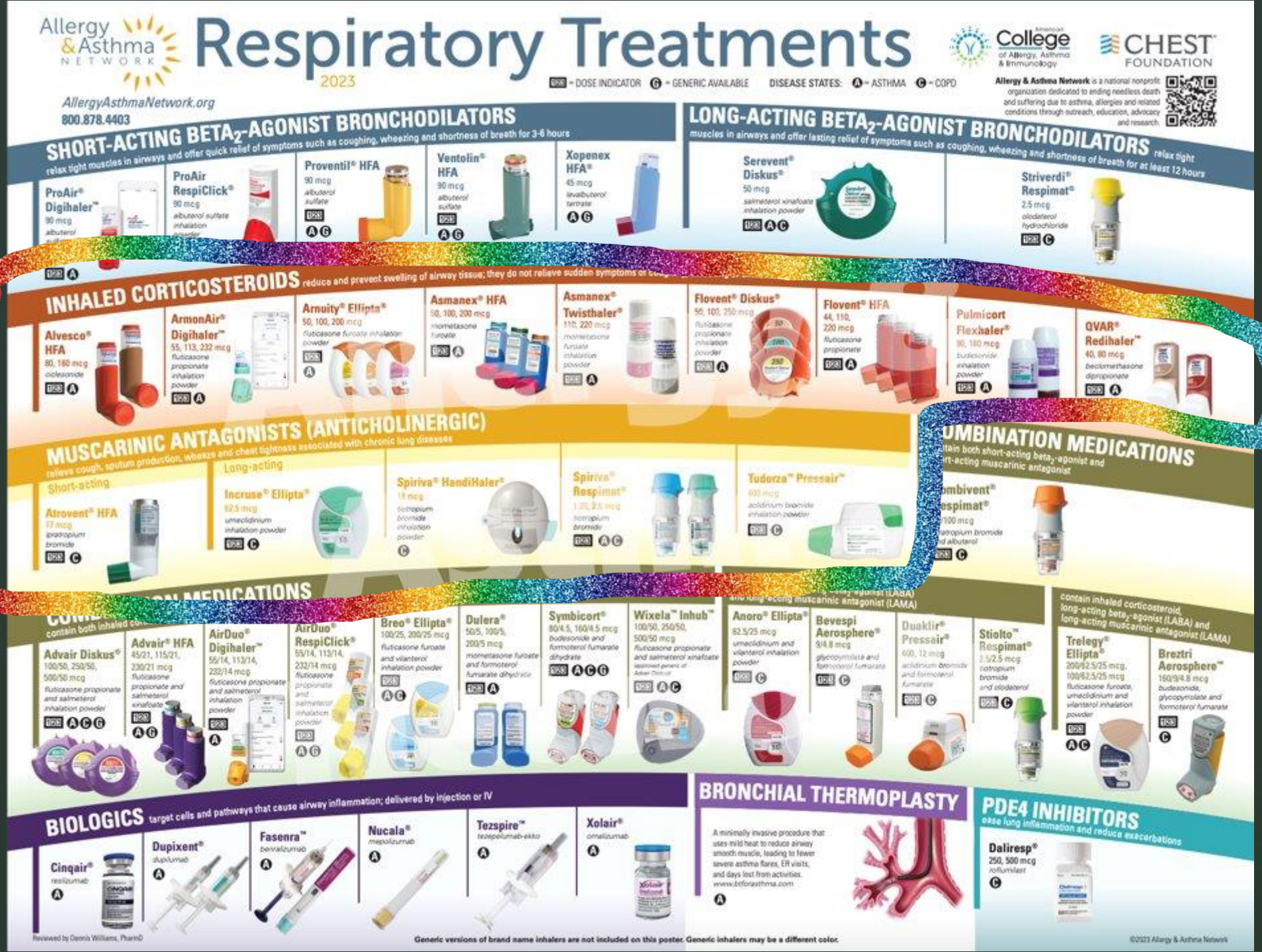
Inhibit production of inflammatory agents

- Budesonide (Pulmicort®)
- Fluticasone (Flovent®)

## Long-acting muscarinic antagonists (LAMAS)

Long-acting bronchodilation, potentially anti-eosinophilic/anti-inflammatory effect

- Tiotropium Bromide (Spiriva®)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relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours
ProAir® Digihaler™
90 mcg
albuterol
ProAir RespiClick®
90 mcg
albuterol sulfate
Proventil® HFA
90 mcg
albuterol sulfate
Ventolin® HFA
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albuterol sulfate
Xopenex HFA®
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levalbuterol tartrate
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reslizumab
Dupixent®
dupilumab
Fasenra™
benralizumab
Nucala®
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# COMBO INHALERS

## ICS + LABA

- Advair Diskus® (Flovent +Salmeterol)
- Symbicort® (Pulmicort + Formoterol)
- Dulera: mometasone-formoterol

## SAMA +SABA

- Combivent
- Duoneb

# Respiratory Treatments

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## COMBINATION MEDICATIONS

contain inhaled corticosteroid, long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Trelegy® Ellipta®** — 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder — DPI A C
- **Breztri Aerosphere™** — 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate — DPI C

## BIOLOGICS

- **Cinqair®** — reslizumab — A
- **Dupixent®** — dupilumab — A
- **Fasenra™** — benralizumab — A
- **Nucala®** — mepolizumab — A
- **Tezspire™** — tezepelumab-ekko — A
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## BRONCHIAL THERMOPLASTY

A minimally invasive procedure that uses mild heat to reduce airway smooth muscle, leading to fewer severe asthma flares, ER visits, and days lost from activities. www.btforasthma.com — A

## PDE4 INHIBITORS

ease lung inflammation and reduce exacerbations

- **Daliresp®** — 250, 500 mcg roflumilast — C

Reviewed by Dennis Williams, PharmD

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# COMBO INHALERS

## LAMA + LABA

- Anoro Ellipta
- Stiolto Respimat
- Bevespi

## TRIPLE THERAPY

## ICS/LAMA/LABA

- Trelegy
- Breztri

# Respiratory Treatments

2023

Allergy & Asthma Network

AllergyAsthmaNetwork.org

800.878.4403

American College of Allergy, Asthma & Immunology

CHEST FOUNDATION

DPI = DOSE INDICATOR  G = GENERIC AVAILABLE  DISEASE STATES: A = ASTHMA  C = COPD

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## SHORT-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **ProAir RespiClick®** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **Proventil® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Ventolin® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Xopenex HFA®** — 45 mcg levalbuterol tartrate — A G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

- **Serevent® Diskus®** — 50 mcg salmeterol xinafoate inhalation powder — DPI A C
- **Striverdi® Respimat®** — 2.5 mcg olodaterol hydrochloride — DPI C

## INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

- **Alvesco® HFA** — 80, 160 mcg ciclesonide — DPI A
- **ArmonAir® Digihaler™** — 55, 113, 232 mcg fluticasone propionate inhalation powder — DPI A
- **Arnuity® Ellipta®** — 50, 100, 200 mcg fluticasone furoate inhalation powder — DPI A
- **Asmanex® HFA** — 50, 100, 200 mcg mometasone furoate — DPI A
- **Asmanex® Twisthaler®** — 110, 220 mcg mometasone furoate inhalation powder — DPI A
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- **Pulmicort Flexhaler®** — 90, 180 mcg budesonide inhalation powder — DPI A
- **QVAR® Redihaler™** — 40, 80 mcg beclomethasone dipropionate — DPI A

## MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

### Short-acting

- **Atrovent® HFA** — 17 mcg ipratropium bromide — DPI C

### Long-acting

- **Incruse® Ellipta®** — 62.5 mcg umeclidinium inhalation powder — DPI C
- **Spiriva® HandiHaler®** — 18 mcg tiotropium bromide inhalation powder — C
- **Spiriva® Respimat®** — 1.25, 2.5 mcg tiotropium bromide — DPI A C
- **Tudorza™ Pressair™** — 400 mcg aclidinium bromide inhalation powder — DPI C

## COMBINATION MEDICATIONS

contain both short-acting beta$_2$-agonist and short-acting muscarinic antagonist

- **Combivent® Respimat®** — 20/100 mcg ipratropium bromide and albuterol — DPI C

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contain both inhaled corticosteroid and long-acting beta$_2$-agonist (LABA)

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- **Dulera®** — 50/5, 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate — DPI A
- **Symbicort®** — 80/4.5, 160/4.5 mcg budesonide and formoterol fumarate dihydrate — DPI A C G
- **Wixela™ Inhub** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate — approved generic of Advair Diskus — DPI A C

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- **Anoro® Ellipta®** — 62.5/25 mcg umeclidinium and vilanterol inhalation powder — DPI C
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target cells and pathways that cause airway inflammation; delivered by injection or IV

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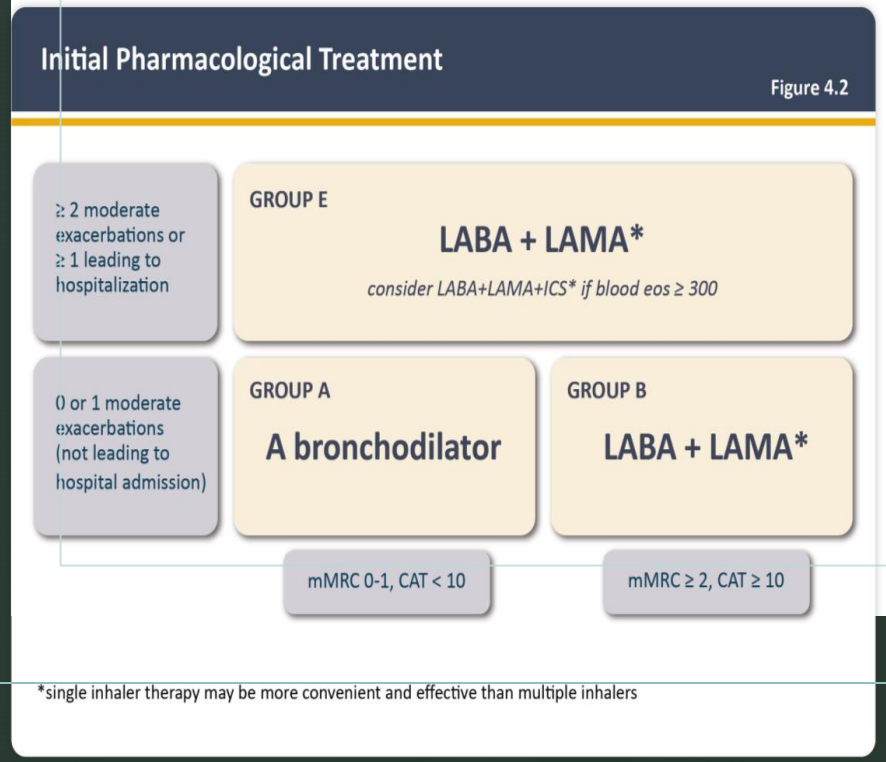


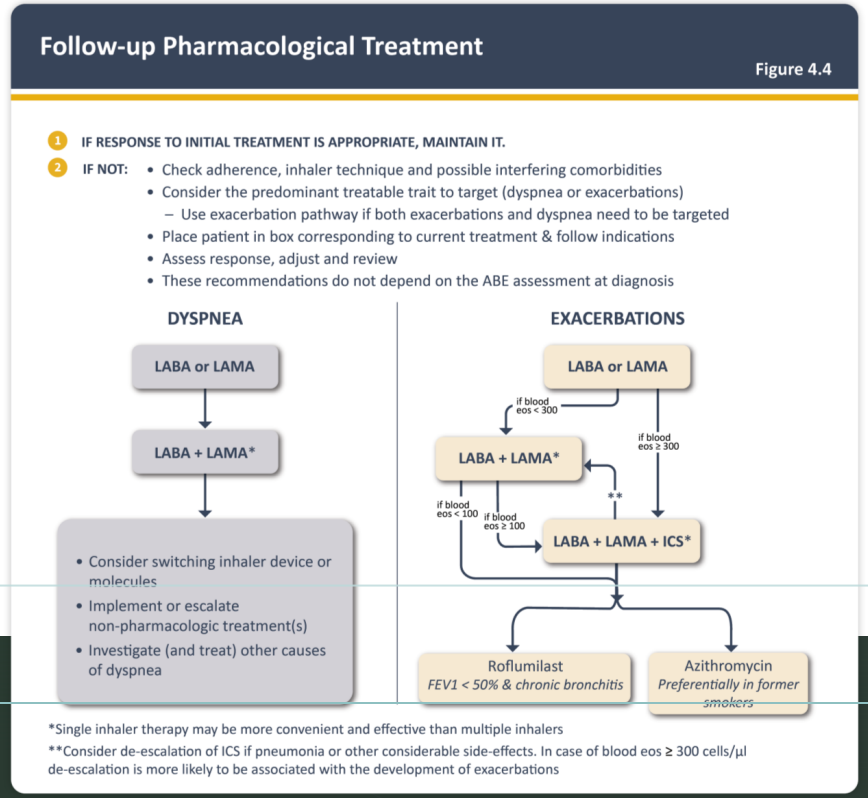


# COPD TREATMENT

# Respiratory Treatments

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relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** 90 mcg albuterol sulfate inhalation powder — DPI A
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- **Xopenex HFA®** 45 mcg levalbuterol tartrate — MDI A G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

- **Serevent® Diskus®** 50 mcg salmeterol xinafoate inhalation powder — DPI A C
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## INHALED CORTICOSTEROIDS

coughing, wheezing or shortness of breath

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## MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

Short-acting

- **Atrovent® HFA** 17 mcg ipratropium bromide — MDI C

Long-acting

- **Incruse® Ellipta®** 62.5 mcg umeclidinium inhalation powder — DPI C
- **Spiriva® HandiHaler®** 18 mcg tiotropium bromide inhalation powder — C
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## COMBINATION MEDICATIONS

contain both short-acting beta$_2$-agonist and short-acting muscarinic antagonist

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- **Wixela™ Inhub™** 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate approved generic of Advair Diskus — DPI A C

contain both long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

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target cells and pathways that cause airway inflammation; delivered by injection or IV

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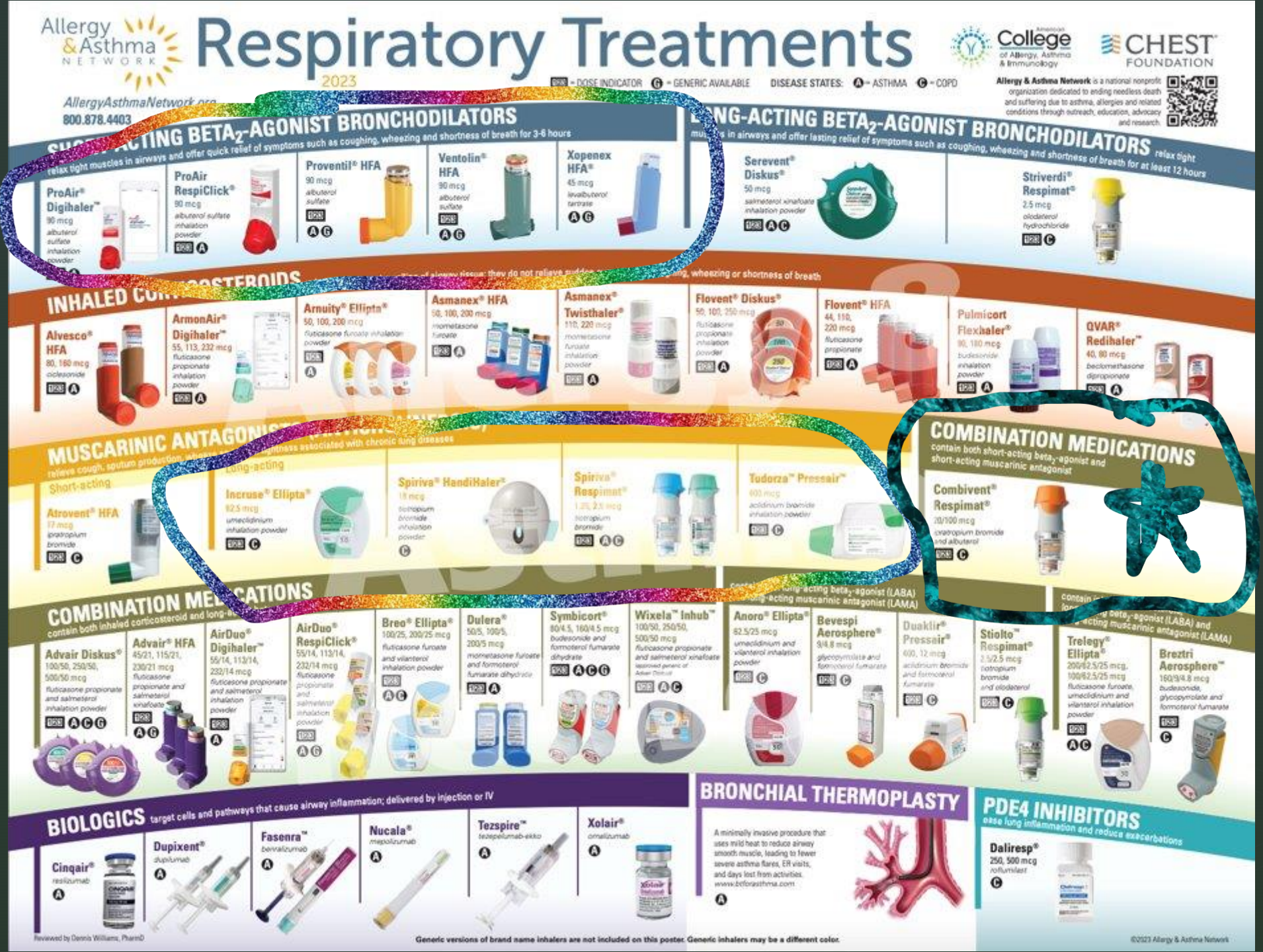
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Reviewed by Dennis Williams, PharmD

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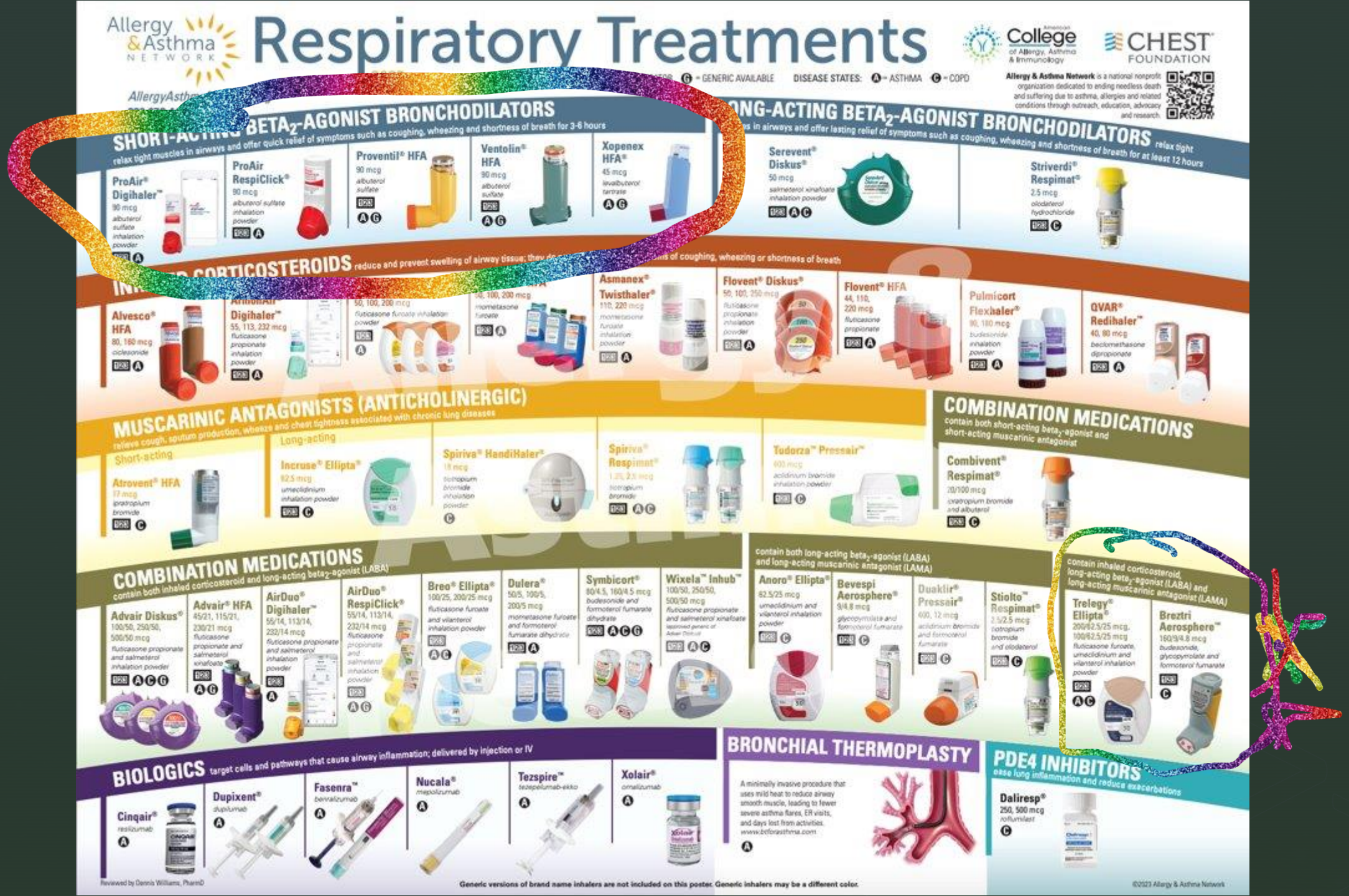
Allergy & Asthma Network
Respiratory Treatments
American College of Allergy, Asthma & Immunology
CHEST FOUNDATION
G = GENERIC AVAILABLE
DISEASE STATES: A = ASTHMA C = COPD
Allergy & Asthma Network is a national nonprofit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.
SHORT-ACTING BETA2-AGONIST BRONCHODILATORS
relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours
ProAir® Digihaler™ 90 mcg albuterol sulfate inhalation powder
ProAir RespiClick® 90 mcg albuterol sulfate inhalation powder
Proventil® HFA 90 mcg albuterol sulfate
Ventolin® HFA 90 mcg albuterol sulfate
Xopenex HFA® 45 mcg levalbuterol tartrate
LONG-ACTING BETA2-AGONIST BRONCHODILATORS
relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours
Serevent® Diskus® 50 mcg salmeterol xinafoate inhalation powder
Striverdi® Respimat® 2.5 mcg olodaterol hydrochloride
INHALED CORTICOSTEROIDS
reduce and prevent swelling of airway tissue; they control symptoms of coughing, wheezing or shortness of breath
Alvesco® HFA 80, 160 mcg ciclesonide
Arnuity Ellipta® 55, 113, 232 mcg fluticasone propionate inhalation powder
50, 100, 200 mcg fluticasone furoate inhalation powder
100, 200 mcg mometasone furoate
Asmanex® Twisthaler® 110, 220 mcg mometasone furoate inhalation powder
Flovent® Diskus® 50, 100, 250 mcg fluticasone propionate inhalation powder
Flovent® HFA 44, 110, 220 mcg fluticasone propionate
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MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)
relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases
Short-acting
Atrovent® HFA 17 mcg ipratropium bromide
Long-acting
Incruse® Ellipta® 62.5 mcg umeclidinium inhalation powder
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Tudorza™ Pressair™ 400 mcg aclidinium bromide inhalation powder
COMBINATION MEDICATIONS
contain both short-acting beta2-agonist and short-acting muscarinic antagonist
Combivent® Respimat® 20/100 mcg ipratropium bromide and albuterol
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Breo® Ellipta® 100/25, 200/25 mcg fluticasone furoate and vilanterol inhalation powder
Dulera® 50/5, 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate
Symbicort® 80/4.5, 160/4.5 mcg budesonide and formoterol fumarate dihydrate
Wixela™ Inhub™ 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate approved generic of Advair Diskus
contain both long-acting beta2-agonist (LABA) and long-acting muscarinic antagonist (LAMA)
Anoro® Ellipta® 62.5/25 mcg umeclidinium and vilanterol inhalation powder
Bevespi Aerosphere® 9/4.8 mcg glycopyrrolate and formoterol fumarate
Duaklir® Pressair™ 400, 12 mcg aclidinium bromide and formoterol fumarate
Stiolto™ Respimat® 2.5/2.5 mcg tiotropium bromide and olodaterol
contain inhaled corticosteroid, long-acting beta2-agonist (LABA) and long-acting muscarinic antagonist (LAMA)
Trelegy® Ellipta® 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder
Breztri Aerosphere™ 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate
BIOLOGICS
target cells and pathways that cause airway inflammation; delivered by injection or IV
Cinqair® reslizumab
Dupixent® dupilumab
Fasenra™ benralizumab
Nucala® mepolizumab
Tezspire™ tezepelumab-ekko
Xolair® omalizumab
BRONCHIAL THERMOPLASTY
A minimally invasive procedure that uses mild heat to reduce airway smooth muscle, leading to fewer severe asthma flares, ER visits, and days lost from activities.
www.btforasthma.com
PDE4 INHIBITORS
ease lung inflammation and reduce exacerbations
Daliresp® 250, 500 mcg roflumilast
Reviewed by Dennis Williams, PharmD
Generic versions of brand name inhalers are not included on this poster. Generic inhalers may be a different color.
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# COPD- Triple Therapy - Dual Therapy = ICS
## Do we Need ICS?

### Pros

Potential impact on exacerbations

Biological plausibility for certain phenotypes

- Reduce airway inflammation
- Upregulate beta receptors
- Mild improvement in $FEV_1$ (initial sustained)

### Cons

Skin thinning and easy bruising

Oral thrush, and hoarseness

Increased risk of pneumonia

Osteoporosis

Early onset diabetes .

Cataracts

Cost

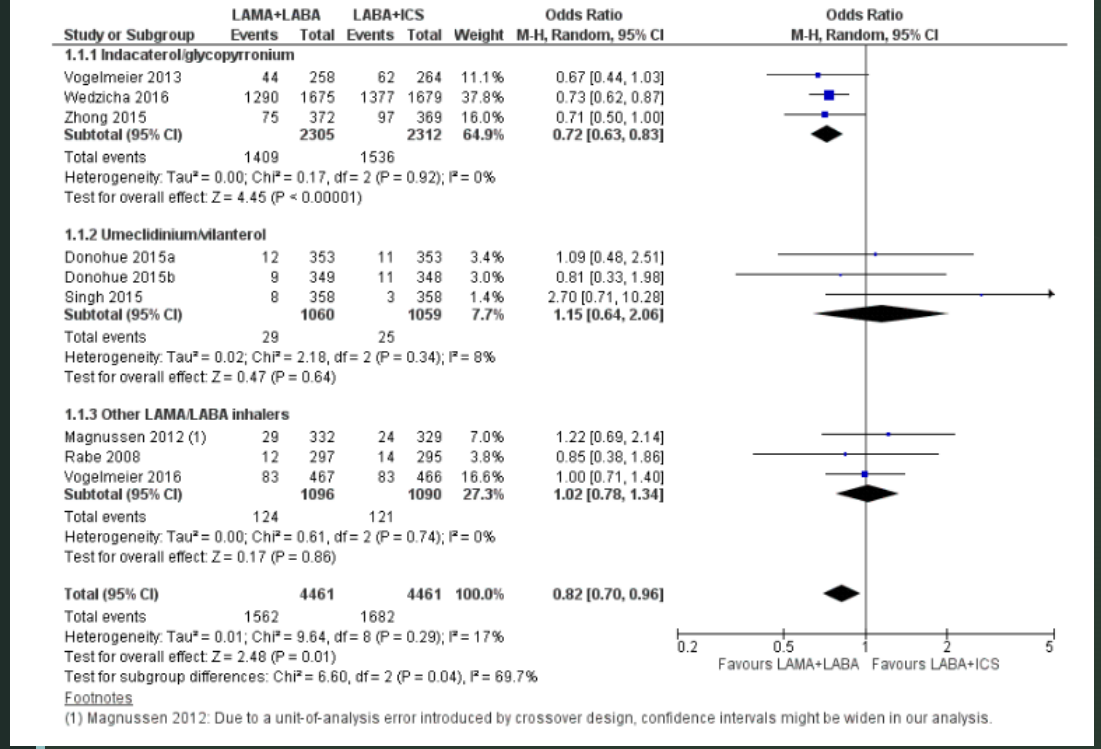
No effect on $FEV_1$ decline

# LAMA-LABA vs. LABA - ICS

More Exacerbations

Likely More Adverse Effects

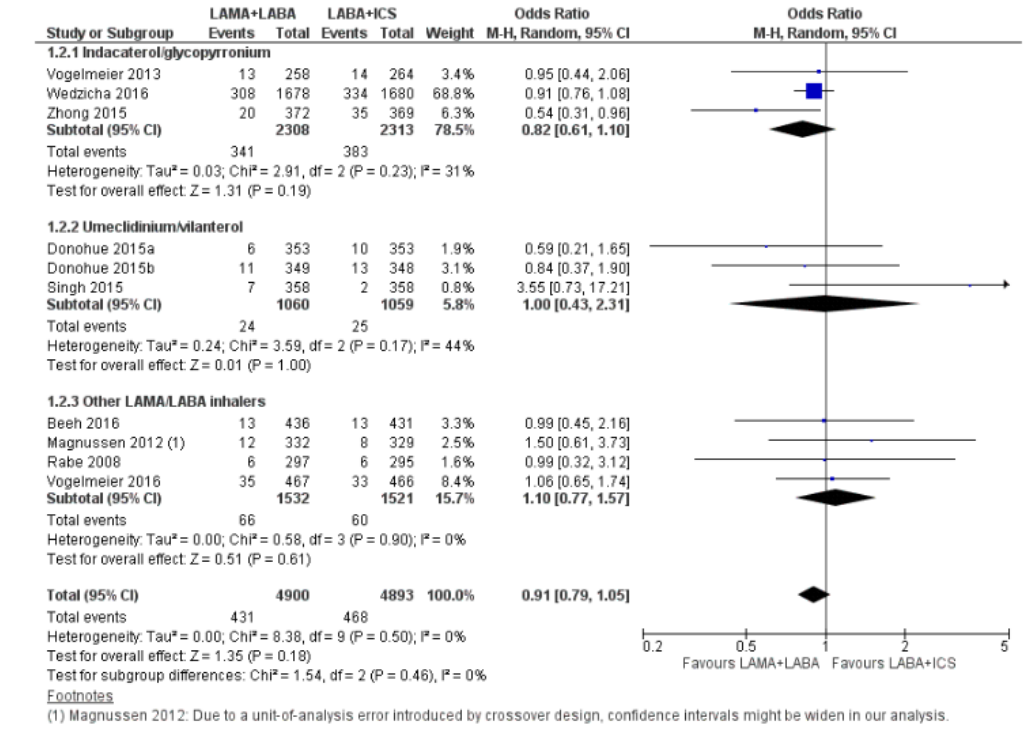
**Figure 3. Forest plot of comparison: 1 Long-acting muscarinic antagonist (LAMA) plus long-acting beta-agonist (LABA) versus LABA plus ICS (inhaled corticosteroid), outcome: 1.1 Exacerbation.**




Footnotes

(1) Magnussen 2012: Due to a unit-of-analysis error introduced by crossover design, confidence intervals might be widen in our analysis.

**Figure 4. Forest plot of comparison: 1 Long-acting muscarinic antagonist (LAMA) plus long-acting beta-agonist (LABA) versus LABA plus ICS (inhaled corticosteroid), outcome: 1.2 Serious adverse events.**




Footnotes

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2017 - DOI: 10.1002/14651858.CD012066.pub2

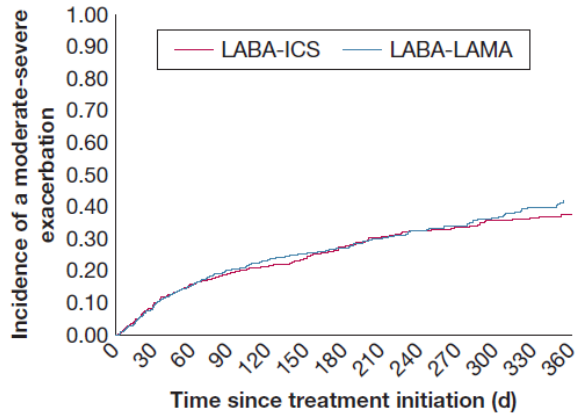


Figure 2 – *One-year cumulative incidence of the first moderate or severe COPD exacerbation, comparing current treatment with LABA-LAMA and LABA-ICS, estimated using the Kaplan-Meier method. See Figure 1 legend for expansion of abbreviations.*

**TABLE 3** ] Crude and Adjusted Hazard Ratios of Severe Pneumonia Comparing LABA-LAMA Initiation With LABA-ICS Initiation in Patients With COPD in the First Year After Treatment Initiation, From the As-Treated Analysis

| Treatment Exposure | No. of Patients | No. of Events | Person-Years | Rate per 100 per Year | Crude[a] HR | Adjusted[b] HR (95% CI) |
|---|---|---|---|---|---|---|
| As-treated exposure | | | | | | |
| LABA-LAMA | 1,977 | 32 | 629 | 5.1 | 0.66 | 0.66 (0.41-1.05) |
| LABA-ICS | 1,977 | 41 | 535 | 7.7 | 1.00 | 1.00 (Reference) |
| On-treatment exposure[c] | | | | | | |
| LABA-LAMA | 1,977 | 49 | 907 | 5.4 | 0.65 | 0.66 (0.48-0.92) |
| LABA-ICS | 1,977 | 143 | 1,778 | 8.0 | 1.00 | 1.00 (Reference) |

See Table 1 and 2 legends for expansion of abbreviations.
[a]Crude, after matching on high-dimensional propensity scores and sex.
[b]After matching on high-dimensional propensity scores and sex, adjusted further for the decile of propensity score.
[c]On-treatment exposure based on analysis of current use during the entire 1-year follow-up, allowing patients to switch or add treatments.

DOI: 10.1016/j.chest.2019.03.005

# LAMA-LABA vs. LABA – ICS – Real world

# Respiratory Treatments

2023

AllergyAsthmaNetwork.org
800.878.4403

DOSE INDICATOR = DOSE INDICATOR · G = GENERIC AVAILABLE · DISEASE STATES: A = ASTHMA · C = COPD


Allergy & Asthma Network is a national nonprofit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.


## SHORT-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** — 90 mcg albuterol sulfate inhalation powder — DOSE INDICATOR, A
- **ProAir RespiClick®** — 90 mcg albuterol sulfate inhalation powder — DOSE INDICATOR, A
- **Proventil® HFA** — 90 mcg albuterol sulfate — DOSE INDICATOR, A, G
- **Ventolin® HFA** — 90 mcg albuterol sulfate — DOSE INDICATOR, A, G
- **Xopenex HFA®** — 45 mcg levalbuterol tartrate — A, G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

- **Serevent® Diskus®** — 50 mcg salmeterol xinafoate inhalation powder — DOSE INDICATOR, A, C
- **Striverdi® Respimat®** — 2.5 mcg olodaterol hydrochloride — DOSE INDICATOR, C

## INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

- **Alvesco® HFA** — 80, 160 mcg ciclesonide — DOSE INDICATOR, A
- **ArmonAir® Digihaler™** — 55, 113, 232 mcg fluticasone propionate inhalation powder — DOSE INDICATOR, A
- **Arnuity® Ellipta®** — 50, 100, 200 mcg fluticasone furoate inhalation powder — DOSE INDICATOR, A
- **Asmanex® HFA** — 50, 100, 200 mcg mometasone furoate — DOSE INDICATOR, A
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- **Pulmicort Flexhaler®** — 90, 180 mcg budesonide inhalation powder — DOSE INDICATOR, A
- **QVAR® Redihaler™** — 40, 80 mcg beclomethasone dipropionate — DOSE INDICATOR, A

## MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

### Short-acting

- **Atrovent® HFA** — 17 mcg ipratropium bromide — DOSE INDICATOR, C

### Long-acting

- **Incruse® Ellipta®** — 62.5 mcg umeclidinium inhalation powder — DOSE INDICATOR, C
- **Spiriva® HandiHaler®** — 18 mcg tiotropium bromide inhalation powder — G
- **Spiriva® Respimat®** — 1.25, 2.5 mcg tiotropium bromide — DOSE INDICATOR, A, C
- **Tudorza™ Pressair™** — 400 mcg aclidinium bromide inhalation powder — DOSE INDICATOR, C

## COMBINATION MEDICATIONS

contain both short-acting beta$_2$-agonist and short-acting muscarinic antagonist

- **Combivent® Respimat®** — 20/100 mcg ipratropium bromide and albuterol — DOSE INDICATOR, C

## COMBINATION MEDICATIONS

contain both inhaled corticosteroid and long-acting beta$_2$-agonist (LABA)

- **Advair Diskus®** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol inhalation powder — DOSE INDICATOR, A, C, G
- **Advair® HFA** — 45/21, 115/21, 230/21 mcg fluticasone propionate and salmeterol xinafoate — DOSE INDICATOR, A, G
- **AirDuo® Digihaler™** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DOSE INDICATOR, A
- **AirDuo® RespiClick®** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DOSE INDICATOR, A, G
- **Breo® Ellipta®** — 100/25, 200/25 mcg fluticasone furoate and vilanterol inhalation powder — DOSE INDICATOR, A, C
- **Dulera®** — 50/5, 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate — DOSE INDICATOR, A
- **Symbicort®** — 80/4.5, 160/4.5 mcg budesonide and formoterol fumarate dihydrate — DOSE INDICATOR, A, C, G
- **Wixela™ Inhub™** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate (approved generic of Advair Diskus) — DOSE INDICATOR, A, C

## COMBINATION MEDICATIONS

contain both long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Anoro® Ellipta®** — 62.5/25 mcg umeclidinium and vilanterol inhalation powder — DOSE INDICATOR, C
- **Bevespi Aerosphere®** — 9/4.8 mcg glycopyrrolate and formoterol fumarate — DOSE INDICATOR, C
- **Duaklir® Pressair®** — 400, 12 mcg aclidinium bromide and formoterol fumarate — DOSE INDICATOR, C
- **Stiolto™ Respimat®** — 2.5/2.5 mcg tiotropium bromide and olodaterol — DOSE INDICATOR, C

## COMBINATION MEDICATIONS

contain inhaled corticosteroid, long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Trelegy® Ellipta®** — 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder — DOSE INDICATOR, A, C
- **Breztri Aerosphere™** — 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate — DOSE INDICATOR, C


NDC 0378-9321-32
Wixela
Inhub
(fluticasone propionate and salmeterol inhalation powder, USP)
250/50
Rx only
60
doses
Pouch opened.
Use by:
Discard 1 month after removal from the foil pouch.
Mylan


250/50
ADVAIR DISKUS
ADVAIR HFA


9:41 AM
Share Report
AirDuo Digihaler Events
Month
Jun 10 - 16
AirDuo Digihaler Event
No Event
AirDuo digihaler
113 mcg/14 mcg
7
Good Inhalations
(More than 45 L/min)
8 / 17


Controllers:

- Inhaled steroids: Qvar, Arnuity, Asmanex, Flovent
- ICS/LABAs: Dulera, Breo, Advair, AirDuo, Symbicort, Wixela
- LAMA: Spiriva
- Triple therapy approved for asthma: Trelegy (200 mg fluticasone dose)


Relievers:

- Short acting beta2-agonist: Albuterol (brands are Proventil, ProAir, Ventolin); Levalbuterol (brand is Xopenex)
- Short acting anti-muscarinic: Ipratropium bromide- Atrovent
- Combination SABA/SAMA – Duoneb solution for nebulizer, Combivent inhaler

# Non – Pharmacologic treatment

| | | |
|---|---|---|
| **Smoking Cessation** | Inhaler training | Pulmonary rehab – for pts in group B & E |
| Oxygen therapy for resting hypoxia | Vaccination: flu, pneumococcal, COVID, RSV | **Spirometry yearly** |

# Exercise Training has benefits: increase efficiency, less sedentary

Pulmonary Rehabilitation aims to

1) Target extra-pulmonary effects of lung disease

2) Ensure patients learn optimally manage disease

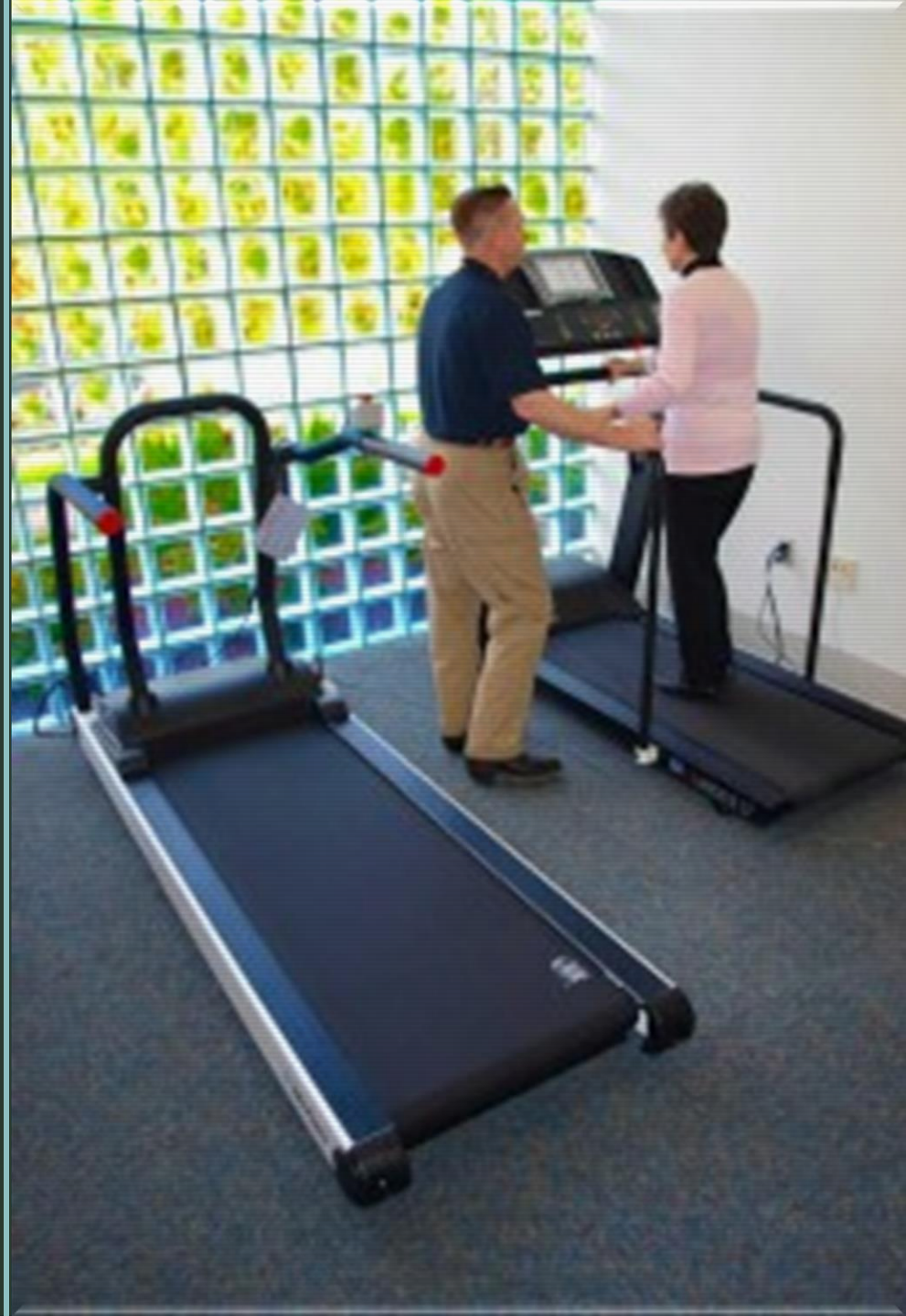
3) Provide patient with skills to lead healthy life

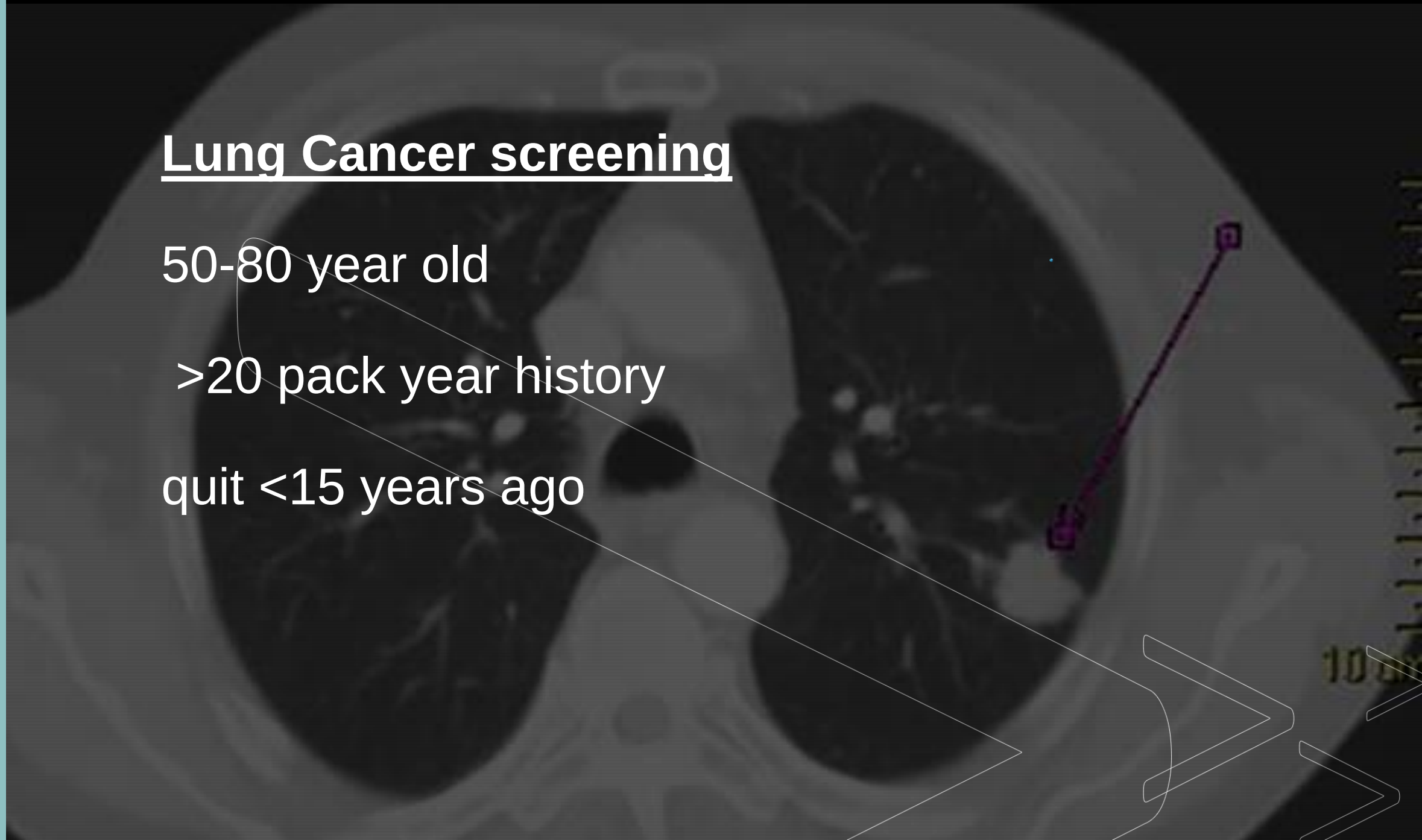
Physical Activity

Nutrition

Emotions/psychological well-being

***effective after exacerbations





## Lung Cancer screening

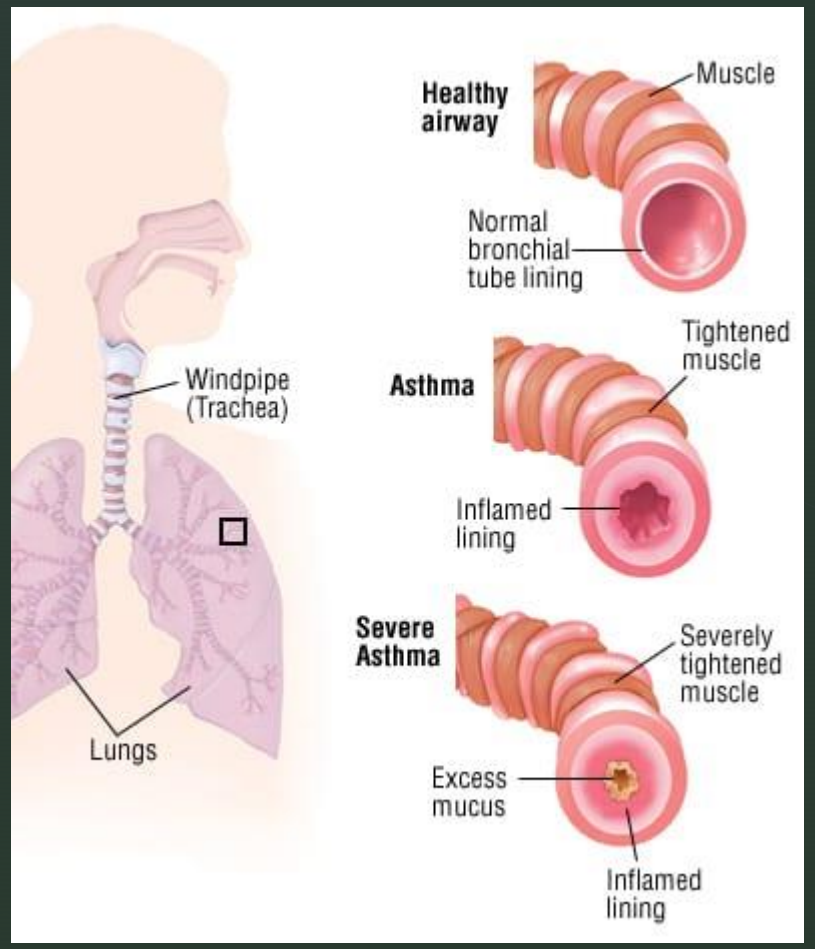
50-80 year old

>20 pack year history

quit <15 years ago


# ASTHMA

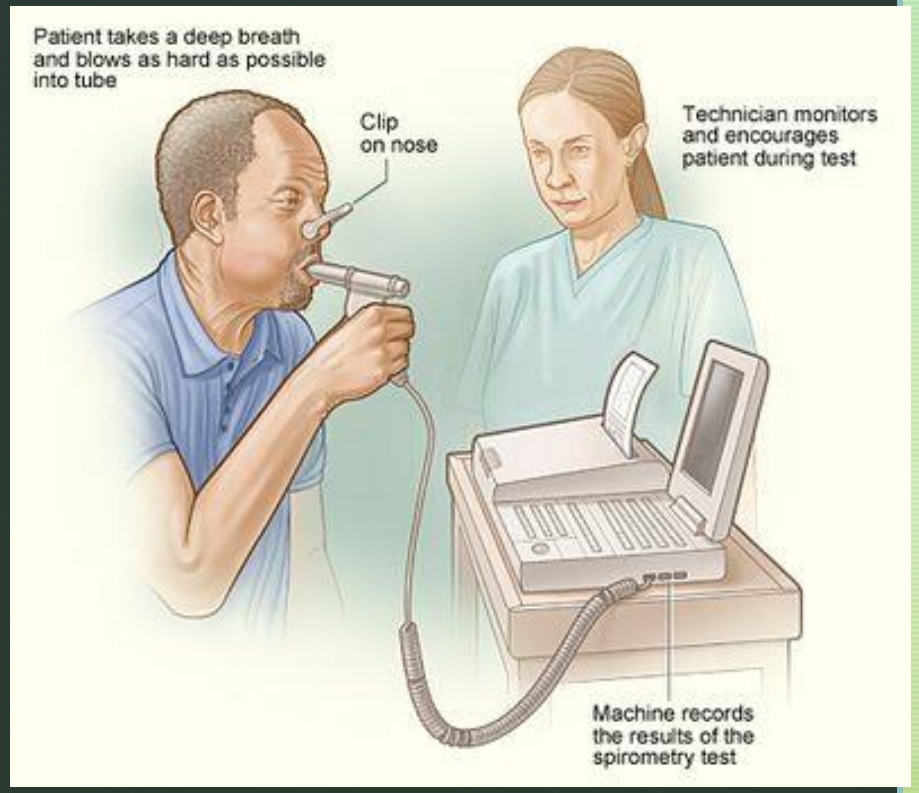
# Chronic airway inflammation
# Asthma





Pets
Exercise
Pollen
Stress
Bugs in the home
Anger
Chemical fumes
Pollution
Cold air
Strong odors
Fungus spores
Smoke
Dust
Asthma Triggers


You better be ready to blow the best breaths you have ever breathed in your entire life.


Patient takes a deep breath and blows as hard as possible into tube
Clip on nose
Technician monitors and encourages patient during test
Machine records the results of the spirometry test

# Variable flow obstruction seen in asthma

This can be measured by spirometry with a baseline measurement and testing after bronchodilator is administered

Significant if-

- $FEV_1$ increases >10% and at least 200 mL

| | | Meas | LLN | Pred | ULN | % | Post | % | %Chg |
|---|---|---|---|---|---|---|---|---|---|
| FVC | L | 3.79 | 2.92 | 3.65 | 4.41 | 103.6 | 3.78 | 103.4 | -0.2 |
| FEV1 | L | 2.32 | 2.47 | 3.08 | 3.67 | 75.3 | 2.87 | 93.1 | 23.7 |
| FEV1/FVC | % | 61 | 73 | 85 | 94 | 72.3 | 76 | 89.6 | 23.9 |


# Guidelines

National Asthma Education and Prevention Program Coordinating Committee (NAEPPCC) (the NAEPP Guidelines)

- Began in 1989
- Big update in 2007, then nothing until 2021!

Global Initiative for Asthma (GINA)

- Began in 1993
- Most recent update in 2022

# Diagnosing Asthma

**CLINICAL SYNDROME!**

**(can be confirmed/supported with testing)**

**Pulmonary function testing**

Spirometry - positive for asthma if airway obstruction is found with reversibility, and significant bronchodilator response

Bronchial Provocation Testing – Methacholine Challenge or Mannitol Challenge

FeNO – Fractionated exhaled nitric oxide - >50 ppb often seen in poorly controlled asthma.

**Labs**

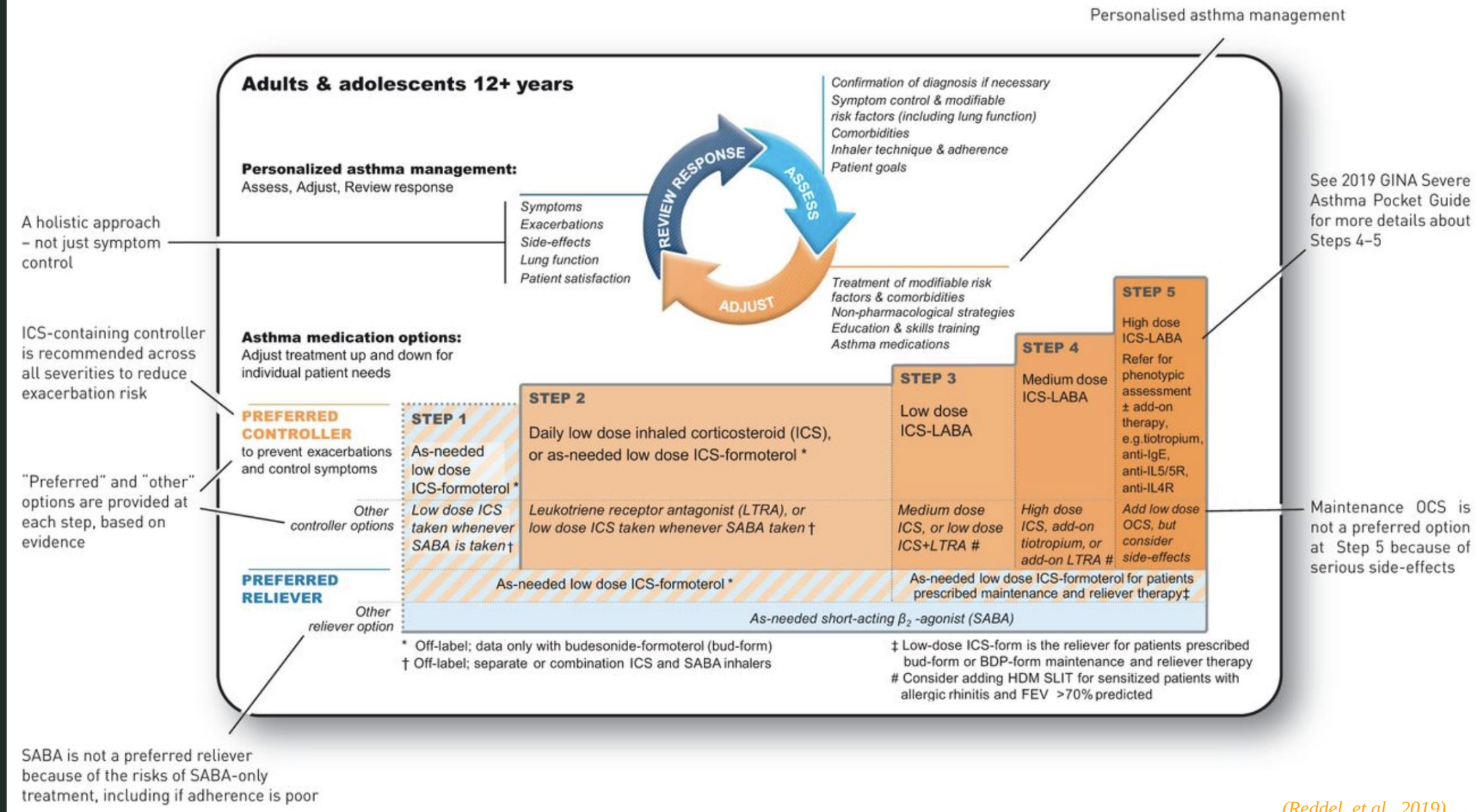
Elevated IgE

peripheral eosinophilia

| Components of Severity | | Classification of Asthma Severity ≥12 years of age | | | |
|---|---|---|---|---|---|
| | | | Persistent | | |
| | | Intermittent | Mild | Moderate | Severe |
| **Impairment**<br><br>**Normal $FEV_1/FVC$:**<br>**8–19 yr 85%**<br>**20 –39 yr 80%**<br>**40 –59 yr 75%**<br>**60 –80 yr 70%** | Symptoms | ≤2 days/week | >2 days/week but not daily | Daily | Throughout the day |
| | Nighttime awakenings | ≤2x/month | 3–4x/month | >1x/week but not nightly | Often 7x/week |
| | Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB) | ≤2 days/week | >2 days/week but not daily, and not more than 1x on any day | Daily | Several times per day |
| | Interference with normal activity | None | Minor limitation | Some limitation | Extremely limited |
| | Lung function | • Normal $FEV_1$ between exacerbations<br>• $FEV_1$ >80% predicted<br>• $FEV_1/FVC$ normal | • $FEV_1$ >80% predicted<br>• $FEV_1/FVC$ normal | • $FEV_1$ >60% but <80% predicted<br>• $FEV_1/FVC$ reduced 5% | • $FEV_1$ <60% predicted<br>• $FEV_1/FVC$ reduced >5% |
| **Risk** | Exacerbations requiring oral systemic corticosteroids | 0–1/year (see note) | ≥2/year (see note) → | | |
| | | ← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to $FEV_1$. | | | |
| **Recommended Step for Initiating Treatment** | | **Step 1** | **Step 2** | **Step 3** and consider short course of oral systemic corticosteroids | **Step 4 or 5** |
| **(See figure 4–5 for treatment steps.)** | | In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly. | | | |

*Source: NAEPP Asthma Guidelines, 2018*

| Treatment | Intermittent Asthma | Management of Persistent Asthma in Individuals Ages 12+ Years | | | | |
|---|---|---|---|---|---|---|
| | STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 5 | STEP 6■ |
| **Preferred** | PRN SABA | Daily low-dose ICS and PRN SABA<br>or<br>PRN concomitant ICS and SABA▲ | Daily and PRN combination low-dose ICS-formoterol▲ | Daily and PRN combination medium-dose ICS-formoterol▲ | Daily medium-high dose ICS-LABA + LAMA and PRN SABA▲ | Daily high-dose ICS-LABA + oral systemic corticosteroids + PRN SABA |
| **Alternative** | | Daily LTRA* and PRN SABA<br>or<br>Cromolyn,* or Nedocromil,* or Zileuton,* or Theophylline,* and PRN SABA | Daily medium-dose ICS and PRN SABA<br>or<br>Daily low-dose ICS-LABA, or daily low-dose ICS + LAMA,▲ or daily low-dose ICS + LTRA,* and PRN SABA<br>or<br>Daily low-dose ICS + Theophylline* or Zileuton,* and PRN SABA | Daily medium-dose ICS-LABA or daily medium-dose ICS + LAMA, and PRN SABA▲<br>or<br>Daily medium-dose ICS + LTRA,* or daily medium-dose ICS + Theophylline,* or daily medium-dose ICS + Zileuton,* and PRN SABA | Daily medium-high dose ICS-LABA or daily high-dose ICS + LTRA,* and PRN SABA | |
| | | Steps 2–4: Conditionally recommend the use of subcutaneous immunotherapy as an adjunct treatment to standard pharmacotherapy in individuals ≥ 5 years of age whose asthma is controlled at the initiation, build up, and maintenance phases of immunotherapy▲ | | | Consider adding Asthma Biologics (e.g., anti-IgE, anti-IL5, anti-IL5R, anti-IL4/IL13)** | |




(Reddel, et al., 2019)

# Respiratory Treatments

2023

DPI = DOSE INDICATOR  G = GENERIC AVAILABLE  DISEASE STATES: A = ASTHMA  C = COPD

AllergyAsthmaNet
800.878.4403

& Immunology
FOUNDATION

**Allergy & Asthma Network** is a national nonprofit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.

## SHORT-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **ProAir RespiClick®** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **Proventil® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Ventolin® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Xopenex HFA®** — 45 mcg levalbuterol tartrate — A G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours relax tight

- **Serevent® Diskus®** — 50 mcg salmeterol xinafoate inhalation powder — DPI A C
- **Striverdi® Respimat®** — 2.5 mcg olodaterol hydrochloride — DPI C

## INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of

- **Alvesco® HFA** — 80, 160 mcg ciclesonide — DPI A
- **ArmonAir® Digihaler™** — 55, 113, 232 mcg fluticasone propionate inhalation powder — DPI A
- **Arnuity® Ellipta®** — 50, 100, 200 mcg fluticasone furoate inhalation powder — DPI A
- **Asmanex® HFA** — 50, 100, 200 mcg mometasone furoate — DPI A
- **Asmanex® Twisthaler®** — 110, 220 mcg mometasone furoate inhalation powder — DPI A
- **Flovent® Diskus®** — 50, 100, 250 mcg fluticasone propionate inhalation powder — DPI A
- **Flovent® HFA** — 44, 110, 220 mcg fluticasone propionate — DPI A
- **Pulmicort Flexhaler®** — 90, 180 mcg budesonide inhalation powder — DPI A
- **QVAR® Redihaler™** — 40, 80 mcg beclomethasone dipropionate — DPI A

## MUSCARINIC ANTAGONISTS (ANTICHOLINERGIC)

relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

Short-acting

- **Atrovent® HFA** — 17 mcg ipratropium bromide — DPI C

Long-acting

- **Incruse® Ellipta®** — 62.5 mcg umeclidinium inhalation powder — DPI C
- **Spiriva® HandiHaler®** — 18 mcg tiotropium bromide inhalation powder — G
- **Spiriva® Respimat®** — 1.25, 2.5 mcg tiotropium bromide — DPI A C
- **Tudorza™ Pressair™** — 400 mcg aclidinium bromide inhalation powder — DPI C

## COMBINATION MEDICATIONS

contain both short-acting beta$_2$-agonist and short-acting muscarinic antagonist

- **Combivent® Respimat®** — 20/100 mcg ipratropium bromide and albuterol — DPI C

## COMBINATION MEDICATIONS

contain both inhaled corticosteroid and long-acting beta$_2$-agonist (LABA)

- **Advair Diskus®** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol inhalation powder — DPI A C G
- **Advair® HFA** — 45/21, 115/21, 230/21 mcg fluticasone propionate and salmeterol xinafoate — DPI A G
- **AirDuo® Digihaler™** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DPI A
- **AirDuo® RespiClick®** — 55/14, 113/14, 232/14 mcg fluticasone propionate and salmeterol inhalation powder — DPI A G
- **Breo® Ellipta®** — 100/25, 200/25 mcg fluticasone furoate and vilanterol inhalation powder — DPI A C
- **Dulera®** — 50/5, 100/5, 200/5 mcg mometasone furoate and formoterol fumarate dihydrate — DPI A
- **Symbicort®** — 80/4.5, 160/4.5 mcg budesonide and formoterol fumarate dihydrate — DPI A C G
- **Wixela™ Inhub™** — 100/50, 250/50, 500/50 mcg fluticasone propionate and salmeterol xinafoate (approved generic of Advair Diskus) — DPI A C

## COMBINATION MEDICATIONS

contain both long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Anoro® Ellipta®** — 62.5/25 mcg umeclidinium and vilanterol inhalation powder — DPI C
- **Bevespi Aerosphere®** — 9/4.8 mcg glycopyrrolate and formoterol fumarate — DPI C
- **Duaklir® Pressair®** — 400, 12 mcg aclidinium bromide and formoterol fumarate — DPI C
- **Stiolto™ Respimat®** — 2.5/2.5 mcg tiotropium bromide and olodaterol — DPI C

## COMBINATION MEDICATIONS

contain inhaled corticosteroid, long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Trelegy® Ellipta®** — 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder — DPI A C
- **Breztri Aerosphere™** — 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate — DPI C

# Medications- Step 1

- NAEPP Guidelines: PRN SABA

  Brands

    Proventil, Ventolin, ProAir (all albuterol)

    Xopenex (levalbuterol)

- GINA Guidelines: PRN low-dose ICS/LABA (but only formoterol!) – budesonide/formoterol most studied, but other combination with formoterol is fine

  Brands

    Symbicort (budesonide/formoterol)

    Dulera (mometasone/formoterol)

    Perforomist (nebulized formoterol – can be combined with ICS)

# Medications – Step 2

NAEPP

- Daily low dose ICS, and as needed SABA for quick relief therapy

OR

- Intermittent as-needed SABA + an ICS use concomitantly (one after the other)

GINA

- Daily low- dose ICS

OR

- As needed low-dose ICS/formoterol

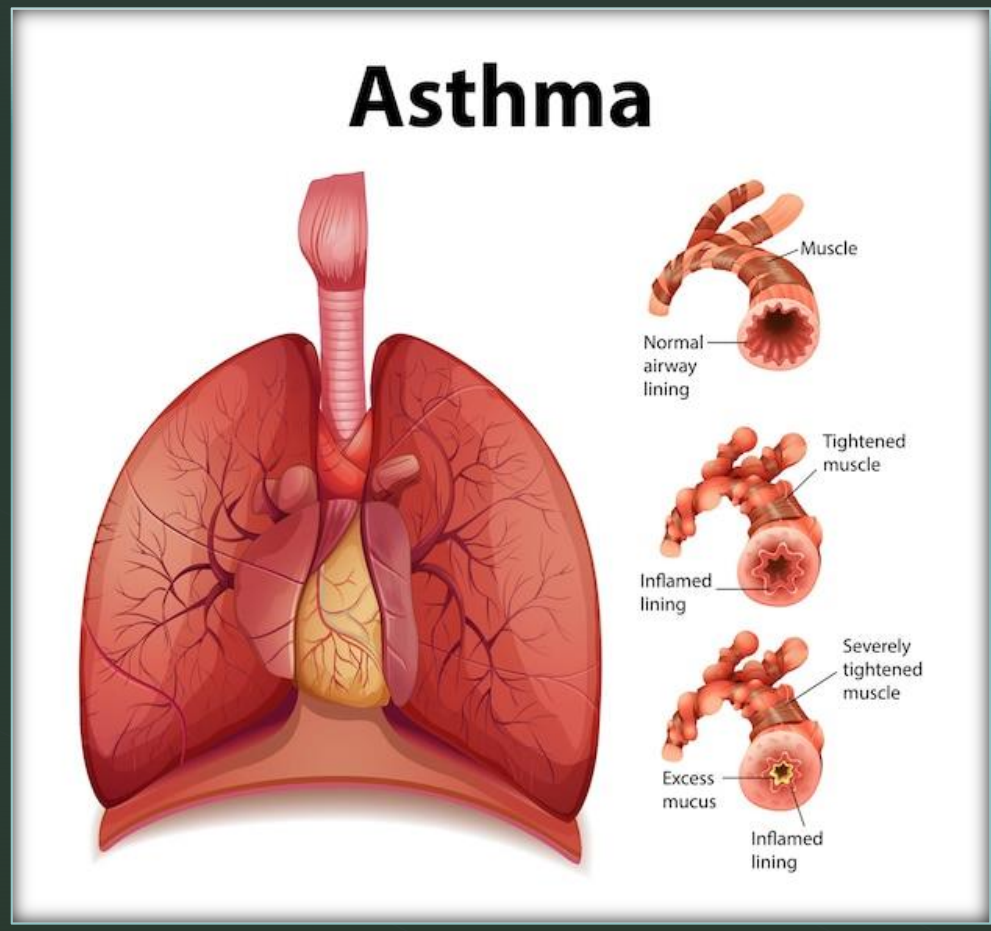
# Medication Step 3

NAEPP

- Daily and PRN low-dose ICS/LABA (Also called SMART (Single Maintenance and Reliever Therapy) – suitable for Steps 3 and 4.)

GINA

- Low-dose ICS/LABA, with PRN ICS/formoterol as rescue. (Essentially this is SMART therapy too! But leaves the daily inhaler up to you if you want to use another LABA type)
- Consider adding on leukotriene modifier (LTRA) – Singulair (montelukast), Accolate (zarfirlukast), Zyflo (Zileuton)



# Leukotriene Modifiers

- Montelukast (Singulair) 10 mg once a day (PO)
- Zafirlukast (Accolate) 20 mg BID (PO)

Bronchoconstriction, vascular permeability, eosinophil recruitment, and chronic inflammation are mediated through the G protein-coupled activation of cysteinyl leukotriene receptors. SO – Leukotriene stimulate airway contraction, and inflammatory cascade ft. mucosal edema, mucous secretion

Montelukast and zafirlukast block cysteinyl leukotriene CysLT1 receptors, resulting in reduced eosinophilic recruitment to airway tissue.

Great for: Exercise-induced bronchospasm, asthma with allergic rhinitis, cold-exacerbated asthma, aspirin-exacerbated respiratory disease (AERD).

- Zileuton (Zyflo) 600 mg QID, or ER dosing 1200 mg BID

Works differently to other LTRAs, Specific 5-lipoxygenase inhibitor which inhibits leukotriene formation.

# Respiratory Treatments

2023

DPI = DOSE INDICATOR  G = GENERIC AVAILABLE  DISEASE STATES: A = ASTHMA  C = COPD

AllergyAsthmaNet
800.878.4403

& Immunology
FOUNDATION

**Allergy & Asthma Network** is a national nonprofit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.

## SHORT-ACTING BETA$_2$-AGONIST BRONCHODILATORS

relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

- **ProAir® Digihaler™** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **ProAir RespiClick®** — 90 mcg albuterol sulfate inhalation powder — DPI A
- **Proventil® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Ventolin® HFA** — 90 mcg albuterol sulfate — DPI A G
- **Xopenex HFA®** — 45 mcg levalbuterol tartrate — A G

## LONG-ACTING BETA$_2$-AGONIST BRONCHODILATORS

muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours relax tight

- **Serevent® Diskus®** — 50 mcg salmeterol xinafoate inhalation powder — DPI A C
- **Striverdi® Respimat®** — 2.5 mcg olodaterol hydrochloride — DPI C

## INHALED CORTICOSTEROIDS

reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of

- **Alvesco® HFA** — 80, 160 mcg ciclesonide — DPI A
- **ArmonAir® Digihaler™** — 55, 113, 232 mcg fluticasone propionate inhalation powder — DPI A
- **Arnuity® Ellipta®** — 50, 100, 200 mcg fluticasone furoate inhalation powder — DPI A
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## COMBINATION MEDICATIONS

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- **Advair® HFA** — 45/21, 115/21, 230/21 mcg fluticasone propionate and salmeterol xinafoate — DPI A G
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## COMBINATION MEDICATIONS

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## COMBINATION MEDICATIONS

contain inhaled corticosteroid, long-acting beta$_2$-agonist (LABA) and long-acting muscarinic antagonist (LAMA)

- **Trelegy® Ellipta®** — 200/62.5/25 mcg, 100/62.5/25 mcg fluticasone furoate, umeclidinium and vilanterol inhalation powder — DPI A C
- **Breztri Aerosphere™** — 160/9/4.8 mcg budesonide, glycopyrrolate and formoterol fumarate — DPI C

# Medications - Step 4

NAEPP

- Daily and PRN medium-dose ICS/LABA (Also called SMART (Single Maintenance and Reliever Therapy) – suitable for Steps 3 and 4.)
- Add LTRA

GINA

- Medium-dose ICS/LABA, with PRN ICS/formoterol as rescue
- LTRA
- Consider use/addition of LAMA – tiotropium (currently the only FDA approved LAMA for asthma in the US)

# Medications – Step 5

NAEPP

- Daily medium to high-dose ICS/LABA
- LTRA
- Albuterol PRN as rescue
- Add LAMA
- Consider biologics

GINA

- High-dose ICS/LABA, with PRN ICS/formoterol as rescue
- LTRA
- LAMA
- Consider biologics
- Systemic glucocorticoids

# Medications - Step 6

NAEPP

- Daily medium to high-dose ICS/LABA
- LTRA
- Albuterol PRN as rescue
- Add LAMA
- Consider bioloigics
- Systemic glucocorticoids

# Inhaler Types

**Controllers/Relievers?!**

- Low dose inhaled steroid + LAMA

- Low dose ICS + SABA, Approved Jan 2023- **FDA approves drug combination treatment for adults with asthma**
  - Airsupra (albuterol and budesonide) inhalation aerosol
  - For the as-needed ***treatment or prevention*** of bronchoconstriction and to reduce the risk of asthma attacks in patients with asthma 18 years of age and older.
  - Combination of albuterol (a beta-2 adrenergic agonist) and budesonide (a corticosteroid)
  - Dose: 2 inhalations of a combination of albuterol 90 mcg and budesonide 80 mcg per inhalation (total dose albuterol 180 mcg and budesonide 160 mcg) as needed for asthma symptoms.


It is the first combination of an inhaled corticosteroid (ICS) and a short-acting beta-agonist to be approved in the U.S. Additionally, *Airsupra is the first product containing an ICS to be approved in the U.S. as a* ***reliever treatment*** *(rather than as a controller) for asthma.*

The treatment works to relax the muscles and reduce inflammation in the lung airways to reduce the risk of severe asthma attacks.

# GLUCOCORTICOIDS

“Systemic corticosteroids use is associated with increased risk of infections and cardiovascular events; of chronic conditions such as type 2 diabetes mellitus, osteoporosis, and cataracts; of metabolic effects such as weight gain; and of neuropsychiatric effects such as insomnia, depression, and behavioral disturbances.

A dose-response relationship with systemic corticosteroid exposure has been documented for many of these events.-

**Even short-term use** of oral corticosteroids (OCS) in a large population-based study has been associated with increased rates of sepsis, thromboembolism, and fracture within 30 days of OCS initiation. Of note, decreases in serum cortisol and markers of bone formation, and changes in white blood cell counts, are evident within hours of oral prednisone administration to healthy subjects.”

*(Price, et al., 2018)*

# GLUCOCORTICOIDS

If you have patients needing even 1-2 bursts of steroids/year for their asthma,

***PLEASE CONSIDER SENDING TO ASTHMA SPECIALIST!!!***

We can help with the following

- Disease education
- Inhaler training
- Exploring and mitigating comorbidities
- Advancing to higher steps of care

# So, what is severe asthma?

- Asthma that requires treatment with high dose ICS + second controller and/or systemic corticosteroids to prevent it from becoming ‘uncontrolled’ or that remains ‘uncontrolled’ despite this therapy.

Defining “Uncontrolled”

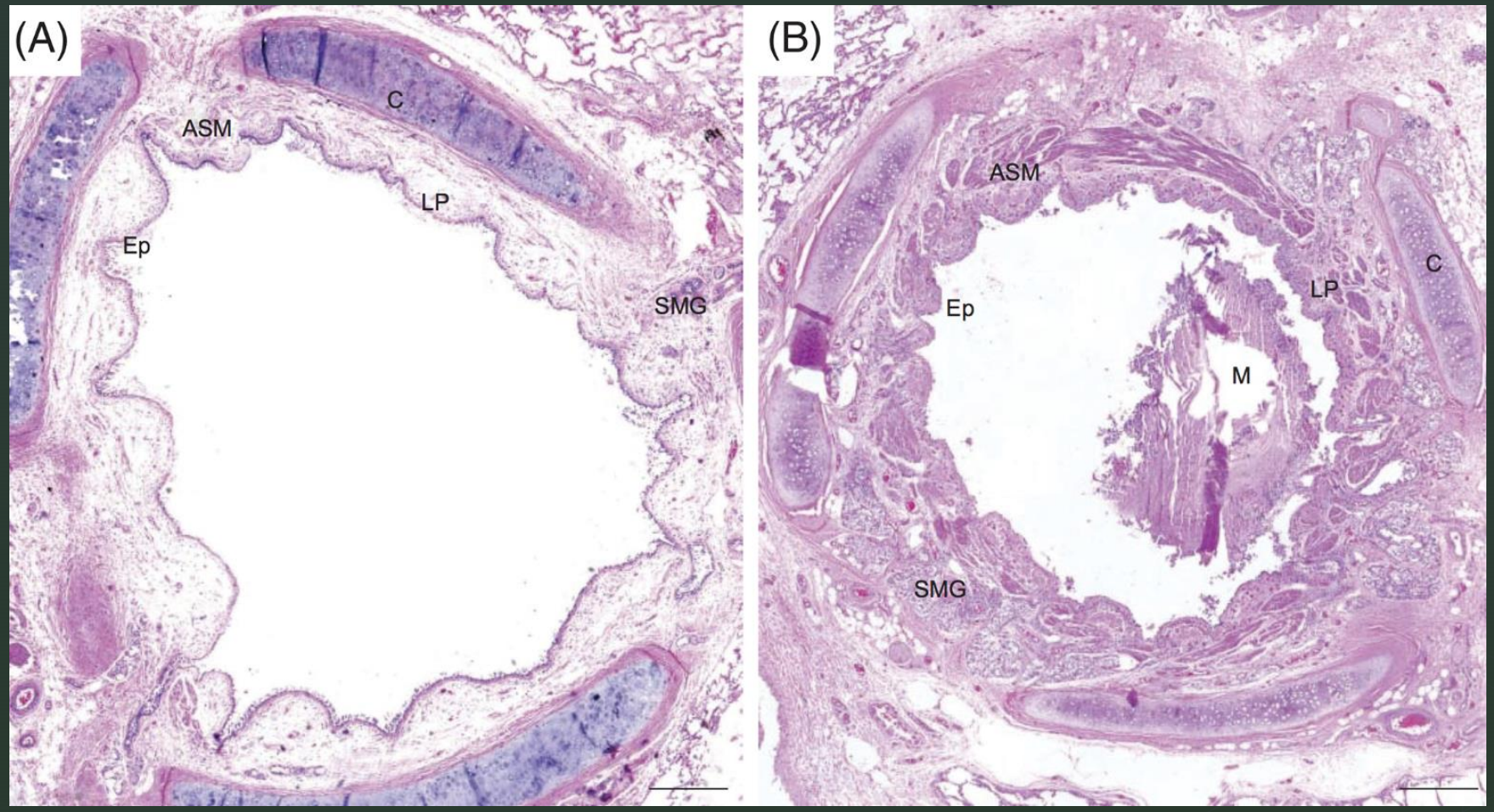
- Poor symptom control (frequent use of rescue/reliever, night time waking, missing work or school)
- Frequent severe exacerbations (>= 2 bursts of systemic steroid in the past year, 1 ED visit or hospitalization for asthma in the past year, history of ICU stay or mechanical ventilation for asthma, or FEV1 that is <80%.) Relatively large proportion of resource expenditure, **only 10% prevalence**

*(Chung et al., 2013)*

# Chronic airway inflammation seen in Asthma

Healthy patient without asthma

Case of fatal asthma




*(King et al., 2018)*

# Treating Severe Asthma

- First, make sure it's asthma – Not every wheeze is asthma!
  - Differentials in adults:
    - Chronic obstructive pulmonary disease
    - Bronchiectasis (Asthma treatment could make this worse!)
    - Congestive heart failure
    - Gastroesophageal reflux disease,
    - Mechanical obstruction of the airways (e.g., tumors, foreign bodies, subglottic stenosis)
    - Vocal cord dysfunction or other laryngeal dysfunction
    - Pulmonary embolism
    - Pulmonary infiltrates with eosinophilia or other parenchymal disease
    - Upper airway disease
  - Differentials in children:
    - Foreign body aspiration causing airway obstruction
    - Pneumonia/bronchiolitis
    - Cystic fibrosis
    - Bronchopulmonary dysplasia (in premature infants)
    - Primary ciliary dyskinesia syndrome
    - Immune deficiency

*Environmental triggers of asthma: Differential diagnosis of asthma. (2021, February 9).*

# NOT Asthma

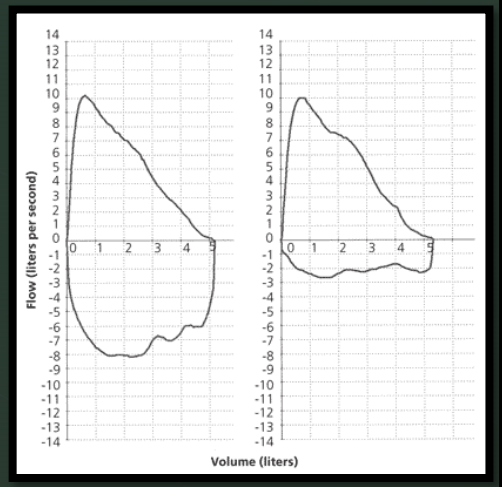
Severe thrush Fungal laryngitis


Severe polypoid corditis from smoking and reflux

# NOT Asthma

## Sinusitis

## Paradoxical Vocal Fold Motion




*Courtesy: C. Milstein, PhD*

# Treating Severe Asthma

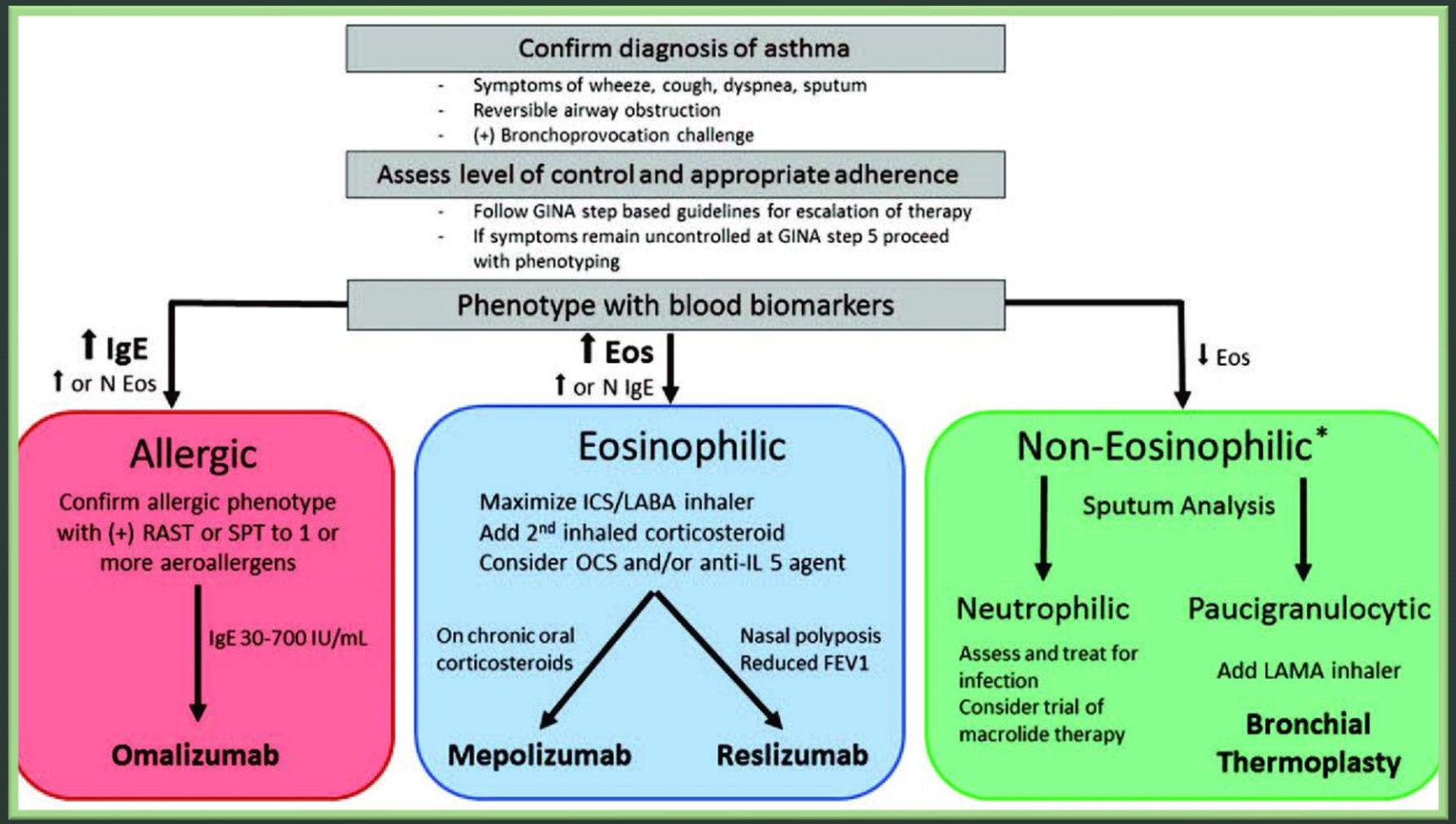
- Airway regimen optimized?
- Patients using inhalers correctly?
- Patients even HAVE their inhalers?!
- Comorbid conditions managed? (OSA, sinusitis, GERD, etc etc)

# Treating Severe Asthma

- PHENOTYPE IT! Phenotype is the variable clinical presentation of a disease state related to both genetic and environmental influences.
  - Clinical characteristics (gender, age of onset, severity, response to steroids)
  - Physiology (lung function, airway hyperresponsiveness)
  - Triggers (respiratory infections, allergens, pollution, tobacco, aspirin sensitivity)

We eventually hope to be able to “endotype” using validated biomarkers too – endotype describing distinct pathophysiologic mechanisms at a cellular and molecular level

***(Kuruvilla et al., 2019)***




# Algorithm to guide selection advanced therapies for severe asthma

*(Oberle and Mathur, 2017)*

# Pregnancy and Asthma – Are Meds Safe?

- Primary goals of asthma treatment during pregnancy are preventing exacerbations and minimizing maternal impairment.

*“The benefits of good adherence to asthma regimens during pregnancy outweigh the risks associated with the medications used.”*

***(Kher & Mota, 2017)***

## Uncontrolled asthma in pregnancy: Effects on mother and fetus

**Maternal effects**

Preeclampsia
Pregnancy-induced hypertension
Gestational diabetes
Premature rupture of membranes
Cesarean birth
Chorioamnionitis
Hyperemesis
Postpartum hemorrhage

**Fetal effects**

Perinatal death
Preterm birth
Low birth weight
Intrauterine growth restriction
Congenital malformations
Admission to neonatal intensive care unit
Hyperbilirubinemia
Respiratory distress syndrome
Transient tachypnea of the newborn
Asphyxia
Increased risk of intracerebral hemorrhage, anemia

## Drug therapy of maternal asthma: Former pregnancy risk categories

| Drug | Category[a] |
|---|---|
| **Short-acting beta-agonist** | |
| Albuterol | C |
| **Long-acting beta-agonists** | |
| Formoterol | C |
| Salmeterol | C |
| **Inhaled corticosteroids** | |
| Budesonide (inhalation) | B |
| Fluticasone (inhalation) | C |
| **Leukotriene modifiers** | |
| Montelukast, zafirlukast | B |
| Zileuton | C |
| **Monoclonal antibody** | |
| Omalizumab | B |
| **Xanthine derivative** | |
| Theophylline | C |
| **Intranasal corticosteroids** | |
| Intranasal budesonide | B |
| Intranasal fluticasone | C |
| Intranasal mometasone | C |
| Intranasal triamcinolone | C |

[a] Former US Food and Drug Administration risk category (see **Drugs**, this page).

## Management of asthma exacerbations in pregnancy

Monitor to ensure the maternal oxygen saturation remains above 95%

Consider systemic (oral) corticosteroids

Administer rescue therapy with a short-acting beta-agonist

Consider hospital admission if symptoms do not improve with emergency room care

Consider admission to intensive care unit and mechanical ventilation if symptoms are severe or if patient shows signs of impending respiratory failure

Carefully monitor fetal health

*(Kher & Mota, 2017)*

# TOBACCO CESSATION

# Smoke a FRESH cigarette"

IF the cigarette you have been smoking stings or burns your throat, switch to Camels and see the difference.

It's the peppery dust left in tobacco by inefficient cleaning methods that makes you cough.

It's the unkindly hot smoke of harsh, dried-out tobacco that burns and irritates your throat.

There is no peppery dust in Camels—that's whisked away by a special vacuum-cleaning process.

There are no stale, crumbly, parched tobaccos—the fine Turkish and mild Domestic tobaccos of which Camels are blended come to you in prime, factory-fresh condition, thanks to the Humidor Pack.

This scientific germ-safe wrapping—not plain ordinary Cellophane, but *moisture-proof* Cellophane which costs nearly twice as much—seals in all the natural aroma and freshness, seals it so tightly that wet weather cannot make Camels damp, nor drought weather make them dry.

Camels are milder and more throat-friendly because they are dust-free and fresh.

Give your throat a vacation, switch to Camels for just one day. Then leave them—if you can.

Tune in CAMEL QUARTER HOUR featuring Morton Downey and Tony Wons — Camel Orchestra, direction Jacques Renard — Columbia System — every night except Sunday

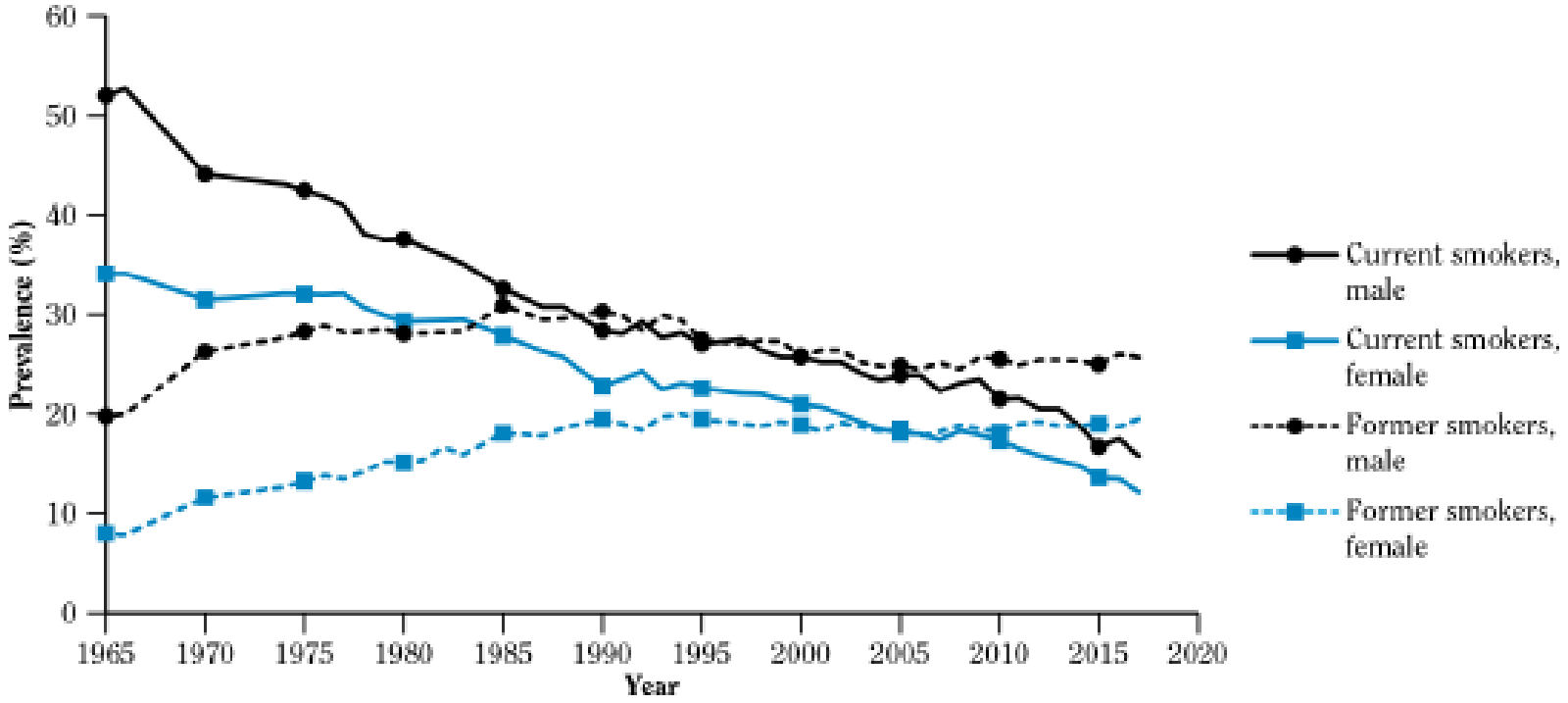

# CAMELS


*Don't remove the moisture-proof wrapping from your package of Camels after you open it. The Humidor Pack is protection against dust and germs. In offices and homes, even in the dry atmosphere of artificial heat, the Humidor Pack delivers fresh Camels and keeps them right until the last one has been smoked*

- Prevalence of cigarette smoking is decreasing in the United States

# Trends in cigarette smoking among adults in the United States 1965 to 2017

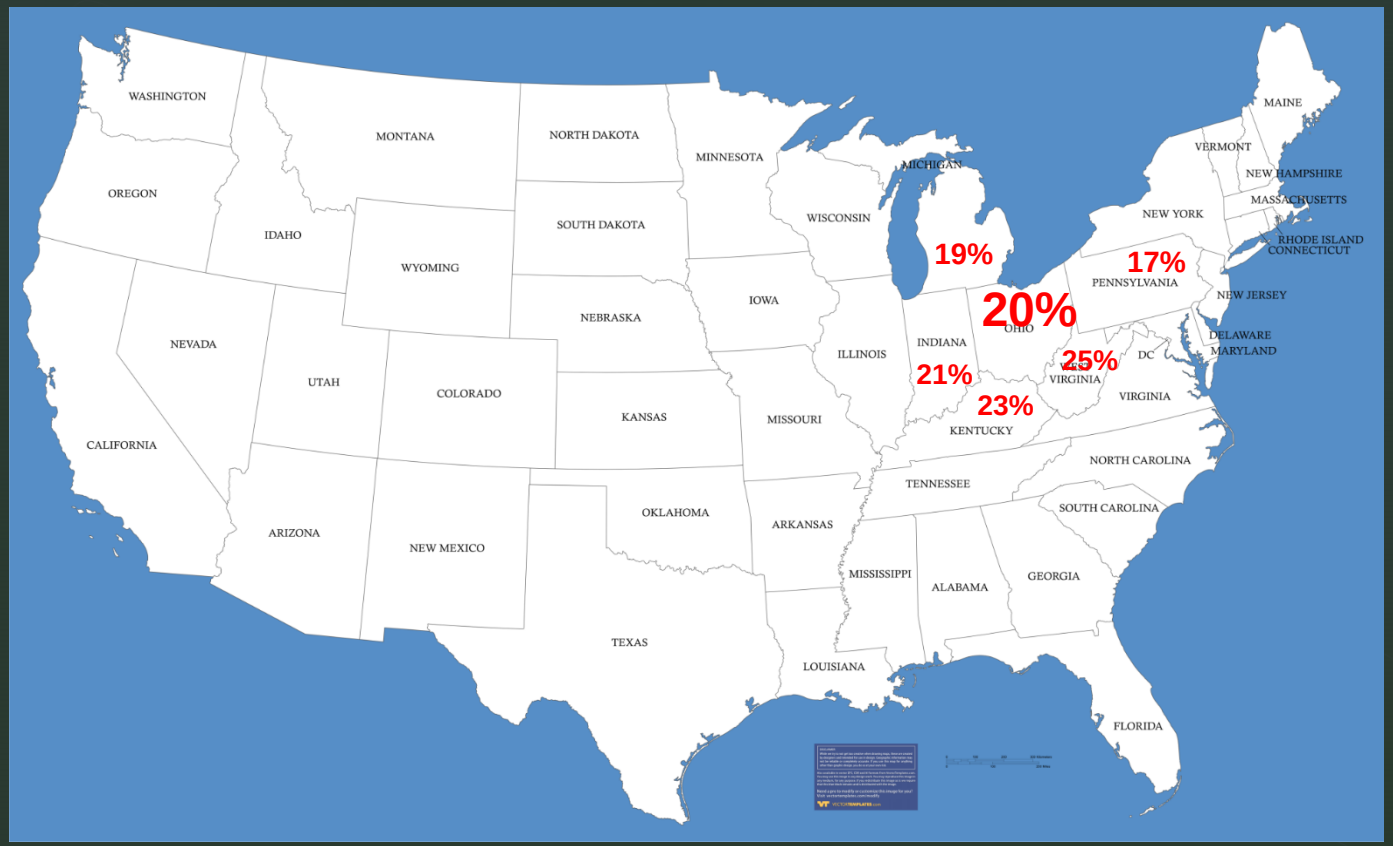
**Figure ES.1 Trends in prevalence (%) of current and former cigarette smoking among adults 18 years of age and older, by sex; National Health Interview Survey (NHIS) 1965–2017; United States**




*Source:* NHIS, National Center for Health Statistics, public use data, 1965–2017.
*Note:* From 1965 to 2017, data were reported for the following years: 1965, 1966, 1970, 1974, 1976–1980, 1983, 1985, 1987, 1988, 1990–1995, and 1997–2017.

# Current cigarette smoking among adults in the United States

US: 12.5%  of adults currently smoke cigarettes ~30 million
OH: 20%
Cleveland: 35 % (2015)




https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm#:~:text=This%20means%20an%20estimated%2030.8,with%20a%20smoking%2Drelated%20disease.

- The prevalence of electronic cigarette or vape use among teenagers is worrisome

# 14.1% of high school students and 3.3% of middle school students reported current use of e-cigarettes

| Characteristic | Overall | | High school | | Middle school | |
|---|---|---|---|---|---|---|
| | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) |
| Among all students (N = 28,291) | | | | | | |
| Current use of e-cigarettes | 2,550,000 | 9.4 (8.0–11.1) | 2,140,000 | 14.1 (12.4–16.0) | 380,000 | 3.3 (2.6–4.2) |
| Among current e-cigarette users | | | | | | |
| Frequency of use during past 30 days | | | | | | |
| 1–5 days | 1,030,000 | 40.6 (37.2–44.1) | 790,000 | 37.2 (33.4–41.1) | 230,000 | 60.0 (53.3–66.3) |
| 6–19 days | 430,000 | 17.1 (14.2–20.4) | 360,000 | 16.8 (13.9–20.2) | 70,000 | 19.3 (12.7–28.3) |
| 20–30 days | 1,080,000 | 42.3 (38.5–46.3) | 980,000 | 46.0 (41.6–50.4) | 80,000 | 20.8 (15.8–26.8) |
| Daily e-cigarette use§ | 700,000 | 27.6 (24.5–31.0) | 640,000 | 30.1 (26.6–33.9) | 40,000 | 11.7 (8.0–16.7) |

Cooper M, et al. MMWR 71:40, 2022

# Disposable and "unknown" brands are the most common

| Characteristic | Overall | | High school | | Middle school | |
|---|---|---|---|---|---|---|
| | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) |
| **Device type most often used¶** | | | | | | |
| Disposables | 1,390,000 | 55.3 (49.5–61.0) | 1,210,000 | 57.2 (51.7–62.6) | 170,000 | 45.8 (34.5–57.6) |
| Prefilled or refillable pods or cartridges | 630,000 | 25.2 (19.7–31.5) | 540,000 | 25.7 (20.2–32.0) | 80,000 | 21.6 (12.8–33.9) |
| Tanks or mod system | 160,000 | 6.7 (5.3–8.4) | 120,000 | 5.9 (4.5–7.8) | 30,000 | 9.8 (7.1–13.5) |
| Don't know the type | 320,000 | 12.8 (10.2–16.1) | 230,000 | 11.2 (8.6–14.4) | 80,000 | 22.8 (17.0–29.9) |
| **Any brand**** | | | | | | |
| Puff Bar | 730,000 | 29.7 (25.5–34.4) | 610,000 | 29.3 (25.0–34.0) | 110,000 | 30.9 (21.3–42.4) |
| Vuse | 580,000 | 23.6 (17.9–30.3) | 490,000 | 23.8 (17.9–30.9) | 70,000 | 20.9 (13.2–31.3) |
| JUUL | 540,000 | 22.0 (17.8–26.9) | 440,000 | 21.2 (16.3–27.1) | 80,000 | 23.8 (17.8–30.9) |
| SMOK (including NOVO) | 330,000 | 13.5 (10.8–16.6) | 290,000 | 14.3 (11.4–17.9) | 20,000 | 7.8 (4.4–13.5) |
| NJOY | 200,000 | 8.3 (6.0–11.4) | 170,000 | 8.2 (5.6–11.7) | 20,000 | 7.3 (4.3–12.1) |
| Hyde†† | 180,000 | 7.3 (4.4–12.0) | 160,000 | 7.9 (4.6–13.3) | —§§ | —§§ |
| blu | 160,000 | 6.5 (4.9–8.6) | 110,000 | 5.6 (3.9–7.8) | 30,000 | 10.2 (5.7–17.6) |
| STIG | 120,000 | 5.0 (3.6–6.8) | 90,000 | 4.7 (3.2–6.7) | —§§ | —§§ |
| Suorin | 110,000 | 4.8 (3.6–6.5) | 90,000 | 4.8 (3.5–6.5) | —§§ | —§§ |
| Logic | 100,000 | 4.3 (3.0–6.1) | 70,000 | 3.8 (2.5–5.6) | —§§ | —§§ |
| Mojo | 90,000 | 4.0 (2.8–5.5) | 70,000 | 3.7 (2.6–5.3) | —§§ | —§§ |
| Leap | 90,000 | 3.7 (2.6–5.2) | 60,000 | 3.0 (2.0–4.4) | —§§ | —§§ |
| Fontsmoke | 80,000 | 3.6 (2.4–5.3) | 60,000 | 2.9 (1.8–4.7) | —§§ | §§ |
| Some other brand not listed | 790,000 | 32.2 (27.8–37.0) | 670,000 | 32.2 (27.4–37.4) | 120,000 | 32.8 (25.5–41.0) |
| Not sure/Don't know the brand | 700,000 | 28.3 (24.8–32.0) | 550,000 | 26.7 (22.7–31.1) | 140,000 | 37.4 (29.7–45.8) |

Cooper M, et al. MMWR 71:40, 2022

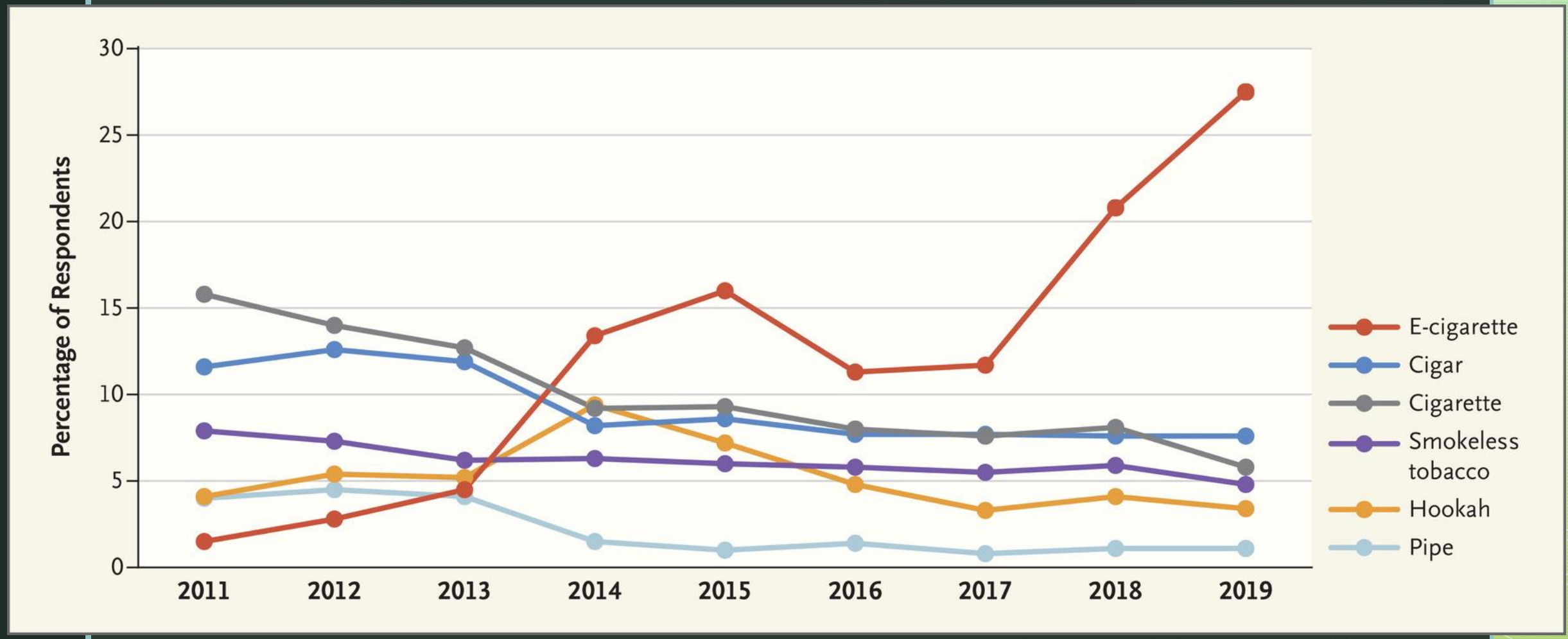
# Strong preference for fruit and candy flavors

## 85% used flavored e-cigarettes

| Characteristic | Overall | | High school | | Middle school | |
|---|---|---|---|---|---|---|
| | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) | Estimated weighted no.† | % (95% CI) |
| **Flavor type used†††** | | | | | | |
| Fruit | 1,450,000 | 69.1 (65.4–72.6) | 1,220,000 | 68.5 (64.4–72.3) | 210,000 | 71.1 (63.9–77.3) |
| Candy, desserts, or other sweets | 800,000 | 38.3 (33.8–42.9) | 660,000 | 37.3 (32.6–42.2) | 130,000 | 43.6 (36.3–51.3) |
| Mint | 610,000 | 29.4 (25.6–33.5) | 540,000 | 30.3 (25.9–35.1) | 70,000 | 23.7 (18.9–29.3) |
| Menthol | 550,000 | 26.6 (21.0–33.1) | 500,000 | 28.2 (22.2–35.2) | 40,000 | 16.2 (10.3–24.6) |
| Alcoholic drinks | 150,000 | 7.6 (5.6–10.2) | 120,000 | 6.8 (4.7–9.8) | 30,000 | 10.8 (7.0–16.1) |
| Chocolate | 80,000 | 4.3 (3.1–5.9) | 60,000 | 3.8 (2.7–5.3) | —§§ | —§§ |
| Clove or spice | 60,000 | 2.9 (1.9–4.6) | 40,000 | 2.6 (1.6–4.2) | —§§ | —§§ |
| Some other flavor not listed | 240,000 | 11.7 (10.1–13.6) | 200,000 | 11.7 (9.9–13.7) | 30,000 | 11.9 (8.0–17.5) |

Cooper M, et al. MMWR 71:40, 2022

# Current tobacco product use among U.S. High School students 2011 to 2019




NEJM January 17, 2020

- Electronic cigarettes or vapes are associated with acute lung inflammation

# CDC - EVALI hospitalizations and deaths

Number of hospitalized EVALI cases and deaths in the United States

As of February 18, 2020

**Hospitalizations**

- 2,807 cases

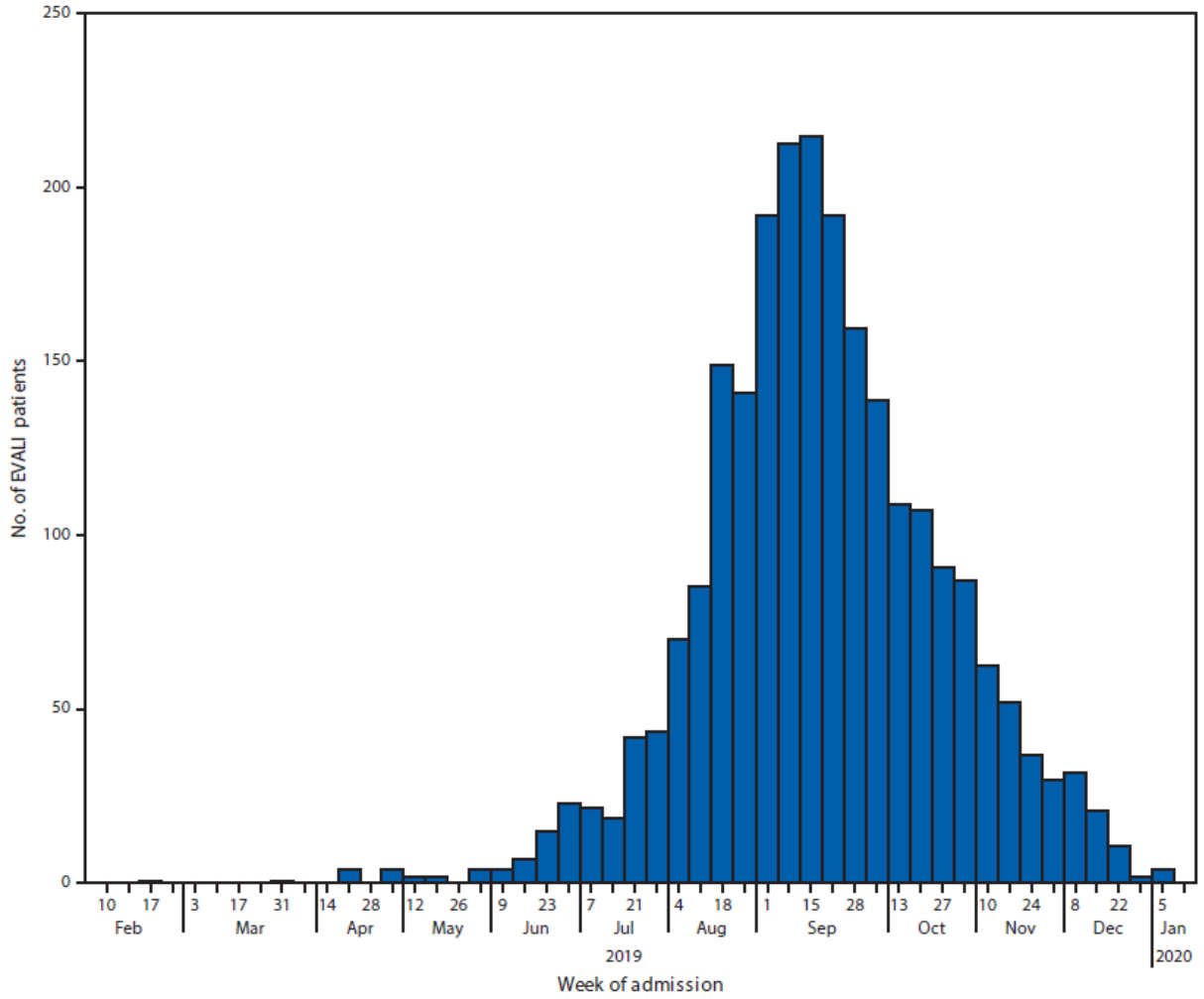
**Deaths**

- 68 deaths have been confirmed in 29 states

https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

# EVALI hospitalizations declined after sharp increase in August-September 2019

FIGURE 1. Number of patients (N = 2,398) with e-cigarette, or vaping, product use–associated lung injury (EVALI) by week of hospital admission — United States, February 10, 2019–January 14, 2020




MMWR January 24, 2020, Vol 69, No 3

# EVALI hospitalizations and deaths

- 82% reported using THC-containing products

  → 50% provided information about source -> 78% informal sources

- 57% reported using nicotine-containing products

  → 54% provided information about source -> 17% informal sources

https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html

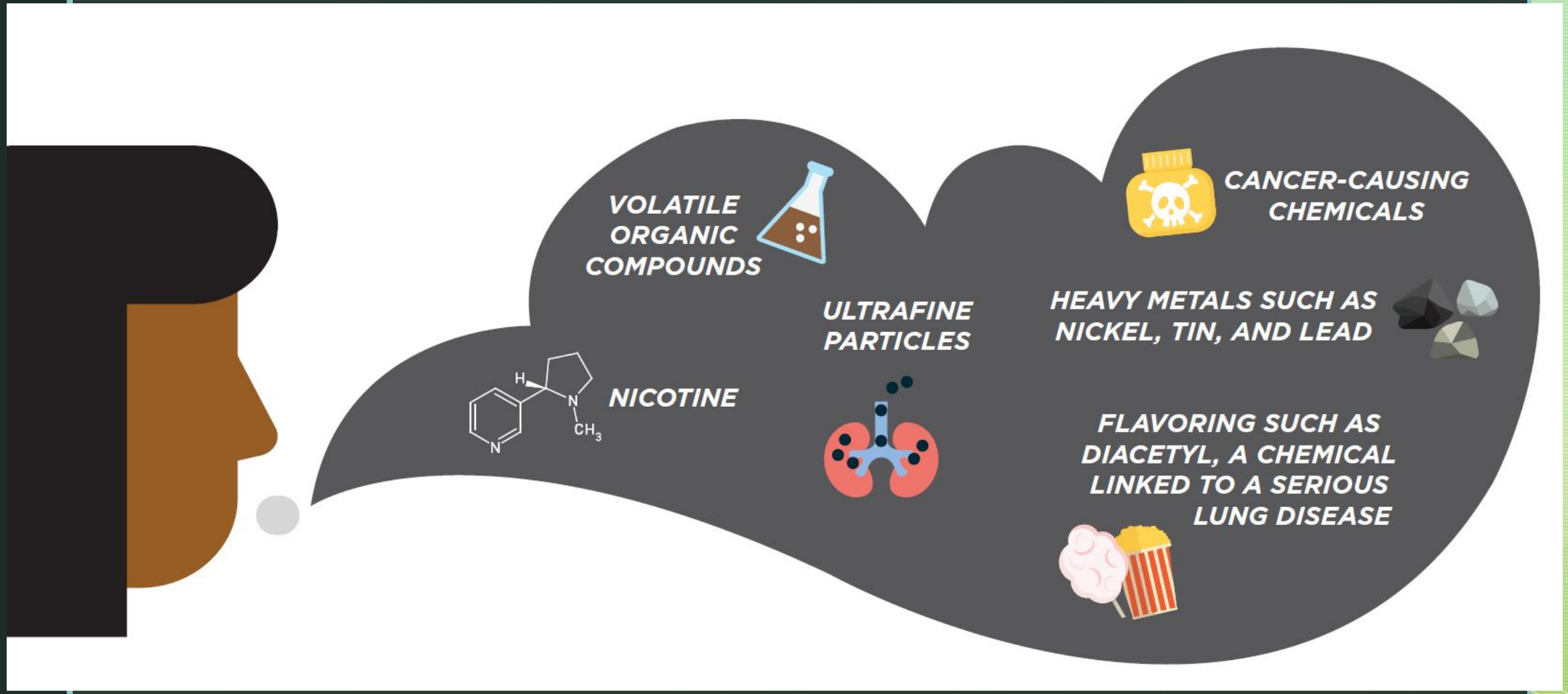
# Which substance was associated with EVALI?

Vitamin E acetate is an additive was linked to the EVALI outbreak.

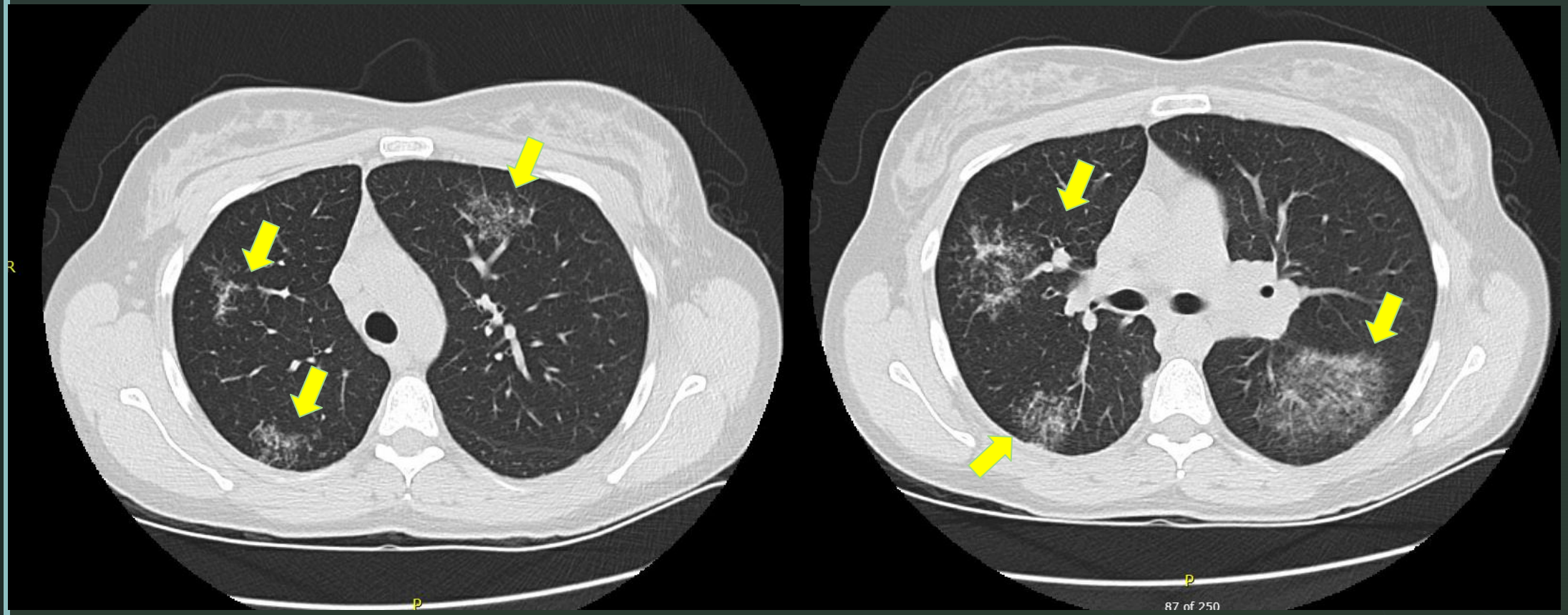
- A study external icon analyzed samples from 51 EVALI cases and a comparison group of samples from 99 comparison individuals without EVALI
- Vitamin E acetate was identified in BAL fluid samples from 48 of the 51 EVALI patients

Blount B et al. N Engl J Med 2020; 382:697-705

# That`s only part of the story



# Acute lung inflammation after vaping




Lin C et al. Repir Med Cae Rep 2020; 31:101169

# 3 months after stopping vaping

Lin C et al. Repir Med Cae Rep 2020; 31:101169

# EVALI requiring ICU admission

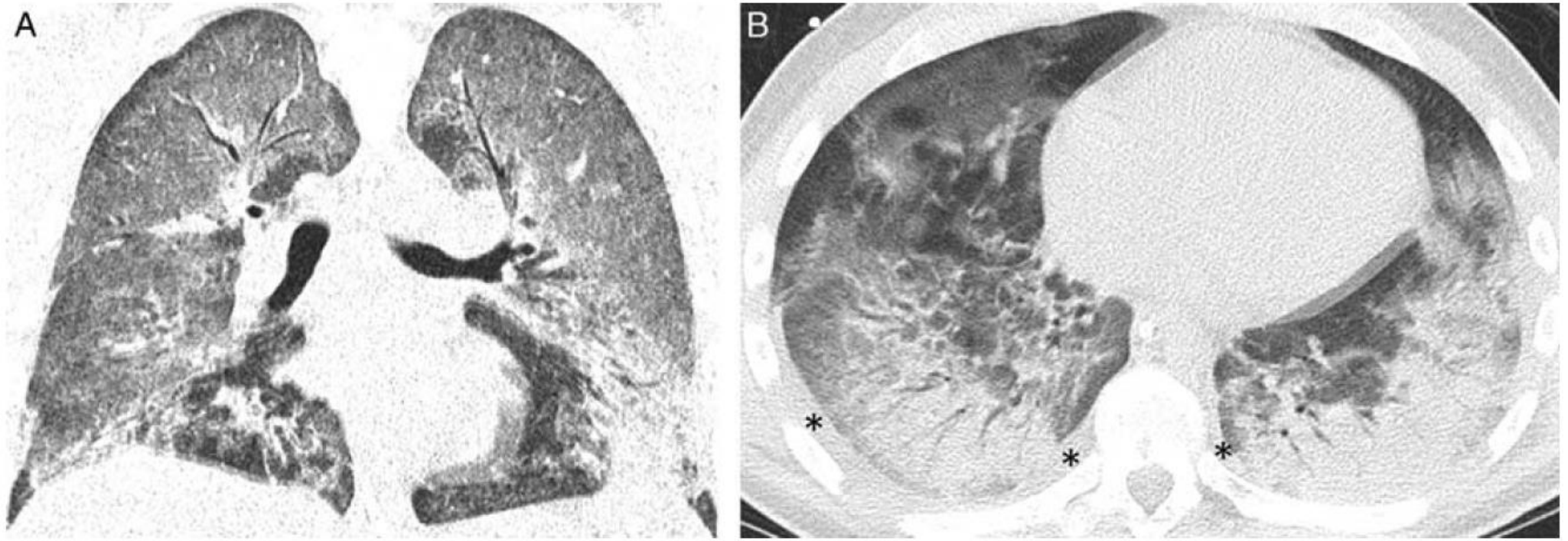



**FIGURE 1.** Coronal (A) and axial (B) CT images in a 21-year-old man show diffuse ground-glass opacities with dense consolidations in the posterior lower lobes, suggestive of DAD. Trace pleural effusions (asterisks) are noted.

J Thorac Imaging 2020;35:277-284

- The long term effects of electronic cigarettes or vapes are unknown

- **It is unknown whether vaping can cause**
  - COPD
  - Lung fibrosis
  - Heart disease
  - Cancer

# E-cigarettes contain harmful chemicals

**Table 1. Levels of Toxicants in E-Cigarette Aerosol Compared With Nicotine Inhaler and Cigarette Smoke**

| Toxicant | Range in Content in Aerosol From 12 E-Cigarette Samples per 15 Puffs* | Range in Content in Conventional Cigarette Micrograms in Mainstream Smoke From 1 Cigarette | Content in Nicotine Inhaler Mist per 15 Puffs* |
|---|---|---|---|
| Formaldehyde, μg | 0.2–5.61 | 1.6–52 | 0.2 |
| Acetaldehyde, μg | 0.11–1.36 | 52–140 | 0.11 |
| Acrolein, μg | 0.07–4.19 | 2.4–62 | ND |
| o-Methylbenzaldehyde, μg | 0.13–0.71 | … | 0.07 |
| Toluene, μg | ND–0.63 | 8.3–70 | ND |
| p,m-xylene, μg | ND–0.2 | … | ND |
| NNN, ng | ND–0.00043 | 0.0005–0.19 | ND |
| NNK, ng | ND–0.00283 | 0.012–0.11 | ND |
| Cadmium, ng | ND–0.022 | … | 0.003 |
| Nickel, ng | 0.011–0.029 | … | 0.019 |
| Lead, ng | 0.003–0.057 | … | 0.004 |

*Circulation*. 2014;129:1972-1986.)

- Pharmacotherapy and behavioral support are each effective when used alone, but combining them is more effective.

# Effectiveness of methods used to treat tobacco dependence

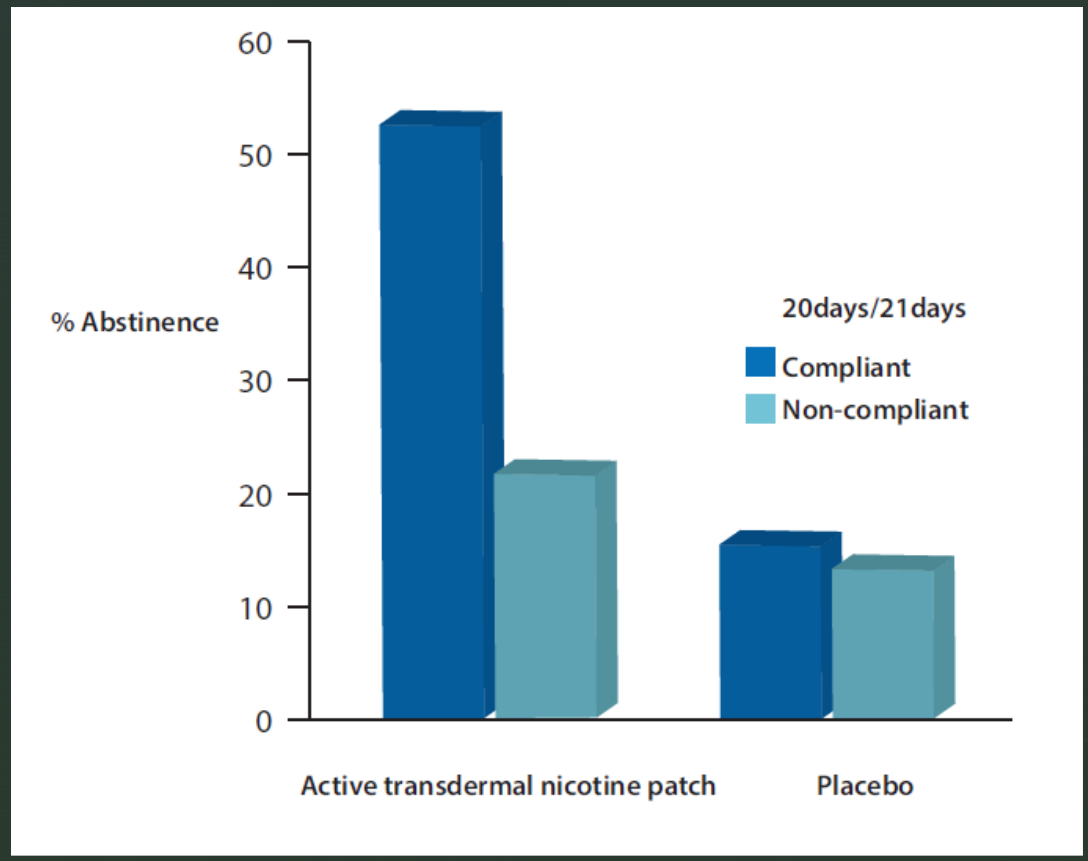
| Method | Versus placebo<br>Odds ratio (95% CI) | Estimated abstinence rate |
|---|---|---|
| Patch | 1.64 (1.52-1.78) | 23.4% |
| Gum | 1.49 (1.40-1.60) | 19% |
| Lozenge | 1.95 (1.61-2.36) | 24.2% |
| Inhaler | 1.90 (1.36-2.67) | 24.8% |
| Nasal spray | 2.02 (1.49-2.73) | 26.7% |
| Bupropion | 2.0 (1.8-2.2) | 24.2% |
| Varenicline | 3.1 (2.5-3.8) | 33.2% |
| Long+short NRT | 1.25 (1.15-1.36) vs single NRT | |
| Varenicline+NRT | 1.62 (1.18-2.23) vs varenicline alone | |

Stead LF, Perera R, Bullen C, et al. Nicotine replacement therapy for smoking cessation. Cochrane Database Syst Rev 2012; 11:CD000146

Rigotti et al. Treatment of tobacco smoking. A review. JAMA 2022;327(6):566-577.

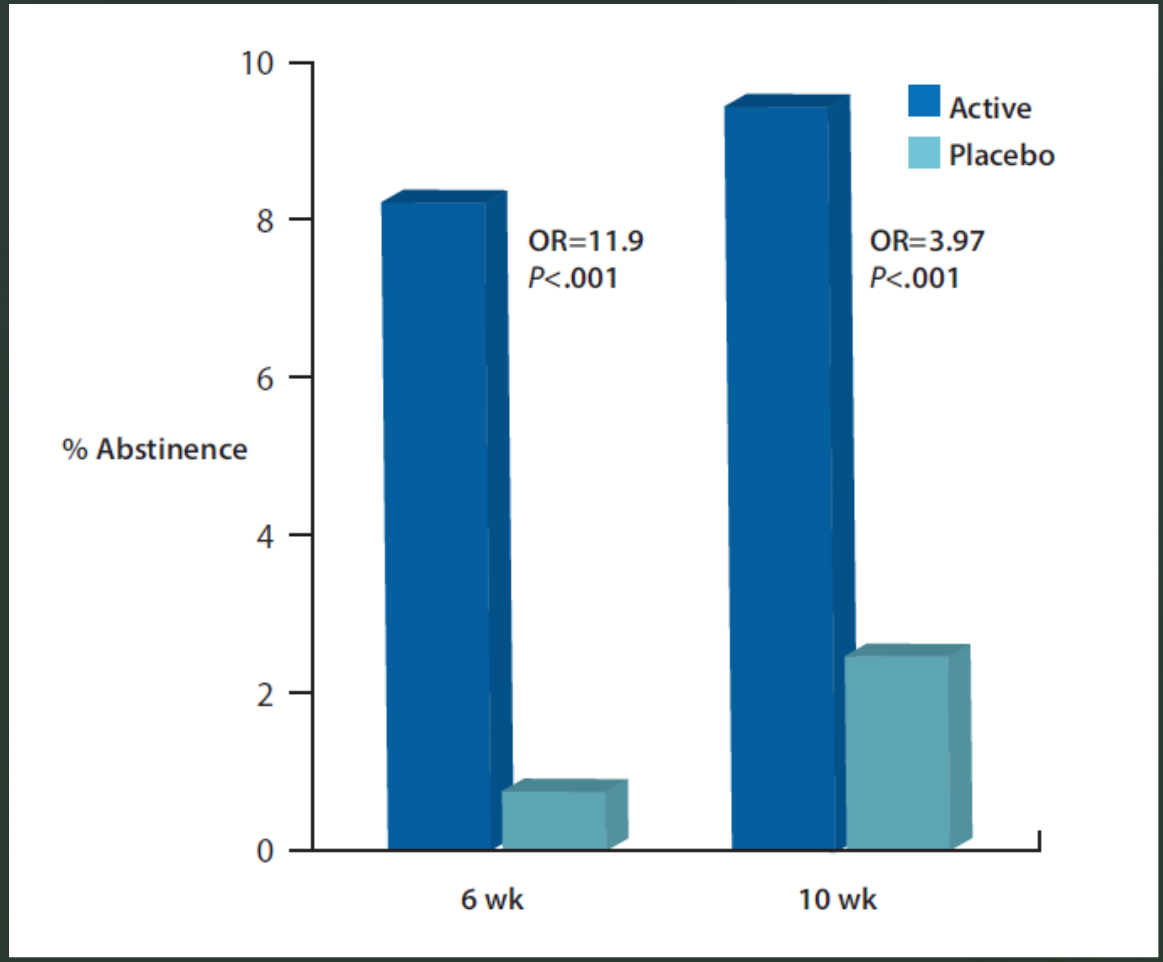
# Wearing NRT patches consistently increases quit rates

Advise not to skip dates -> they won`t work if they are not used.

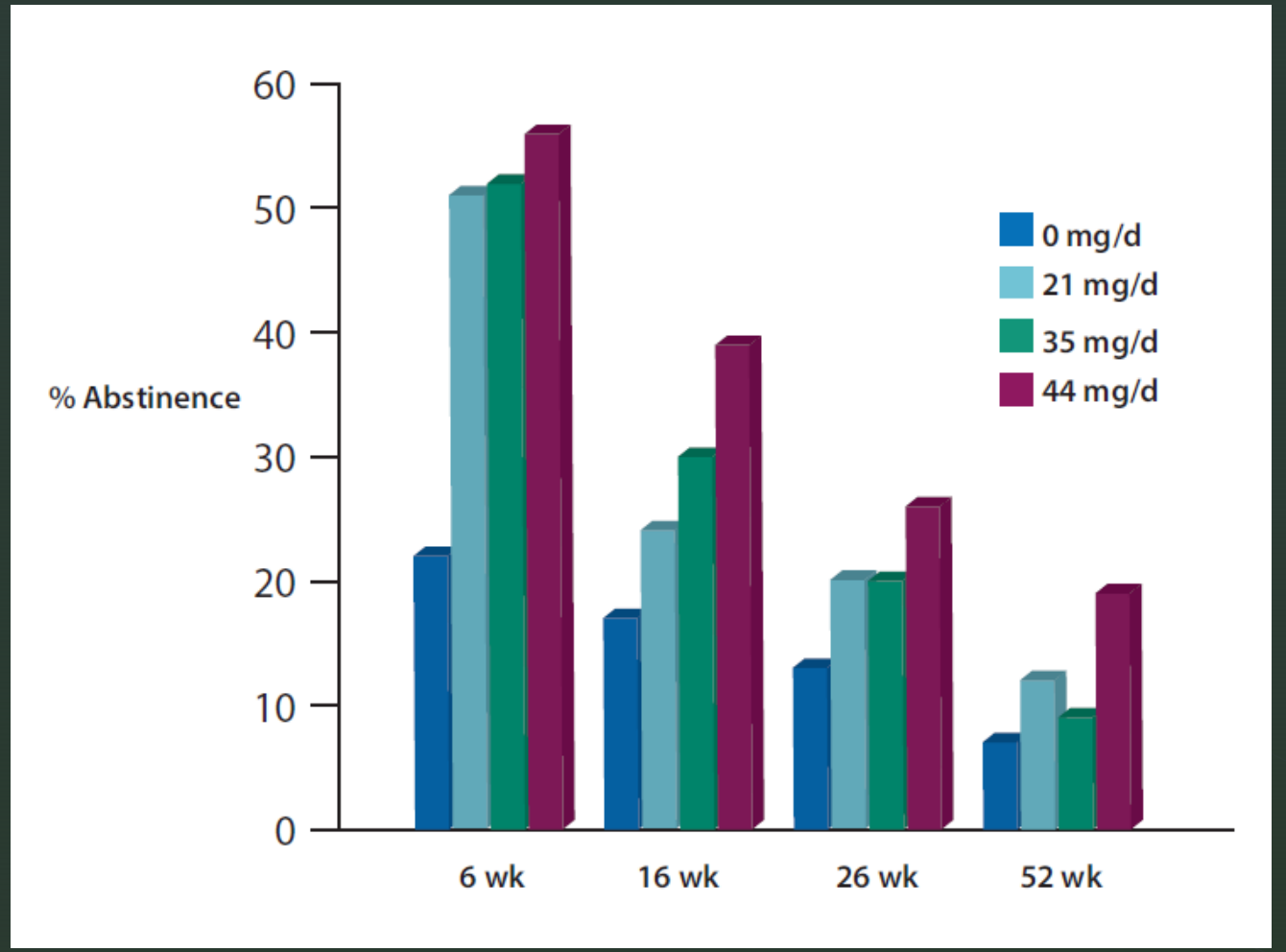


# Continually wearing patches after lapse promotes recovery

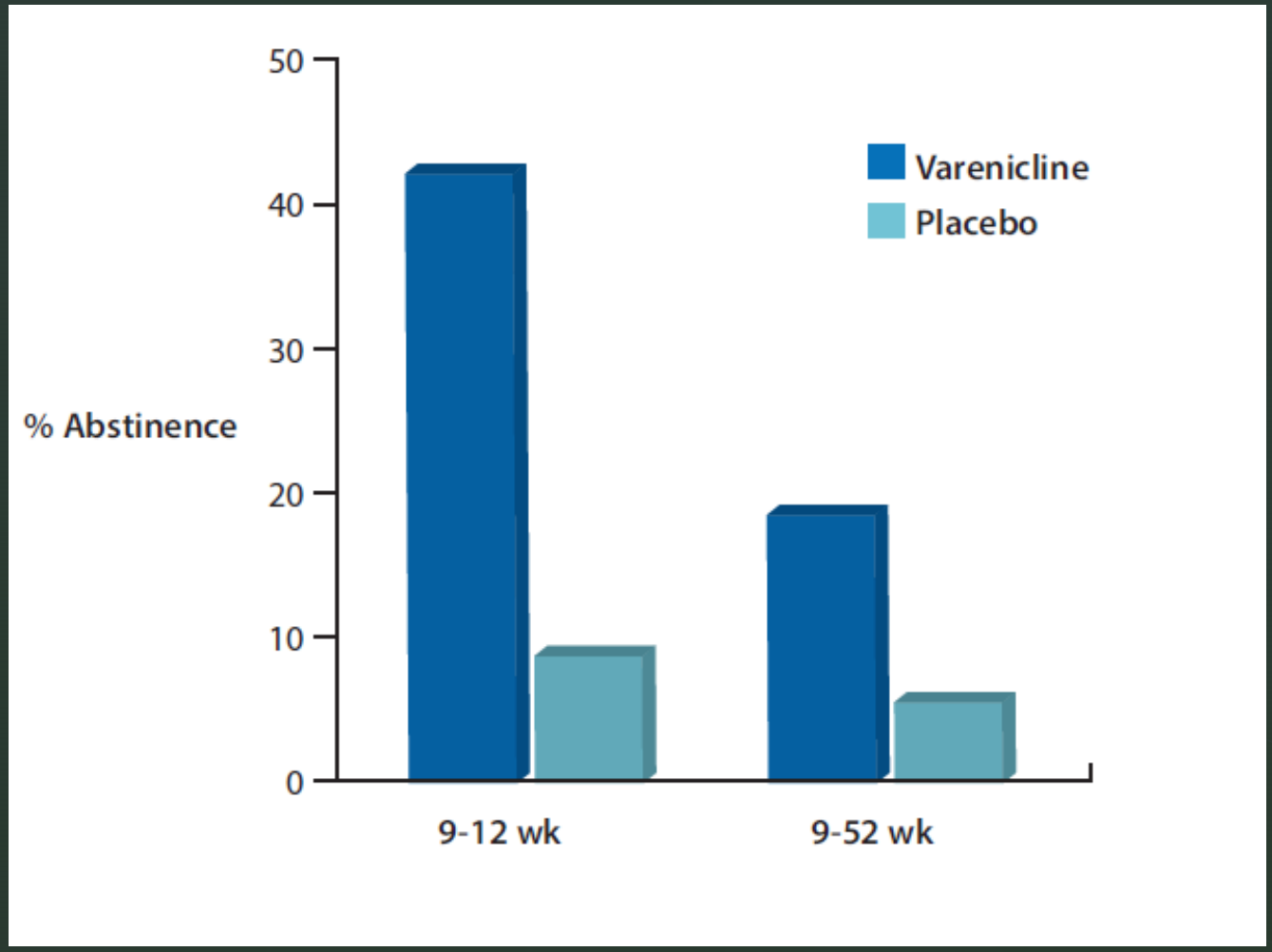
It won`t work if they are not used.



# Higher-dose nicotine patches are safe and may be more effective



# Extending varenicline for 6 months to prevent relapse is effective



# 2018 ACC Expert Consensus Decision Pathway on Tobacco Cessation Treatment

**TABLE 4** Recommended Pharmacotherapy for Smoking Cessation in Patients with CVD

| | Outpatient With Stable CVD | Inpatient With ACS |
|---|---|---|
| 1st line | Varenicline OR combination NRT* | *In-hospital to relieve nicotine withdrawal:* Nicotine patch OR combination NRT*<br>*At discharge:* Combination NRT or varenicline† |
| 2nd line | Bupropion OR single NRT product | *At discharge:* Single NRT product |
| 3rd line | Nortriptyline‡ | Bupropion§ |
| If single agent is insufficient to achieve abstinence | Combine categories of FDA-approved drugs:<br>Varenicline + NRT (single agent)<br>Varenicline + bupropion<br>Bupropion + NRT (single agent) | n/a |

Barua et al. JACC 2018

- Tobacco treatment is safe

# There is no significant increase in the risk of serious adverse events with the use of nicotine-replacement therapy

Meta- regression analysis

- 92 RCTs involving 32,185 participants

- 28 observational studies involving 145,205 participants

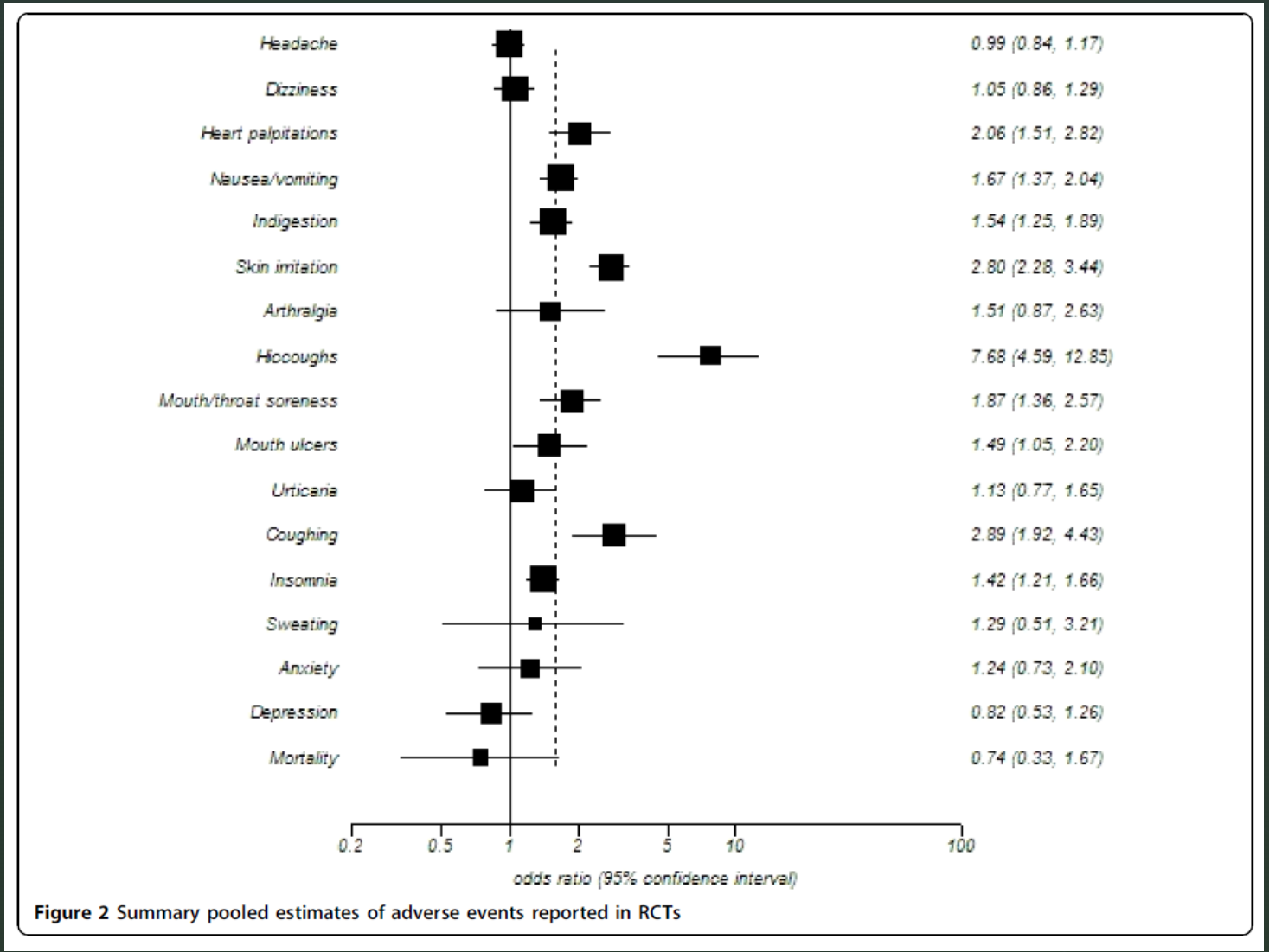
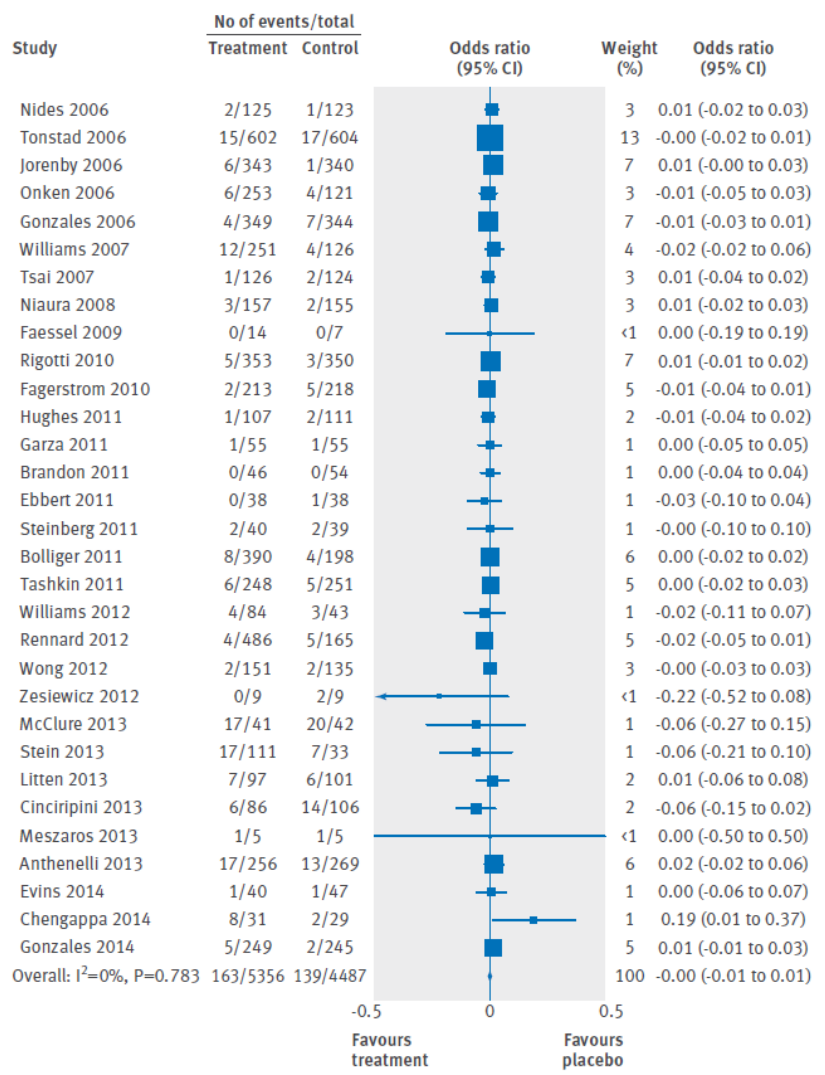



**Figure 2** Summary pooled estimates of adverse events reported in RCTs

Tobacco Induced Diseases 2010; 8:8

# Risk of neuropsychiatric adverse events with varenicline

**Risk of depression events associated with varenicline use in 31 placebo RCT**



| Study | No of events/total Treatment | Control | Odds ratio (95% CI) | Weight (%) | Odds ratio (95% CI) |
|---|---|---|---|---|---|
| Nides 2006 | 2/125 | 1/123 | | 3 | 0.01 (-0.02 to 0.03) |
| Tonstad 2006 | 15/602 | 17/604 | | 13 | -0.00 (-0.02 to 0.01) |
| Jorenby 2006 | 6/343 | 1/340 | | 7 | 0.01 (-0.00 to 0.03) |
| Onken 2006 | 6/253 | 4/121 | | 3 | -0.01 (-0.05 to 0.03) |
| Gonzales 2006 | 4/349 | 7/344 | | 7 | -0.01 (-0.03 to 0.01) |
| Williams 2007 | 12/251 | 4/126 | | 4 | -0.02 (-0.02 to 0.06) |
| Tsai 2007 | 1/126 | 2/124 | | 3 | 0.01 (-0.04 to 0.02) |
| Niaura 2008 | 3/157 | 2/155 | | 3 | 0.01 (-0.02 to 0.03) |
| Faessel 2009 | 0/14 | 0/7 | | <1 | 0.00 (-0.19 to 0.19) |
| Rigotti 2010 | 5/353 | 3/350 | | 7 | 0.01 (-0.01 to 0.02) |
| Fagerstrom 2010 | 2/213 | 5/218 | | 5 | -0.01 (-0.04 to 0.01) |
| Hughes 2011 | 1/107 | 2/111 | | 2 | -0.01 (-0.04 to 0.02) |
| Garza 2011 | 1/55 | 1/55 | | 1 | 0.00 (-0.05 to 0.05) |
| Brandon 2011 | 0/46 | 0/54 | | 1 | 0.00 (-0.04 to 0.04) |
| Ebbert 2011 | 0/38 | 1/38 | | 1 | -0.03 (-0.10 to 0.04) |
| Steinberg 2011 | 2/40 | 2/39 | | 1 | -0.00 (-0.10 to 0.10) |
| Bolliger 2011 | 8/390 | 4/198 | | 6 | 0.00 (-0.02 to 0.02) |
| Tashkin 2011 | 6/248 | 5/251 | | 5 | 0.00 (-0.02 to 0.03) |
| Williams 2012 | 4/84 | 3/43 | | 1 | -0.02 (-0.11 to 0.07) |
| Rennard 2012 | 4/486 | 5/165 | | 5 | -0.02 (-0.05 to 0.01) |
| Wong 2012 | 2/151 | 2/135 | | 3 | -0.00 (-0.03 to 0.03) |
| Zesiewicz 2012 | 0/9 | 2/9 | | <1 | -0.22 (-0.52 to 0.08) |
| McClure 2013 | 17/41 | 20/42 | | 1 | -0.06 (-0.27 to 0.15) |
| Stein 2013 | 17/111 | 7/33 | | 1 | -0.06 (-0.21 to 0.10) |
| Litten 2013 | 7/97 | 6/101 | | 2 | 0.01 (-0.06 to 0.08) |
| Cinciripini 2013 | 6/86 | 14/106 | | 2 | -0.06 (-0.15 to 0.02) |
| Meszaros 2013 | 1/5 | 1/5 | | <1 | 0.00 (-0.50 to 0.50) |
| Anthenelli 2013 | 17/256 | 13/269 | | 6 | 0.02 (-0.02 to 0.06) |
| Evins 2014 | 1/40 | 1/47 | | 1 | 0.00 (-0.06 to 0.07) |
| Chengappa 2014 | 8/31 | 2/29 | | 1 | 0.19 (0.01 to 0.37) |
| Gonzales 2014 | 5/249 | 2/245 | | 5 | 0.01 (-0.01 to 0.03) |
| Overall: $I^2$=0%, P=0.783 | 163/5356 | 139/4487 | | 100 | -0.00 (-0.01 to 0.01) |

-0.5 0 0.5

Favours treatment | Favours placebo

Increased risk:

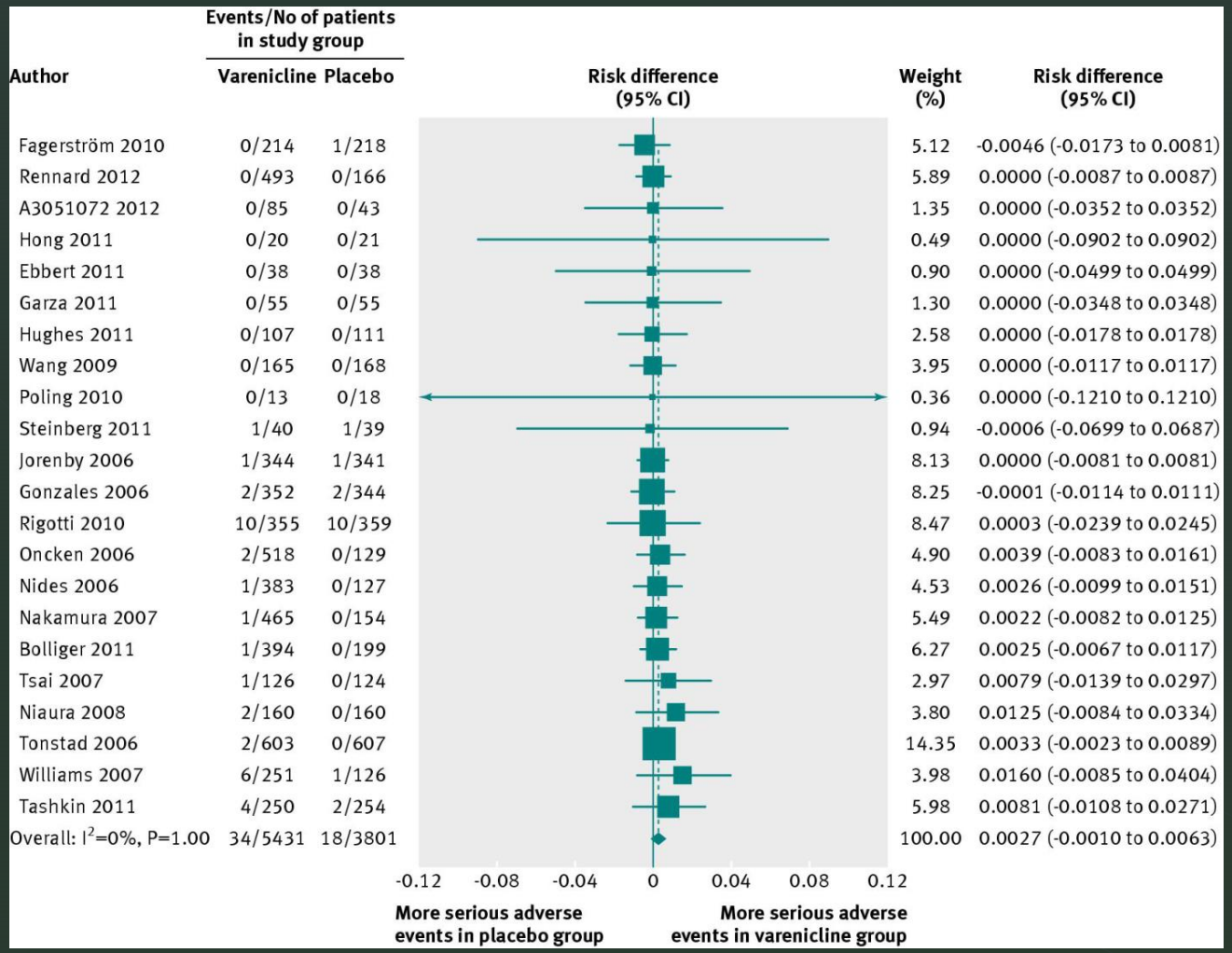
- sleep disorders
- insomnia
- abnormal dreams
- Fatigue

No increased risk:

- Depression
- Suicidal ideation
- Aggression
- Death

BMJ 2015;350:h1109

# No significant increased risk of adverse cardiovascular events associated with varenicline




Examples: myocardial infarction, unstable angina, coronary revascularisation, coronary artery disease, arrhythmias, transient ischaemic attacks, stroke, sudden death or cardiovascular related death, or congestive heart failure.

*BMJ* 2012;344:e2856

- We don`t know the best way to treat nicotine dependence associated with electronic cigarettes

# Electronic cigarettes

There are different types of e-cigarette devices.

Dinardo P, Rome E. Vaping the new wave of nicotine addiction. Clev Clin J Med 2019.

# E-liquids

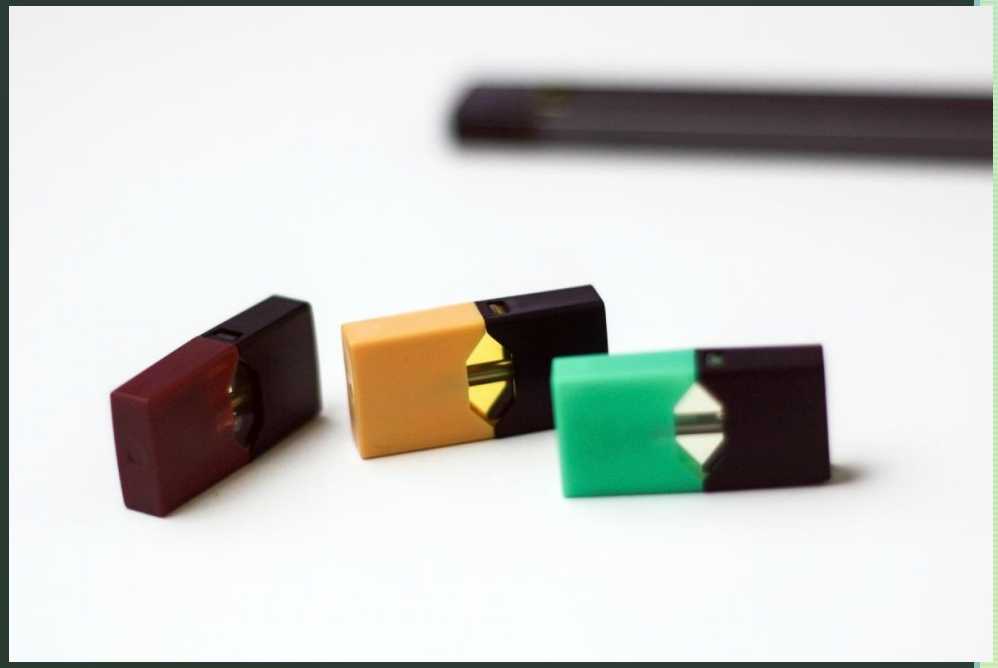
There are even more different types of e-liquids

# Nicotine content in cigarettes vs e-cigs

1 cigarette = 10-12 mg nicotine

1 cigarette = inhale 1-1.8mg nicotine

1 pack = inhale 20-36 mg nicotine



1 JUUL pod 3% = 23mg nicotine

1 JUUL pod 5% = 40 mg nicotine

- Electronic cigarettes or vapes are not smoking cessation aids

# NRT vs e-cigarette with nicotine 18mg

**Table 2. Abstinence Rates at Different Time Points and Smoking Reduction at 52 Weeks.***

| Outcome | E-Cigarettes (N=438) | Nicotine Replacement (N=446) | Primary Analysis: Relative Risk (95% CI)† | Sensitivity Analysis: Adjusted Relative Risk (95% CI) |
|---|---|---|---|---|
| Primary outcome: abstinence at 52 wk — no. (%) | 79 (18.0) | 44 (9.9) | 1.83 (1.30–2.58) | 1.75 (1.24–2.46)‡ |
| Secondary outcomes | | | | |
| Abstinence between wk 26 and wk 52 — no. (%) | 93 (21.2) | 53 (11.9) | 1.79 (1.32–2.44) | 1.82 (1.34–2.47)§ |
| Abstinence at 4 wk after target quit date — no. (%) | 192 (43.8) | 134 (30.0) | 1.45 (1.22–1.74) | 1.43 (1.20–1.71)¶ |
| Abstinence at 26 wk after target quit date — no. (%) | 155 (35.4) | 112 (25.1) | 1.40 (1.14–1.72) | 1.36 (1.15–1.67)‡ |
| Carbon monoxide–validated reduction in smoking of ≥50% in participants without abstinence between wk 26 and wk 52 — no./total no. (%) | 44/345 (12.8) | 29/393 (7.4) | 1.75 (1.12–2.72) | 1.73 (1.11–2.69)‖ |

80% of those in the e-cigarette group were still vaping at 12 months
9% of the NRT group were still using NRT

N Engl J Med 2019;380:629-37.

# Electronic cigarettes or vapes are not smoking cessation aids

2021 Cochrane systematic review with 16,759 participants
- E-cigarettes more effective than NRT or non-nicotine devices (moderate certainty)

USPSTF
- Evidence is insufficient to evaluate balance of risk and benefits

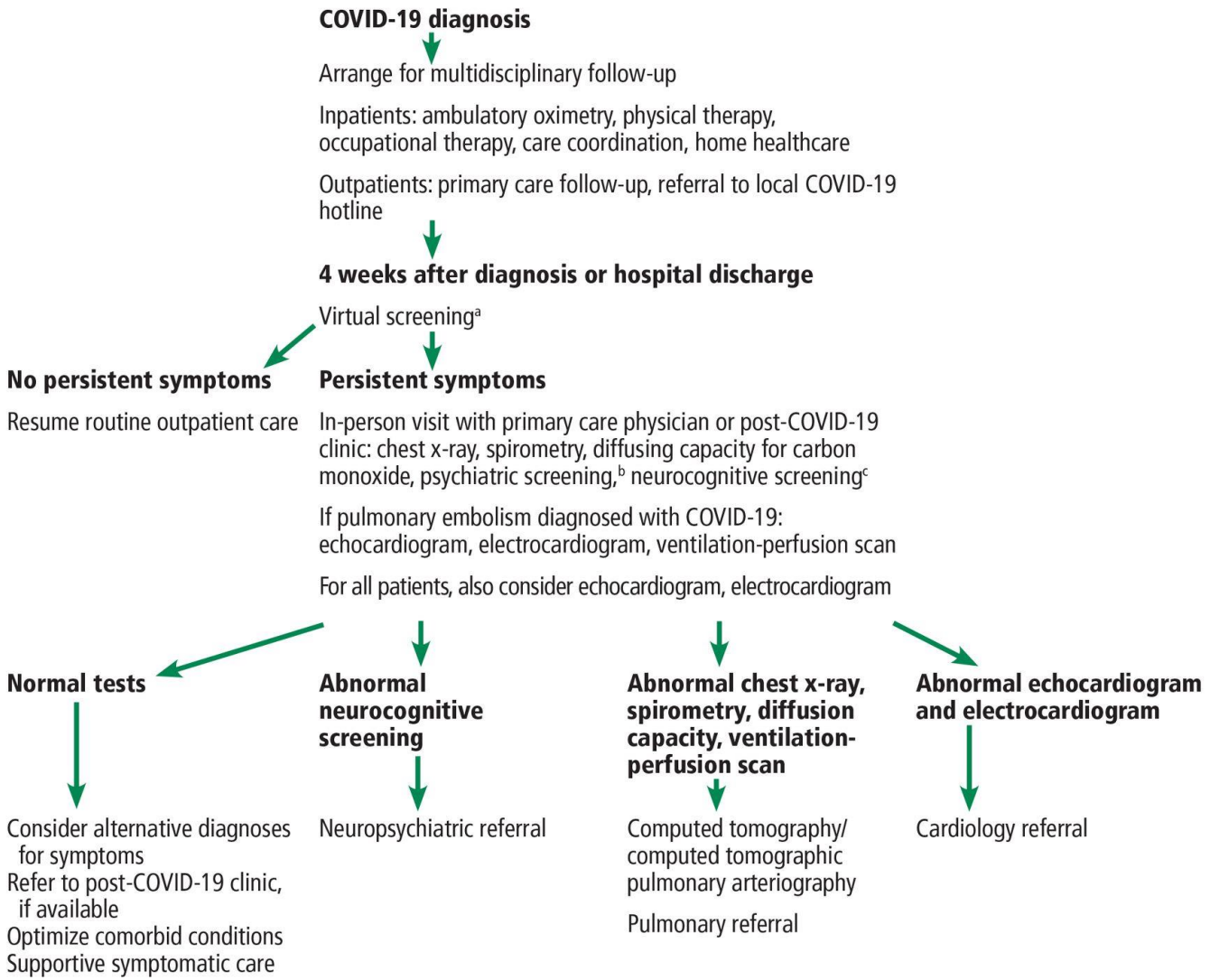
General Recommendation
- Use FDA approved smoking cessation aids

# COVID-19

# Post-COVID Syndrome (PCS)

- **The most commonly reported symptoms are fatigue, cough, shortness of breath, chest, difficulty concentrating, arthralgia, low-grade fever, and headache**

Cleveland Clinic Journal of Medicine May 2021, 88 (5) 267-272; DOI: https://doi.org/10.3949/ccjm.88a.21010



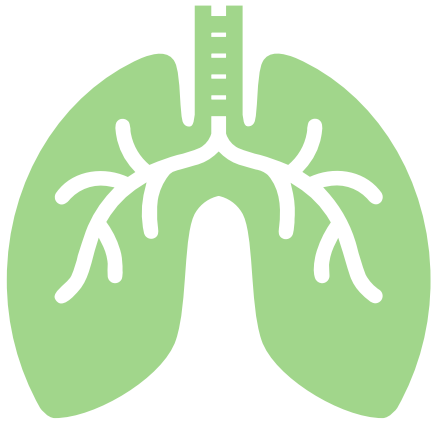

[a]Screening tools to consider: Post-COVID-19 Functional Status Scale, COVID-19 Yorkshire Rehabilitation Screen, University of Pennsylvania Post-COVID Screening Measures.

[b]Available psychiatric screening tools: General Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9; for depression screening), PTSD Checklist for DSM-5 (PCL-5), Impact of Event Scale-6 (IES-R; for PTSD screening), Hospital Anxiety and Depression Score (HADS).

[c]Available neurocognitive screening tools: Montreal Cognitive Assessment (MoCA), Mini-Mental State Examination (MMSE), Cognitive Assessment Tool Rapid Version (CAT-rapid).

- Fatigue represents the most common concern in patients with PCS

- Respiratory symptoms are common in PCS patients with PCS, and dyspnea is often the most prevalent



Approximately 5% of patients develop adult respiratory distress syndrome (ARDS).Breathlessness and cough are noted in a substantial proportion of patients with long COVID-19

Batiha GES, Al-Kuraishy HM., Al-Gareeb AI, et al.

In one survivor study, 42% of patients evaluated in clinic three months after hospital discharge had a significant reduction in diffusion capacity of the lung on pulmonary function testing, and this finding is the most commonly reported physiological lung impairment after acute COVID-19.

Van den Borst B, et al.

Roughly half of COVID-19 survivors have persistent and pulmonary radiological changes for up to six months following the acute illness.

## Testing

All patients with persistent dyspnea following a COVID-19 illness should undergo **pulmonary function testing and high-resolution chest imaging**.

## Treatment

Evidence of variable or fixed airflow obstruction can be managed with a trial of **inhaled steroid and long-acting bronchodilator therapy**. If patients do not have a clinical response to inhaled controller therapy, systemic steroids can be prescribed.

# Persistent Post-COVID-19 Interstitial Lung Disease. An Observational Study of Corticosteroid Treatment

- Annals of American Thoracic Society- 2021
- Observational Study of Corticosteroid Treatment
- 837 patients , 325 had on going symptoms (39%)
- ILD, PNA, functional deficit in 35 (4.8%)
- Given corticosteroids- significant improvement in radiological, and mean of 9.6% increase FVC

doi: 10.1513/AnnalsATS.202008-1002OC.

- **Echocardiogram** and **ventilation/perfusion lung scanning** can be ordered in the evaluation of persistent dyspnea, particularly if the pulmonary evaluation is unrevealing.

- **Invasive cardiopulmonary exercise testing** can be performed if the pulmonary and cardiac evaluations are unremarkable.

- For unexplained dyspnea following COVID-19 illness, we recommend referral to **pulmonary rehabilitation**.
- Patients can also be referred **to speech-language pathologists** for the evaluation of dysfunctional breathing patterns. This condition can be successfully managed with **respiratory retraining therapy.**

- Cardiopulmonary exercise testing (CPET)

- Patients with post-COVID-19 dyspnea require a **multidisciplinary team approach** to ascertain the cause of the patient’s symptoms, and the pulmonary evaluation is critical to establishing a diagnosis and treatment plan.

https://recovercovid.org/

RECOVER: Researching COVID to Enhance Recovery
The National Institutes of Health (NIH) created the RECOVER Initiative to learn about the long-term effects of COVID.
The goal of RECOVER is to rapidly improve our understanding of and ability to predict, treat, and prevent PASC (post-acute sequelae of SARS-CoV-2), including Long COVID.

Questions!

# Citations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# THANK YOU!

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