Clear Air Ahead: Anatomy, Illness and Intervention

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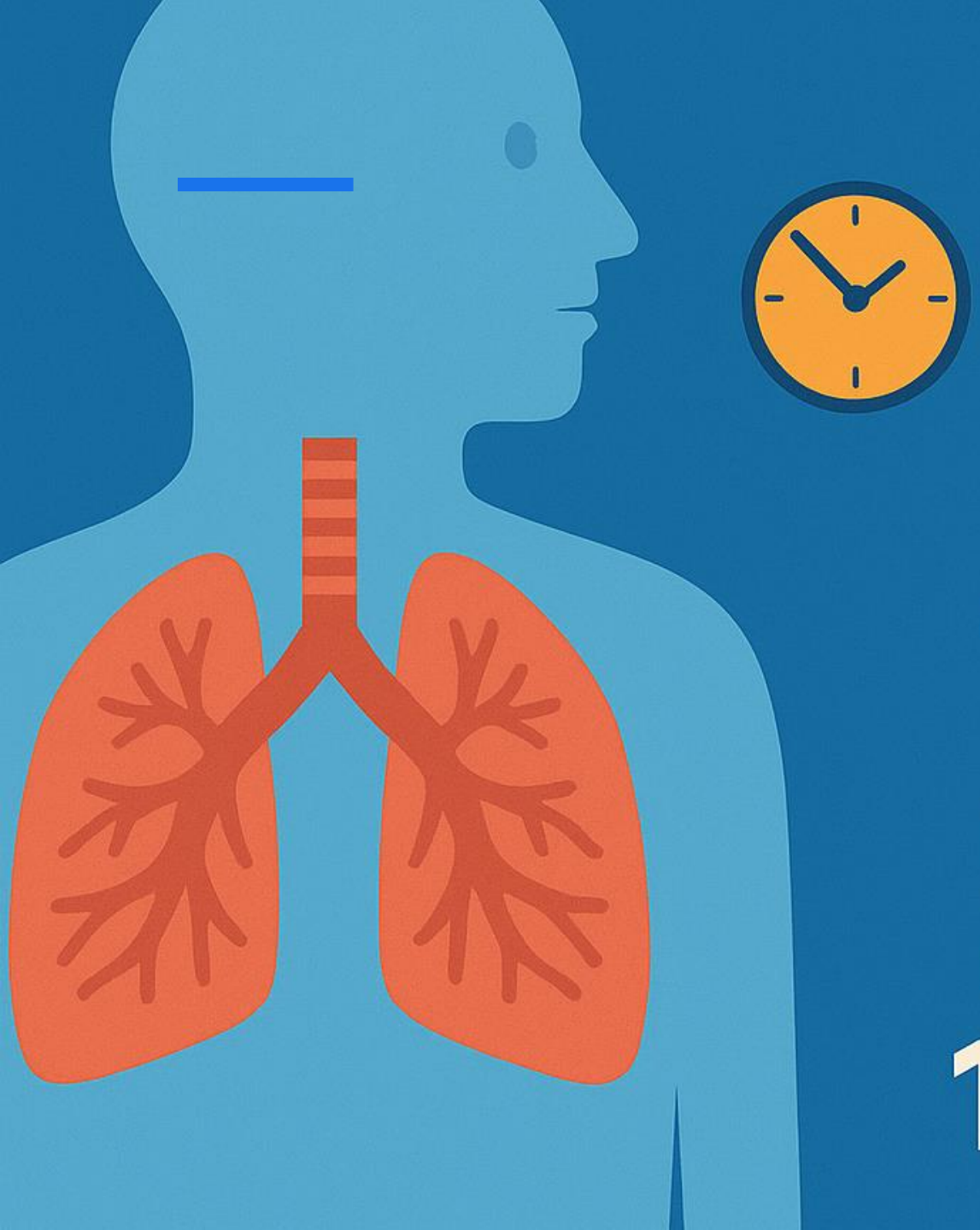
LECTURER, UNIVERSITY OF TORONTO

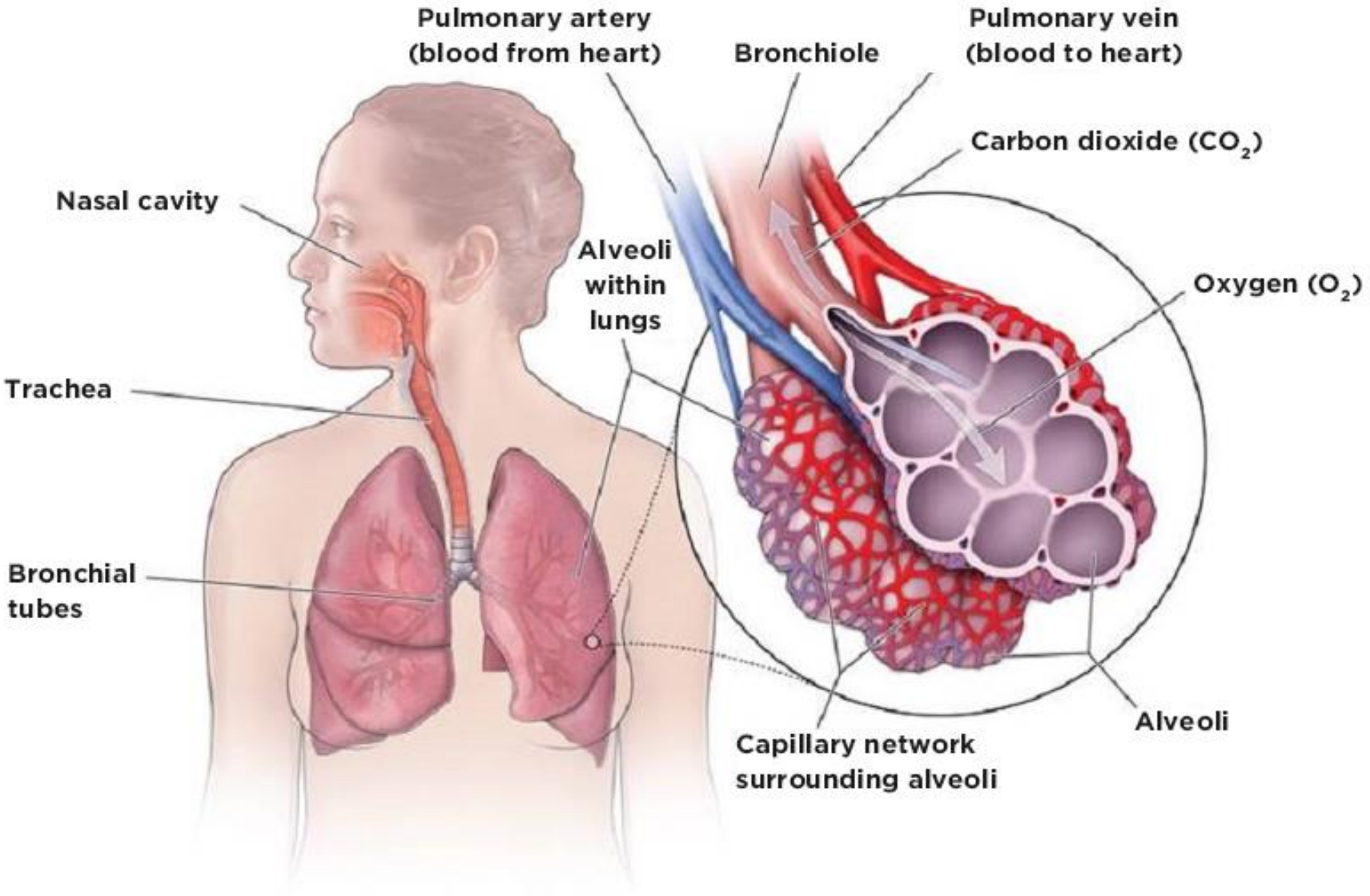


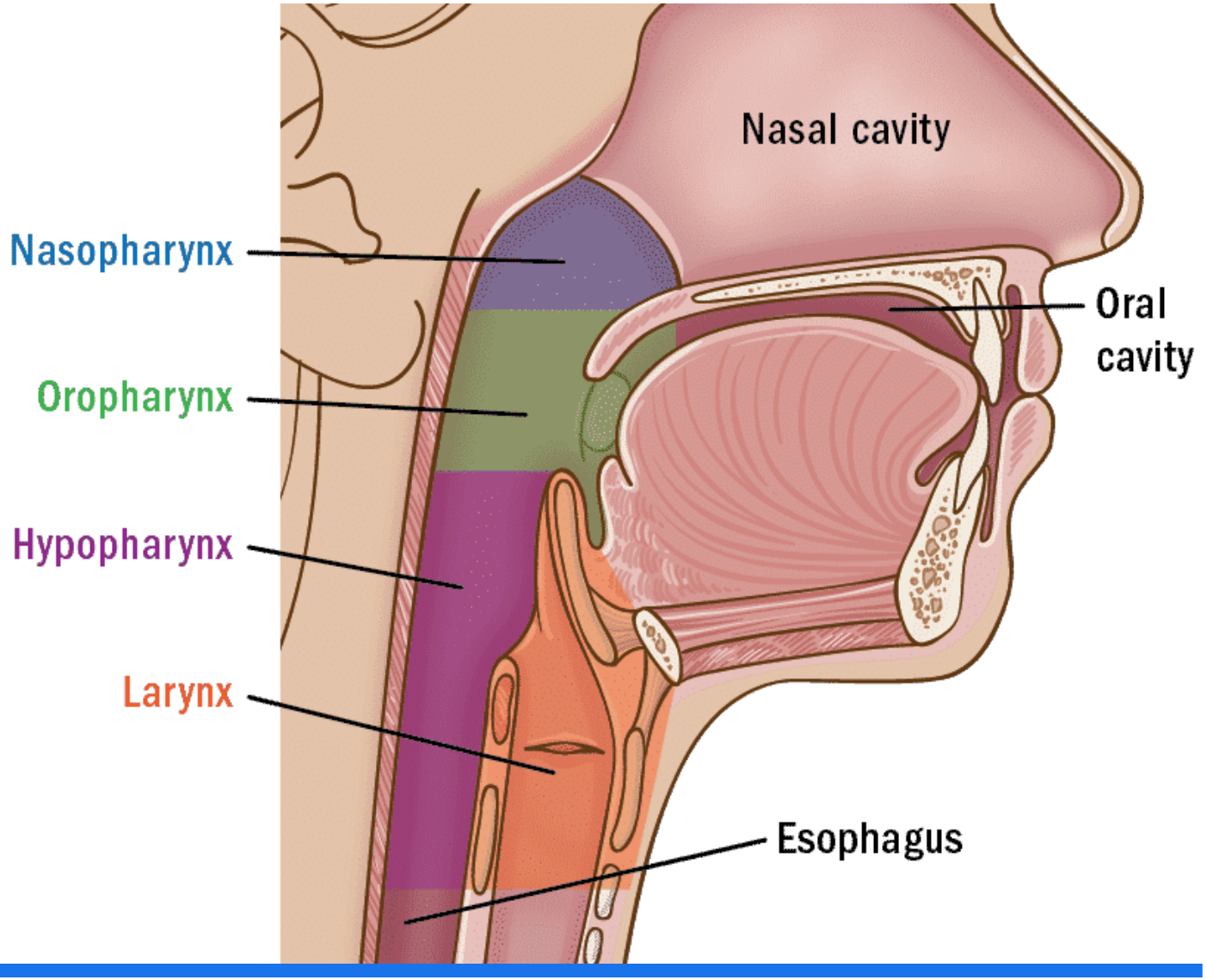
20,000
BREATHS PER DAY

10,000
LITERS OF AIR EXCHANGED PER DAY

1,5 MILLION
BREATHS OVER A LIFETIME

Respiratory System





Nasopharynx and Oropharynx

- Chronic rhinosinusitis with or without nasal polyps
- Laryngeal disorders including functional disorders
- Aspiration
- Reflux

Airways Diseases

ASTHMA

- Inflammation
- Variable airway diameter
- Twitchy airways (hyperresponsive)
- Tendency to irritation

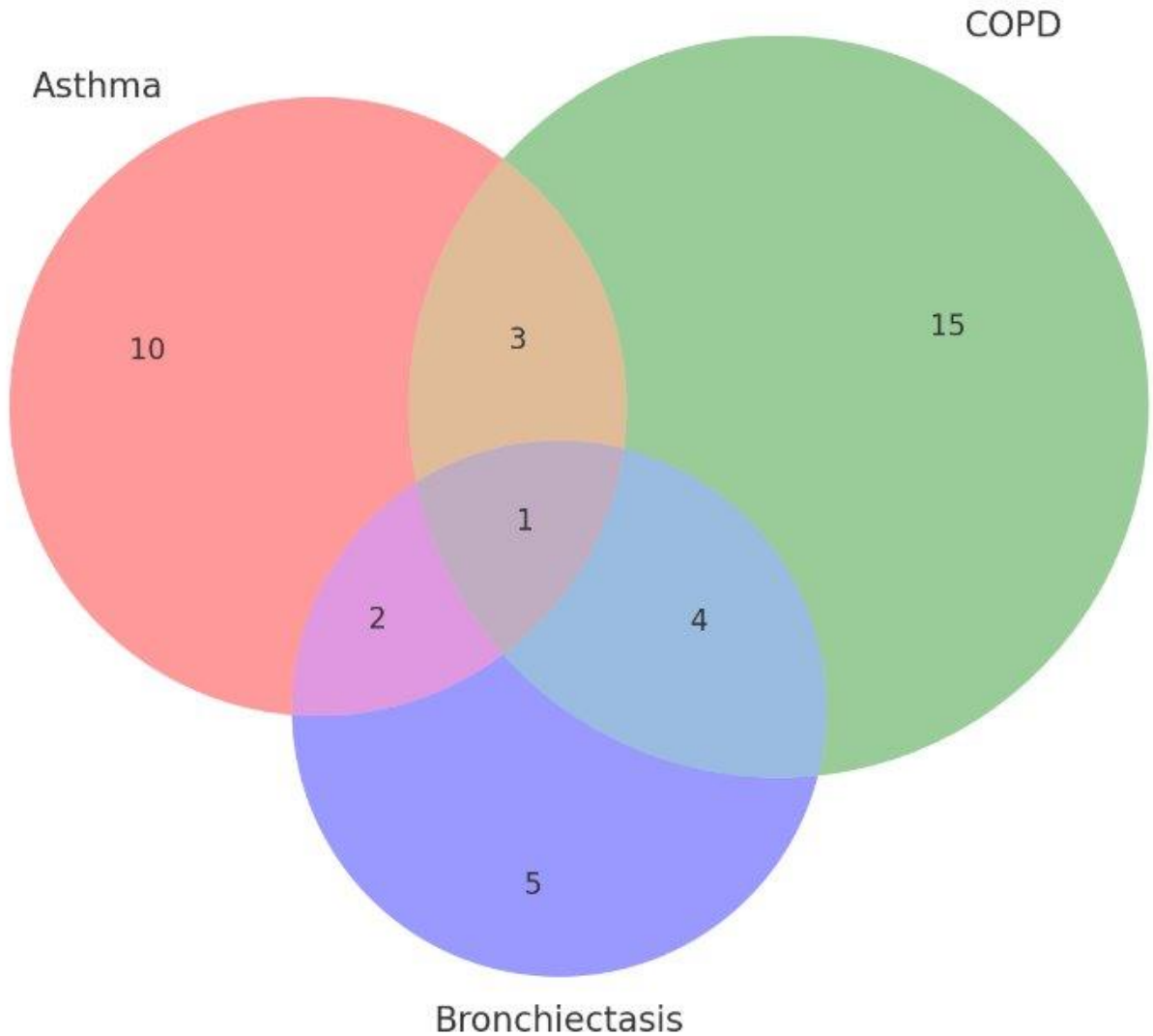
COPD

- Inflammation
- Reduced airway diameter
- Damaged alveoli
- Susceptible to infection

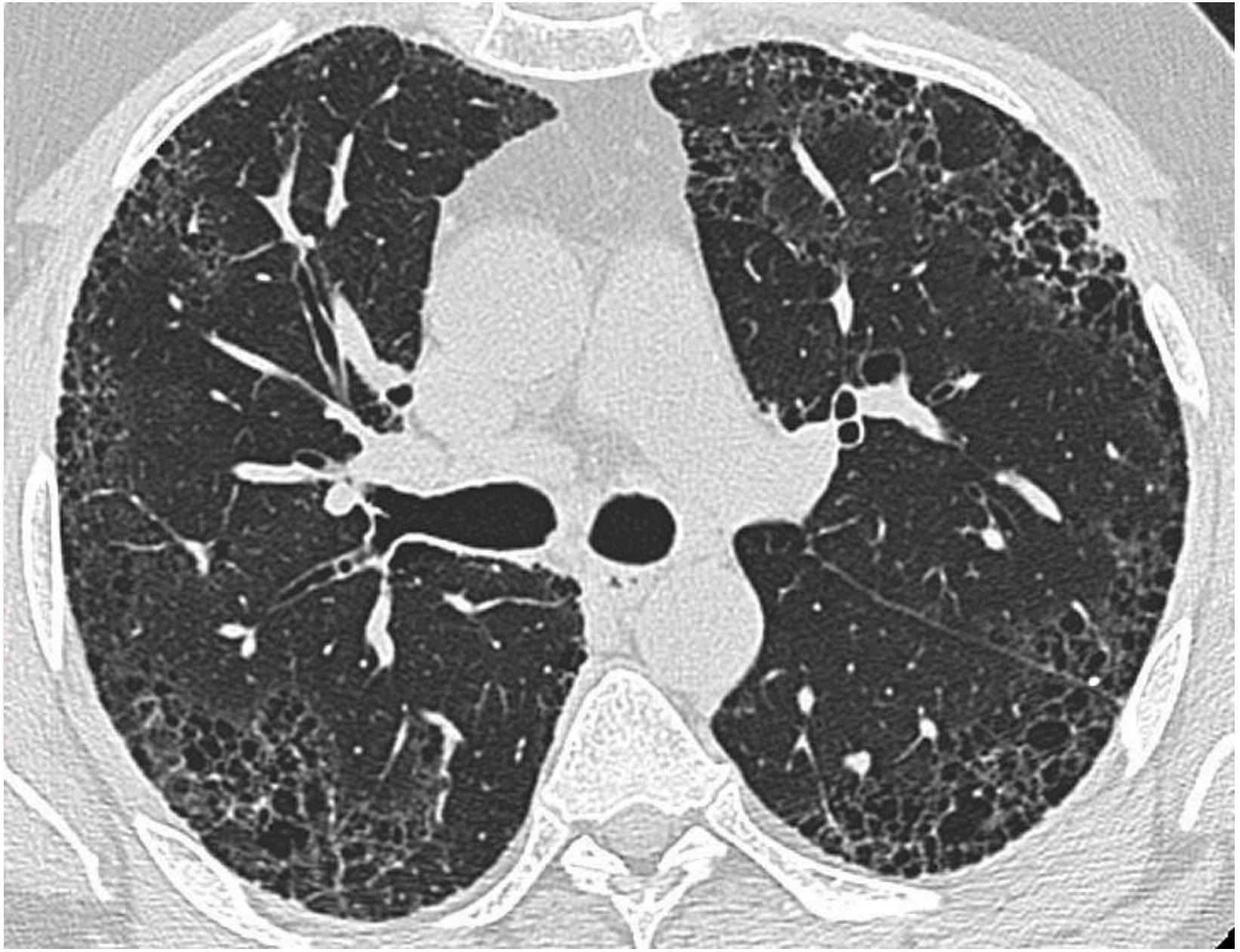
BRONCHIECTASIS

- Inflammation
- Dilated airway
- Damaged cilia
- Increased mucous
- Bacterial colonization and infection

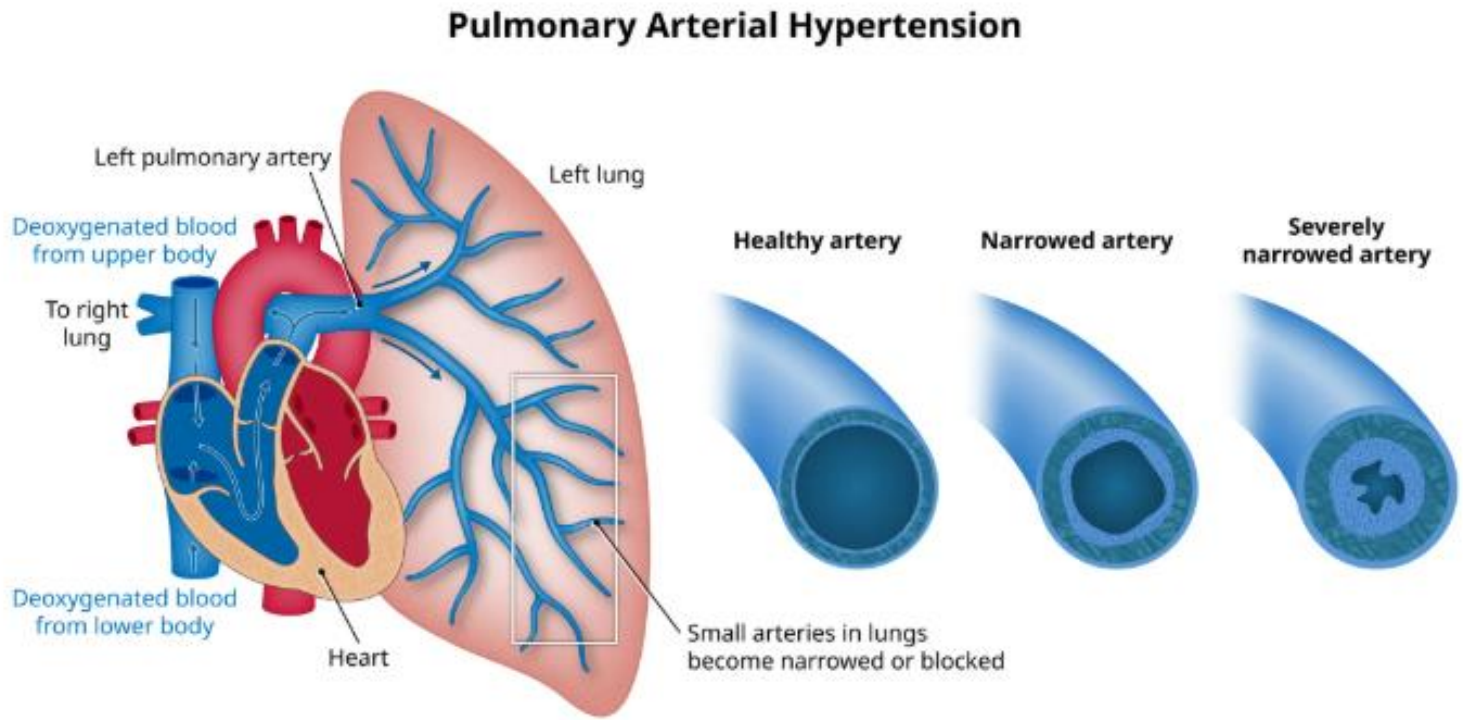
Overlap of Chronic Airway Diseases: Asthma, COPD, and Bronchiectasis



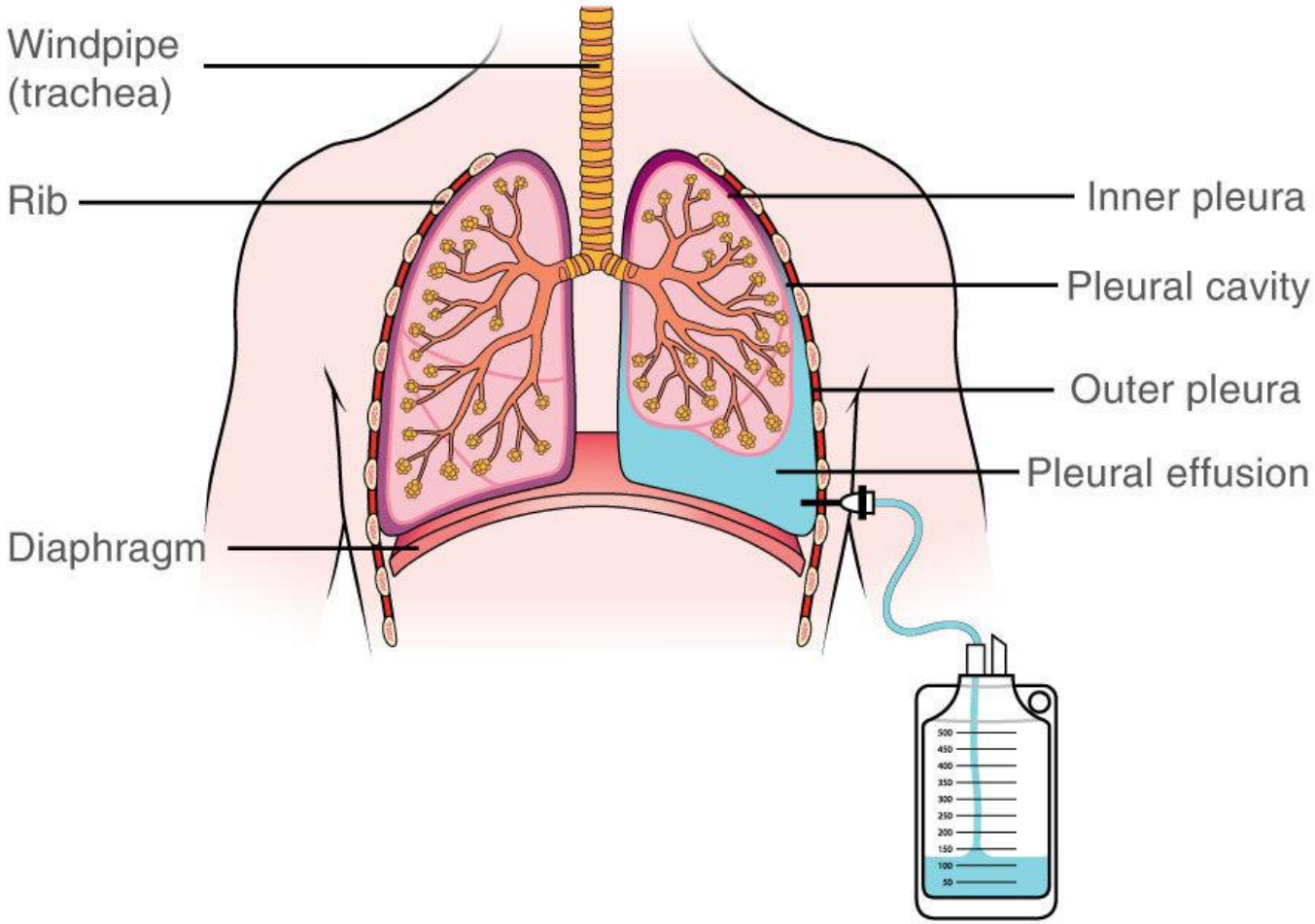
Interstitial Lung Diseases



Pulmonary Vascular Disease

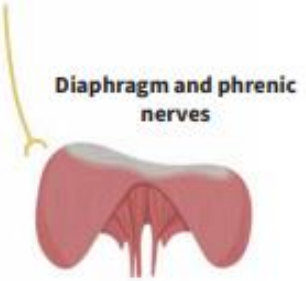


Pleural Disease

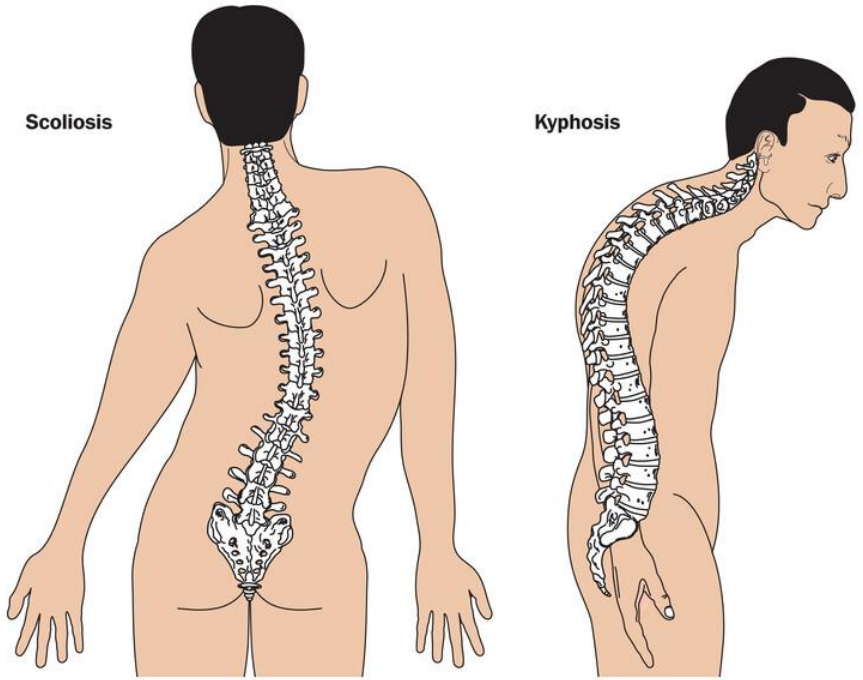


Respiratory Muscle and Chest Wall Diseases

Extradiaphragmatic inspiratory muscles
- scalene muscles (ventral, middle and dorsal)
- sternocleidomastoid muscles
- external parasternal intercostal muscles
- internal intercostal muscles



Expiratory muscles
- internal parasternal intercostal
- abdominal muscles
  - transversus abdominis
  - rectus abdominis
  - internal oblique
  - external oblique



Approaches to Understanding Disease

How clinicians organize medical knowledge

Anatomical Approach

Focus: Where disease occurs

- Respiratory system occurs
- Localized lesions su. upper vs. lobe gas exchange
- Pneumonia in th right lower lobe

Physiological/ Functional Apprach

Focus: How the body's function is alterec

- Disrupted processes (e.g, ventilation, perfusion, gas exchange
- Used in physiology, pathophysiology, and pharmacology

→ Sarcoidosis = noncaseating granulomas impairing airflow

Etiological Approach

Focus: What caused the aese

- A group of signs/symmptomns without an immediate cause
- Useful in early diagnosis or resource-limited settings

→ Acute bronchitis = cugh + sputum **production**

Clinical Syndromic Approach

Focus: What it

disease looks li

- Acute, subacu. or chronic

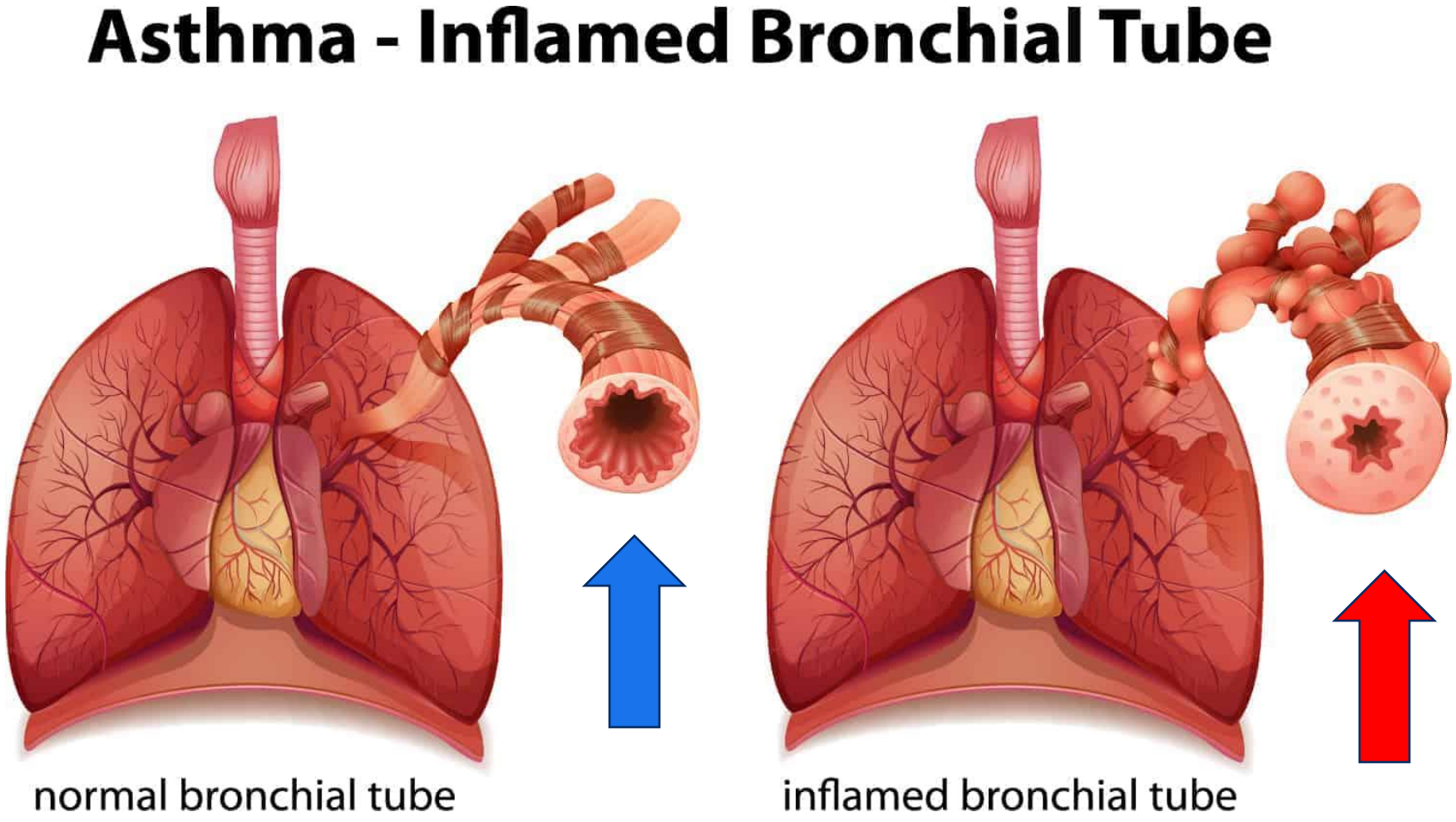
Temporal Approach

When and how long. ong

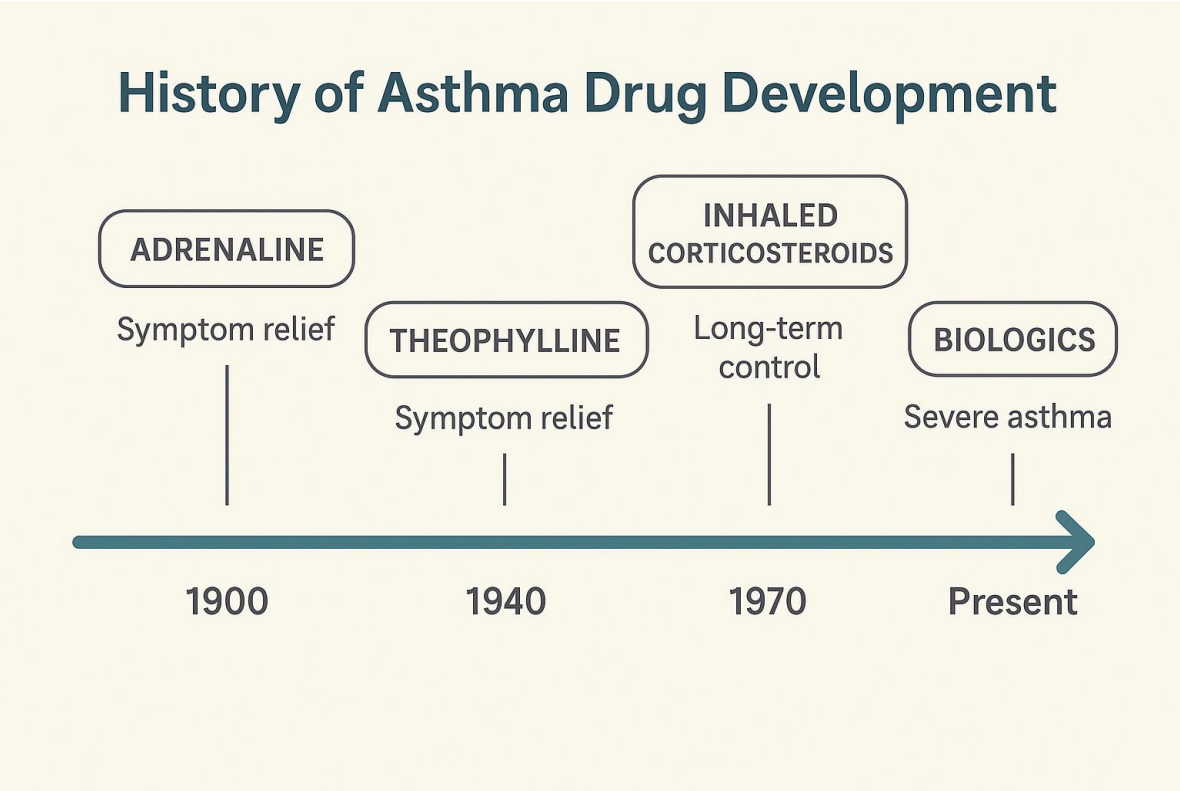
- Acute, subacute, or chronic

→ **Chronic cough =** symptoms > 8 weeks, → think asthma, COPD

Asthma


Asthma - Inflamed Bronchial Tube
normal bronchial tube
inflamed bronchial tube

Asthma therapies



- Anti-inflammatory therapies
  - Inhaled corticosteroids
  - Oral anti-leukotriene ("Singulair" aka montelukast)
  - "Biologic" (antibody) therapies that target and block SPECIFIC components of the immune response pathway
- Bronchodilator therapies are complementary to anti-inflammatory
  - Should not be used on their own

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RESPIRATORY TRAINING
& EDUCATOR COURSE

ASTHMA INHALED MEDICATIONS

www.resptrec.org
www.lungsask.ca

Corticosteroids

ICS
(Inhaled Corticosteroid)
Controller

Aermony Respiclick
(fluticasone propionate)
55; 113; 232 mcg/actuation

Duration: 12h
Company: TEVA

Asmanex™ Twisthaler™
(mometasone furoate)
100; 200; 400 mcg/actuation

Duration: 24h
Company: Organon

Alvesco® MDI
(ciclesonide)
100; 200 mcg/actuation

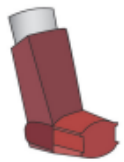
Duration: 24h
Company: Covis

Flovent® Diskus®
(fluticasone propionate)
100; 250; 500 mcg/blister

Duration: 12h
Company: GSK

Arnuity™ Ellipta®
(fluticasone furoate)
100; 200 mcg/actuation

Duration: 24h
Company: GSK

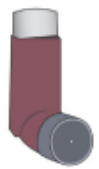


Flovent® MDI
(fluticasone propionate)
50; 125; 250 mcg/actuation

Duration: 12h
Company: GSK

Pulmicort® Turbuhaler®
(budesonide)
100; 200; 400 mcg/actuation

Duration: 12h
Company: AZ
*nebules also available



Qvar™ MDI
(beclomethasone dipropionate)
50; 100 mcg/actuation

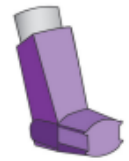
Duration: 12h
Company: Bausch

Company Key

AZ - AstraZeneca Canada Inc.
BI - Boehringer Ingelheim Canada Ltd.
Covis - Covis Pharma
GSK – GlaxoSmithKline Inc.
Novartis – Novartis Pharmaceuticals Canada Inc.
Organon - Organon Canada Inc.
Takeda – Takeda Canada Inc.
TEVA – TEVA Canada
Valeo – Valeo Pharma Inc.
Viatris – Viatris

Combination Inhalers

ICS/LABA
(Inhaled Corticosteroid and Long-Acting Beta2-Agonist)
Controller



Advair® MDI
(fluticasone propionate /salmeterol xinafoate)
125/25; 250/25 mcg/ actuation

Duration: 12h
Company: GSK

Advair® Diskus®
(fluticasone propionate/ salmeterol xinafoate)
100/50; 250/50; 500/50 mcg/ blister

Duration: 12h
Company: GSK

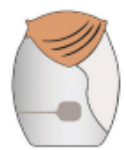
Atectura® Breezhaler®
(indacaterol/ mometasone furoate)
150/80; 150/160; 150/320 mcg/capsule

Duration: 24h
Company: Valeo

ICS/LAMA/LABA

Enerzair® Breezhaler®
(indacaterol / glycopyronium mometasone furoate)
150/50/160 mcg/capsule

Duration: 24h
Company: Valeo



Trelegy™ Ellipta™
(fluticasone furoate/ umeclidinium / vilanterol)
100/62.5/25; 200/62.5/25 mcg/ actuation

Duration: 24h
Company: GSK

Breo™ Ellipta®
(fluticasone furoate/ vilanterol trifenatate)
100/25; 200/25 mcg/ actuation

Duration: 24h
Company: GSK

Symbicort® Turbuhaler®
(budesonide/ formoterol fumarate)
100/6*; 200/6*; 400/12 mcg (FORTE) mcg/actuation

*May also be used as a reliever

Duration: 12h
Company: AZ

Wixela® Inhub®
(fluticasone propionate/ salmeterol xinafoate)
100/50; 250/50; 500/50 mcg/actuation

Duration: 12h
Company: Viatris

Zenhale™ MDI
(mometasone furoate/ formoterol fumarate)
100/5; 200/5 mcg/actuation

Duration: 12h
Company: Organon

Bronchodilators

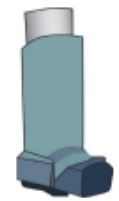
SABA
(Short-Acting Beta2-Agonist)
Reliever

Bricanyl® Turbuhaler®
(terbutaline sulphate)
0.5 mcg/actuation

Duration: 4-7h
Company: AZ

Ventolin® Diskus®
(salbutamol sulphate)
200 mcg/blister

Duration: 3-6h
Company: GSK



Ventolin® MDI
(salbutamol sulphate)
100 mcg/actuation

Duration: 4-6h
Company: GSK
*generic brands available

LABA
(Long-Acting Beta2-Agonist)
Controller

Never used on its own for asthma without an ICS

Oxeze® Turbuhaler®
(formoterol fumarate)
6; 12 mcg/actuation

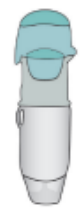
Duration: 12h
Company: AZ

Serevent® Diskus®
(salmeterol xinafoate)
50 mcg/blister

Duration: 12h
Company: GSK

LAMA
(Long-Acting Muscarinic Antagonist)
Controller

*Never used on its own for asthma without an ICS



Spiriva® Respimat®
(tiotropium bromide monohydrate)
2.5 mcg/actuation

Duration: 24h
Company: BI

Inhaler Errors

Poor coordination

Not exhaling before use

Incorrect head position

Low inspiratory flow

Critical inhalation technique errors associated with poor disease outcomes in patients with COPD on dry powder inhaler maintenance therapy

Error 1: Preparation; Error 2: Remove protective cap; Error 3: Sit up/stand straight & tilt head; Error 4: Hold inhaler in correct position during preparation; Error 5: Hold inhaler in correct position during inhalation; Error 6: Breathe out completely before inhalation; Error 7: Teeth and lips sealed around mouthpiece; Error 9: Breathe in; Error 10: Hold breath (for at least 6 seconds); Error 11: Breathe out calmly after inhalation

Small effect on clinical outcomes

p>0.2 on all outcomes

* E2

E3

E4

E7

CRITICAL ERRORS

Individual errors

Significantly associated with health outcomes (CCQ & CAT)

E10

E11

E9

E1

E5

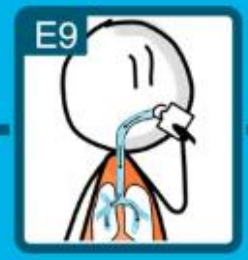
Significantly associated with severe exacerbations

Error pattern

The combination of these errors was associated with worse COPD outcomes (CCQ, CAT and severe exacerbations)

E6

+ E9

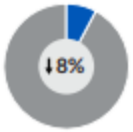
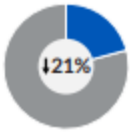
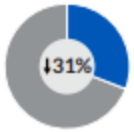


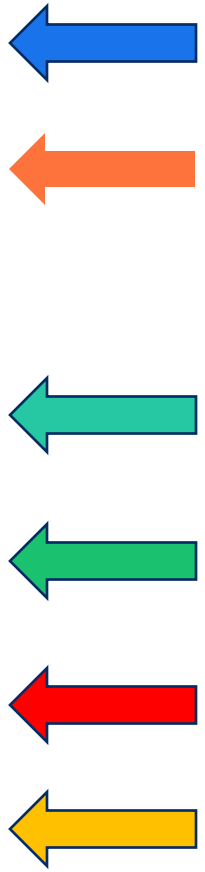
+ E10

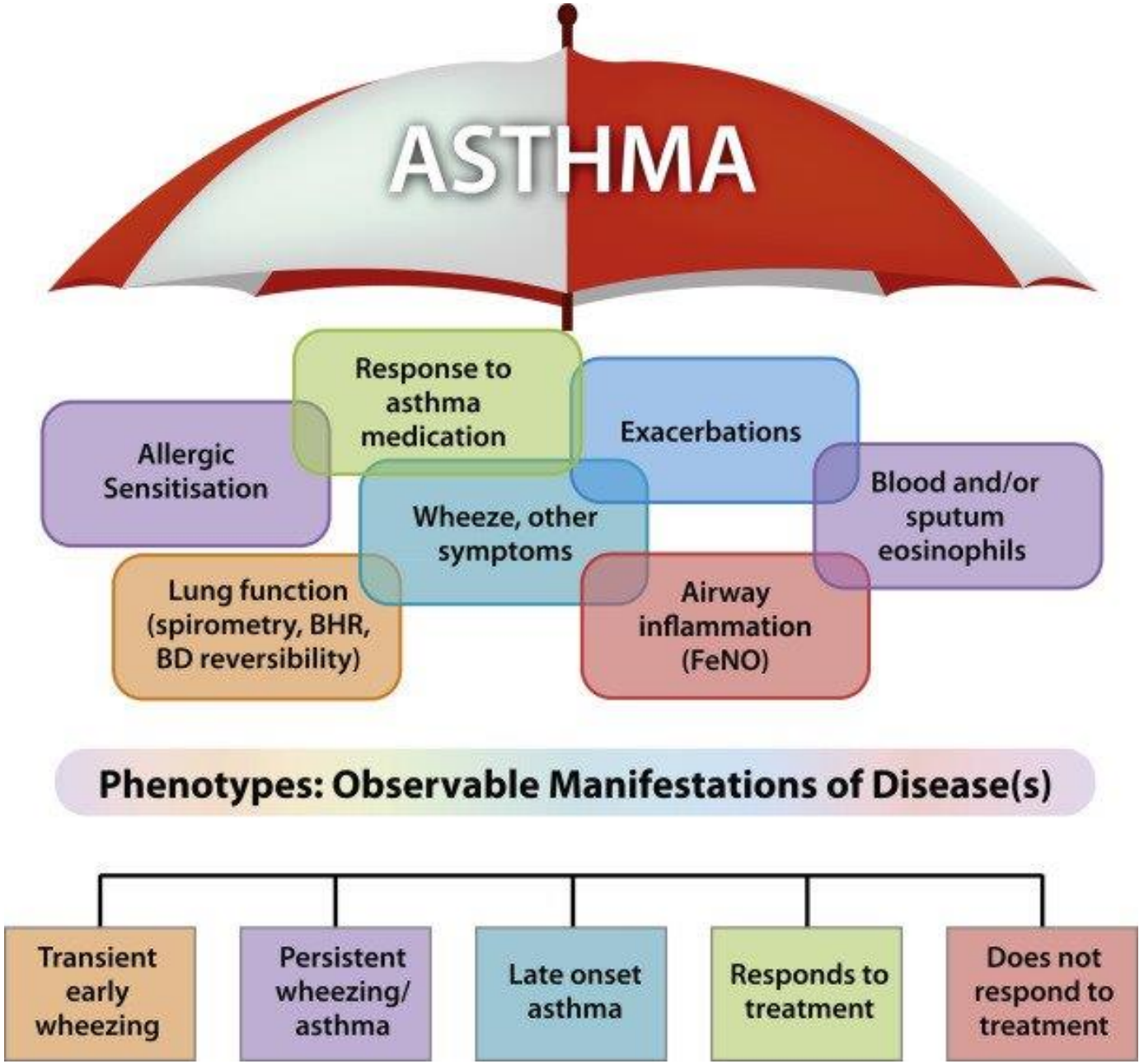
eAMS
The Electronic Asthma Management System

Which Asthma Medication(s) Should Your Patient Take to Best Manage Mild Asthma?

A Conversation Aid (for patients 12 and over)

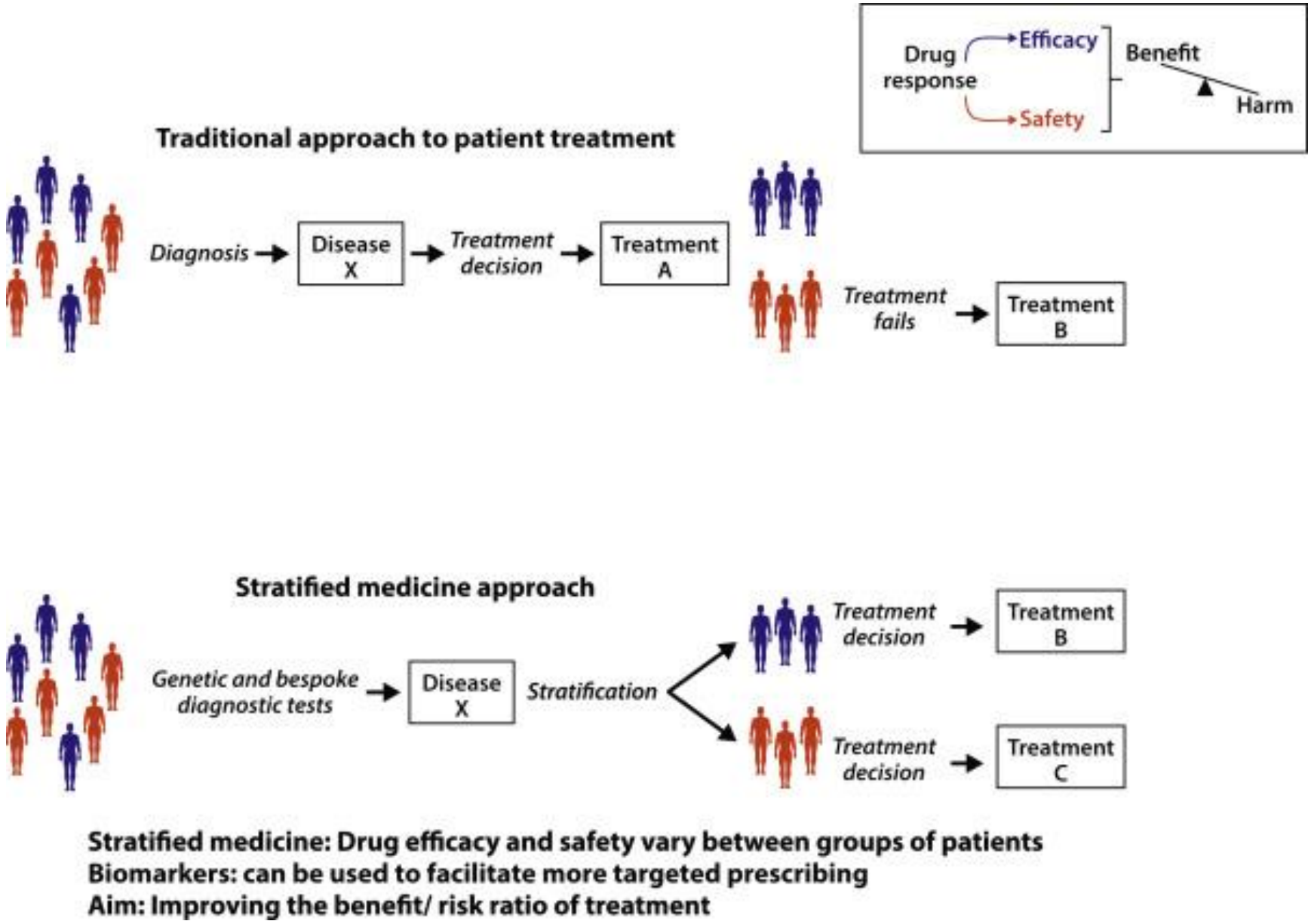
Your 3 Medication Options:	1. As-Needed Short-Acting Reliever	2. As-Needed Budesonide-Formoterol Combination (200/6 µg)	3. Daily Inhaled Steroid (With As-Needed Reliever)
	Reliever only	Controller + Reliever (in a single inhaler)	Controller + Reliever (as 2 separate inhalers)
How do these 3 asthma medication options compare when it comes to:			
A. How often people need their rescue medication:	Half of the days 	Half of the days 	A quarter of the days 
B. How much inhaled steroid will enter a person's body over a year:	≈0 inhalers (≈0 doses)	≈1 inhaler (200 doses) 	≈2.7 inhalers (540 doses)* 
C. How much the swelling in the airways will decrease over a year:			
D. How much of the time a person's asthma symptoms are under good control:	30% of the year	35% of the year	45% of the year
E. How many people will have a severe asthma flare-up over a year (e.g. prednisone/ER visit/ hospitalization):	20 out of 100 people 	7 out of 100 people 	9 out of 100 people 
F. How much these medications could cost (without coverage) over a year:	$40	$215	$280
G. How many people will have a hoarse voice over a year:	0 out of 100 people 	2 out of 100 people 	3 out of 100 people 
Your Patient's Preferred Option:	☐	☐	☐





Many types of asthma

Understanding "phenotype" of asthma may help us personalize treatment



Add-on treatment to high-dose ICS-LABA for patients with severe allergic or eosinophilic asthma

Fasenra
benralizumab 30mg/mL

Xolair
omalizumab 150mg • 75mg/0.5mL • 150mg/mL

Dupixent

Nucala

HOW DO BIOLOGICS WORK FOR ASTHMA?

Monoclonal antibody therapies are designed to block the clinical effects of type 2 inflammation by targeting either immunoglobulin E or interleukin cytokines in the inflammatory pathway. By blocking their action, biologics can reduce airway inflammation and improve asthma symptoms.

- Markedly reduces the rate of severe asthma exacerbations
- Improves asthma symptom control
- Reduces emergency department visits or hospitalisation
- Reduces the use of systemic corticosteroids

Asthma biologics

- Block key immune pathways (ie. Interleukins)
- Highly effective for certain types of asthma with little side effects
- High cost (ie. $2000 per month)
- Not curative (ie. Ongoing therapy)

ASTHMA

Pattern Variable symptoms
Exacerbations between episodes

Cause Allergies, irritants

Course Reversible

Treatment Goals Control symptoms
Prevent flares

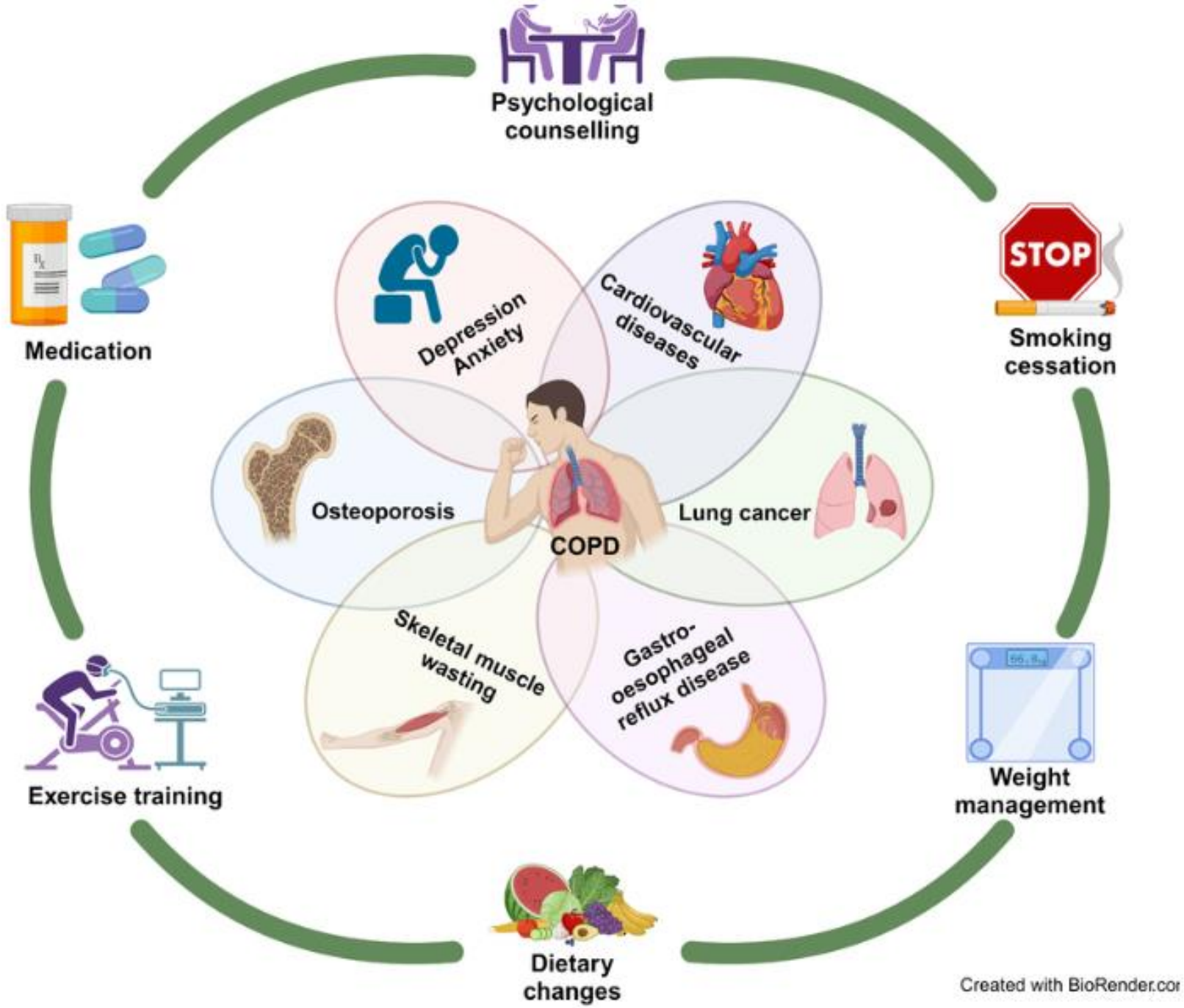
COPD

Pattern Chronic, progressive
Worsening over time

Course Smoking, pollution

Course Irreversible

Treatment Goals Relieve symptoms
Function & life

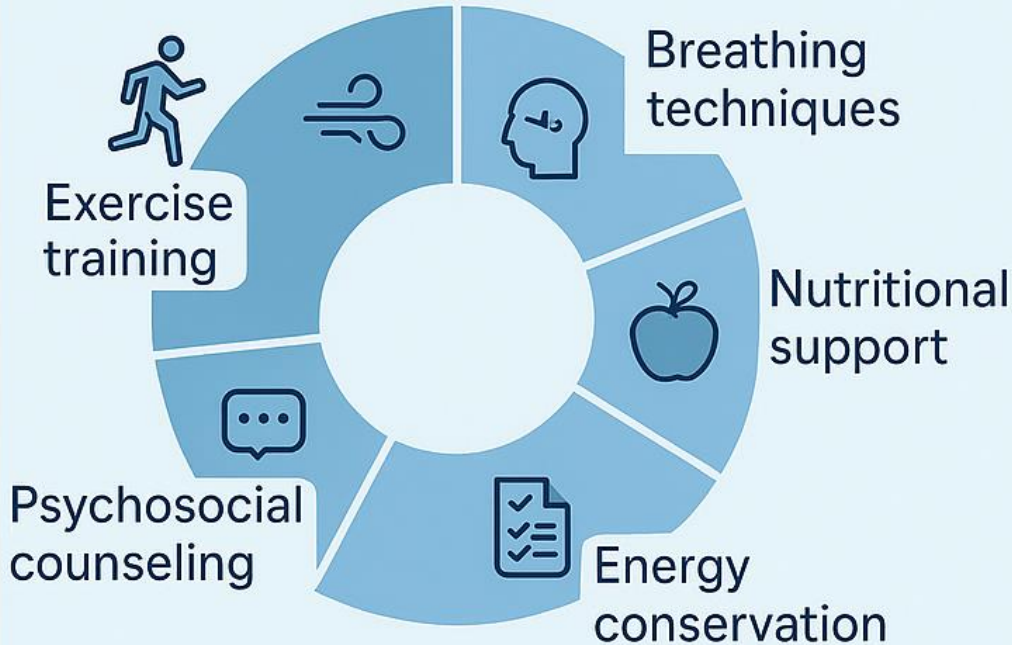

Psychological counselling
Medication
Smoking cessation
Depression Anxiety
Cardiovascular diseases
Osteoporosis
COPD
Lung cancer
Skeletal muscle wasting
Gastro-oesophageal reflux disease
Exercise training
Weight management
Dietary changes
Created with BioRender.com

Beyond Medications: The Power of Education and Pulmonary Rehab in COPD

COPD Education

- Lung anatomy & disease understanding
- Correct inhaler technique
- Recognizing early signs of exacerbation
- Action plans & medication use
- Self-management skills

Pulmonary Rehabilitation



↓ Breathlessness ↑ Exercise capacity ↓ Hospital visits

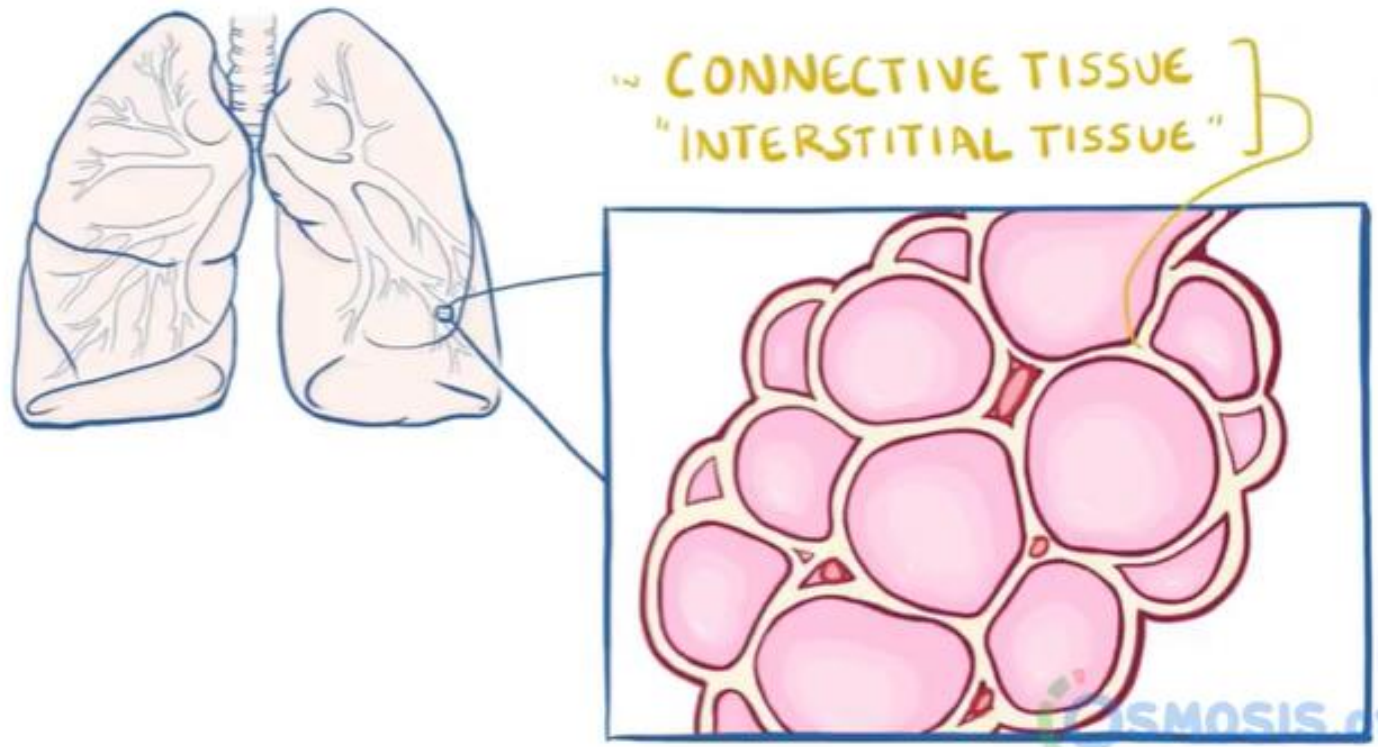
✓ Confidence and independence

IDIOPATHIC PULMONARY FIBROSIS

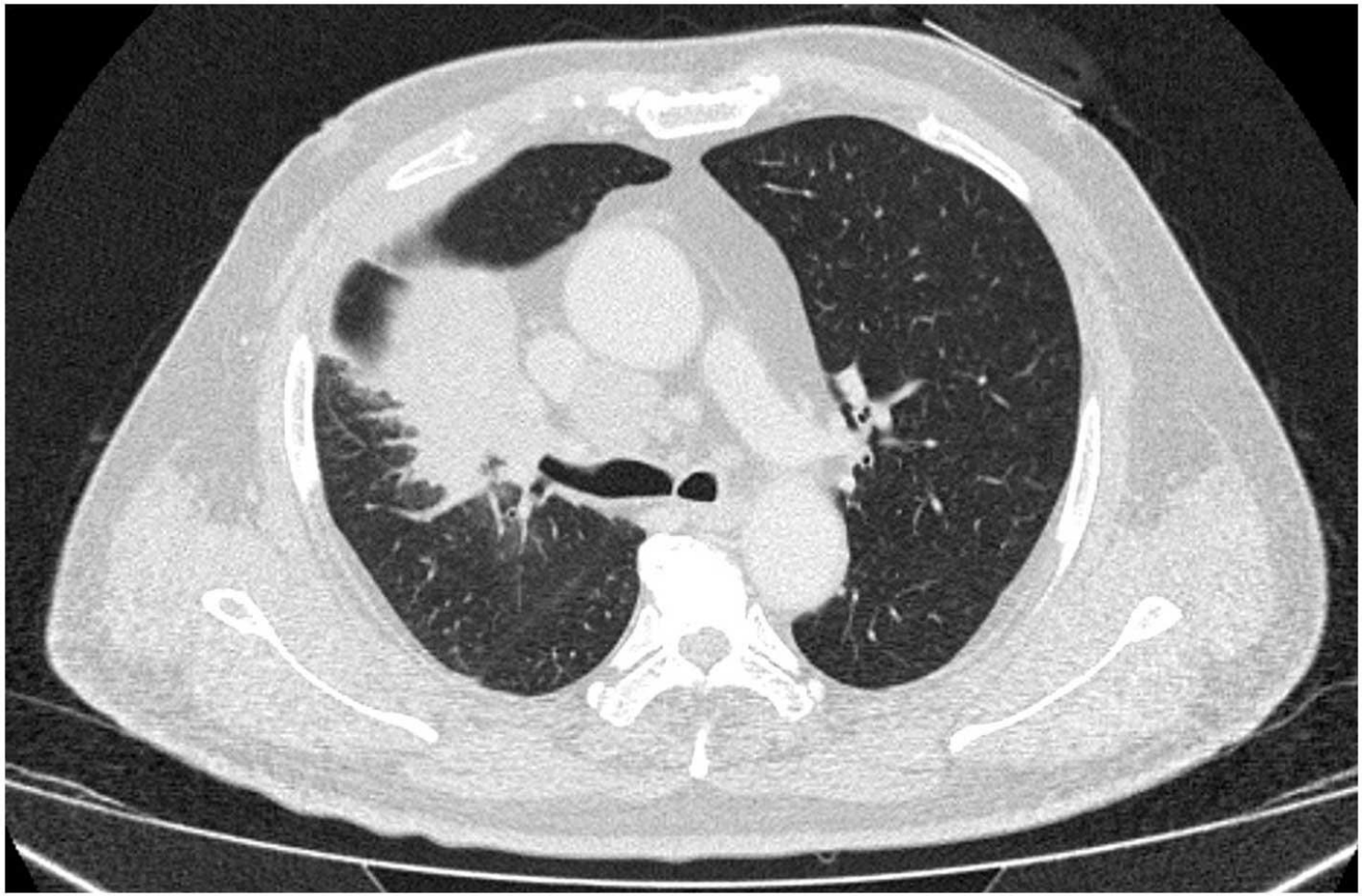
CAUSE NOT KNOWN

LUNGS

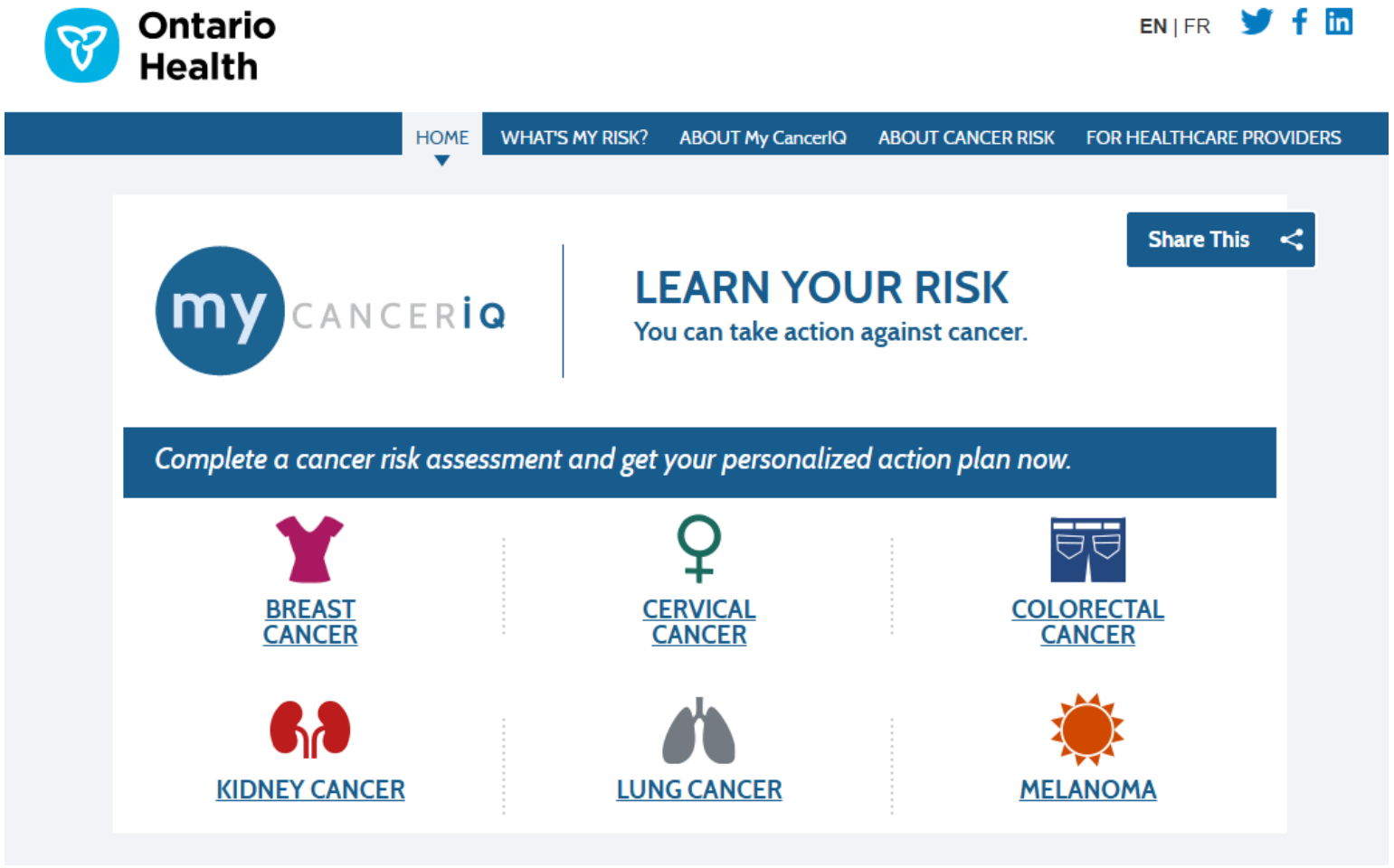
EXCESS COLLAGEN



Lung Cancer

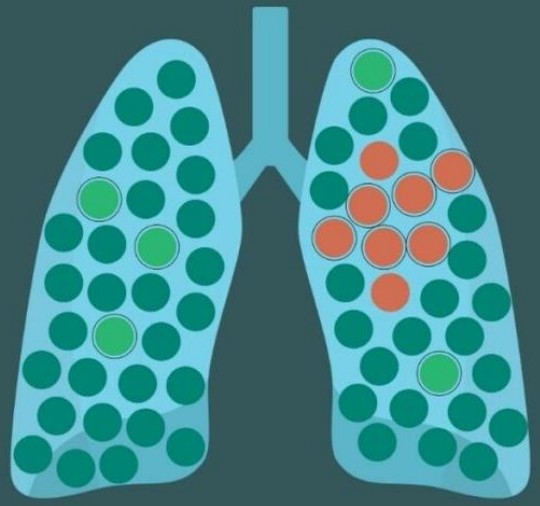


Ontario Lung Screening Program

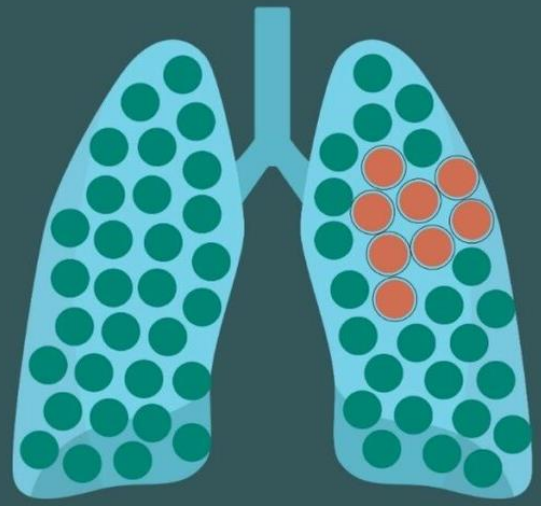


Lung Cancer Treatment

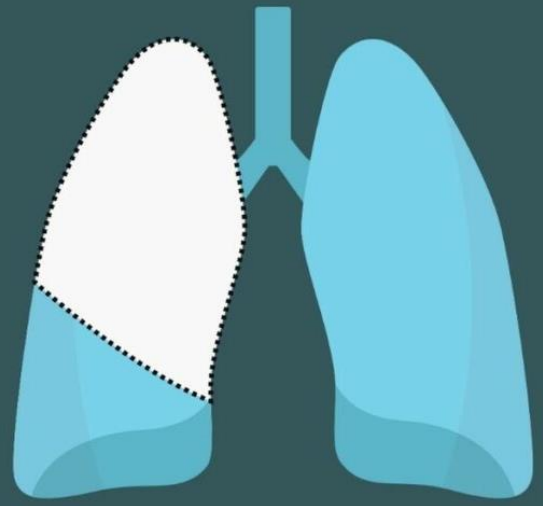
CHEMOTHERAPY
Can Kill Healthy Cells



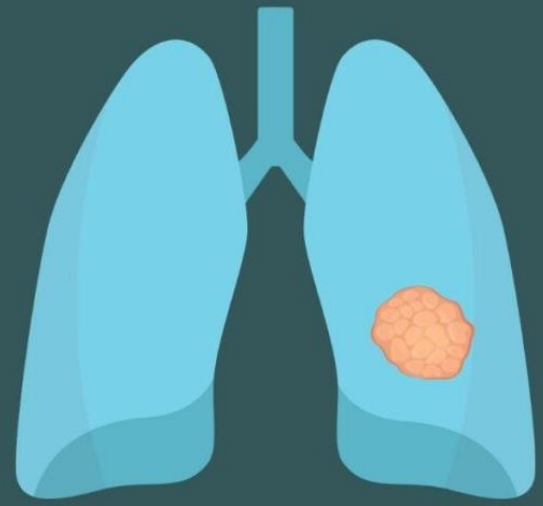
TARGETED THERAPY
Minimizes Damage to Normal Cells



SURGERY



IMMUNOTHERAPY



Normal Cells | Cancer Cells | Killed Cells

LUNG CANCER CENTER

Your First Resource After Diagnosis

Thank you for joining us today!

Keep learning, stay curious, and most of all — keep breathing easy.

Knowledge is medicine. Food is medicine. Exercise is medicine.

Online Resources:

- Internet search engine
  - Use term "patient information" before any search words
- For AI (eg. Chat GPT)
  - I'm looking for general information about [condition/treatment/symptom] to better understand it as a patient.
  - “I’m a patient trying to better understand my condition. Can you explain [e.g., asthma or COPD] in plain language?
  - What does the Canadian Lung Association or CDC say about…?"
  - Can you help me understand the difference between Spiriva and Symbicort so I can discuss this with my doctor?

Online resources:

- AI: Questions to avoid
  - You can mention age, gender, and general health context (e.g., "non-smoker," "history of asthma") **without including identifiable or sensitive personal health data** like names, exact dates, or health card numbers.
  - Avoid asking ChatGPT to diagnose a symptom or guide you in an emergency.
    - INSTEAD: What are common causes of [symptom] that I can ask my doctor about

Online resources:

- www.mlhc.ca/patientresources
- Lung Health Foundation
- Candadian Lung Foundation, Lung Saskatchewan
- American, British, European, Australian Lung Foundations
- [DISEASE} Foundation.....
- RED FLAGS: Selling products online