



Asthma

Bayhealth Internal
Medicine Residents

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DISCUSSION

1

Lung Physiology

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2

What is Asthma?

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3

How to control your Asthma?

Dr. Ana Estrada
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4

How to use an Inhaler?

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What if your Asthma gets worse?

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Bayhealth Medical Center

- PGY-2
 - Internal Medicine
- Interest:
 - Pulmonary Medicine
- Hobbies
 - Basketball
 - Traveling
 - Music

My Why

Why I chose medicine



I chose medicine in order to make a difference in the lives of my community and find ways to give back

The moment I knew

Working for and shadowing doctors

The people who helped me

My family

The work

Tackling complex problems

How Your Lungs Work

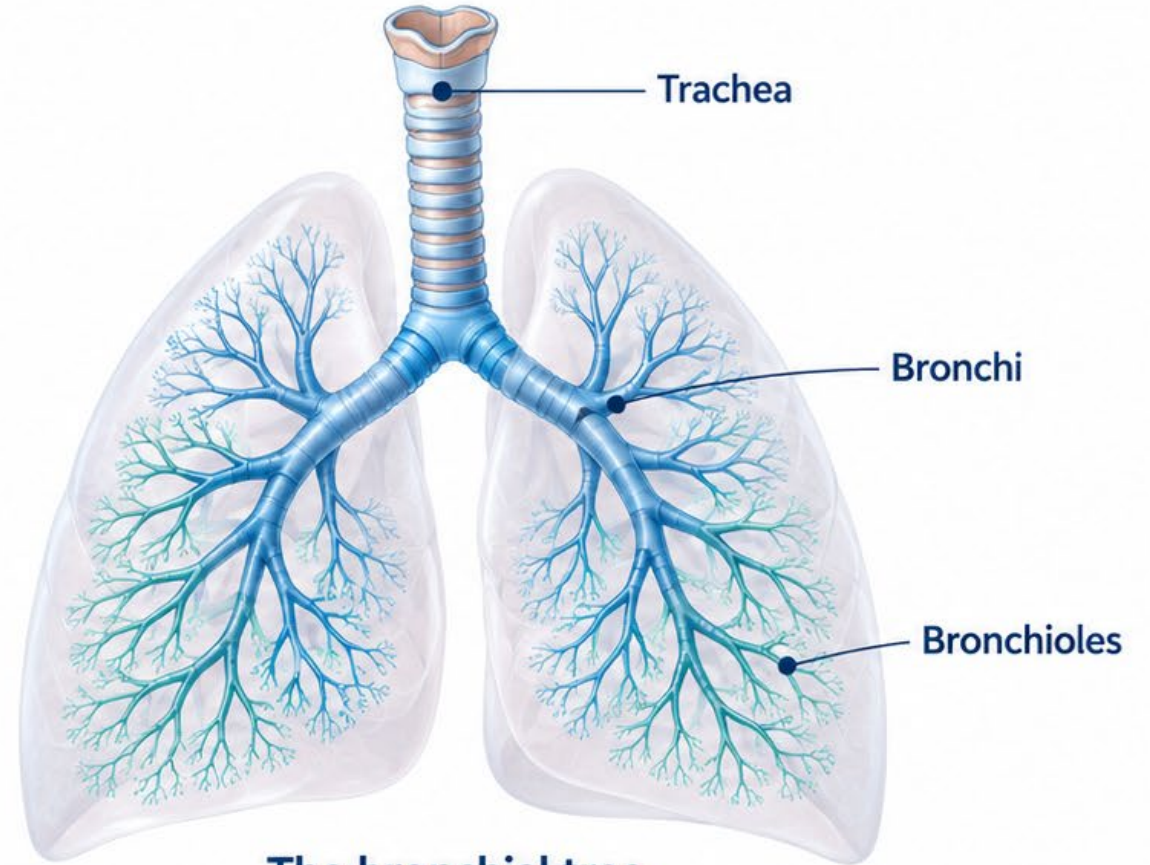
Oxygen in, carbon dioxide out — and the plumbing that makes it happen

The Bronchial Tree

Your airways branch into smaller and smaller tubes, much like a tree.



A tree

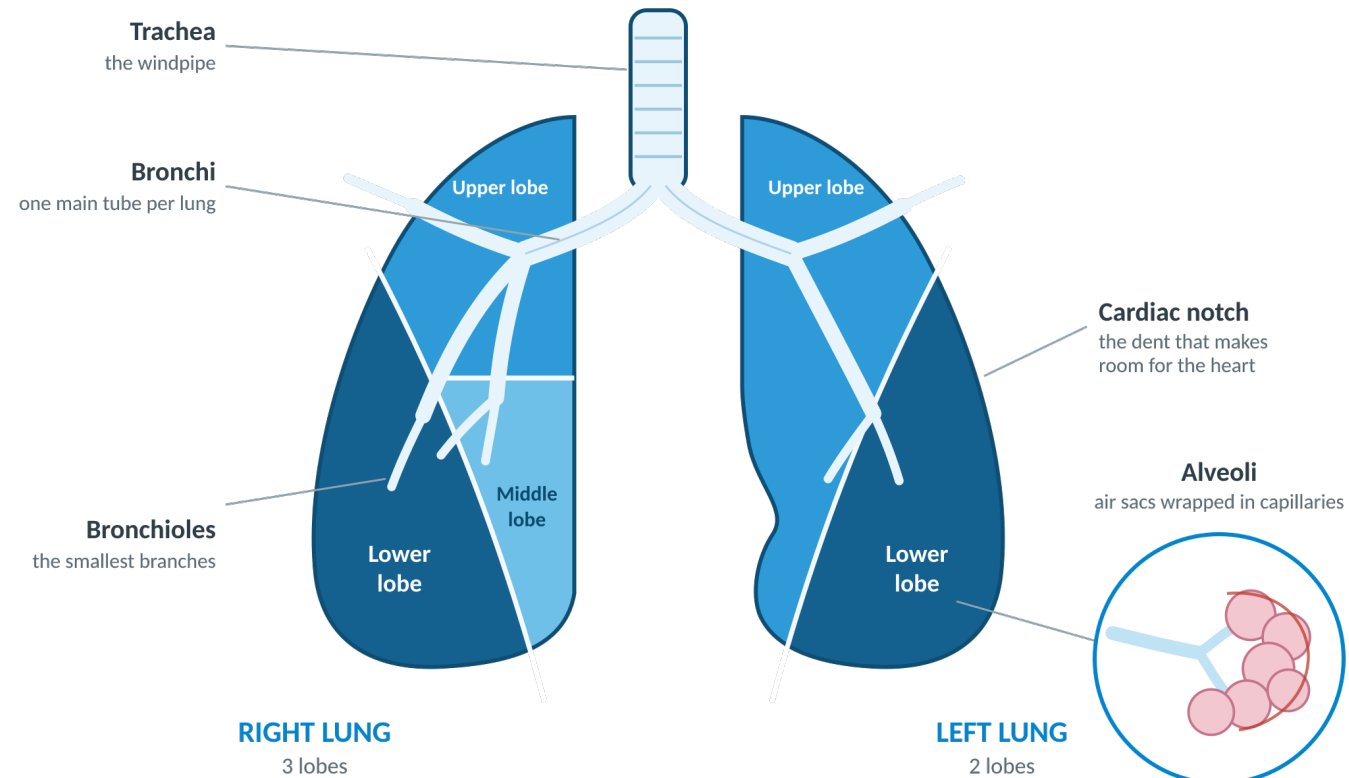


The bronchial tree

The trachea is like the trunk. The bronchi and bronchioles are its branches. Tiny air sacs called alveoli sit at the ends.

The Parts of the Lungs

Anterior view — as you face someone, their right lung is on your left.



Right lung

3 lobes

Upper, middle, and lower — divided by the horizontal and oblique fissures.

Left lung

2 lobes

Upper and lower only, separated by a single oblique fissure.

Why the difference?

The heart

The heart sits slightly left of center, so the left lung gives up a lobe and gains the cardiac notch.

The Two Big Jobs



Bring in oxygen (O₂)

Every cell in your body uses oxygen to turn food into usable energy. Without a steady supply, cells cannot make the energy they need to work.



Remove carbon dioxide (CO₂)

Carbon dioxide is the waste gas made when cells produce energy. Too much of it is harmful, so the lungs breathe it out.

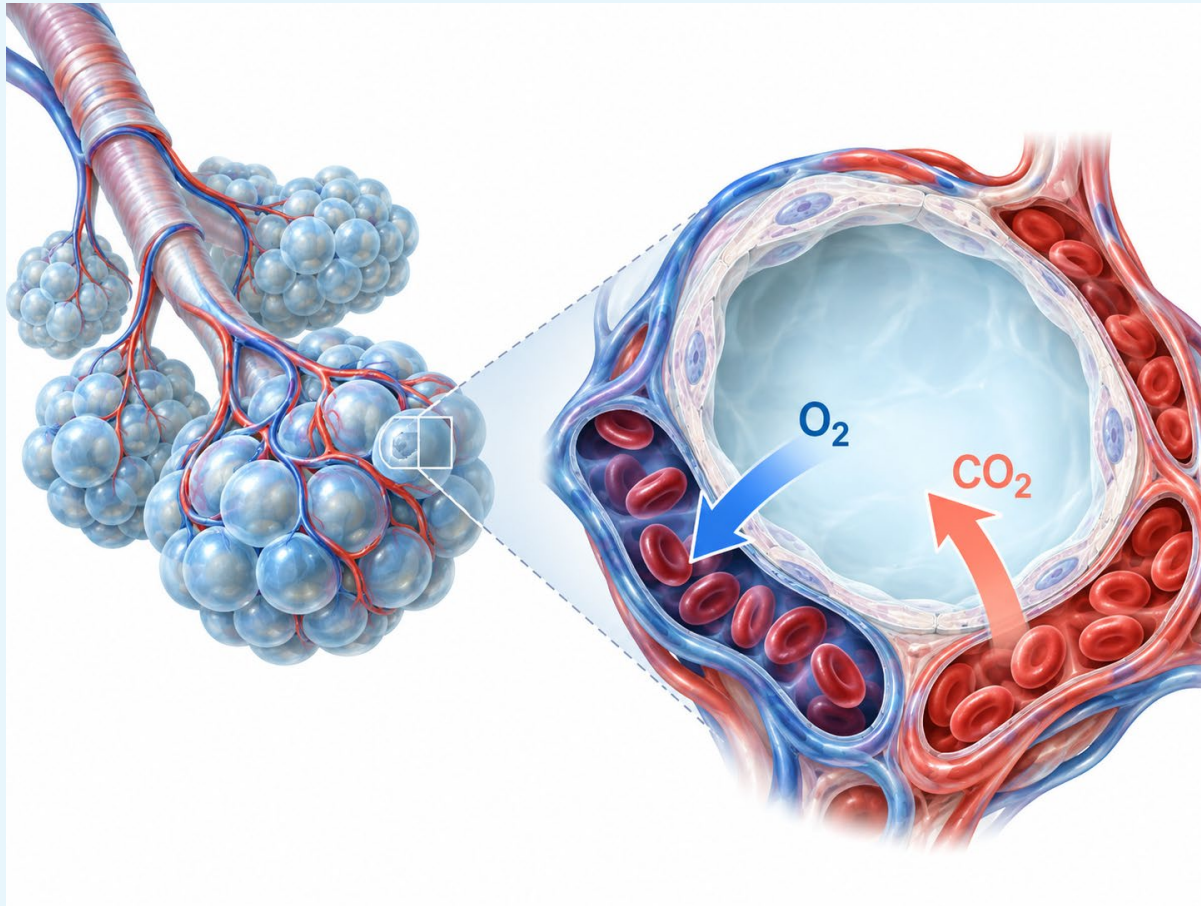


The trade, in one sentence

The lungs move air in and out, and swap oxygen for carbon dioxide between that air and the blood.

Gas Exchange in the Alveoli

Bronchioles deliver air to tiny air sacs called alveoli



A thin wall makes this possible

Oxygen moves into the blood

O_2 crosses from the air in the alveoli into nearby capillaries. Blood carries it to the body.

Carbon dioxide moves out

CO_2 crosses from the blood into the alveoli, then leaves the body when you breathe out.

Build a Set of Lungs in a Bottle

A hands-on model of how the diaphragm helps us breathe



Ask an adult to cut the bottle and cover sharp edges.

What you need

1 clean plastic soda or water bottle (1 or 2-liter)

3 balloons (two small/medium, one large)

1 or 2 drinking straws

Rubber bands or sticky tape

Modeling clay or playdough

Scissors



Why it works

Pull the big balloon down and the space inside the bottle gets bigger, so the pressure drops and air rushes into the small balloons. Let go and they empty. Nothing pushes the air in — exactly how your diaphragm works.

Lung Physiology Recap

Choose the best answer

Where do oxygen and carbon dioxide exchange between air and blood?

- A.** The trachea
- B.** The alveoli
- C.** The main bronchi
- D.** The diaphragm





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- PGY-2
 - Internal Medicine
- Interest:
 - Pulmonary Medicine
- Hobbies

What Is Asthma?

A long-term disease of sensitive, easily narrowed airways



What Is Asthma?

A long-term (chronic) disease of the airways — the tubes that carry air into the lungs.

In asthma, the airways become swollen, narrow, and clogged, which makes it hard to breathe.

It comes and goes

A person can feel completely fine, then have a flare-up (an asthma attack) when something triggers their airways.

The airways are "twitchy"

People with asthma have oversensitive airways — called airway hyperresponsiveness. Things that would not bother most people set off an immune overreaction.

It often runs in families

The tendency is inherited and closely linked to allergies such as eczema, hay fever, and food allergies.

Three Things Happen Inside the Airways

During an attack, all three shrink the space air can flow through.



Muscle squeezing

Bronchoconstriction

The tiny muscles wrapped around the airways tighten and clamp down, narrowing the tube.



Swelling

Inflammation

The walls of the airways become puffy and swollen, leaving less room inside.



Extra mucus

Mucus plugging

The airways make too much thick, sticky mucus, which plugs up the tube.

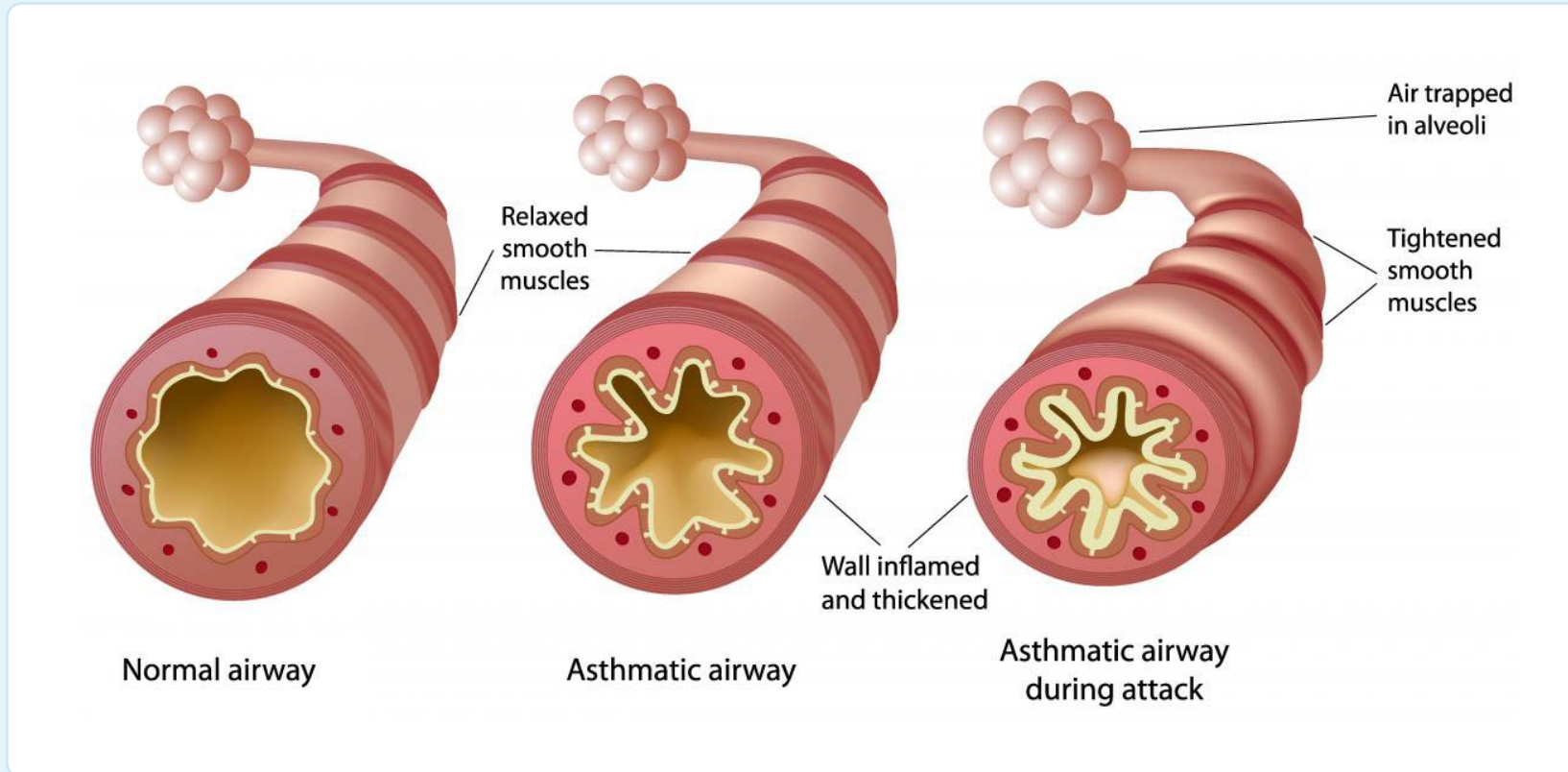


Think of breathing through a straw

Asthma is that straw getting squeezed, having swollen walls, and being partly clogged with goo — all at once. Because the tube is narrowed, it is especially hard to push air back out, which is why people wheeze.

What It Looks Like Inside

The same airway, healthy and asthmatic — and during an attack.



The asthmatic airway is already narrowed and thickened before an attack — the attack adds muscle tightening on top of that.

What It Feels Like

The four classic symptoms of asthma.



Wheezing

A whistling sound when breathing out.



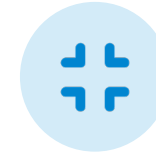
Coughing

Often worse at night or early in the morning.



Shortness of breath

Feeling like you cannot get enough air.



Chest tightness

A squeezing or heavy feeling in the chest.

Symptoms come and go, vary in how bad they are, and are often worse at night or during and after exercise.

What Sets Off an Attack

A trigger is anything that starts symptoms or makes them worse.



Colds and infections

Respiratory infections are the most common trigger, especially in children.



Allergens

Pollen, dust mites, mold, pet dander, and cockroaches.



Irritants in the air

Tobacco smoke, vaping, and air pollution.



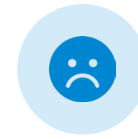
Exercise

Especially exercise in cold air.



Cold air and weather

Cold air and sudden weather changes.



Strong emotions

Stress and intense emotions can set symptoms off.

The Straw Challenge

Twenty seconds of what a narrowed airway feels like.



1

Hold your nose

Pinch it closed so all your air has to go through the straw.



2

Breathe through a stir straw

For 15-20 seconds – breath in and out through it, as if you were drinking



3

Say it in one word

Describe how that felt using a single word. Everyone shares theirs.



Now imagine you cannot take the straw out

That is a flare-up. And real asthma is harder — the tough part is pushing air back OUT, not pulling it in. That is why people wheeze on the way out.



Pass it on

Challenge your friends — now you can explain what they are feeling.

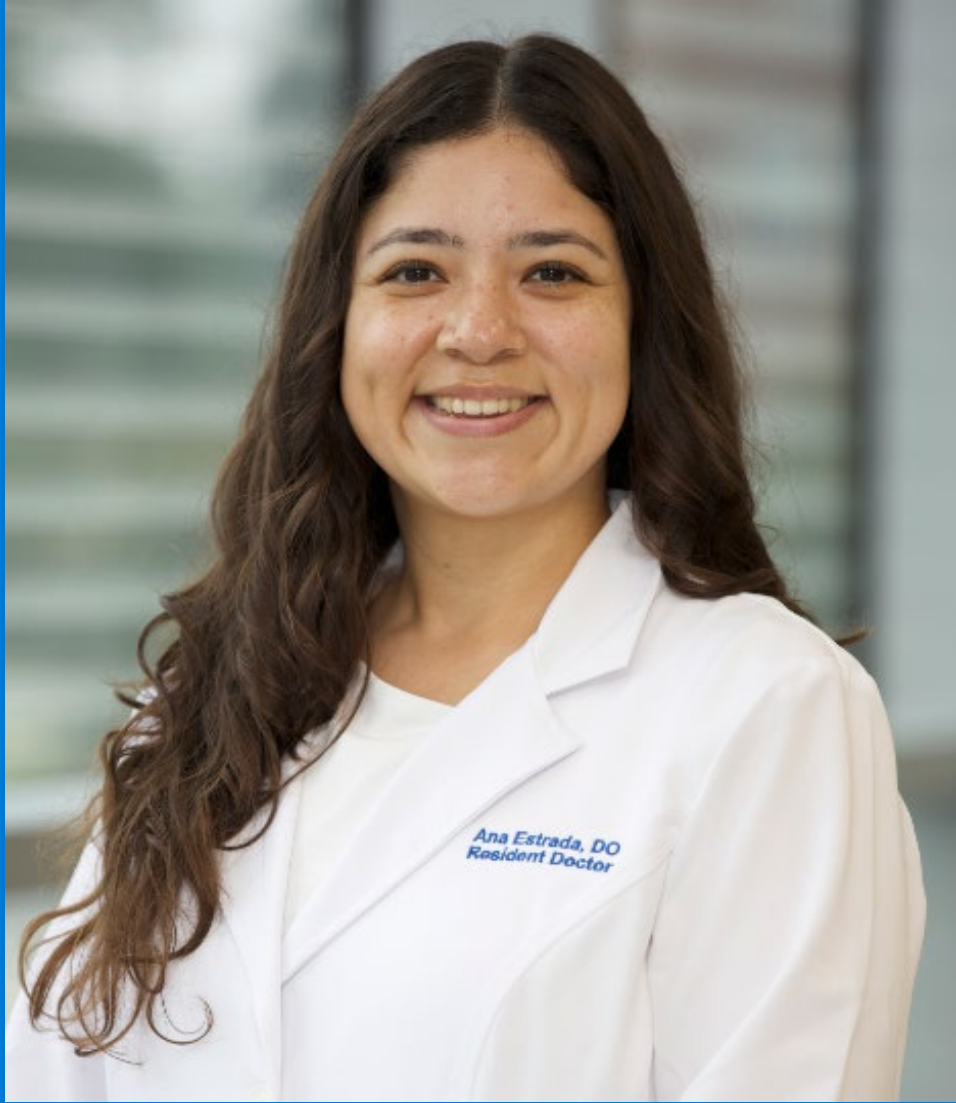
What Is Asthma? Recap

Choose the best answer

What happens to the airways during an asthma attack?

- A.** The airways widen and mucus decreases
- B.** Only the breathing muscles become tired
- C.** The air sacs fill with extra oxygen
- D.** Muscles tighten, walls swell, and mucus increases





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- Interest:
 - Gastroenterology
- Hobbies
 - Running
 - Reading
 - Puzzles
- My Why?
 - Community Health, underserved communities

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My Why

Why I chose medicine



I chose medicine because I get to keep learning, help people when they need it most, and make a difference in someone's life every day.

The moment

Community Clinic

The person (who made me love it?)

Mentors

The work (who makes it worth it?)

Family

How to Detect Your Asthma

Symptoms, Triggers and Criteria

Getting the Right Diagnosis

Other conditions have symptoms similar to asthma, so the right diagnosis comes first.



History

- Bring notes to your appointment
- All previous medical conditions
- Personal or family history of allergies or eczema — both raise the chance of asthma
- The medicines you take, and your lifestyle
- Home or work exposures: animal dander, pollen, dust, tobacco smoke
- Whether you get chest symptoms when you have a head cold



Body check

- A physical exam of the ears, eyes, nose, throat, skin, chest, and lungs
- A lung function test to measure how well you exhale air
- Possibly an X-ray of your lungs or sinuses

The Four Levels of Asthma

Your level is based on your lung function and how often you have symptoms.

1

Intermittent

DAYTIME SYMPTOMS

Less than twice a week

WAKING AT NIGHT

Fewer than two nights a month

2

Mild Persistent

DAYTIME SYMPTOMS

Two or more days a week

WAKING AT NIGHT

Three to four nights a month

3

Moderate Persistent

DAYTIME SYMPTOMS

At least every day

WAKING AT NIGHT

One or more nights a week

4

Severe Persistent

DAYTIME SYMPTOMS

Throughout the day

WAKING AT NIGHT

Every night due to asthma

Your doctor may also ask how often asthma keeps you from normal activities, and how often you reach for a quick-relief inhaler.

Tests to Help Diagnose Asthma

Your doctor combines your symptoms, examination, and test results



Spirometry, before and after an inhaler

Measures how much air you blow out and how fast, then checks for improvement after medicine.



Peak flow tracking

Measures your fastest breath out. Repeated readings help show changes in airflow.



FeNO breath test

Measures nitric oxide in your breath, which can suggest airway inflammation.



Challenge testing

Checks whether exercise or a test medicine causes your airways to narrow, under supervision.



Allergy testing

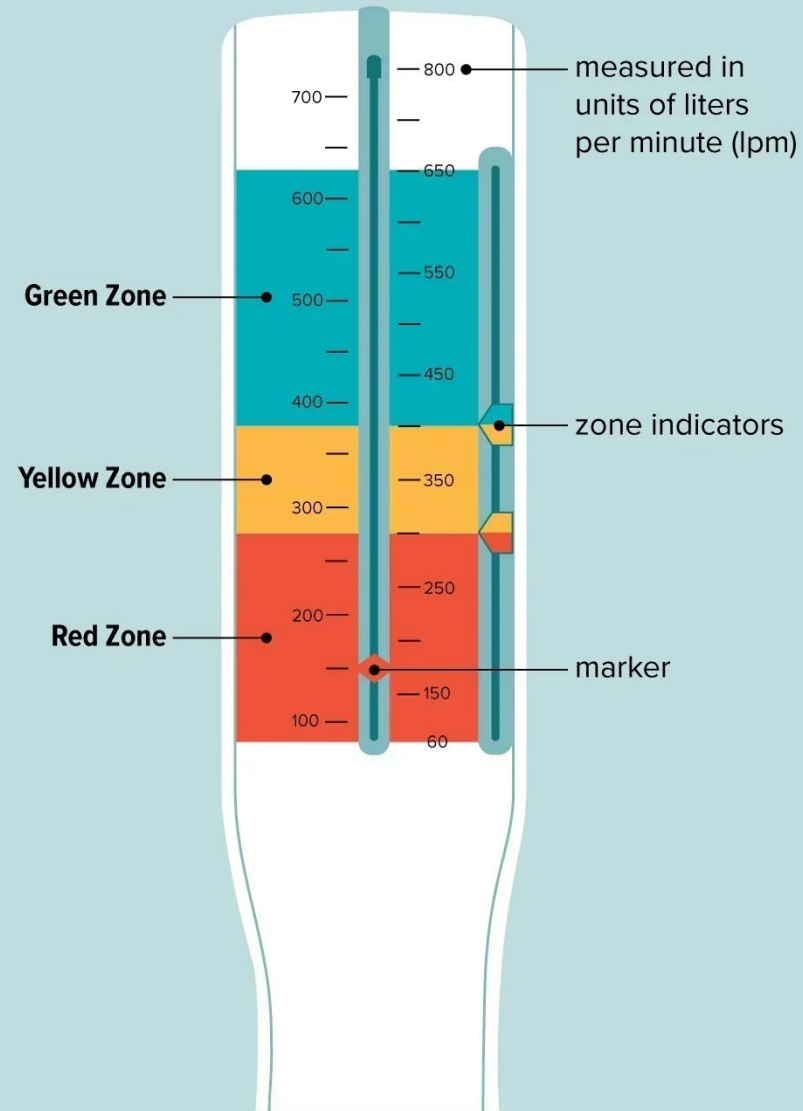
Helps identify allergic triggers, such as pollen or dust mites. It does not diagnose asthma by itself.



Not everyone needs every test. Normal results may need repeating when symptoms occur.

Peak Flow Meter

PEAK FLOW METER



Diagnosing Asthma



Create an Action Plan

Three simple zones tell you how your asthma is doing right now — and what to do about it.



Green Zone

GO

Your breathing is good, with no cough, wheezing, or chest tightness. You can work, play, and sleep through the night.

Keep following your daily treatment plan.



Yellow Zone

CAUTION

Early warning signs appear. You may notice them before you have any real trouble breathing.

Treat at first sign. Follow the yellow zone in your action plan



Red Zone

DANGER

Asthma is worsening quickly and quick-relief medicine is not helping. This is a medical emergency.

Act now — get medical help right away.

Yellow Zone: What To Do

The key to controlling your asthma is taking your medicine at the earliest sign that it is getting worse.



Treat at the first sign

Take your asthma medicines as soon as you notice early warning signs. Your Yellow Zone treatment may be a quick-relief medicine such as albuterol, or a combination controller and reliever medicine.



Call if it does not improve

If your symptoms do not get better after treating them, call your doctor.



Write down your own signs

Make a list of your personal early warning signs, and talk with your doctor about exactly what to do when you notice them.

In the Yellow Zone two or more times a week? That is a sign your asthma is not controlled — tell your doctor.

Red Zone: A Medical Emergency

Asthma may lead to a medical emergency. You are in the Red/Danger Zone if you have any of the following:

- **Asthma is getting worse quickly**
- **Quick-relief medicine is not helping**
- **Fast breathing with chest retractions**

Skin sucks in between or around the chest plate and/or rib bones when inhaling

- **Cyanosis — a tissue color change**

On the tongue, lips, around the eyes, and fingertips or nail beds: grayish or whitish on darker skin tones, bluish on lighter skin tones

- **Rapid movement of the nostrils**

More common in children

- **Ribs or stomach moving in and out deeply and rapidly**

More common in children

- **An expanded chest that does not deflate when you exhale**
- **Infants who fail to respond to or recognize parents**
- **Trouble speaking**



Any one of these signs is enough — call for emergency help right away.

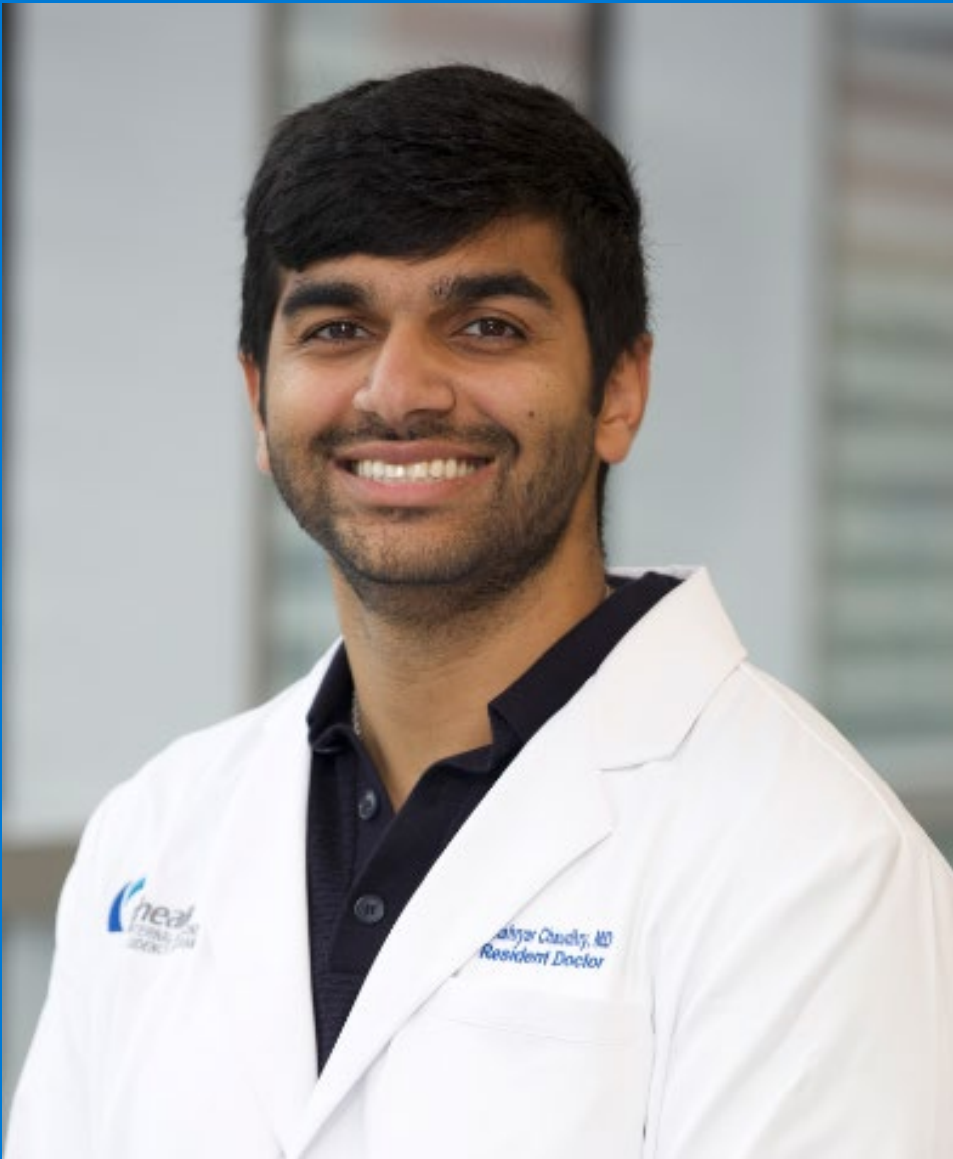
How to Control Your Asthma Recap

Choose the best answer

What is the best way to learn which triggers make your asthma worse?

- A.** Assume everyone has the same triggers
- B.** Avoid every kind of physical activity
- C.** Track symptoms and exposures with your care team
- D.** Wait until a severe attack to look for a cause





Dr Shahryar Chaudhury, MD

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Bayhealth Medical Center

- PGY-2
 - Internal Medicine
- Interest:
 - Cardiology
- Hobbies
- My Why?

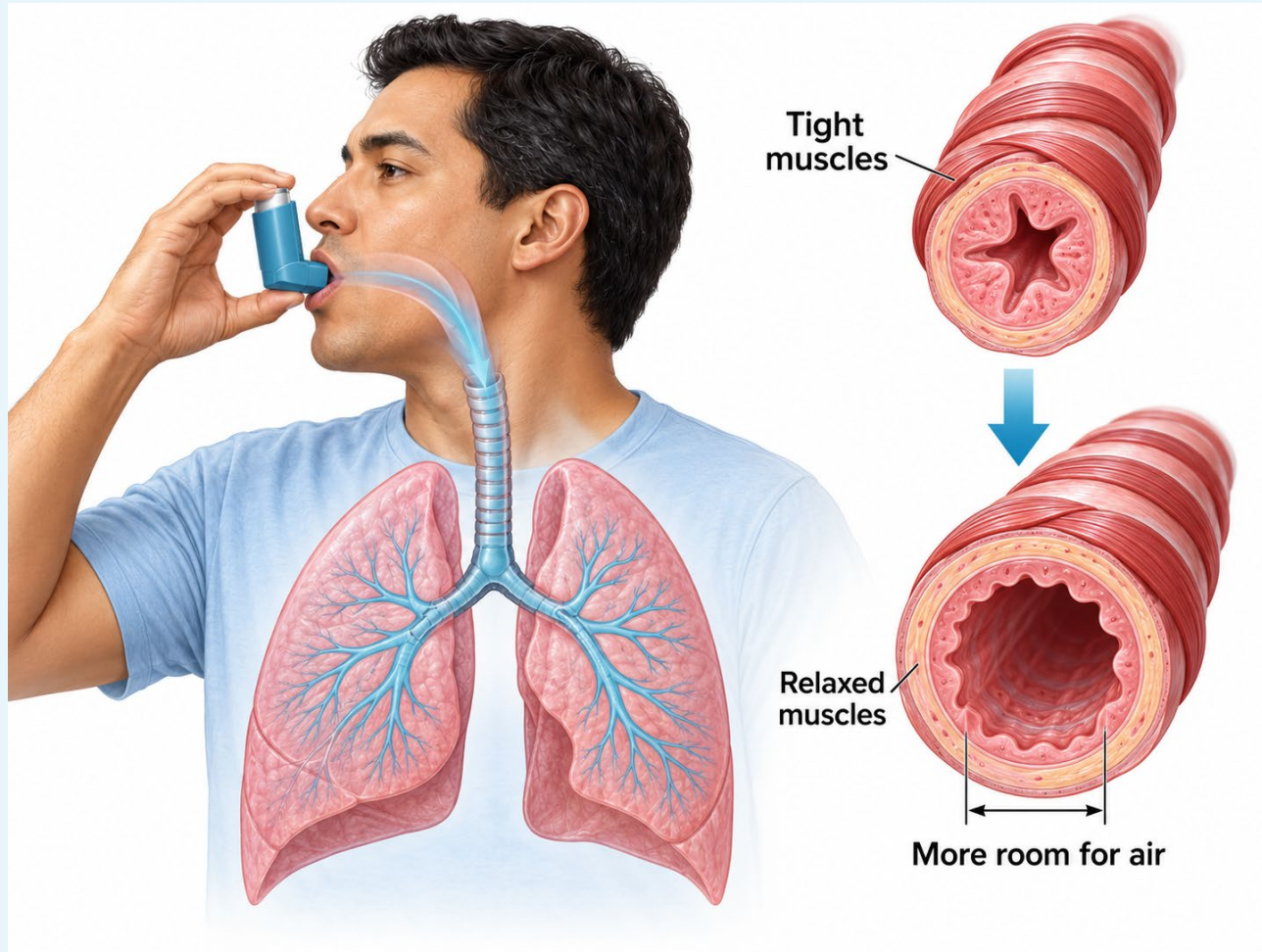
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Asthma Inhalers

Medications and Prevention

Asthma Medicines: Relievers and Controllers

Bronchodilators relax the muscles around the airways, making breathing easier



Relievers

Rescue medicine

- Works fast during an attack
- Relaxes the tight airway muscles and opens the tube
- Albuterol is a good example
- Does not fix the underlying swelling



Controllers

Preventer medicine

- Taken regularly, even on good days
- Usually contains an inhaled steroid
- Calms the ongoing inflammation over time
- Lowers the risk of attacks

Some prescribed combination inhalers serve both roles. Follow your asthma action plan.

Asthma Medications



Asthma and COPD Medicines

Quick Reliever Medicines

Short-Acting Beta₂-Agonists (SABA)

Albuterol Sulfate HFA
42 mcg/actuate
90 mcg



Albuterol Sulfate Neb
0.09 mg/0.5 mL, 1.26 mg/3 mL
25 mg/3 mL



ProAir[®] RespiClick
albuterol sulfate
107 mcg



Proventil[®] HFA
albuterol sulfate
107 mcg



Ventolin[®] HFA
albuterol sulfate
90 mcg



Xopenex HFA[®]
levalbuterol tartrate
50 mcg



Xopenex[®] Neb
levalbuterol tartrate
0.31 mg/3 mL, 0.62 mg/3 mL, 1.26 mg/3 mL



Short-Acting Muscarinic Antagonists (SAMA)

Atrivent[®] HFA
ipratropium bromide
17 mcg



Atrivent[®] Neb
ipratropium bromide
20.000 mcg



Short-Acting Combinations (SABA-SAMA)

Combivent[®] Respimat[®]
ipratropium bromide and albuterol sulfate
30/100 mcg



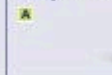
DuoNeb[®]
ipratropium bromide and albuterol sulfate
0.5 mg/3 mL, 0.5 mg/3 mL



AIR

Short-Acting Combinations (SABA-ICS)

AirSupra[®]
fluticasone propionate and albuterol sulfate
90/100 mcg



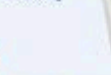
Maintenance/Controller Medicines

Inhaled Corticosteroids (ICS) asthma only

Alvesco[®] HFA
ciclesonide
80/160 mcg



ArmonAir[™] RespiClick[®]
fluticasone propionate
55/110/220 mcg



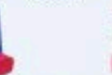
Armuly[®] Ellipta[®]
fluticasone propionate
100/200 mcg



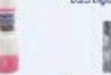
Asmanex[®] HFA
mometasone furoate
100/200 mcg



Asmanex[®] Twisthaler[®]
mometasone furoate
150/300 mcg



Budesonide Inhalation Suspension
0.25 mg/2 mL, 0.5 mg/2 mL, 1 mg/2 mL



Fluticasone Propionate Diskus[®]
fluticasone propionate
50/100/200 mcg



Fluticasone Propionate HFA
fluticasone propionate
44/110/220 mcg



Pulmicort[®] Flexhaler[®]
budesonide
80/160 mcg



Pulmicort Respules[®]
budesonide
0.25 mg/0.5 mL, 0.5 mg/0.5 mL, 1 mg/0.5 mL



QVAR[®] RediHaler[®]
beclomethasone dipropionate
4/8/16 mcg



Combination Therapy (Inhaled Corticosteroid - Long-Acting Beta₂-Agonists) (ICS-LABA)

Advair Diskus[®]
fluticasone propionate and salmeterol
100/200, 250/500, 500/500 mcg



Advair[®] HFA
fluticasone propionate and salmeterol
45/21, 110/21, 220/21 mcg



AirDuo[®] RespiClick[®]
fluticasone propionate and salmeterol
55/14, 110/14, 220/14 mcg



Breo[®] Ellipta[®]
fluticasone and vilanterol
100/25, 200/25 mcg



Wixela[™] Inhub[™]
fluticasone propionate and salmeterol
100/50, 250/50, 500/50 mcg



SMART/MART

Symbicort[®]
budesonide and formoterol
80/4.5, 160/4.5 mcg



Breyna[™]
budesonide and formoterol
80/4.5, 160/4.5 mcg



Dulera[®]
mometasone furoate and formoterol
4/4, 8/4, 16/4 mcg



Triple Therapy (ICS-LABA-LAMA)

Trelegy Ellipta[®]
fluticasone, vilanterol, and umeclidinium
100 mcg/25 mcg/25 mcg



Breztri Aerosphere[®]
budesonide, glycopyrrate, and formoterol
160/9/4 mcg



Trimbow[®]
budesonide, glycopyrrate, and formoterol
48 mcg/8 mcg/4 mcg



Long-Acting Muscarinic Antagonists (LAMA)

Incruse[®] Ellipta[®]
umeclidinium
62.5 mcg



Lonhala Magnair[®]
glycopyrrate
18 mcg/1 mL



Spiriva[®] HandiHaler[®]
tiotropium bromide
18 mcg



Spiriva[®] Respimat[®]
tiotropium bromide
18 mcg



Tudorza[®] Pressair[®]
acetylsalicylic acid
40 mcg

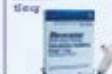


Yupelri[®] Neb
tiotropium bromide
17.5 mcg/3 mL



Long-Acting Beta₂-Agonists (LABA) COPD only

Brovana[®] Neb
salmeterol
15 mcg



Perforomist[®] Neb
formoterol
20 mcg



Serevent[®] Diskus[®]
salmeterol
50 mcg



Spiriverd[®] Respimat[®]
salmeterol and formoterol
25 mcg



LAMA-LABA COPD only

Anoro[®] Ellipta[®]
fluticasone, vilanterol, and umeclidinium
88/22, 44/22 mcg



Bevespi Aerosphere[®]
glycopyrrate and formoterol
9/4.8 mcg



Duaklir[®] Pressair[®]
acetylsalicylic acid and formoterol
40/20 mcg



Stiolto[®] Respimat[®]
tiotropium bromide
18/25 mcg



Add-On Medicines

Monoclonal Antibody (biologics, injection)

Cinqair[®]
mepolizumab
150 mg



Dupixent[®]
dupilumab
300/600 mcg



Fasenra[®]
reslizumab
30 mg



Exelsur[™]
alprostadil
150 mcg



Nucala[®]
mepolizumab
150 mg



Tezspire[™]
triazolam
25 mcg



Xolair[®]
omalizumab
150/300 mg



PDE Inhibitors

PDE4 Daliresp[®]
roflumilast
250/500 mcg



PDE3/4 Ohtuvayre[™]
omaxodine
30 mg/3.5 mL



Leukotriene Receptor Antagonists (LTRA)

Singulair[®]
montelukast
4.5 mg/10 mg



Zyflo[®]
zileuton
600 mg



Use a valved holding chamber/spacer

All HFA inhalers should be used with a compatible valved holding chamber/spacer.



You can also connect with a lung health navigator for one-on-one, free support from the American Lung Association's Lung Helpline at 1-800-LUNGUSA.

How-To Videos



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Legend: A Asthma C COPD G Generic S SMART AIR AIR M Contains Milk

Lung Helpline: 1-800-LUNGUSA | Lung.org

Two Kinds of Inhaler

Inhalers deliver a measured dose of medicine through your mouth, straight to your airways.



Metered dose inhaler (MDI)

A pressurized canister



Dry powder inhaler (DPI)

Medicine in powder form

Different types of inhalers are used in different ways. Read the instructions that come with yours, ask your doctor or pharmacist to show you, then try it yourself and have them check that you are doing it right.

Spacers and Valved Holding Chambers

A spacer sits between the inhaler and your mouth, and makes an MDI much easier to use.



Spacer with a mouthpiece



Spacer with a facemask

Why use one

- Less medicine lands on your tongue or the back of your mouth
- Less irritation to your throat
- More medicine gets down into your lungs, where it belongs
- Spacers are not needed for dry powder devices

Spacers come in many forms — with a mouthpiece, or with a facemask sized for infants, children, or adults. Some fit on the end of an inhaler, some take the canister inside, and some MDIs have one built in. Ask to be shown how to use and clean yours.

How to use your Asthma Inhaler



What Your Medicines Should Do

These are the goals your doctor is weighing at every visit.



Prevent ongoing symptoms

You should not need your quick-relief medicine more than two days a week.



Maintain normal lung function

Your breathing should stay near where it should be for you.



Let you be as active as you want

At work, at school, and everywhere else.



Prevent repeated attacks

Flare-ups should become rare, not routine.



Cause few side effects

The right medicine at the lowest dose that keeps control.

It may take several visits to find exactly the right medicines and doses. If you have done well for several months your doctor may reduce them; if control is poor, they may add medicines or raise a dose. That is why tracking symptoms and keeping appointments matters.

The Goals of Good Management

Well-controlled asthma should let you live as if you did not have it.



No or few symptoms

During the day and during the night



Sleep through the night

No waking up coughing or short of breath.



Be physically active

Sports, gym, play - without asthma stopping you.



No missed school or work

Asthma should not cost you days.



Limit medication needed

The lowest dose that keeps you well controlled.



No ED visits or hospital stays

No emergency care for asthma.



Near-normal lung function

Measured on a breathing test, not just how you feel.



The bottom line

Anything less than this is a reason to talk to your doctor.

How to Use Your Inhaler Recap

Choose the best answer

What is the best way to check that you use your inhaler correctly?

- A.** Demonstrate your technique to your doctor or pharmacist
- B.** Use the same technique for every inhaler
- C.** Judge your technique by the taste of the medicine
- D.** Take extra doses whenever you are unsure





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Bayhealth Medical Center

- PGY-3
 - Internal Medicine
 - Chief Resident
- Interest:
 - Pulmonary Medicine
- Hobbies
 - Spending time with family
 - Learning how to swim
 - Playing table tennis
- My Why?
 - Community Health, Serving the underserved

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My Why

Why I chose medicine



I chose medicine to help others as well as to fulfill my own curiosity.

The moment

My PCP

The person

Mentors

The work

My family and colleagues

Preventative Measures

Your doctor may also treat other conditions that affect your asthma.



Allergy shots

Immunotherapy

An option if your allergies are not easily controlled by avoiding triggers and taking medicine.



Vaccination

Prevention

Vaccines

- Pneumonia, Influenza
- COVID, RSV, Tdap



Antibiotics

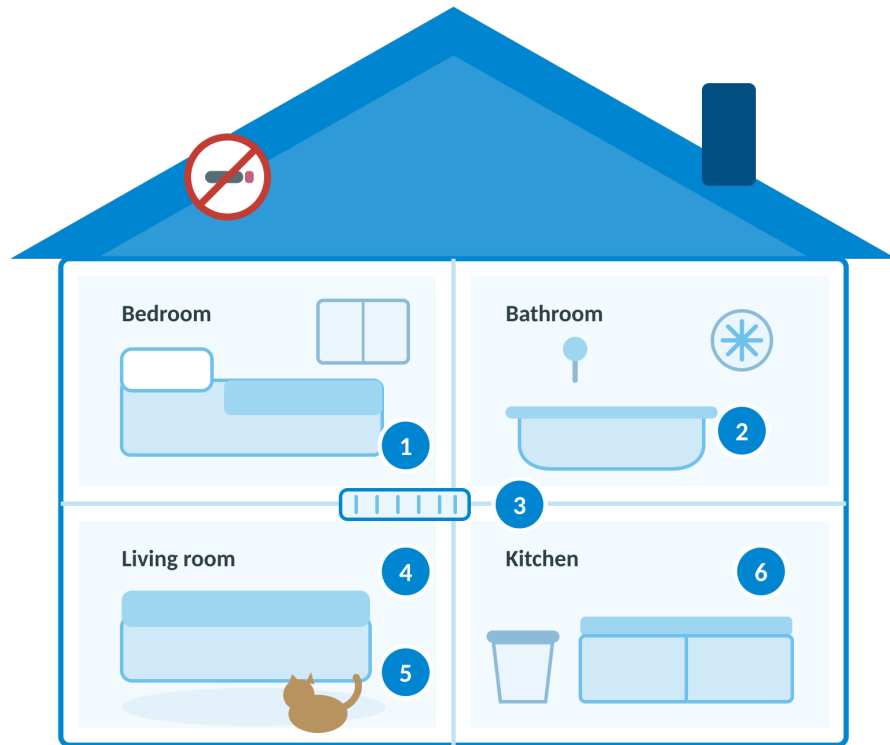
Only when there is a bacterial infection

For something like pneumonia or suspected bacterial sinusitis.

Antibiotics are not recommended for the routine or emergency treatment of asthma itself.

Preventing Attacks at Home

Most asthma triggers live indoors — and most of them you can do something about.



1 Bedroom first

Zip allergen-proof covers on the mattress and pillows. Wash sheets weekly in hot water.

2 Dry out the damp

Run the bathroom fan or crack a window during showers, and fix leaks quickly. Mold grows wherever damp sits.

3 Change the filter

Swap the furnace or HVAC filter on schedule — that matters more than having the ducts cleaned.

4 Dust and vacuum

Damp-dust instead of dry-sweeping, which just lifts dust into the air. Vacuum with a HEPA filter while the person with asthma is out of the room.

5 Pets off the bed

If pets are a trigger, keeping them out of the bedroom helps most. Wash hands after handling them.

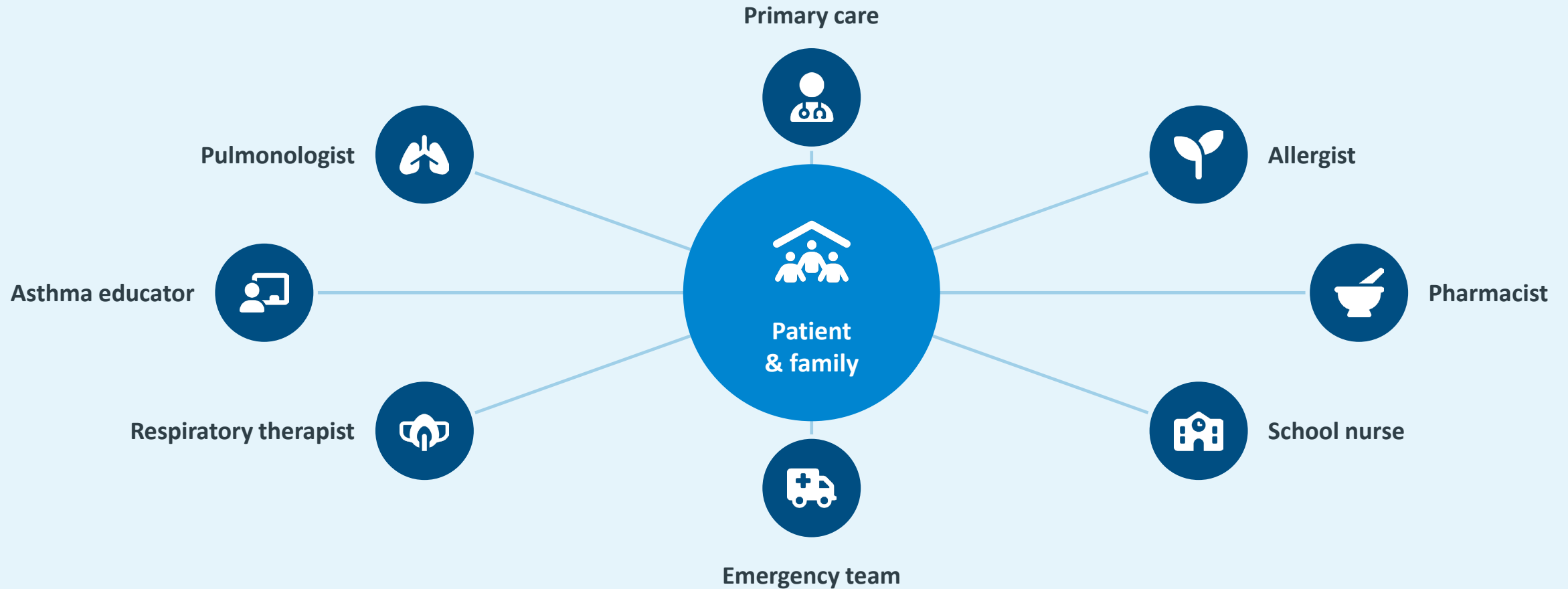
6 Close the kitchen

Seal food, wipe crumbs, and take the trash out — cockroach droppings are a major trigger. Use baits rather than sprays.

Biggest win of all: no smoking or vaping indoors — ever.

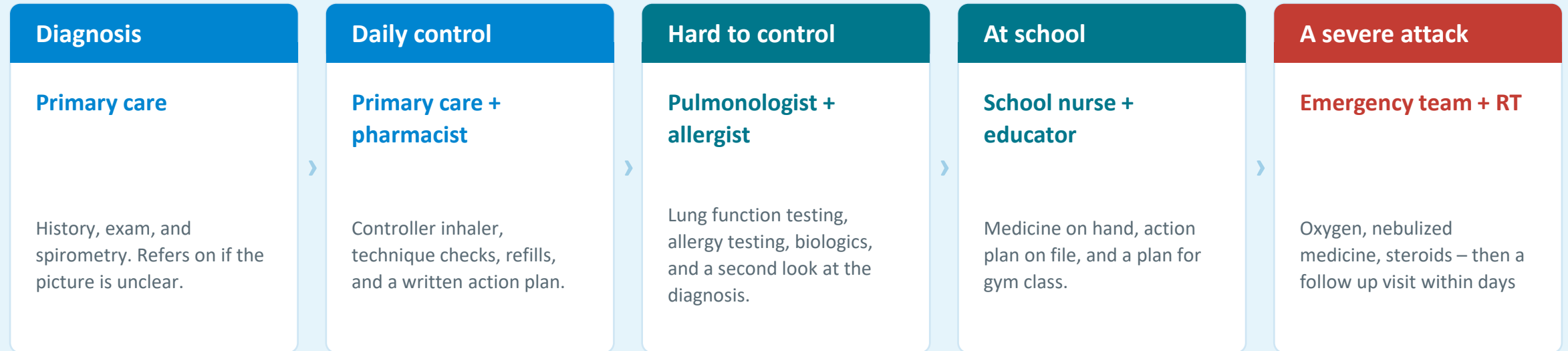
Asthma Takes a Team

No single specialty owns asthma — the person at the centre does.

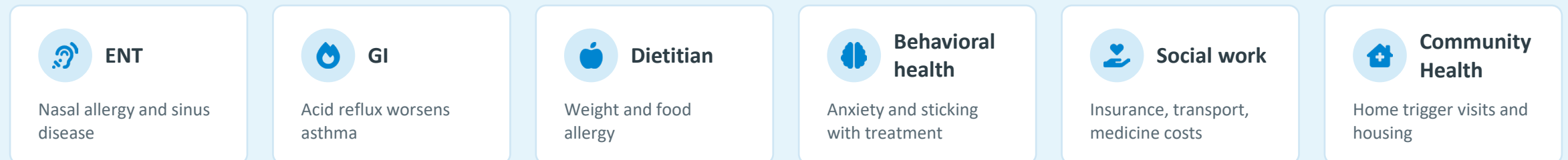


Who Leads, and When

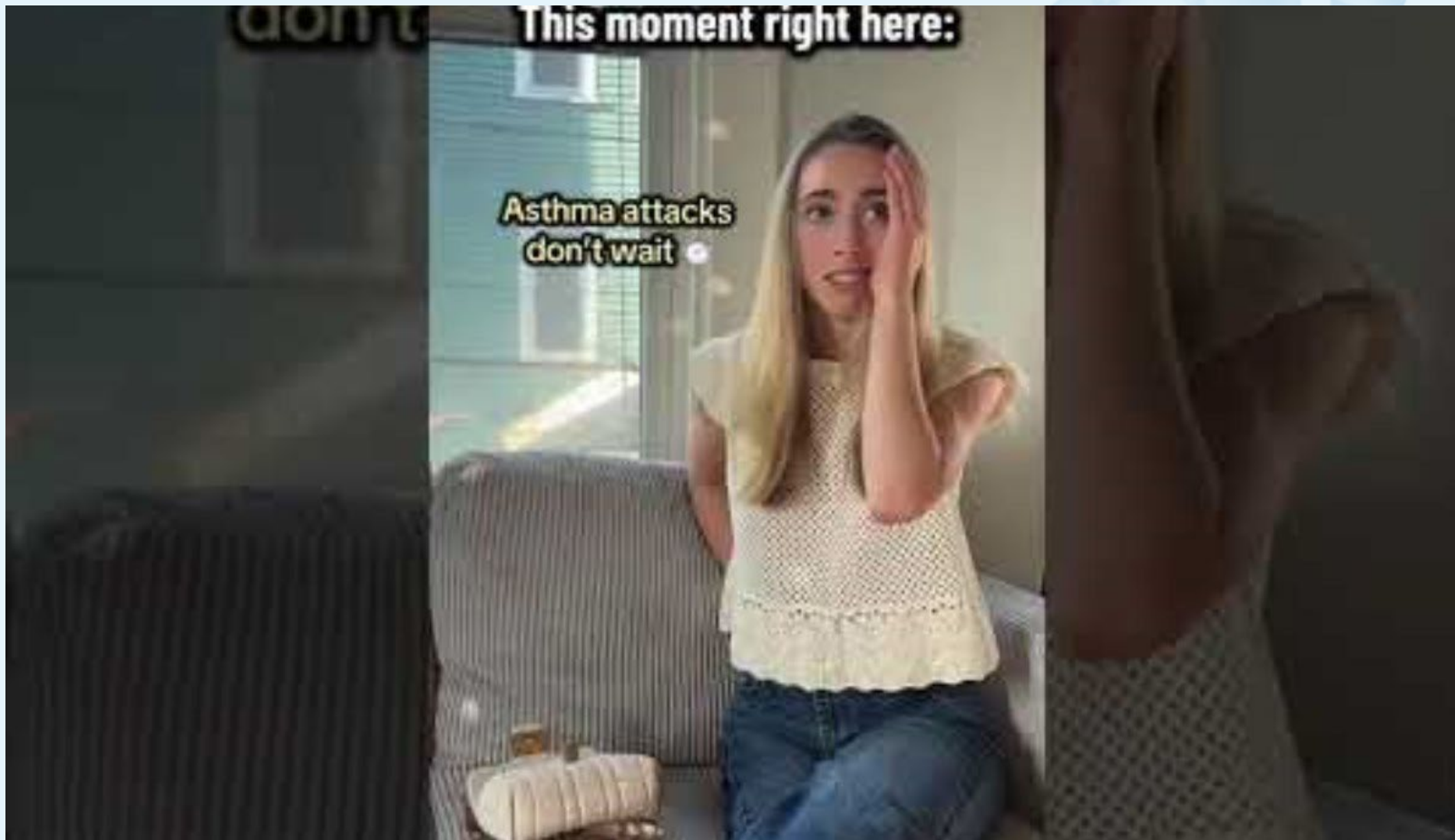
One patient, one year — the team changes shape as the need changes.



The wider team — because asthma rarely travels alone



Severe Asthma



What Can You Do?

Create an action plan with steps to tell you how your asthma is doing right now — and what to do about it.



Green Zone

GO

Your breathing is good, with no cough, wheezing, or chest tightness. You can work, play, and sleep through the night.

Keep following your daily treatment plan.



Yellow Zone

CAUTION

Early warning signs appear. You may notice them before you have any real trouble breathing.

Treat at first sign. Follow the Yellow zone steps on your action plan



Red Zone

DANGER

Asthma is worsening quickly and quick-relief medicine is not helping. This is a medical emergency.

Act now — get medical help right away.

When Asthma Gets Worse Recap

Choose the best answer

You have a classmate who is breathing is very hard, speaking is difficult, and reliever medicine is not helping. What should you do?

- A.** Tell them to wait until their next routine appointment
- B.** Call 911 for emergency help now
- C.** Tell them to lie down and try to sleep through it
- D.** Keep repeating doses without seeking help



Sources

- [Pulmonary Physiology for Pre-Clinical Students](#)
- [Controlling Asthma: What You Need to Know - Asthma Flipchart | American Lung Association](#)
- [So You Have Asthma: A Guide for Patients and their Families](#)
- [Managing Your Asthma Revised February 2024](#)
- [The World's Burden of Chronic Respiratory Disease: An Epidemiological Review of Asthma, COPD, Interstitial Lung Disease, and Smoking in the 21st Century - ScienceDirect](#)



THANK YOU FOR
JOINING US TODAY.