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Asthma

Registrar Education Series

Updated January 2023

Quick reference

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Suspect?

What is the definition of asthma?

When should asthma be suspected?

What symptoms/patterns lowers the likelihood of asthma?





Diagnosis?

How is asthma diagnosed? and confirmed?

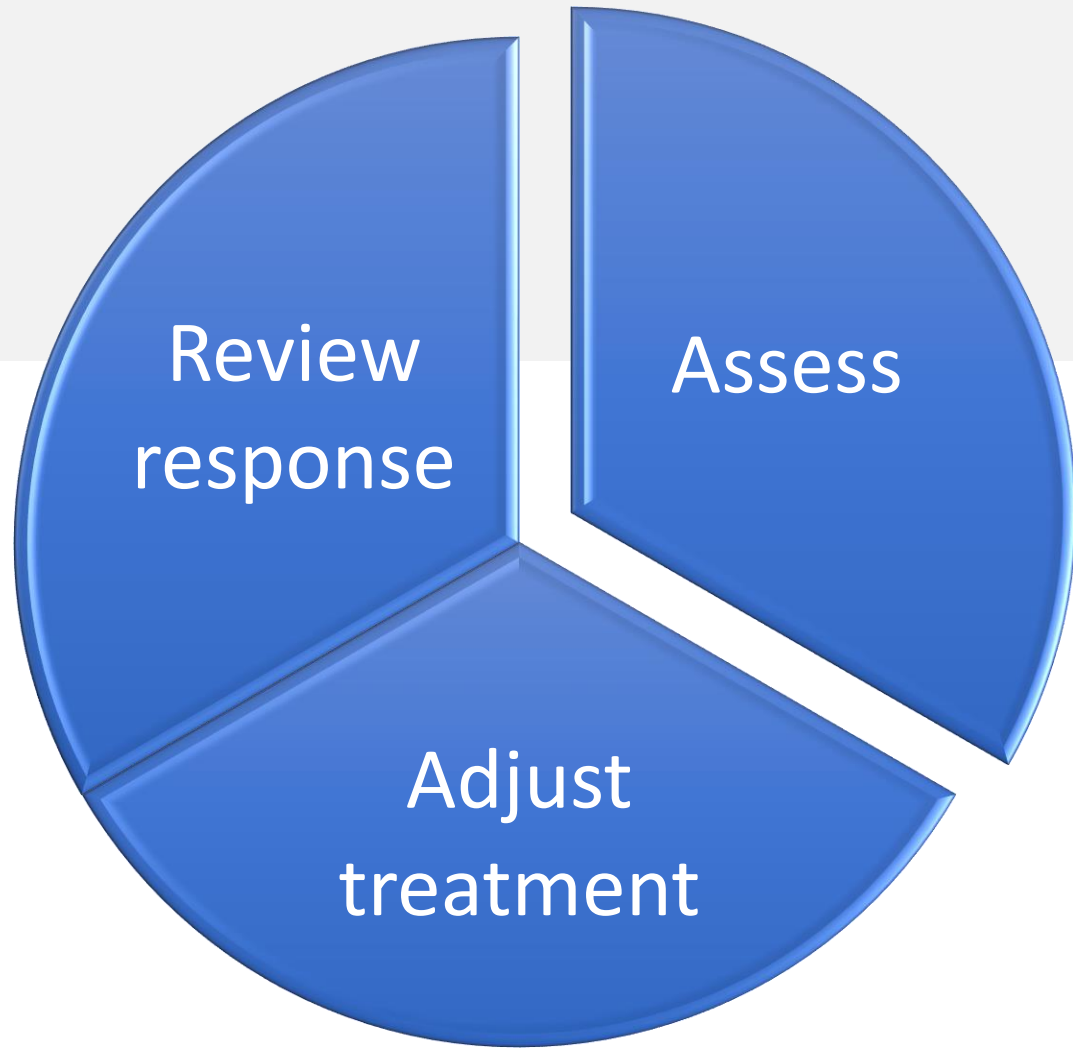
How can you confirm the diagnosis if the patient is already on treatment?

What else is commonly on the differential with asthma?





Assessing control?



How is symptom control assessed?

What are the main risk factors for future exacerbations?

How is severity assessed?





Medications?

- What are the 3 main categories of medications?
- Why are each used?





Initial treatment?

How is initial treatment decided?

What are the preferred treatments for each Step?



Follow up?

How is the frequency of follow up decided?

How often is typical follow up in the outpatient setting?

When do you schedule follow up after an exacerbation?

How long does it take to get the full benefit for most controller medications?

What is on the asthma assessment checklist?



Stepping Up?



When should step up treatment be considered?

What are the 3 methods for stepping up therapy?

When are each used?





Stepping

Down?

When can a patient consider stepping down therapy?

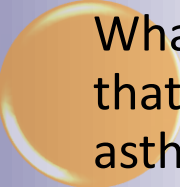
What should be done prior to stepping down therapy?

What are methods of stepping down treatment based on their current step?





Modifiable risk factors?



What are the different modifiable risk factors that should be addressed for all patients with asthma?





Self Management?

What are the clinical/POEM benefits associated with asthma self management?

What are the components of an asthma self management program?



Suspect

Definition: chronic airway inflammation with variable expiratory airway limitation

Suspected:

>1 symptom: wheeze, SOB, chest tightness, cough which vary over time and intensity

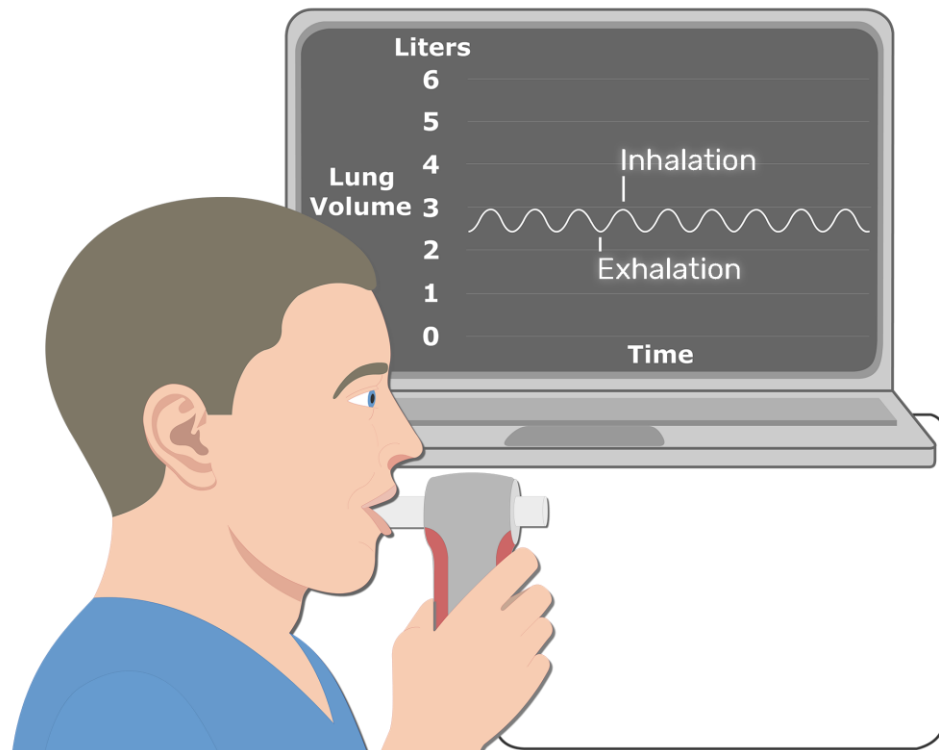
- Common triggers include exercise, allergen/irritant exposure, change in weather, viral respiratory illnesses, laughter

Lower likelihood: isolated cough without other respiratory symptoms, chronic sputum production, SOB associated with dizziness/lightheadedness/peripheral tingling, CP, exercise induced dyspnea and noisy inspiration





Diagnosis



Diagnosed by a history of characteristic symptom patterns and evidence of variable expiratory airflow limitation

Confirmed by an FEV1/FVC $<0.75-0.8$ in adults and <0.9 in children and excessive variability in the absence of infection

If on treatment already can confirm by

- Repeat spirometry
- Check between visit variability, if normal consider alternate diagnosis or stepping down controller treatment
- Step down controller treatment

Differential includes: chronic upper airway cough syndrome, medication induced cough, GERD, chronic sinusitis, COPD, hyperventilation, cardiac failure, pulmonary embolism, tuberculosis, congenital heart disease, cystic fibrosis





Excessive variability



Adults increase in FVC1 by 12% and 200mL or PEF \geq 20%, children FVC1 $>$ 12% measured 10-15 minutes after 200-400mg of salbutamol or equivalent. Must hold SABA \geq 4 hours, BID LABA 24 hours, QD LABA 36 hours

PEF average daily diurnal variability $>$ 10% adults and 13% children

Improvement in lung function after 4 weeks of anti-inflammatory treatment 12% and 200mL

Positive exercise challenge: fall $>$ 10% and 200mL in adults, 12% or PEF $>$ 15% in children

Positive bronchial challenge \geq 20% with methacholine, \geq 15% with standard hyperventilation, hypertonic saline or mannitol

Excessive variability in lung function between visits 12% and 200mL in adults and 12% or PEF $>$ 15% in children



Assessing control

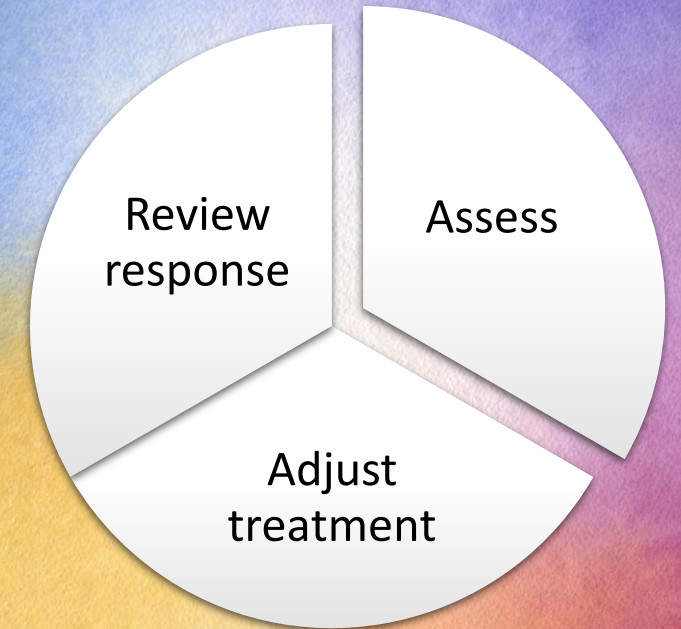
Symptoms:

- In the past 4 weeks has the patient had
 - *Daytime symptoms more than twice/week?*
 - *Any night waking due to asthma?*
 - *SABA reliever for symptoms more than twice a week?*
 - *Any activity limitation due to asthma?*
- 0: well controlled, 1-2 partly controlled, 3-4 uncontrolled

Risk of exacerbations

- Lung function, medications, medical conditions, exposures, context, type 2 inflammatory markers, other

Severity is assessed retrospectively based on level of treatment needed to control symptoms and exacerbations



Risks for exacerbations

Lung function: low FEV₁ (especially <60%), high bronchodilator responsiveness, uncontrolled symptoms

Medications: high SABA use ($\geq 3 \times 200$ dose canisters/year, ≥ 1 /month), inadequate ICS, not prescribed ICS, poor adherence, poor technique

Medical conditions: obesity, chronic rhinosinusitis, GERD, confirmed food allergy, pregnancy

Exposures: smoking, e-cig, allergen exposure is sensitized, air pollution

Context: major psychological or socioeconomical problems

Type 2 inflammatory markers, higher blood eosinophils, decreased FeNO (in adults with allergic asthma taking ICS)

Other: ever intubated or in ICU for asthma, ≥ 1 severe exacerbation in the last 12 months

Risks for medication side-effects: Frequent OCS, long term, high dose and/or potent ICS, also taking p450 inhibitors, poor inhaler technique

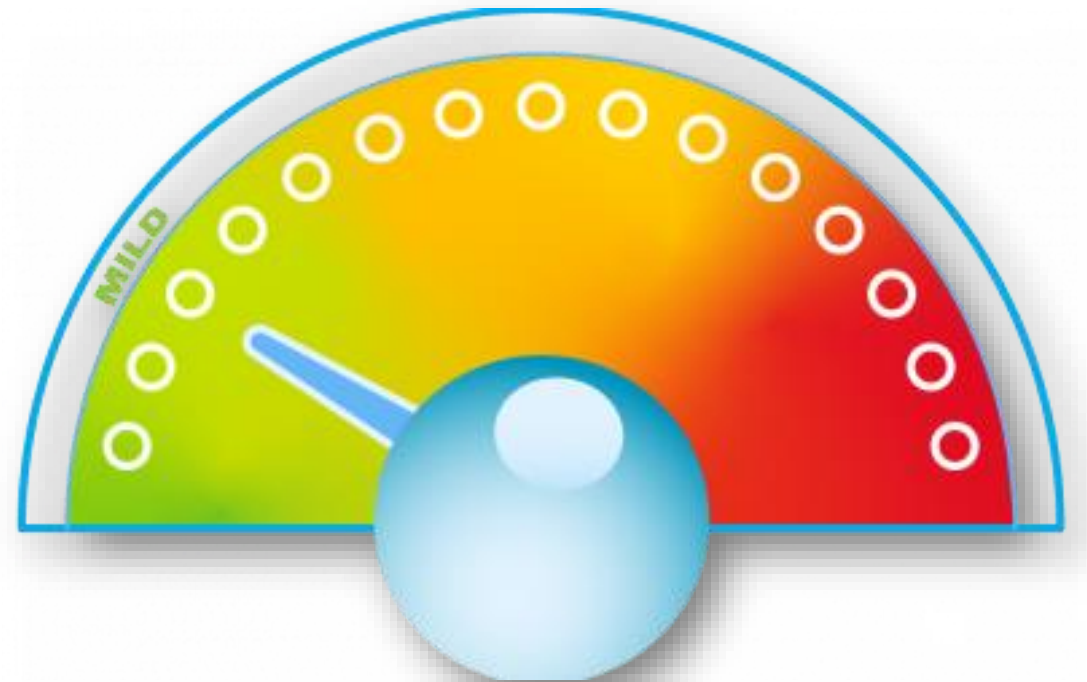


Severity

Severe: remains uncontrolled despite optimized treatment with high dose ICS-LABA or requires high dose ICS-LABA to prevent it from being controlled in the absence of medication adherence/technique issues or certain co-morbidities.

Moderate: well-controlled on Step 3 or 4 with a low or medium dose ICS-LABA in either treatment track

Mild: well-controlled with as needed ICS-formoterol or low dose ICS plus as needed SABA



Medications

Controller medications

Contain inhaled corticosteroids.
Decrease airway inflammation,
control symptoms, decrease risk of
further exacerbation and decline in
lung function.

Add-on medications

Are utilized when a patient
has persistent symptoms
and/or exacerbations despite
optimized treatment with
high dose controller
medications and treat of
modifiable risk factors

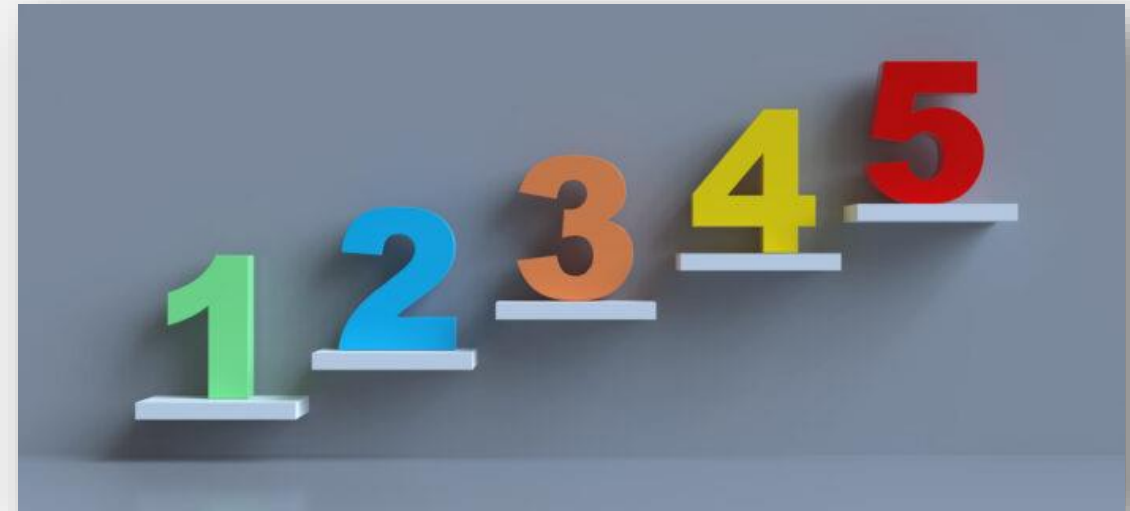
Reliever

Provided to all patients for as
needed relief of breath through
symptoms and short-term
prevention of exercise induced
bronchoconstriction. Low dose
ICS-formoterol is preferred but
SABA can also be used.





Initial treatment



Initial treatment is based on symptoms

Track 1 is preferred, track 2 is an alternate if ICS-formoterol is not available

STEP	Symptoms	Track 1	Track 2
STEP 1	Infrequent asthma symptoms and no r.f. for exacerbations	As needed low dose ICS-formoterol	<u>Low dose ICS</u> with as needed SABA
STEP 2	Symptoms less than 4-5 days per week	As needed low dose ICS-formoterol	Low dose ICS plus as needed SABA
STEP 3	Troublesome symptoms most days (4-5) OR waking due to asthma $\geq 1/wk$	Low dose ICS-formoterol maintenance and reliever	Low dose ICS-LABA with as needed SABA
STEP 4	Daily symptoms or waking with asthma $\geq 1/wk$ and low lung function	Medium dose ICS-formoterol maintenance and low dose ICS-formoterol reliever	Medium or high dose ICS-LABA with as needed SABA
STEP 5	Might need short course OCS if severely uncontrolled	<u>Add-on therapy</u> decided by specialist	Add-on therapy decided by specialist



Refer to specialist for add-on treatments



High dose maintenance ICS-formoterol: provides little additional benefit with an increase in risk of side-effects and adrenal suppression.

Add on LAMA: modestly improves lung function but not quality of life and no clinically important changes in status.

Add on azithromycin: despite high dose ICS-LABA with 500mg 3 times a week for at least 6 months to reduce exacerbations. Must check sputum for atypical mycobacteria and perform ECG at baseline and 1 month into treatment for long QTc

Anti-IgE (omalizumab): moderate to severe allergic asthma \geq 6yo

Anti-IL-5/5R (mepolizumab): severe eosinophilic asthma \geq 12yo

Anti-interleukin-IL4R (dupilumab): \geq 6yo with severe eosinophilic/type 2 asthma, \geq 12yo requiring maintenance OCS

Anti-TSLP (tezepelumab): \geq 12yo with severe asthma

Sputum guided treatment: Uncontrolled adults despite high dose ICS or ICS-LABA. Reduces exacerbations and/or lowers doses of ICS

Add on bronchial thermoplasty: limited evidence

As a last resort add-on low dose oral corticosteroids: \leq 7.5mg/day prednisone equivalent

Maintenance and reliever therapy (MART) with ICS-formoterol



Follow Up

Frequency is based on initial level of control, response to treatment, level of engagement in self-management.

- 1-3 months after starting treatment
- 3-12 months thereafter
- 1 week after an exacerbation
- Full benefit for most controller medications may take 3-4 months, longer if severe or chronically under-treated

Checklist:

- [Symptoms](#) over the last 4 weeks
- [Risk](#) for exacerbations
- [Lung function measurement](#) (baseline, 3-6 months after treatment, then 1-2 years if controlled)
- Document current [treatment Step](#)
- Watch inhaler technique
- Assess adherence and side effects
- Written asthma action plan
- Review patient attitudes/goals towards asthma
- Assess co-morbidities: rhinitis, rhinosinusitis, GERD, obesity, OSA, anxiety, depression, [vaccines](#)



Vaccines

Annual influenza

COVID per CDC

PCV 20 (per CDC, GINA states evidence is insufficient)

- Alternative: PCV15 followed by PPSV23 one year later





Lung function interpretation

Low FEV1% predicted: identifies patients at risk for exacerbations, lung function decline.

- Few symptoms with a low FEV1 suggests limitation of lifestyle or poor perception of airway limitation

Normal or near normal FEV1 with frequent symptoms:

- Consider alternate causes/diagnosis, i.e. cardiac disease, PND cough, GERD, etc

Persistent bronchodilator responsiveness:

- FEV1 >12% and 200mL from baseline while on a controller treatment OR has taken SABA within 4 hours OR LABA within 12-24 hours suggests uncontrolled asthma

Children: cannot reliably obtain spirometry until 5 years old





Stepping up

Consider stepping up treatment if there are persistent symptoms and/or exacerbations on current step when the patient has proper inhaler technique, proper adherence, and when allergen exposure and multi-morbidities have been accounted for.

Day to day adjustment:

- Patients whose reliever inhaler is low dose ICS-formoterol, the patient adjusts the number of as needed doses from day to day according to symptoms. Reduces risk of developing a severe exacerbation requiring OCS in the next 3-4 weeks.

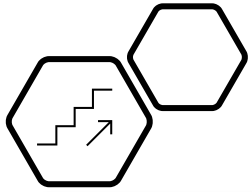
Short term for: (1-2 weeks)

- A short-term increase in ICS dose for 1-2 weeks may be necessary, i.e. viral infections, seasonal allergies. Patient or provider initiated.

Sustained step up: (at least 2-3 months)

- For patients who have confirmed asthma symptoms despite good adherence and correct technique and modifiable risk factors have been addressed. A step up should be a trial, if no response after 2-3 months reduce to the previous level and consider alternate treatments/referrals.
- Step up based on their current medications





Step Up

Medication	Short term change (1-2 weeks)	Evidence
Increase usual reliever		
Low dose ICS-formoterol	<ul style="list-style-type: none"> Increase frequency of as needed ICS-formoterol 	A
Short acting beta-agonist (SABA)	<ul style="list-style-type: none"> Increase frequency of SABA, use spacer with pMDI 	A
Increase usual controller		
Maintenance and reliever ICS-formoterol	<ul style="list-style-type: none"> Continue maintenance ICS-formoterol and increase reliever ICS-formoterol as needed 	A
Maintenance ICS with SABA as reliever	<ul style="list-style-type: none"> In adults and adolescents quadruple ICS dose 	B
Maintenance ICS-formoterol with SABA as reliever	<ul style="list-style-type: none"> Quadruple maintenance ICS-formoterol 	B
Maintenance ICS + other LABA with SABA as reliever	<ul style="list-style-type: none"> Step up to higher dose formulation of ICS + other LABA In adults consider adding separate ICS inhaler to quadruple ICS dose 	B D
Add oral corticosteroids and contact doctor		
OCS prednisone or prednisolone	<ul style="list-style-type: none"> Add if severe (PEF or FEV1 <60%) or if not responding to step up treatment over 48 hours Prednisolone 40-50mg/day for 5-7 days Children 6-11yo: 1-2/mg/kg/day max of 40mg for 3-5 days 	A D B





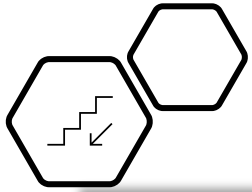
Stepping down

Once good control has been maintained for ≥ 3 months and lung function has plateaued treatment can be reduced without loss of asthma control.

Assess risk factors for an exacerbation, timing and give an asthma action plan

[Step down](#) based on current medications





Step Down

Current Step	Current medication and dose	Options for stepping down	Evidence
Step 5	High dose ICS-LABA + OCS	<ul style="list-style-type: none"> Continue ICS-LABA and reduce OCS dose Use sputum guided approach to reduce OCS Alternate-day OCS treatment Replace OCS with high dose ICS 	D B D D
	High dose ICS-LABA + other add-on agents	<ul style="list-style-type: none"> Refer for expert advice 	D
Step 4	Moderate-high dose ICS-LABA	<ul style="list-style-type: none"> Continue combo with 50% reduction in ICS component 	B
	Medium dose ICS-formoterol as maintenance and reliever	<ul style="list-style-type: none"> Reduce maintenance ICS-formoterol to low dose and continue as needed low dose ICS-formoterol reliever 	D
	High dose ICS + second controller	<ul style="list-style-type: none"> Reduce ICS dose by 50% and continue second inhaler 	B
Step 3	Low dose ICS-LABA maintenance	<ul style="list-style-type: none"> Reduce ICS-LABA to once daily 	D
	Low dose ICS-formoterol as maintenance and reliever	<ul style="list-style-type: none"> Reduce ICS-formoterol dose to once daily and continue as needed low dose ICS-formoterol reliever 	C
	Medium or high dose ICS	<ul style="list-style-type: none"> Reduce ICS by 50% Adding LTRA may allow ICS dose to be stepped down 	A B
Step 2	Low dose ICS	<ul style="list-style-type: none"> Once daily dosing (budesonide, ciclesonide, mometasone) Switch to as needed low dose ICS-formoterol Switch to taking ICS whenever SABA is taken 	A A B
	LTRA	<ul style="list-style-type: none"> Switch to as needed low dose ICS-formoterol 	A





Modifiable risk factors

Written action plan appropriate to health literacy level

[Inhaler technique](#)

Medication adherence

[Identify avoidable triggers](#)

Smoking cessation if someone in family smokes

Weight reduction if obese

[Major psychological problem](#)

[Major socioeconomic problem](#)

Confirmed food allergy

Allergen exposure if sensitized

Sputum eosinophilia



Identifiable triggers

Benefit:

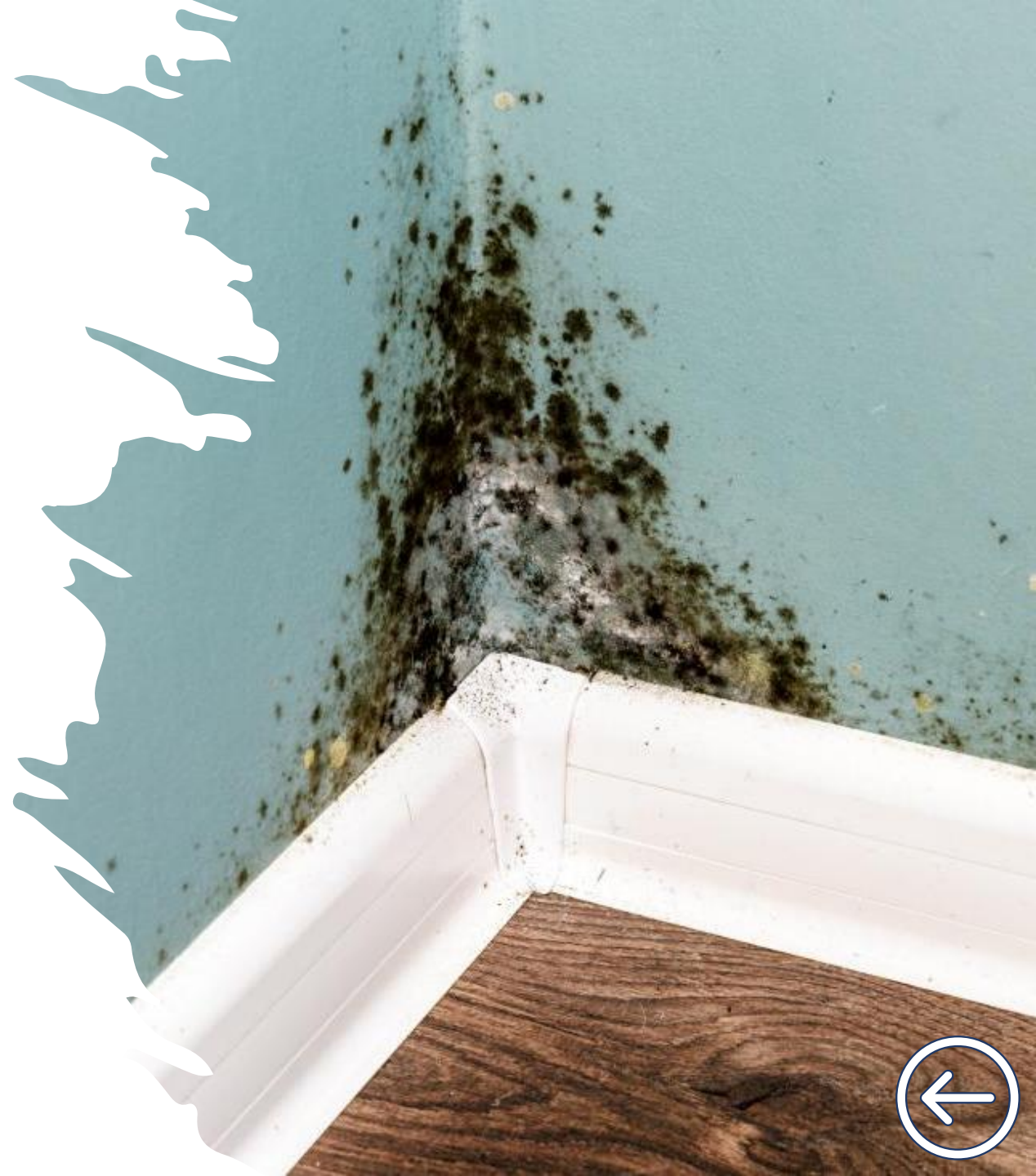
- Remediating moist/mold in household
- Baits for roaches and rodents

No clinical benefit:

- Replacing carpets with hard wood flooring, removing cats or dogs, keeping pets from main living areas, washing pets, washing bedding on hot cycle

Avoidance of outdoor allergens are impossible to avoid completely.

- Patients with uncontrolled asthma can close windows/doors, use air conditioning and avoid strenuous outdoor physical activity with unfavorable environmental conditions and when pollen and mold counts are highest (evidence D – panel consensus)



Psychological

Help patient distinguish asthma symptoms from depression, anxiety and panic.

Help improve or facilitate care for improving mental health





Major socioeconomic problems

Identify most cost-effective ICS based regimen

Use coupons

Find patient assistance programs

Assist in enrolling the patient in insurance

Locate clinics that offer free/near free medications

- Low cost/charity clinic using Direct Relief/Americares
- FQHCs with 340B programs



Self Management

Asthma self management programs that include regular communication with a health professional reduce asthma morbidity, asthma-related hospitalizations, emergency department visits, unscheduled visits, missed work/school days, nocturnal wakening

Asthma self management programs should include:

- [Skills training to use inhaler effectively](#)
- Adherence with medications/appointments/advice and agreed strategy
- [Asthma information](#)
- Training in guided self management with self-monitoring of symptoms or peak flow, [written action plan](#)
- Regular communication with a health professional



Asthma action plan

Asthma Action Plan Name: _____ Date: ____/____/____

Doctor's Name: _____ Main Emergency Contact: _____
 Doctor's Phone Number: _____ Backup Emergency Contact: _____

Green Zone: No coughing, wheezing, chest tightness, or shortness of breath. Can do usual activities. Doing Well

Every day: Take these medicines, even if you're not having any symptoms. Avoid triggers that you know make your asthma worse.

Medicine	How much to take	When to take

Before you exercise: Take | 2 or 1 | 4 Puffs of _____ 5 minutes before you start, as needed.

Yellow Zone: One or more of these symptoms: coughing, wheezing, chest tightness, breathing trouble, waking up at night due to asthma. Or, if you can only do some, but not all, usual activities. Some Symptoms

Keep taking your Green Zone medicine and avoiding triggers as usual **AND** take this medicine:

Medicine	How much to take and how often
(Quick-relief)	_____ Puffs Can repeat every _____ minutes, up to _____ times
OR	_____ Nebulizer: Use it once

If you return to the Green Zone after 1 hour, keep monitoring to be sure you stay in the Green Zone.
 If you do not return to the Green Zone after 1 hour take this medicine:

Medicine	How much to take and how often
(Quick-relief)	_____ Puffs
OR	_____ Nebulizer: Use it once

AND: (Oral Steroid) Take _____ mg each day for _____ (3 to 10) days

Call your doctor (or have someone call) just before you take the oral steroid OR _____ minutes/hours after taking the oral steroid, based on the instructions your doctor gave when the medicine was prescribed.

All patients should have a written action plan appropriate to their level of asthma control and health literacy level

State how and when to:

- Change reliever and controller medications
- Use oral corticosteroids: prednisone equivalent 40-50mg/day for 5-7 days if they fail to respond to an increase in reliever and controller medication for 2-3 days
 - *Children:* 1-2mg/kg/day max of 40mg/day for 3-5 days
- Access medical care if symptoms fail to respond to treatment

Advise patient with a history of rapid deterioration to go to an acute care facility or see their doctor immediately if they start worsening

If relevant discuss avoidance of triggers

Base the action plan on changes in symptoms or (adults) peak expiratory flow

Asthma Action Plan Name: _____ Date: ____/____/____

Doctor's Name: _____ Main Emergency Contact: _____
 Doctor's Phone Number: _____ Backup Emergency Contact: _____

Red Zone: EMERGENCY! Very short of breath, or quick-relief medicines have not helped, or symptoms are the same or worse after 24 hours in the Yellow Zone. Or, if you cannot do any of your usual activities. Severe Symptoms Emergency

Take this medicine	How much to take
(Quick-relief)	_____ Puffs Can repeat every _____ minutes, up to _____ times
OR	_____ Nebulizer: Can repeat every _____ minutes, up to _____ times
(Oral steroid)	Take _____ mg.

After you take your medicine, call your doctor right away!
 If you're still in the Red Zone after 15 minutes and have not reached your doctor, go to the hospital or call 911!

If you have these **DANGER SIGNS**: trouble walking or talking due to shortness of breath or your lips or fingernails are blue, pale, or gray, take _____ puffs of your quick-relief medicine and **GO** to the hospital or call 911 **NOW!**

These **DANGER SIGNS** mean you need help right away. Don't wait to hear back from your doctor. **GO** to the hospital or call 911 **NOW!**

If you use a peak flow meter you can use these scores to determine your current zone:

Your best score	Your green zone	Your yellow zone	Your red zone
_____	_____ or higher (80% of best score)	_____ to _____ (50 to 80% of best score)	_____ or lower (50% of best score)





Asthma information

Diagnosis

Rationale for treatment

Difference between relievers and controllers

Potential side effects

Prevention of symptoms and flare ups

How to recognize worsening asthma and what actions to take

When to seek medical attention



Effective use of inhalers



Choose the most appropriate inhaler based on device, patient skills and cost

Include the patient in shared decision making

Use spacers with pMDIs

Avoid multiple different inhaler types when possible

Check inhaler technique at every opportunity

Ask the patient to show you how they use their inhaler

Identify any errors using a device specific checklist

Show the patient how to use the device correctly and repeat the above steps

Train yourself



Exacerbations

Assessment

Core Management

Other Management

Response to treatment

Discharge





Assessment?

What are common triggers for asthma exacerbations?

What are features of a mild-moderate exacerbation?

What are features of a severe exacerbation?

What are features of a life-threatening exacerbation?





Assessment

- *Triggers: viral respiratory infection, allergen exposure, food allergy, outdoor air pollution, seasonal changes, poor adherence with ICS*

Mild to moderate

- Talks in phrases
- Prefers sitting to lying
- Not agitated
- Respiratory rate increase
- Accessory muscles not used
- Pulse 100-120
- O₂ sat on RA 90-95%
- PEF > 50% predicted or best

Severe

- Talks in words
- Sits hunched forward
- Agitated
- Respiratory rate > 30
- Accessory muscles in use
- Pulse > 120
- O₂ sat on RA < 90%
- PEF ≤ 50% predicted or best

Life threatening

- Drowsy
- Confused
- Silent chest





Core Management?

What bronchodilator is typically used?

How is the bronchodilator delivered and in what frequency?

What dose and duration is preferred for oral corticosteroids?

When and how are oxygen administered?

When is a chest x-ray performed?

When should antibiotics be prescribed?



Core management

SABA salbutamol (albuterol):

4-10 puffs every 20 minutes for the first hour by pMDI with a spacer

- Then varies from 4-10 puffs q3-4 hours to 6-10 puffs q1-2 hours

Ipratropium bromide

Can be added as a bronchodilator with severe exacerbations

Oral corticosteroid

Equivalent to 40-50mg daily for 5-7 days

- Children 1mg/kg/day, max of 40mg

Oxygen

By controlled flow is given to adults to a goal of 93-95%

- Children 94-98%

Chest x-ray should not routinely be performed unless there is a complicating or alternate cardiopulmonary process suspected

Antibiotics should not be routinely prescribed unless there is strong evidence of a lung infection (fever and purulent sputum or radiographic evidence of pneumonia)





Other management?

What are other interventions used during an acute asthma exacerbation?

Are they helpful?





Other management



IM epinephrine

Only for anaphylaxis

Ipratropium bromide

For moderate-severe asthma exacerbations for adults and children in the ED, no benefit if a child is hospitalized

Aminophylline and theophylline

Not recommended and should not be used based on poor efficacy and safety profile

IV magnesium 2gm over 20 minutes

May be useful if FEV1 < 25-30% and for adults and children who fail to respond to initial treatment and have persistent hypoxemia and children whose FEV1 remains < 60% after 1 hour of care

Helium oxygen

No role in routine care

Sedatives

Must be avoided

Non-invasive ventilation

Evidence is weak but can be trialed





Response to treatment?

When should the patient be reevaluated once treatment has begun?

What are the three main clinical parameters that are being evaluated?

When is it safe to discharge a patient?



Response to treatment

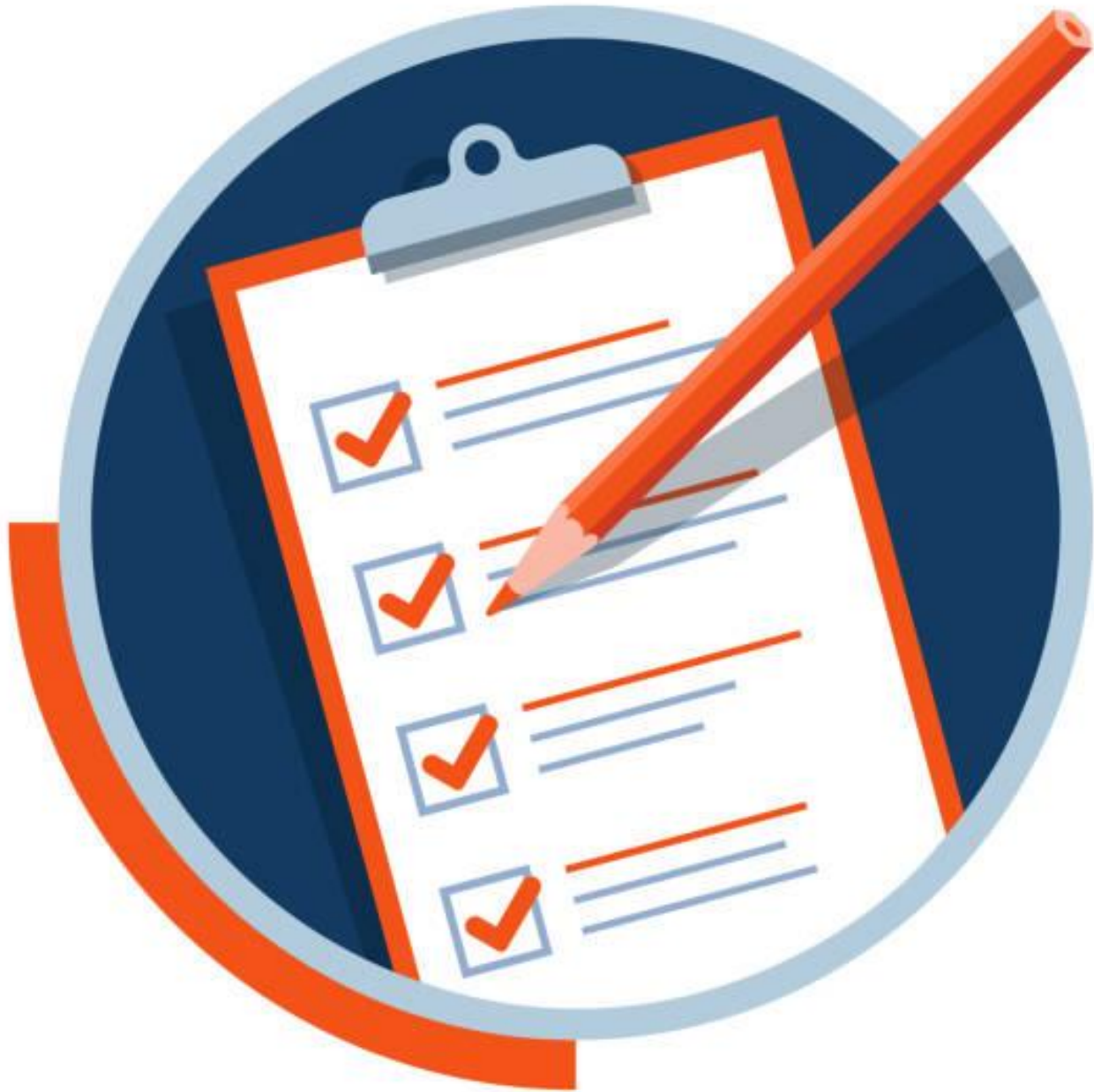
Review the response to treatment within 1 hour

Focus on symptoms, oxygen saturation and lung function

The patient be safely discharged if:

- Symptoms have improved not needing SABA
- PEF improving and 60-80%
 - (Can consider if 40-60%)
- O₂ saturation >94% on room air
- Resources at home are adequate





Discharge?

What is included on the asthma discharge checklist?

How long should the discharge controller be continued?

When should follow up be scheduled?



Discharge

A treatment plan for home should include:

Medications

- Reliever: make as needed and reduce treatment
- [ICS controller](#): start ICS controller (ICS-formoterol is preferred) treatment or stepping up the dose of existing controller treatment for 2-4 weeks and reducing the as needed reliever treatment
- Oral corticosteroid: finish off the total course of 5-7 days (children 3-5 days)

Check and correct [modifiable risk factors](#) and [triggers](#)

Check [inhaler technique](#) and discuss adherence

Provide a [written asthma action plan](#)

Schedule follow up in 2-7 days (children 1-2 days)



Children

Diagnosis ≤ 5 years old

Differential ≤ 5 years old

Assess control

Initial treatment/Steps ≤ 5 yo

Initial treatment/Steps 6-11 yo

Inhaled steroids ≤ 5 yo

Inhaled steroids 6-11 yo

Acute asthma ≤ 5 yo



< 5years old diagnosis?

What is the most likely cause of recurrent wheezing?

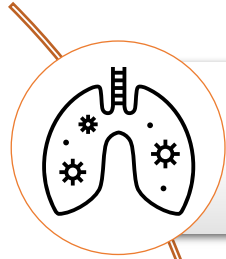
When should lung function testing be performed?

Which clinical prediction tools are good at determining who will develop persistent asthma?

What characteristics increase the likelihood of asthma in a child under 5 years old?



< 5years old diagnosis



Recurrent wheezing is common in children 5 years and younger, usually secondary to recurrent viral respiratory infections



Children 5 and under cannot reliably perform lung function testing



Risk profile tools do not perform well at determining who will develop persistent asthma



Asthma is more likely if there is a history of other allergic diseases (eczema, allergic rhinitis), allergen sensitization or asthma in a 1st degree relative, clinical improvement during 2-3 months of controller treatment and worsening after cessation





Pediatric differential?

What is on the differential when asthma is being considered in children?

What characteristics require further work up?

Differential Diagnosis

Most Likely

"I'm concerned it could be this."

Need to Rule out

"Based on the hx /risks, we need to rule it out."

Not likely

"I thought about it, and I'm not concerned."



Pediatric differential

Differential:

- Recurrent viral respiratory tract infections
- GERD
- Foreign body aspiration
- Persistent bacterial bronchitis
- Tracheomalacia
- Tuberculosis
- Congenital heart disease
- Cystic fibrosis
- Primary ciliary dyskinesia
- Vascular ring
- Bronchopulmonary dysplasia
- Immune deficiency

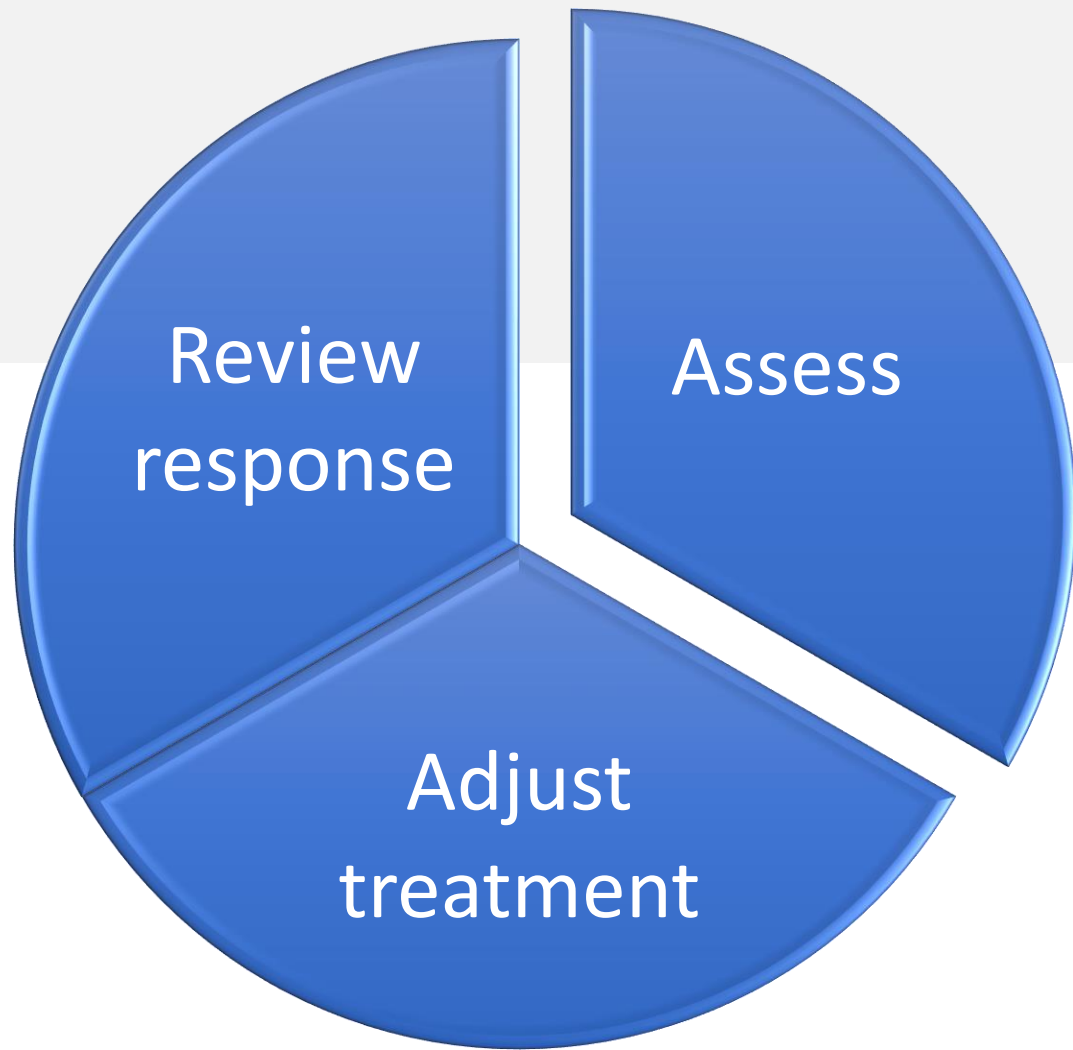
Require further investigations:

- Failure to thrive
- Very early onset asthma
- Vomiting associated with respiratory symptoms
- Continuous wheezing
- Failure to respond to asthma medications
- No association of symptoms with typical triggers
- Focal lung or cardiovascular signs
- Hypoxemia outside context of viral illness





Assessing control?



How is symptom control assessed?

What are the main risk factors for poor asthma outcomes?



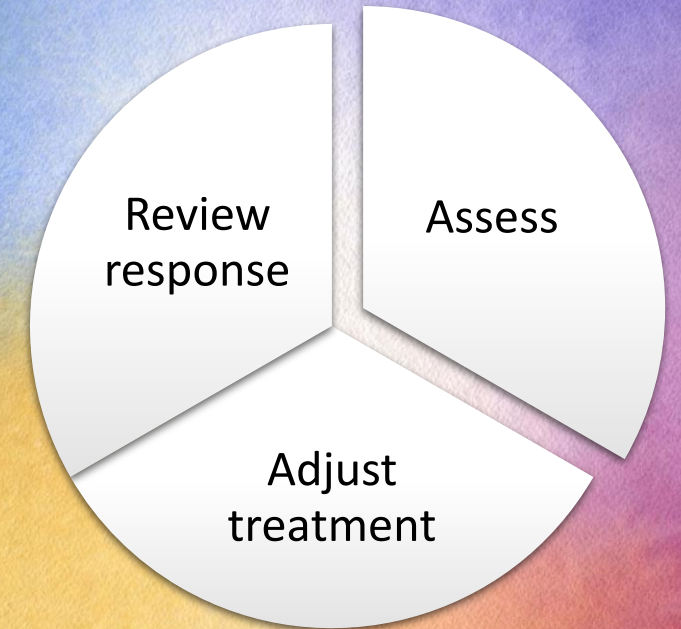
Assessing control

Symptoms:

- In the past 4 weeks has the child had
 - *Daytime symptoms for more than a few minutes more than once a week?*
 - *Any activity limitation due to asthma?*
 - *SABA reliever medication needed more than once a week?*
 - *Any night waking or night coughing due to asthma?*
- 0: well controlled, 1-2 partly controlled, 3-4 uncontrolled

Risk of poor outcomes

- Uncontrolled symptoms
- Severe exacerbations
- Typical flare up season
- Exposures
- Poor adherence with controller or incorrect technique
- Outdoor pollution
- Major psychological or socio-economical problems for child or family



Initial treatment ≤ 5 years old



If <3yo preferred device is a pressurized metered dose inhaler and spacer with face mask and if 3-5yo with mouthpiece

Check [inhaler skills](#), adherence, exposure and consider alternate diagnosis prior to stepping up

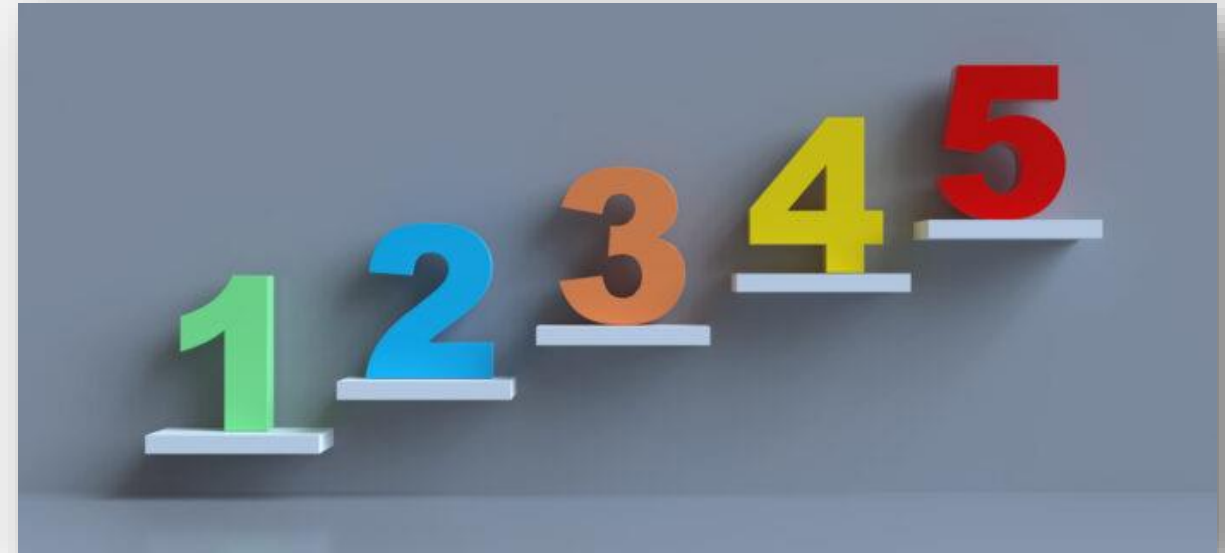
Inhaled corticosteroid doses

STEP	Indication	Preferred controller	Other controller options
STEP 1	Infrequent viral wheezing and no or few interval symptoms	Consider intermittent short course ICS at onset of viral illness	Consider daily low dose ICS
STEP 2	Symptoms consistent with asthma and not well controlled or ≥ 3 exacerbations/year	Daily low dose ICS	Daily LTRA or intermittent short course ICS at onset of viral illness
STEP 3	Asthma diagnosis and asthma not well controlled on low dose ICS	Double low dose ICS	Low dose ICS + LTRA Consider specialist referral
STEP 4	Asthma not well controlled on double ICS	Continue controlled and refer to specialist	Add LTRA or increase ICS frequency or add intermittent ICS





Initial treatment 6-11 years old



Initial treatment is based on symptoms

As needed SABA or low dose ICS-formoterol reliever for MART

Inhaled corticosteroid doses

STEP	Symptoms	Preferred controller	Other controller options
STEP 1	Symptoms less than twice a month	Consider low dose ICS taken whenever SABA taken	Consider daily low dose ICS
STEP 2	Symptoms twice a month or more, but less than daily	Daily low dose ICS	Daily LTRA or low dose ICS taken whenever SABA is taken
STEP 3	Symptoms most days, or waking with asthma more than once a week	Low dose ICS-LABA or medical dose ICS or very low dose ICS-formoterol maintenance and reliever	Low dose ICS + LTRA
STEP 4	Symptoms most days, or waking with asthma once a week or more and low lung function	Medium dose ICS-LABA or low dose ICS-formoterol maintenance and reliever	Add tiotropium or add LTRA
STEP 5	Refer for phenotypic assessment	+/- higher dose ICS-LABA or add on therapy	Add-on IL-5 or as last resort consider add on low dose OCS



Inhaled corticosteroids (6-11 years old)

Children (6-11 years old)

Inhaled corticosteroids	Total daily ICS dose (mcg)		
	Low	Medium	High
Beclomethasone dipropionate (pMDI, SP, HFA)	100-200	>200-400	>400
Beclomethasone dipropionate (pMDI, EP, HFA)	50-100	>100-200	>200
Budesonide (DPI)	100-200	>200-400	>400
Budesonide (nebules)	250-500	>500-1000	>1000
Ciclesonide (pMDI, EP, HFA)	80	>80-160	>160
Fluticasone furoate (DPI)	50		n.a.
Fluticasone propionate (DPI, pMDI, SP, HFA)	50-100	>100-200	>200
Mometasone furoate (pMDI, SP, HFA)	100		200

DPI: dry powder inhaler

pMDI: pressured metered dose inhaler (should be used with a spacer)

HFA: hydrofluoroalkane propellant

SP: standard particle

EP: extrafine particle



Acute asthma in children < 5yo

Mild to moderate

- Breathless
- Agitated
- Pulse \leq 180bpm (0-3yo) or \leq 150bpm (3-5yo)
- O2 sat on RA \geq 92%

Severe or life-threatening: Transfer

- Unable to speak or drink
- Central cyanosis
- Confusion or drowsiness
- Respiratory rate $>$ 40/min
- Pulse $>$ 180 (0-3yo) or $>$ 150 (3-5yo)
- O2 sat on RA $<$ 92%
- Silent chest

Start Treatment

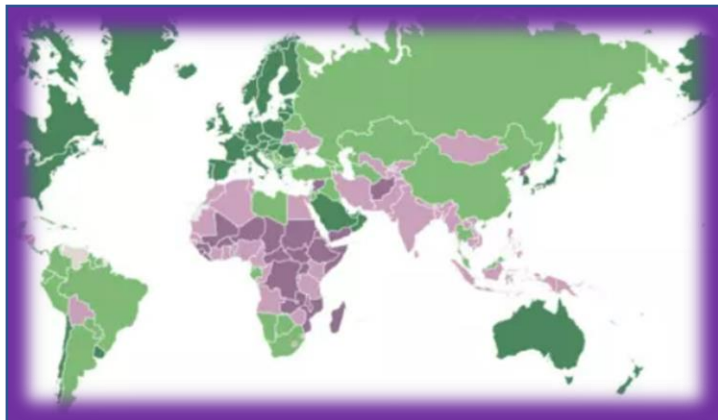
- Salbutamol 100mcg 2 puffs by pMDI + spacer or 2.5mg by nebulizer
- Repeat q20min for the 1st hour if needed
- Controlled O2 if needed to 94-98%
- Consider adding ipratropium 1-2 puffs

Continue Treatment

- *If needed for symptoms recurring within 3-4 hours*
- Give extra salbutamol 2-3 puffs per hour
- Give prednisone 2mg/kg (max 20mg $<$ 2 years, max 30mg for 2-5yo) orally
 - Rx for total of 3-5d



Low & middle income countries



Diagnosis

- Typically underdiagnosed and undertreated
- Challenges in assessing lung function tests
- Differential includes TB, HIV/AIDS related lung diseases, parasitic infections, fungal infections
- Use clinical findings/syndromic approach to diagnosis

PEF

- $\geq 20\%$ improvement 15 minutes after 2 puffs of albuterol
- Improvement in symptoms and PEF 4 weeks after trial of anti-inflammatory treatment
- 1 week of OCS if necessary prior to start long term controller therapy

Barriers to treatment

- Availability and affordability of inhaled medications
- Prioritization of acute care over chronic care by healthcare systems
- Spacers can be made from plastic bottles
- Prescribe ICS-formoterol as a symptom reliever with (GINA Steps 3-5) or without (STEPS 1-2)

