You Take My Breath Away: Management of Asthma in Children

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March 10, 2019
Disclosures

I have nothing to disclose.

Use of the GINA slide set has been authorized.
Pediatric Asthma Learning Objectives

• Discuss the prevalence of asthma and common respiratory disorders in children
• Identify common nonpharmacological options for reducing asthma exacerbations in children
• Review pharmacotherapy for treating asthma
• Discuss appropriate treatment options and patient counseling regarding management of asthma.
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Asthma is one of the most common chronic diseases worldwide with an estimated 300 million affected individuals.

Prevalence is increasing in many countries, especially in children.

Asthma is a major cause of school and work absence.

Health care expenditure on asthma is very high:

- Developed economies might expect to spend 1-2 percent of total health care expenditures on asthma.
- Developing economies likely to face increased demand due to increasing prevalence of asthma.
- Poorly controlled asthma is expensive.
- However, investment in prevention medication is likely to yield cost savings in emergency care.
Prevalence of asthma in children aged 13-14 years
How big is the problem?

• #1 Missed school days
• #3 Reason for hospitalization in peds
## CDC Asthma Data

<table>
<thead>
<tr>
<th>Child age groups</th>
<th>Number w/asthma (thousands)</th>
<th>Percent w/asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 years old</td>
<td>767</td>
<td>3.8</td>
</tr>
<tr>
<td>5-11 years old</td>
<td>2750</td>
<td>9.6</td>
</tr>
<tr>
<td>12-17 years old</td>
<td>2615</td>
<td>10.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race Children&lt;18</th>
<th>Number w/asthma</th>
<th>Percent w/asthma</th>
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</thead>
<tbody>
<tr>
<td>White NH</td>
<td>2687</td>
<td>7.1</td>
</tr>
<tr>
<td>Black NH</td>
<td>1561</td>
<td>15.7</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1233</td>
<td>6.7</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>236</td>
<td>12.9</td>
</tr>
<tr>
<td>Mexican American</td>
<td>760</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Accessed 1/17/19: https://www.cdc.gov/asthma/most_recent_data.htm
Key changes in GINA 2017 - other changes

- **Cough in infancy**
  - Prolonged cough in infancy, and cough without cold symptoms, are associated with later parent-reported physician-diagnosed asthma, independent of infant wheeze [Oren 2015]
Key changes in GINA 2017 - lung function

- Clarification about ‘periodical’ assessment of lung function
  - Most adults: lung function should be recorded at least every 1-2 yrs
  - More frequently in higher risk patients
  - More frequently in children based on severity and clinical course

- Lung function trajectories
  - Children with persistent asthma may have reduced growth in lung function, and some are at risk of accelerated decline in lung function in early adult life [McGeachie, NEJM 2016]

- Low resource areas
  - Poverty is commonly associated with spirometric restriction, so where possible, both FEV$_1$ and FVC should be recorded
Question 1
How would you respond?

- A mother presents to your pharmacy with a patient who is newly diagnosed with asthma. She asks to speak with you regarding the new medication for her son. He has been started on Flovent, her friend that is in nursing school told her it will cause growth issues.
Key changes in GINA 2017 - ICS and growth in children

- Assessment of future risk
  - Height should be checked at least yearly, as poorly-controlled asthma can affect growth [Pedersen 2001], and growth velocity may be lower in the first 1-2 years of ICS treatment [Loke, 2015].
  - Consider referral if there is growth delay

- Choice of controller treatment
  - Discuss relative benefits and risks with parents or caregivers, including the importance of maintaining normal physical activity
  - Effects of ICS on growth velocity are not progressive or cumulative [Kelly 2012, Loke 2015].
  - The one study that examined long-term outcomes showed a difference of only 0.7% in adult height [Kelly 2012, Loke 2015]
Checking height in children with asthma

Check height at least yearly, because:

- Poorly-controlled asthma can affect growth [Pedersen 2001]
- Growth velocity may be lower in the first 1-2 years of ICS treatment but this is not progressive or cumulative [Kelly 2012, Loke 2015].
- The one study that examined long-term outcomes showed a difference of only 0.7% in adult height [Kelly 2012, Loke 2015]

If decreased growth velocity is seen, also consider:

- Poorly-controlled asthma
- Frequent use of OCS
- Poor nutrition
What is known about asthma?

- Asthma can be effectively treated
- When asthma is well-controlled, patients can
  - Avoid troublesome symptoms during the day and night
  - Need little or no reliever medication
  - Have productive, physically active lives
  - Have normal or near-normal lung function
  - Avoid serious asthma flare-ups (also called exacerbations, or severe attacks)
Typical spirometric tracings

Note: Each FEV$_1$ represents the highest of three reproducible measurements.

GINA 2017
1. **Asthma control - two domains**
   - Assess symptom control over the last 4 weeks
   - Assess risk factors for poor outcomes, including low lung function

2. **Treatment issues**
   - Check inhaler technique and adherence
   - Ask about side-effects
   - Does the patient have a written asthma action plan?
   - What are the patient’s attitudes and goals for their asthma?
### A. Symptom control

<table>
<thead>
<tr>
<th>In the past 4 weeks, has the patient had:</th>
<th>Level of asthma symptom control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Daytime asthma symptoms more than twice a week?</td>
<td>Well-controlled</td>
</tr>
<tr>
<td></td>
<td>Yes [ ] No [ ]</td>
</tr>
<tr>
<td>• Any night waking due to asthma?</td>
<td>Partly controlled</td>
</tr>
<tr>
<td></td>
<td>Yes [ ] No [ ]</td>
</tr>
<tr>
<td>• Reliever needed for symptoms*</td>
<td>Uncontrolled</td>
</tr>
<tr>
<td>more than twice a week?</td>
<td>None of these</td>
</tr>
<tr>
<td></td>
<td>1-2 of these</td>
</tr>
<tr>
<td>• Any activity limitation due to asthma?</td>
<td>3-4 of these</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Excludes reliever taken before exercise, because many people take this routinely
Assessment of risk factors for poor asthma outcomes

Independent* risk factors for exacerbations include:

- Ever intubated for asthma
- Uncontrolled asthma symptoms
- Having ≥1 exacerbation in last 12 months
- Low FEV₁ (measure lung function at start of treatment, at 3-6 months to assess personal best, and periodically thereafter)
- Incorrect inhaler technique and/or poor adherence
- Smoking
- Elevated FeNO in adults with allergic asthma
- Obesity, pregnancy, blood eosinophilia

* Independent of the level of symptom control
Assessing asthma severity

How?
- Asthma severity is assessed retrospectively from the level of treatment required to control symptoms and exacerbations

When?
- Assess asthma severity after patient has been on controller treatment for several months
- Severity is not static – it may change over months or years, or as different treatments become available

Categories of asthma severity
- **Mild asthma**: well-controlled with Steps 1 or 2 (as-needed SABA or low dose ICS)
- **Moderate asthma**: well-controlled with Step 3 (low-dose ICS/LABA)
- **Severe asthma**: requires Step 4/5 (moderate or high dose ICS/LABA ± add-on), or remains uncontrolled despite this treatment
### How to distinguish between uncontrolled and severe asthma

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Watch patient using their inhaler. Discuss adherence and barriers to use. Compare inhaler technique with a device-specific checklist, and correct errors; recheck frequently. Have an empathic discussion about barriers to adherence.</td>
</tr>
<tr>
<td>2</td>
<td>Confirm the diagnosis of asthma. If lung function normal during symptoms, consider halving ICS dose and repeating lung function after 2–3 weeks.</td>
</tr>
<tr>
<td>3</td>
<td>Remove potential risk factors. Assess and manage comorbidities. Check for risk factors or inducers such as smoking, beta-blockers, NSAIDs, allergen exposure. Check for comorbidities such as rhinitis, obesity, GERD, depression/anxiety.</td>
</tr>
<tr>
<td>4</td>
<td>Consider treatment step-up. Consider step up to next treatment level. Use shared decision-making, and balance potential benefits and risks.</td>
</tr>
<tr>
<td>5</td>
<td>Refer to a specialist or severe asthma clinic. If asthma still uncontrolled after 3–6 months on Step 4 treatment, refer for expert advice. Refer earlier if asthma symptoms severe, or doubts about diagnosis.</td>
</tr>
</tbody>
</table>

GINA 2017, Box 2-4 (5/5) © Global Initiative for Asthma
Health literacy affects health outcomes, including in asthma

- ‘The degree to which individuals have the capacity to obtain, process and understand basic health information and services to make appropriate health decisions’ (Rosas-Salazar, JACI 2012)

Strategies for reducing the impact of impaired health literacy

- Prioritize information (most important to least important)
- Speak slowly, avoid medical language, simplify numeric concepts
- Use anecdotes, drawings, pictures, tables and graphs
- Use the ‘teach-back’ method – ask patients to repeat instructions
- Ask a second person to repeat the main messages
- Pay attention to non-verbal communication
Choosing between controller options – population-level decisions

Choosing between treatment options at a population level
e.g. national formularies, health maintenance organisations, national guidelines

The ‘preferred treatment’ at each step is based on:

- **Efficacy**
- **Effectiveness**
- **Safety**
- **Availability and cost at the population level**

Based on group mean data for symptoms, exacerbations and lung function (from RCTs, pragmatic studies and observational data)
Choosing between controller options – individual patient decisions

Decisions for individual patients

Use shared decision-making with the patient/parent/carer to discuss the following:

1. Preferred treatment for symptom control and for risk reduction
2. Patient characteristics (phenotype)
   • Does the patient have any known predictors of risk or response? (e.g. smoker, history of exacerbations, blood eosinophilia)
3. Patient preference
   • What are the patient’s goals and concerns for their asthma?
4. Practical issues
   • Inhaler technique - can the patient use the device correctly after training?
   • Adherence: how often is the patient likely to take the medication?
   • Cost: can the patient afford the medication?
Initial controller treatment for adults, adolescents and children 6–11 years

- Start controller treatment early
  - For best outcomes, initiate controller treatment as early as possible after making the diagnosis of asthma

- Indications for regular low-dose ICS - any of:
  - Asthma symptoms more than twice a month
  - Waking due to asthma more than once a month
  - Any asthma symptoms plus any risk factors for exacerbations

- Consider starting at a higher step if:
  - Troublesome asthma symptoms on most days
  - Waking from asthma once or more a week, especially if any risk factors for exacerbations

- If initial asthma presentation is with an exacerbation:
  - Give a short course of oral steroids and start regular controller treatment (e.g. high dose ICS or medium dose ICS/LABA, then step down)
Audience Survey

Which of the following was the “guideline” for Asthma during your training?

- EPR-3 from NHLBI
- GINA
- I can not recall, honestly
The pediatric asthma yardstick

Bradley E. Chipps, MD, Leonard B. Bacharier, MD, Judith R. Farrar, PhD, Daniel J. Jackson, MD, Kevin R. Murphy, MD, Wanda Phipatanakul, MD, MS, Stanley J. Szefler, MD, W. Gerald Teague, MD, Robert S. Zeiger, MD, PhD

Annals of Allergy, Asthma & Immunology
Volume 120, Issue 6, Pages 559-579.e11 (June 2018)
DOI: 10.1016/j.anai.2018.04.002
Figure 1

**Young Children**

**Stepping up from GINA STEP 1 to STEP 2 - PATIENT PROFILE:**
Wheezing with or without coughing ≥2x/wk or who wakes due to wheezing ≥1x/mo, or has a ≥10 point decrease in TRACK score, and/or ≥2 exacerbations requiring OCS, ED visit, or hospitalization in past year despite using as-needed ICS or LTRA (given at same time as SABA) for intermittent asthma.*

- Daily low-dose ICS
- OR LTRA
- OR intermittent high-dose ICS

3-month therapeutic trial with reassessment at 2-5 weeks

**Referral to pediatric asthma specialist**

**Stepping up from GINA STEP 2 to STEP 3 - PATIENT PROFILE:**
Wheezing with or without coughing ≥2x/wk or who wakes due to wheezing ≥1x/mo, or has a ≥10 point decrease in TRACK score after 3 mo of treatment with low-dose ICS and/or has had ≥2 exacerbations requiring OCS, ED visit, or hospitalization in past year.*

- Double low-dose ICS
- OR add LTRA to low-dose ICS

3-month therapeutic trial with reassessment at 2-5 weeks

**Referral to pediatric asthma specialist**

**Stepping up from GINA STEP 3 to STEP 4 - PATIENT PROFILE:**
Wheezing with or without coughing throughout most days or who wakes due to wheezing >1x/wk and has a ≥10 point decrease in TRACK score after 3 mo of treatment with double low-dose ICS (with or without LTRA) and/or whose daily activity is limited by symptoms and/or has had ≥3 exacerbations requiring OCS, ED visit, or hospitalization in past year.*

- Continue to optimize medication:
  - Increase to higher dose ICS with or without LTRA
  - Consider ICS/LABA (FP/salmeterol is approved down to age 4 years)

3-month therapeutic trial with reassessment at 2-5 weeks

**Referral to pediatric asthma specialist**

*Prior to stepping up therapy, confirm that the increased level of symptoms is due to asthma. The patient should be assessed for non-adherence with the management plan, potential comorbidities, and other factors that might negatively impact response to therapy, (see Table 3) including an age-appropriate understanding of asthma and the management plan as well as parent and/or caregiver knowledge.

**Given at same time as albuterol.**
### Stepwise management - pharmacotherapy

**Diagnosis**
- Symptom control & risk factors (including lung function)
- Inhaler technique & adherence
- Patient preference

**Asthma medications**
- Non-pharmacological strategies
- Treat modifiable risk factors

#### Symptoms
- Exacerbations
- Side-effects
- Patient satisfaction
- Lung function

#### Review Response

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4</th>
<th>Step 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low dose ICS</td>
<td>Low dose ICS/LABA**</td>
<td>Med/high ICS/LABA</td>
<td>Refer for add-on treatment, e.g. tiotropium, anti-IgE, anti-IL5*</td>
<td></td>
</tr>
<tr>
<td>Consider low dose ICS</td>
<td>Leukotriene receptor antagonists (LTRA) Low dose theophylline*</td>
<td>Med/high dose ICS/LABA (or + theoph*)</td>
<td>Add tiotropium** High dose ICS LTRA (or + theoph*)</td>
<td>Add low dose OCS</td>
</tr>
<tr>
<td>As-needed short-acting beta&lt;sub&gt;2&lt;/sub&gt;-agonist (SABA)</td>
<td>As-needed SABA or low dose ICS/formoterol#</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Not for children <12 years**

**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS**

# For patients prescribed BDP/formoterol or BUD/formoterol maintenance and reliever therapy

† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations

GINA 2017, Box 3-5  (2/8) (upper part)
Step 1 – as-needed inhaled short-acting beta$_2$-agonist (SABA)

**PREFERRED CONTROLLER CHOICE**

- **STEP 1**
  - As-needed short-acting beta$_2$-agonist (SABA)
  - Consider low dose ICS

- **STEP 2**
  - Low dose ICS
  - Leukotriene receptor antagonists (LTRA)
  - Low dose theophylline*

- **STEP 3**
  - Med/high dose ICS/LABA
  - Med/high dose ICS
  - Low dose ICS/LABA**

- **STEP 4**
  - Med/high dose ICS/LABA
  - Add low dose OCS

- **STEP 5**
  - Refer for add-on treatment e.g., tiotropium,*, anti-IgE, anti-IL5*

**RELIEVER**

- As-needed SABA or low dose ICS/formoterol#

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*Not for children <12 years
**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS
#For patients prescribed BDP/formoterol or BUD/formoterol maintenance and reliever therapy
† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations
Preferred option: as-needed inhaled short-acting beta$_2$-agonist (SABA)

- SABAs are highly effective for relief of asthma symptoms
- However …. there is insufficient evidence about the safety of treating asthma with SABA alone
- This option should be reserved for patients with infrequent symptoms (less than twice a month) of short duration, and with no risk factors for exacerbations

Other options

- Consider adding regular low dose inhaled corticosteroid (ICS) for patients at risk of exacerbations
Question 2
What would you do?

• A mother presents to your pharmacy with a patient requesting a refill for Proair. The rx is for her son and you follow the OBRA guidance and note her son received his Proair inhaler three weeks ago.
Step 2 – low-dose controller + as-needed inhaled SABA

**PREFERRED CONTROLLER CHOICE**

**STEP 1**
- Consider low dose ICS

**STEP 2**
- Low dose ICS
  - Leukotriene receptor antagonists (LTRA)
  - Low dose theophylline*

**STEP 3**
- Low dose ICS/LABA**
  - Med/high dose ICS
  - Low dose ICS+LTRA (or + theoph*)

**STEP 4**
- Med/high ICS/LABA
  - Add tiotropium**†
  - High dose ICS + LTRA (or + theoph*)

**STEP 5**
- Refer for add-on treatment e.g. tiotropium,* anti-IgE, anti-IL5*
  - Add low dose OCS

**RELIEVER**

- As-needed short-acting beta₂-agonist (SABA)

- As-needed SABA or low dose ICS/formoterol#

*Not for children <12 years
**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS
#For patients prescribed BDP/formoterol or BUD/ formoterol maintenance and reliever therapy
† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations
Step 2 – Low dose controller + as-needed SABA

Preferred option: regular low dose ICS with as-needed inhaled SABA

- Low dose ICS reduces symptoms and reduces risk of exacerbations and asthma-related hospitalization and death

Other options

- Leukotriene receptor antagonists (LTRA) with as-needed SABA
  - Less effective than low dose ICS
  - May be used for some patients with both asthma and allergic rhinitis, or if patient will not use ICS

- Combination low dose ICS/long-acting beta$_2$-agonist (LABA) with as-needed SABA
  - Reduces symptoms and increases lung function compared with ICS
  - More expensive, and does not further reduce exacerbations

- Intermittent ICS with as-needed SABA for purely seasonal allergic asthma with no interval symptoms
  - Start ICS immediately symptoms commence, and continue for 4 weeks after pollen season ends
Step 3 – one or two controllers + as-needed inhaled reliever

**PREFERRED CONTROLLER CHOICE**

**STEP 1**
- Consider low dose ICS

**STEP 2**
- Low dose ICS
  - Leukotriene receptor antagonists (LTRA)
  - Low dose theophylline*

**STEP 3**
- Low dose ICS/LABA**
  - Med/high dose ICS
  - Low dose ICS+LTRA (or + theoph*)

**STEP 4**
- Med/high ICS/LABA
  - Add tiotropium**†
  - High dose ICS + LTRA (or + theoph*)
  - Add low dose OCS

**STEP 5**
- Refer for add-on treatment e.g. tiotropium,*† anti-IgE, anti-IL5*

**RELEVER**
- As-needed short-acting beta2-agonist (SABA)

**As-needed SABA or low dose ICS/formoterol**#

*Not for children <12 years
**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS
#For patients prescribed BDP/formoterol or BUD/ formoterol maintenance and reliever therapy
† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations
Step 3 – one or two controllers + as-needed inhaled reliever

Before considering step-up
- Check inhaler technique and adherence, confirm diagnosis

Adults/adolescents: preferred options are either combination low dose ICS/LABA maintenance with as-needed SABA, OR combination low dose ICS/formoterol maintenance and reliever regimen*
  - Adding LABA reduces symptoms and exacerbations and increases FEV$_1$, while allowing lower dose of ICS
  - In at-risk patients, maintenance and reliever regimen significantly reduces exacerbations with similar level of symptom control and lower ICS doses compared with other regimens

Children 6-11 years: preferred option is medium dose ICS with as-needed SABA

Other options
- Adults/adolescents: Increase ICS dose or add LTRA or theophylline (less effective than ICS/LABA)
- Adults: consider adding SLIT (see Non-pharmacological interventions)
- Children 6-11 years – add LABA (similar effect as increasing ICS)

*Approved only for low dose beclometasone/formoterol and low dose budesonide/formoterol
Step 4 – two or more controllers + as-needed inhaled reliever

**PREFERRED CONTROLLER CHOICE**

**STEP 1**
- Consider low dose ICS

**STEP 2**
- Leukotriene receptor antagonists (LTRA)
- Low dose theophylline*
- Low dose ICS

**STEP 3**
- Med/high dose ICS/LABA
- Add tiotropium**†
- Add low dose OCS

**STEP 4**
- Med/high dose ICS/LABA
- Add tiotropium**†
- Add high dose ICS + LTRA
- Add low dose OCS

**STEP 5**
- Refer for add-on treatment e.g., tiotropium,† anti-IgE, anti-IL5*

**RELIEVER**
- As-needed short-acting beta₂-agonist (SABA)
- As-needed SABA or low dose ICS/formoterol#

*Not for children <12 years
**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS
#For patients prescribed BDP/formoterol or BUD/formoterol maintenance and reliever therapy
† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations
Step 4 – two or more controllers + as-needed inhaled reliever

- Before considering step-up
  - Check inhaler technique and adherence
  - Adults or adolescents: preferred option is combination low dose ICS/formoterol as maintenance and reliever regimen*, OR combination medium dose ICS/LABA with as-needed SABA
  - Children 6–11 years: preferred option is to refer for expert advice
  - Other options (adults or adolescents)
    - Tiotropium by mist inhaler may be used as add-on therapy for patients aged ≥12 years with a history of exacerbations
    - Trial of high dose combination ICS/LABA, but little extra benefit and increased risk of side-effects
    - Increase dosing frequency (for budesonide-containing inhalers)
    - Add-on LTRA or low dose theophylline

*Approved only for low dose beclometasone/formoterol and low dose budesonide/formoterol
Step 5 – higher level care and/or add-on treatment

**STEP 1**
- Consider low dose ICS
- Leukotriene receptor antagonists (LTRA)
- Low dose theophylline*

**STEP 2**
- Low dose ICS
- Leukotriene receptor antagonists (LTRA)
- Low dose theophylline*

**STEP 3**
- Low dose ICS/LABA**
- Med/high dose ICS/LABA
- Med/high dose ICS/LABA
- Add tiotropium**†
- As-needed SABA or low dose ICS/formoterol#

**STEP 4**
- Refer for add-on treatment e.g., tiotropium, anti-IgE, anti-IL5*
- Add tiotropium**†
- Add low dose OCS

**STEP 5**
- Add low dose OCS

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*Not for children <12 years
**For children 6-11 years, the preferred Step 3 treatment is medium dose ICS
#For patients prescribed BDP/formoterol or BUD/formoterol maintenance and reliever therapy
† Tiotropium by mist inhaler is an add-on treatment for patients ≥12 years with a history of exacerbations
Step 5 – higher level care and/or add-on treatment

- Preferred option is referral for specialist investigation and consideration of add-on treatment
  - If symptoms uncontrolled or exacerbations persist despite Step 4 treatment, check inhaler technique and adherence before referring
  - Add-on tiotropium for patients ≥12 years with history of exacerbations
  - Add-on anti-IgE (omalizumab) for patients with severe allergic asthma
  - Add-on anti-IL5 (mepolizumab (SC) or reslizumab (IV)) for severe eosinophilic asthma (≥12 yrs)

- Other add-on treatment options at Step 5 include:
  - Sputum-guided treatment: this is available in specialized centers; reduces exacerbations and/or corticosteroid dose
  - Add-on low dose oral corticosteroids (≤7.5mg/day prednisone equivalent): this may benefit some patients, but has significant systemic side-effects. Assess and monitor for osteoporosis
  - See ERS/ATS Severe Asthma Guidelines (Chung et al, ERJ 2014) for more detail
**Low, medium and high dose inhaled corticosteroids**

**Adults and adolescents (≥12 years)**

- This is not a table of equivalence, but of estimated clinical comparability.
- Most of the clinical benefit from ICS is seen at low doses.
- High doses are arbitrary, but for most ICS are those that, with prolonged use, are associated with increased risk of systemic side-effects.

<table>
<thead>
<tr>
<th>Inhaled corticosteroid</th>
<th>Total daily dose (mcg)</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclometasone dipropionate (CFC)</td>
<td></td>
<td>200–500</td>
<td>&gt;500–1000</td>
<td>&gt;1000</td>
</tr>
<tr>
<td>Beclometasone dipropionate (HFA)</td>
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<td>&gt;200–400</td>
<td>&gt;400</td>
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<tr>
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<td>&gt;320</td>
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<td>n.a.</td>
<td>200</td>
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<td>100–250</td>
<td>&gt;250–500</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Mometasone furoate</td>
<td></td>
<td>110–220</td>
<td>&gt;220–440</td>
<td>&gt;440</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td></td>
<td>400–1000</td>
<td>&gt;1000–2000</td>
<td>&gt;2000</td>
</tr>
</tbody>
</table>

GINA 2017, Box 3-6 (1/2)
• Based on the previous slide, do you see an issue with GINA dosing for the patients you serve?
Low, medium and high dose inhaled corticosteroids
Children 6–11 years

<table>
<thead>
<tr>
<th>Inhaled corticosteroid</th>
<th>Total daily dose (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Beclometasone dipropionate (CFC)</td>
<td>100–200</td>
</tr>
<tr>
<td>Beclometasone dipropionate (HFA)</td>
<td>50–100</td>
</tr>
<tr>
<td>Budesonide (DPI)</td>
<td>100–200</td>
</tr>
<tr>
<td>Budesonide (nebules)</td>
<td>250–500</td>
</tr>
<tr>
<td>Ciclesonide (HFA)</td>
<td>80</td>
</tr>
<tr>
<td>Fluticasone furoate (DPI)</td>
<td>n.a.</td>
</tr>
<tr>
<td>Fluticasone propionate (DPI)</td>
<td>100–200</td>
</tr>
<tr>
<td>Fluticasone propionate (HFA)</td>
<td>100–200</td>
</tr>
<tr>
<td>Mometasone furoate</td>
<td>110</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td>400–800</td>
</tr>
</tbody>
</table>

- This is not a table of equivalence, but of estimated clinical comparability
- Most of the clinical benefit from ICS is seen at low doses
- High doses are arbitrary, but for most ICS are those that, with prolonged use, are associated with increased risk of systemic side-effects
Reviewing response and adjusting treatment

- How often should asthma be reviewed?
  - 1-3 months after treatment started, then every 3-12 months
  - During pregnancy, every 4-6 weeks
  - After an exacerbation, within 1 week

- Stepping up asthma treatment
  - Sustained step-up, for at least 2-3 months if asthma poorly controlled
    - Important: first check for common causes (symptoms not due to asthma, incorrect inhaler technique, poor adherence)
  - Short-term step-up, for 1-2 weeks, e.g. with viral infection or allergen
    - May be initiated by patient with written asthma action plan
  - Day-to-day adjustment
    - For patients prescribed low-dose ICS/formoterol maintenance and reliever regimen*

- Stepping down asthma treatment
  - Consider step-down after good control maintained for 3 months
  - Find each patient’s minimum effective dose, that controls both symptoms and exacerbations

*Approved only for low dose beclometasone/formoterol and low dose budesonide/formoterol
**Choose**

- Choose an appropriate device before prescribing. Consider medication options, arthritis, patient skills and cost. For ICS by pMDI, prescribe a spacer
- Avoid multiple different inhaler types if possible

**Check**

- Check technique at every opportunity – “*Can you show me how you use your inhaler at present?*”
- Identify errors with a device-specific checklist

**Correct**

- Give a physical demonstration to show how to use the inhaler correctly
- Check again (up to 2-3 times)
- Re-check inhaler technique frequently, as errors often recur within 4-6 weeks

**Confirm**

- Can you demonstrate correct technique for the inhalers you prescribe?
- Brief inhaler technique training improves asthma control
Check adherence with asthma medications

- Poor adherence:
  - Is very common: it is estimated that 50% of adults and children do not take controller medications as prescribed
  - Contributes to uncontrolled asthma symptoms and risk of exacerbations and asthma-related death

- Contributory factors
  - Unintentional (e.g. forgetfulness, cost, confusion) and/or
  - Intentional (e.g. no perceived need, fear of side-effects, cultural issues, cost)

- How to identify patients with low adherence:
  - Ask an empathic question, e.g. “Do you find it easier to remember your medication in the morning or the evening?”, or “Would you say you are taking it 3 days a week, or less, or more?”
  - Check prescription date, label date and dose counter
  - Ask patient about their beliefs and concerns about the medication

GINA 2017, Box 3-12
Highly effective in improving asthma outcomes

- Reduced hospitalizations, ED visits, symptoms, night waking, time off work, improved lung function and quality of life

Three essential components

- Self-monitoring of symptoms and/or PEF
- Written asthma action plan
  - Describe how to recognize and respond to worsening asthma
  - Individualize the plan for the patient’s health literacy and autonomy
  - Provide advice about a change in ICS and how/when to add OCS
  - If using PEF, base action plan on personal best rather than predicted
- Regular medical review
Optimize dose of ICS/LABA
- Complete resistance to ICS is rare
- Consider therapeutic trial of higher dose

Consider low dose maintenance oral corticosteroids
- Monitor for and manage side-effects, including osteoporosis

Add-on treatments without phenotyping
- Tiotropium - reduces exacerbations (history of exacerbations, age ≥12 years)
- Theophylline, LTRA – limited benefit

Phenotype-guided treatment
- Severe allergic asthma: add-on omalizumab (anti-IgE)
- Severe eosinophilic asthma: add-on mepolizumab or reslizumab (anti-IL5)
- Sputum-guided treatment to reduce exacerbations and/or steroid dose
- Aspirin-exacerbated respiratory disease: consider add-on LTRA

Non-pharmacological interventions
- Consider bronchial thermoplasty for selected patients
- Comprehensive adherence-promoting program

For detailed guidelines, see Chung et al, ERJ 2014
Identify patients at risk of asthma-related death

Patients at increased risk of asthma-related death should be identified

- Any history of near-fatal asthma requiring intubation and ventilation
- Hospitalization or emergency care for asthma in last 12 months
- Not currently using ICS, or poor adherence with ICS
- Currently using or recently stopped using OCS
  - (indicating the severity of recent events)
- Over-use of SABAs, especially if more than 1 canister/month
- Lack of a written asthma action plan
- History of psychiatric disease or psychosocial problems
- Confirmed food allergy in a patient with asthma

Flag these patients for more frequent review
All patients should have a written asthma action plan

- The aim is to show the patient how to recognize and respond to worsening asthma
- It should be individualized for the patient’s medications, level of asthma control and health literacy
- Based on symptoms and/or PEF (children: only symptoms)

The action plan should include:

- The patient’s usual asthma medications
- When/how to increase reliever and controller or start OCS
- How to access medical care if symptoms fail to respond

Why?

- When combined with self-monitoring and regular medical review, action plans are highly effective in reducing asthma mortality and morbidity

GINA 2017
Increase inhaled reliever
- Increase frequency as needed
- Adding spacer for pMDI may be helpful

Early and rapid increase in inhaled controller
- Up to maximum ICS of 2000mcg BDP/day or equivalent
- Options depend on usual controller medication and type of LABA
- See GINA 2017 report Box 4-2 for details

Add oral corticosteroids if needed
- Adults: prednisolone 1mg/kg/day up to 50mg, usually 5-7 days
- Children: 1-2mg/kg/day up to 40mg, usually 3-5 days
- Morning dosing preferred to reduce side-effects
- Tapering not needed if taken for less than 2 weeks
- Remember to advise patients about common side-effects (sleep disturbance, increased appetite, reflux, mood changes)
A patient presents to your pharmacy with an Rx for ProAir Respclick. Your CPhT enters the Rx and the patient's DOB is 3/9/16. The caregiver is waiting in the store.
## Choosing an inhaler device for children ≤5 years

<table>
<thead>
<tr>
<th>Age</th>
<th>Preferred device</th>
<th>Alternate device</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3 years</td>
<td>Pressurized metered dose inhaler plus dedicated spacer with face mask</td>
<td>Nebulizer with face mask</td>
</tr>
<tr>
<td>4–5 years</td>
<td>Pressurized metered dose inhaler plus dedicated spacer with mouthpiece</td>
<td>Pressurized metered dose inhaler plus dedicated spacer with face mask, or nebulizer with mouthpiece or face mask</td>
</tr>
</tbody>
</table>
Medications to Treat Asthma: How to Use a Spray Inhaler

Remember to breathe in slowly.

1. Take off the cap. Shake the inhaler.

2. Stand up. Breathe out.

3. Put the inhaler in your mouth or put it just in front of your mouth. As you start to breathe in, push down on the top of the inhaler and keep breathing in slowly.


The health-care provider should evaluate inhaler technique at each visit.

Source: “What You and Your Family Can Do About Asthma” by the Global Initiative for Asthma Created and funded by NIH/NHLBI
Medications to Treat Asthma: Inhalers and Spacers

Spacers can help patients who have difficulty with inhaler use and can reduce potential for adverse effects from medication.
Medications to Treat Asthma: Nebulizer

- Used for small children or for severe asthma episodes
- No evidence that it is more effective than an inhaler used with a spacer
Probability of asthma diagnosis or response to asthma treatment in children ≤5 years

Symptom Pattern (may change over time)

- Symptoms (cough, wheeze, heavy breathing) for <10 days during upper respiratory tract infections
  - 2–3 episodes per year
  - No symptoms between episodes

- Symptoms (cough, wheeze, heavy breathing) for >10 days during upper respiratory tract infections
  - >3 episodes per year, or severe episodes and/or night worsening

- Between episodes child may have occasional cough, wheeze or heavy breathing

- Between episodes child has cough, wheeze or heavy breathing during play or when laughing
  - Atopy, or family history of asthma

- Proportion of children with viral-induced wheeze fitting these symptom patterns
- Proportion of children with viral-induced wheeze that are likely to have asthma diagnosis or respond to regular controller treatment, based on symptom pattern
Symptom patterns in children ≤5 years

Symptom Pattern
(\textit{may change over time})

- **Symptoms (cough, wheeze, heavy breathing) for <10 days during upper respiratory tract infections**
  - 2–3 episodes per year
  - No symptoms between episodes

- **Symptoms (cough, wheeze, heavy breathing) for >10 days during upper respiratory tract infections**
  - >3 episodes per year, or severe episodes and/or night worsening
  - Between episodes child may have occasional cough, wheeze or heavy breathing

- **Symptoms (cough, wheeze, heavy breathing) for >10 days during upper respiratory tract infections**
  - >3 episodes per year, or severe episodes and/or night worsening
  - Between episodes child has cough, wheeze or heavy breathing during play or when laughing
  - Atopy, or family history of asthma
## Features suggesting asthma in children ≤5 years

<table>
<thead>
<tr>
<th>Feature</th>
<th>Characteristics suggesting asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cough</strong></td>
<td>Recurrent or persistent non-productive cough that may be worse at night or accompanied by some wheezing and breathing difficulties. Cough occurring with exercise, laughing, crying or exposure to tobacco smoke in the absence of an apparent respiratory infection. Prolonged cough in infancy, and cough without cold symptoms, are associated with later parent-reported physician-diagnosed asthma, independent of infant wheeze.</td>
</tr>
<tr>
<td><strong>Wheezing</strong></td>
<td>Recurrent wheezing, including during sleep or with triggers such as activity, laughing, crying or exposure to tobacco smoke or air pollution.</td>
</tr>
<tr>
<td><strong>Difficult or heavy breathing or shortness of breath</strong></td>
<td>Occurring with exercise, laughing, or crying.</td>
</tr>
<tr>
<td><strong>Reduced activity</strong></td>
<td>Not running, playing or laughing at the same intensity as other children; tires earlier during walks (wants to be carried).</td>
</tr>
<tr>
<td><strong>Past or family history</strong></td>
<td>Other allergic disease (atopic dermatitis or allergic rhinitis). Asthma in first-degree relatives.</td>
</tr>
<tr>
<td><strong>Therapeutic trial with low dose ICS and as-needed</strong></td>
<td>Clinical improvement during 2–3 months of controller treatment and worsening when treatment is stopped.</td>
</tr>
</tbody>
</table>
# GINA assessment of asthma control in children ≤5 years

## A. Symptom control

<table>
<thead>
<tr>
<th>Symptom control</th>
<th>Level of asthma symptom control</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the past 4 weeks, has the child had:</td>
<td>Well-controlled</td>
</tr>
<tr>
<td>• Daytime asthma symptoms for more than few minutes, more than once/week?</td>
<td>Yes☐ No☒</td>
</tr>
<tr>
<td>• Any activity limitation due to asthma? (runs/plays less than other children, tires easily during walks/playing)</td>
<td>Yes☐ No☒</td>
</tr>
<tr>
<td>• Reliever needed* more than once a week?</td>
<td>Yes☐ No☒</td>
</tr>
<tr>
<td>• Any night waking or night coughing due to asthma?</td>
<td>Yes☐ No☒</td>
</tr>
</tbody>
</table>

## B. Risk factors for poor asthma outcomes

**ASSESS CHILD’S RISK FOR:**
- Exacerbations within the next few months
- Fixed airflow limitation
- Medication side-effects
Risk factors for poor asthma outcomes in children ≤5 years

Risk factors for exacerbations in the next few months

- Uncontrolled asthma symptoms
- One or more severe exacerbation in previous year
- The start of the child’s usual ‘flare-up’ season (especially if autumn/fall)
- Exposures: tobacco smoke; indoor or outdoor air pollution; indoor allergens (e.g. house dust mite, cockroach, pets, mold), especially in combination with viral infection
- Major psychological or socio-economic problems for child or family
- Poor adherence with controller medication, or incorrect inhaler technique
### Risk factors for exacerbations in the next few months

- Uncontrolled asthma symptoms
- One or more severe exacerbation in previous year
- The start of the child’s usual ‘flare-up’ season (especially if autumn/fall)
- Exposures: tobacco smoke; indoor or outdoor air pollution; indoor allergens (e.g. house dust mite, cockroach, pets, mold), especially in combination with viral infection
- Major psychological or socio-economic problems for child or family
- Poor adherence with controller medication, or incorrect inhaler technique

### Risk factors for fixed airflow limitation

- Severe asthma with several hospitalizations
- History of bronchiolitis
### Risk factors for exacerbations in the next few months

- Uncontrolled asthma symptoms
- One or more severe exacerbation in previous year
- The start of the child’s usual ‘flare-up’ season (especially if autumn/fall)
- Exposures: tobacco smoke; indoor or outdoor air pollution; indoor allergens (e.g. house dust mite, cockroach, pets, mold), especially in combination with viral infection
- Major psychological or socio-economic problems for child or family
- Poor adherence with controller medication, or incorrect inhaler technique

### Risk factors for fixed airflow limitation

- Severe asthma with several hospitalizations
- History of bronchiolitis

### Risk factors for medication side-effects

- Systemic: Frequent courses of OCS; high-dose and/or potent ICS
- Local: moderate/high-dose or potent ICS; incorrect inhaler technique; failure to protect skin or eyes when using ICS by nebulizer or spacer with face mask
Control-based asthma management cycle in children ≤5 years

Symptoms
Exacerbations
Side-effects
Parent satisfaction

Diagnosis
Symptom control & risk factors
Inhaler technique & adherence
Parent preference

Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors
Stepwise approach to control symptoms and reduce risk (children ≤5 years)

**PREFERRED CONTROLLER CHOICE**

**Other controller options**

**RELIEVER**

**CONSIDER THIS STEP FOR CHILDREN WITH:**

**KEY ISSUES**

**ALL CHILDREN**

- **Assess** symptom control, future risk, comorbidities
- **Self-management:** education, inhaler skills, written asthma action plan, adherence
- **Regular review:** assess response, adverse events, establish minimal effective treatment
- (Where relevant): environmental control for smoke, allergens, indoor/outdoor air pollution

**STEP 1**

Daily low dose ICS

<table>
<thead>
<tr>
<th>Infrequent viral wheezing and no or few interval symptoms</th>
</tr>
</thead>
</table>

**STEP 2**

Double 'low dose' ICS

<table>
<thead>
<tr>
<th>Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year</th>
</tr>
</thead>
</table>

**STEP 3**

Continue controller & refer for specialist assessment

<table>
<thead>
<tr>
<th>Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks. Give diagnostic trial for 3 months.</th>
</tr>
</thead>
</table>

**STEP 4**

As-needed short-acting beta2-agonist (all children)

<table>
<thead>
<tr>
<th>Asthma diagnosis, and not well-controlled on low dose ICS</th>
</tr>
</thead>
</table>

**Diagnosis**

- Symptom control & risk factors
- Inhaler technique & adherence
- Parent preference

**Asthma medications**

- Non-pharmacological strategies
- Treat modifiable risk factors

**Symptoms**

- Exacerbations
- Side-effects
- Parent satisfaction

**ASSESS**

**REVIEW RESPONSE**

**ADJUST TREATMENT**

GINA 2017, Box 6-5 (2/8)

© Global Initiative for Asthma
Stepwise approach – pharmacotherapy (children ≤5 years)

**CONSIDER THIS STEP FOR CHILDREN WITH:**

- Infrequent viral wheezing and no or few interval symptoms
- Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year
- Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks. Give diagnostic trial for 3 months.
- Asthma diagnosis, and not well-controlled on low dose ICS
- Not well-controlled on double ICS

**PREFERRED CONTROLLER CHOICE**

- **RELIEVER**
  - As-needed short-acting beta₂-agonist (all children)

- **STEP 1**
  - Daily low dose ICS

- **STEP 2**
  - Leukotriene receptor antagonist (LTRA)
  - Intermittent ICS

- **STEP 3**
  - Double ‘low dose’ ICS
  - Low dose ICS + LTRA

- **STEP 4**
  - Continue controller & refer for specialist assessment
  - Add LTRA
  - inc. ICS frequency
  - Add intermittent ICS

GINA 2017, Box 6-5 (3/8)
Step 1 (children ≤5 years) – as-needed inhaled SABA

CONSIDER THIS STEP FOR CHILDREN WITH:

- Infrequent viral wheezing and no or few interval symptoms
- Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year
- Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks. Give diagnostic trial for 3 months.

PREFERRED CONTROLLER CHOICE

STEP 1
As-needed short-acting beta₂-agonist (all children)

STEP 2
Daily low dose ICS
- Leukotriene receptor antagonist (LTRA) Intermittent ICS

STEP 3
Double ‘low dose’ ICS
- Low dose ICS + LTRA
- Add LTRA Inc. ICS frequency Add intermittent ICS

STEP 4
Continue controller & refer for specialist assessment

OTHER CONTROLLER OPTIONS

RELIEVER

GINA 2017, Box 6-5 (5/8) © Global Initiative for Asthma
Step 2 (children ≤5 years) – initial controller + as-needed SABA

**CONSIDER THIS STEP FOR CHILDREN WITH:**
- Infrequent viral wheezing and no or few interval symptoms
- Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year
- Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks. Give diagnostic trial for 3 months.
- Asthma diagnosis, and not well-controlled on low dose ICS
- First check diagnosis, inhaler skills, adherence, exposures

**PREFERRED CONTROLLER CHOICE**
- Daily low dose ICS
- Leukotriene receptor antagonist (LTRA) Intermittent ICS

**RELIEVER**
- As-needed short-acting beta₂-agonist (all children)

**STEP 1**
- Other controller options

**STEP 2**
- Daily low dose ICS
- Leukotriene receptor antagonist (LTRA) Intermittent ICS

**STEP 3**
- Double ‘low dose’ ICS
- Low dose ICS + LTRA
- Add LTRA Inc. ICS frequency Add intermittent ICS

**STEP 4**
- Continue controller & refer for specialist assessment
- Not well-controlled on double ICS

**GINA 2017, Box 6-5 (6/8)**
Step 2 (children ≤5 years) – initial controller + as-needed SABA

- **Indication**
  - Child with symptom pattern consistent with asthma, and symptoms not well-controlled, or ≥3 exacerbations per year
  - May also be used as a diagnostic trial for children with frequent wheezing episodes

- **Preferred option: regular daily low dose ICS + as-needed inhaled SABA**
  - Give for ≥3 months to establish effectiveness, and review response

- **Other options depend on symptom pattern**
  - (Persistent asthma) – regular leukotriene receptor antagonist (LTRA) leads to modest reduction in symptoms and need for OCS compared with placebo
  - (Intermittent viral-induced wheeze) – regular LTRA improves some outcomes but does not reduce risk of exacerbations
  - (Frequent viral-induced wheeze with interval symptoms) – consider episodic or as-needed ICS, but give a trial of regular ICS first
Step 3 (children ≤5 years) – medium dose ICS + as-needed inhaled SABA

**CONSIDER THIS STEP FOR CHILDREN WITH:**
- Infrequent viral wheezing and no or few interval symptoms
- Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year
- Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks.
- Give diagnostic trial for 3 months.

**Step 1:** Daily low dose ICS

**Leukotriene receptor antagonist (LTRA)**

**Intermittent ICS**

**Prefered controller choice**

**Other controller options**

**Reliever**

**Step 2:** Double ‘low dose’ ICS

**Low dose ICS + LTRA**

**Step 3:** Continue controller & refer for specialist assessment

**Step 4:**

- Asthma diagnosis, and not well-controlled on low dose ICS
- Not well-controlled on double ICS
- First check diagnosis, inhaler skills, adherence, exposures

**GINA 2017, Box 6-5 (7/8)**

© Global Initiative for Asthma
Step 3 (children ≤5 years) – medium dose ICS + as-needed inhaled SABA

- **Indication**
  - Asthma diagnosis, and symptoms not well-controlled on low dose ICS
  - First check symptoms are due to asthma, and check adherence, inhaler technique and environmental exposures

- **Preferred option: medium dose ICS with as-needed inhaled SABA**
  - Review response after 3 months

- **Other options**
  - Consider adding LTRA to low dose ICS (based on data from older children)
Step 4 (children ≤5 years) – refer for expert assessment

CONSIDER THIS STEP FOR CHILDREN WITH:

- Infrequent viral wheezing and no or few interval symptoms
- Symptom pattern consistent with asthma and asthma symptoms not well-controlled, or ≥3 exacerbations per year
- Symptom pattern not consistent with asthma but wheezing episodes occur frequently, e.g. every 6–8 weeks. Give diagnostic trial for 3 months.

PREFERRED CONTROLLER CHOICE

- Daily low dose ICS
- Leukotriene receptor antagonist (LTRA)
- Intermittent ICS
- As-needed short-acting beta₂-agonist (all children)

RELIEVER

- Other controller options

STEP 1

- As-needed short-acting beta₂-agonist (all children)

STEP 2

- Daily low dose ICS
- Leukotriene receptor antagonist (LTRA)
- Intermittent ICS

STEP 3

- Double ‘low dose’ ICS
- Low dose ICS + LTRA
- Add LTRA
- Inc. ICS frequency
- Add intermittent ICS

STEP 4

- Continue controller & refer for specialist assessment
- Asthma diagnosis, and not well-controlled on low dose ICS
- Not well-controlled on double ICS
- First check diagnosis, inhaler skills, adherence, exposures
Step 4 (children ≤5 years) – refer for expert assessment

- **Indication**
  - Asthma diagnosis, and symptoms not well-controlled on medium dose ICS
  - First check symptoms are due to asthma, and check adherence, inhaler technique and environmental exposures

- **Preferred option:** continue controller treatment and refer for expert assessment

- **Other options (preferably with specialist advice)**
  - Higher dose ICS and/or more frequent dosing (for a few weeks)
  - Add LTRA, theophylline or low dose OCS (for a few weeks only)
  - Add intermittent ICS to regular daily ICS if exacerbations are the main problem
  - ICS/LABA not recommended in this age group
### ‘Low dose’ inhaled corticosteroids (mcg/day) for children ≤5 years

<table>
<thead>
<tr>
<th>Inhaled corticosteroid</th>
<th>Low daily dose (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclometasone dipropionate (HFA)</td>
<td>100</td>
</tr>
<tr>
<td>Budesonide (pMDI + spacer)</td>
<td>200</td>
</tr>
<tr>
<td>Budesonide (nebulizer)</td>
<td>500</td>
</tr>
<tr>
<td>Fluticasone propionate (HFA)</td>
<td>100</td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>160</td>
</tr>
<tr>
<td>Mometasone furoate</td>
<td>Not studied below age 4 years</td>
</tr>
<tr>
<td>Triamcinolone acetonide</td>
<td>Not studied in this age group</td>
</tr>
</tbody>
</table>

- This is not a table of equivalence
- A low daily dose is defined as the dose that has not been associated with clinically adverse effects in trials that included measures of safety
Primary care management of acute asthma or wheezing in pre-schoolers

**Primary Care**
- Child presents with acute or sub-acute asthma exacerbation or acute wheezing episode

**Assess the Child**
- Consider other diagnoses
- Risk factors for hospitalization
- Severity of exacerbation?

**Mild or Moderate**
- Breathless, agitated
- Pulse rate ≥200 bpm (0-3 yrs) or ≥180 bpm (4-6 yrs)
- Oxygen saturation ≤92%
- **Start Treatment**
  - Salbutamol 100 mcg two puffs by pMDI + spacer or 2.5 mg by nebulizer
  - Repeat every 20 min for the first hour if needed
  - Controlled oxygen (if needed and available): target saturation 94-98%

**Monitor Closely** for 1-2 hours
- Transfer to high level care if any of:
  - Lack of response to salbutamol over 1-2 hrs
  - Any signs of severe exacerbation
  - Increasing respiratory rate
  - Decreasing oxygen saturation
- **Improving**
  - **Continue Treatment if Needed**
    - Monitor closely as above
    - If symptoms recur within 3-4 hrs
    - Give extra salbutamol 2-3 puffs per hour
    - Give prednisolone 2mg/kg (max: 20mg for <2 yrs; max: 30mg for 2-6 yrs) orally

**Discharge/Follow-up Planning**
- Ensure that resources at home are adequate
- Reliever: continue as needed
- Controller: consider need for, or adjustment of, regular controller
- Check inhaler technique and adherence
- Followup: within 1-3 days
- Provide and explain action plan

**Follow-up Visit**
- Reliever: Reduce to as-needed
- Controller: Continue or adjust depending on cause of exacerbation, and duration of need for extra salbutamol
- Risk factors: Check and correct modificable risk factors that may have contributed to exacerbation, including inhaler technique and adherence
- Action plan: Is it understood? Was it used appropriately? Does it need modification?
- Schedule next follow-up visit
Indications for immediate transfer to hospital for children ≤5 years

Transfer immediately to hospital if ANY of the following are present:

Features of severe exacerbation at initial or subsequent assessment
- Child is unable to speak or drink
- Cyanosis
- Subcostal retraction
- Oxygen saturation <92% when breathing room air
- Silent chest on auscultation

Lack of response to initial bronchodilator treatment
- Lack of response to 6 puffs of inhaled SABA (2 separate puffs, repeated 3 times) over 1-2 hours
- Persisting tachypnea* despite 3 administrations of inhaled SABA, even if the child shows other clinical signs of improvement

Unable to be managed at home
- Social environment that impairs delivery of acute treatment
- Parent/carer unable to manage child at home

*Normal respiratory rates (breaths/minute): 0-2 months: <60; 2-12 months: <50; 1-5 yrs: <40
Child presents with acute or sub-acute asthma exacerbation or acute wheezing episode

**ASSESS the CHILD**
- Consider other diagnoses
- Risk factors for hospitalization
- Severity of exacerbation?

**MILD or MODERATE**
- Breathless, agitated
- Pulse rate ≤200 bpm (0-3 yrs) or ≤180 bpm (4-5 yrs)
- Oxygen saturation ≥92%

**START TREATMENT**
- **Salbutamol** 100 mcg two puffs by pMDI + spacer or 2.5mg by nebulizer
- Repeat every 20 min for the first hour if needed
- **Controlled oxygen** (if needed and available): target saturation 94-98%

**MONITOR CLOSELY for 1-2 hours**
- Transfer to high level care if any of:
  - Lack of response to salbutamol over 1-2 hrs
  - Any signs of severe exacerbation
  - Increasing respiratory rate
  - Decreasing oxygen saturation

**SEVERE OR LIFE THREATENING**
- any of:
  - Unable to speak or drink
  - Central cyanosis
  - Confusion or drowsiness
  - Marked subcostal and/or sub-glottic retractions
  - Oxygen saturation <92%
  - Silent chest on auscultation
  - Pulse rate > 200 bpm (0-3 yrs) or >180 bpm (4-5 yrs)

**TRANSFER TO HIGH LEVEL CARE** (e.g. ICU)
- While waiting give:
  - **Salbutamol** 100 mcg 6 puffs by pMDI+spacer (or 2.5mg nebulizer). Repeat every 20 min as needed.
  - Oxygen (if available) to keep saturation 94-98%
  - **Prednisolone** 2mg/kg (max. 20 mg for <2 yrs; max. 30 mg for 2–5 yrs) as a starting dose
  - Consider 160 mcg ipratropium bromide (or 250 mcg by nebulizer). Repeat every 20 min for 1 hour if needed.
PRIMARY CARE: Patient presents with acute or sub-acute asthma exacerbation

ASSESS the PATIENT: Is it asthma? Risk factors for asthma-related death? Severity of exacerbation?

MILD or MODERATE: Talks in phrases, prefers sitting to lying, not agitated. Respiratory rate increased. Accessory muscles not used. Pulse rate 100–120 bpm. O₂ saturation (on air) 90–95%. PEF >50% predicted or best.

SEVERE: Talks in words, sits hunched forwards, agitated. Respiratory rate >30/min. Accessory muscles in use. Pulse rate >120 bpm. O₂ saturation (on air) <90%. PEF ≤50% predicted or best.

LIFE-THREATENING: Drowsy, confused or silent chest.

TRANSFER TO ACUTE CARE FACILITY: While waiting: give inhaled SABA and ipratropium bromide, O₂, systemic corticosteroid.

URGENT
MILD or MODERATE
Talks in phrases
Prefers sitting to lying
Not agitated
Respiratory rate increased
Accessory muscles not used
Pulse rate 100–120 bpm
O₂ saturation (on air) 90–95%
PEF >50% predicted or best

SEVERE
Talks in words
Sits hunched forwards
Agitated
Respiratory rate >30/min
Accessory muscles being used
Pulse rate >120 bpm
O₂ saturation (on air) < 90%
PEF ≤50% predicted or best

Short-acting beta₂-agonists
Consider ipratropium bromide
Controlled O₂ to maintain saturation 93–95% (children 94-98%)
Oral corticosteroids

Short-acting beta₂-agonists
Ipratropium bromide
Controlled O₂ to maintain saturation 93–95% (children 94-98%)
Oral or IV corticosteroids
Consider IV magnesium
Consider high dose ICS
Primary prevention of asthma

- The development and persistence of asthma are driven by gene-environment interactions
- For children, a ‘window of opportunity’ exists in utero and in early life, but intervention studies are limited
- For intervention strategies including allergen avoidance
  - Strategies directed at a single allergen have not been effective
  - Multifaceted strategies may be effective, but the essential components have not been identified
- Current recommendations are
  - Avoid exposure to tobacco smoke in pregnancy and early life
  - Encourage vaginal delivery
  - Advise breast-feeding for its general health benefits
  - Where possible, avoid use of acetaminophen and broad-spectrum antibiotics in the first year of life
References


• The Centers for Disease Control and Prevention (CDC, 2019) (Centers for Disease Control and Prevention [CDC], 2019) [Accessed 15 Feb. 2019].

• Annals of Allergy, Asthma & Immunology 2018 120, 559-579.e11DOI: (10.1016/j.anai.2018.04.002