Objectives

- Discuss guidelines for inpatient management of status asthmaticus
  - Recognize variability in asthma scoring tools, asthma pathways and mode of medication delivery
  - Understand interactions of therapies/medications provided
- Discuss how to improve transitions of care for patients with asthma
  - Identify discharge criteria
  - Assess ability to use home going medications
- Discuss inpatient asthma education
  - List what areas of education should be provided
  - Describe 1 new tool to augment asthma education
Inpatient Management

>6.1 MILLION CHILDREN IN US HAVE ASTHMA
135,000 HOSPITALIZATIONS/ YEAR

Case

- Kevin - 5 year old male with mild persistent asthma on fluticasone propionate HFA
  - Ran out of controller two weeks ago
  - Played with friend’s cat
- Increased WOB, wheezing and coughing
  - No fever, hives or angioedema
- 30 kg

- Call PCP
Management of asthma exacerbations in children: Home treatment algorithm for clinicians

Assess severity
Patients at high risk for a fatal attack require immediate medical attention after initial treatment. Symptoms and signs suggestive of a more serious exacerbation, such as marked breathlessness, inability to speak more than short phrases, use of accessory muscles, or cyanosis, should result in initial treatment while immediately consulting with a clinician.
Less severe signs and symptoms can be treated initially with assessment of response to therapy and further steps as listed below.

Initial treatment
Inhaled SABA (eg, albuterol [salbutamol]) MDI two to four puffs with valved holding chamber or 1.25 mg to 2.5 mg solution by nebulizer.
May give up to two treatments, 20 minutes apart.

Good response
No wheezing or dyspnea (assess tachypnea in young children).
Symptoms do not return within four hours of treatment.
Instructions for patients:
- Contact primary care clinician and/or asthma specialist for follow-up instructions and further management
- May continue inhaled SABA up to every four hours for 24 to 48 hours as needed

Incomplete response
Persistent wheezing and dyspnea (tachypnea) OR symptoms return within four hours of treatment.
Instructions for patient:
- Add oral glucocorticoid (eg, prednisone 2 mg/kg, maximum 60 mg), if available
- Continue inhaled SABA up to every two hours for up to eight hours after taking oral glucocorticoid; then every four hours for 24 to 48 hours, and then up to every four hours as needed
- Contact clinician urgently (same day) for further instructions regarding treatment plan and need for evaluation (eg, ED, same day office visit, or outpatient follow-up in 24 to 48 hours)

Poor response
Marked wheezing and dyspnea.
Instructions for patient:
- Add oral glucocorticoid (eg, prednisone 2 mg/kg, maximum 60 mg), if available
- Repeat inhaled SABA immediately
- If distress is severe (see top box) and/or nonresponsive to initial treatment, then immediately:
  - Contact clinician
  - Call for ambulance transport to ED (eg, call 9-1-1)

Reassess 10 to 20 minutes after each dose

MDI: metered-dose inhaler; SABA: short-acting beta2-agonist (quick-relief inhaler); ED: emergency department.

Management of asthma exacerbations in children: Home treatment algorithm for clinicians

Assess severity
Patients at high risk for a fatal attack require immediate medical attention after initial treatment. Symptoms and signs suggestive of a more serious exacerbation, such as marked breathlessness, inability to speak more than short phrases, use of accessory muscles, or drowsiness, should result in initial treatment while immediately consulting with a clinician.

Less severe signs and symptoms can be treated initially with assessment of response to therapy and further steps as listed below.

Initial treatment
Inhaled SABA (eg, albuterol [salbutamol] MDI two to four puffs with valved holding chamber or 1.25 mg to 2.5 mg solution by nebulizer).
May give up to two treatments, 20 minutes apart.

Reassess 10 to 20 minutes after each dose
Case-Home Plan #1

- Get away from cat
- Give albuterol now - Starting at 2.5 mg or 4 puffs
  - Nebulized - 2.5 to 5 mg
    - Dose 0.15 mg/kg to 0.3 mg/kg
  - Inhaler with spacer - 4-8 puffs
    - Dose ¼-1/3 puff/kg (2-8 puffs)
- Give albuterol second time in 20 minutes if needed
  - then q4-6 hours PRN
- May give fluticasone propionate HFA 4x home dose
  - Doubled not effective, this is not proven either
**Good response**
No wheezing or dyspnea (assess tachypnea in young children).
Symptoms do not return within four hours of treatment.
Instructions for patient:
- Contact primary care clinician and/or asthma specialist for follow-up instructions and further management.
- May continue inhaled SABA up to every four hours for 24 to 48 hours as needed.

**Incomplete response**
Persistent wheezing and dyspnea (tachypnea) OR symptoms return within four hours of treatment.
Instructions for patient:
- Add oral glucocorticoid (eg, prednisone 0.5 mg/kg, maximum 60 mg), if available.
- Continue inhaled SABA up to every two hours for up to eight hours after taking oral glucocorticoid, then every four hours for 24 to 48 hours, and then up to every four hours as needed.
- Contact clinician urgently (same day) for further instruction regarding treatment plan and need for evaluation (eg, ED, same day office visit, or outpatient follow-up in 24 to 48 hours).

**Poor response**
Marked wheezing and dyspnea.
Instructions for patient:
- Add oral glucocorticoid (eg, prednisone 2 mg/kg, maximum 60 mg), if available.
- Repeat inhaled SABA immediately.
- If distress is severe (see top box) and/or nonresponsive to initial treatment, then immediately:
  - Contact clinician
  - Call for ambulance transport to ED (eg, call 9-1-1)

To ED

MDI: metered-dose inhaler; SABA: short-acting beta₂ agonist (quick-relief inhaler); ED: emergency department.

After 2nd albuterol patient still in respiratory distress, now with retractions

PCP recommended emergency care

In triage: RR 35 HR 130 Pox 92%

Suprasternal and subcostal retractions, decreased AE, inspiratory and expiratory wheezing, dyspneic with sentences
Examples of Asthma Scoring

- Certain tools can help with deciding to admit (PASS)
- Interrater differences
  - Eggink et al shows insufficient validity and reliability
  - No auscultation, dyspnea not asthma
- Modified hospital to hospital
<table>
<thead>
<tr>
<th>Signs</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suprasternal retractions</td>
<td>Absent</td>
<td>Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scalene muscle contraction</td>
<td>Absent</td>
<td>Present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air entry*</td>
<td>Normal</td>
<td>Decreased at bases</td>
<td>Widespread decrease</td>
<td>Absent/minimal</td>
</tr>
<tr>
<td>Wheezing*</td>
<td>Absent</td>
<td>Expiratory only</td>
<td>Inspiratory and expiratory</td>
<td>Audible without stethoscope/silent chest with minimal air entry</td>
</tr>
<tr>
<td>O₂ saturation</td>
<td>≥95%</td>
<td>92%-94%</td>
<td>&lt;92%</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. *If asymmetric findings between the right and left lungs, the most severe side is rated. Reprinted from The Journal of Pediatrics, Vol. 137, Issue 6. Chalut DS, Ducharme FM, Davis GM. The Preschool Respiratory Assessment Measure (PRAM): A responsive ... 

Francine M. Ducharme, Dominic Chalut, Laurie Plotnick, Cheryl Savdie, Denise Kudirka, Xun Zhang, Linyan Meng, David McGillivray

The Pediatric Respiratory Assessment Measure: A Valid Clinical Score for Assessing Acute Asthma Severity from Toddlers to Teenagers


http://dx.doi.org/10.1016/j.jpeds.2007.08.034

<table>
<thead>
<tr>
<th>Score</th>
<th>&lt;6 Years</th>
<th>≥6 Years</th>
<th>Wheezing</th>
<th>Accessory Muscle Use—Sternocleidomastoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&lt;30</td>
<td>&lt;20</td>
<td>None</td>
<td>No apparent increase</td>
</tr>
<tr>
<td>1</td>
<td>31–45</td>
<td>21–35</td>
<td>Terminal expiration with stethoscope</td>
<td>Mild increase</td>
</tr>
<tr>
<td>2</td>
<td>46–60</td>
<td>36–50</td>
<td>Entire expiration with stethoscope</td>
<td>Increased</td>
</tr>
<tr>
<td>3</td>
<td>&gt;60</td>
<td>&gt;50</td>
<td>Inspiration and expiration without stethoscope</td>
<td>Maximal activity</td>
</tr>
</tbody>
</table>
# Pediatric Asthma Score

1. PAS should be done prior to treatment and repeated 15 minutes afterward (preferably by the same provider).
2. Add elements into a single score.
3. Document score in Epic flowsheet

## Elements and Points

<table>
<thead>
<tr>
<th>Element</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td><strong>1. Respiratory Rate</strong></td>
<td></td>
</tr>
<tr>
<td>Obtain over 30 sec and multiple by 2</td>
<td>≤34</td>
</tr>
<tr>
<td>2-3 yrs</td>
<td></td>
</tr>
<tr>
<td>4-5 yrs</td>
<td>≤30</td>
</tr>
<tr>
<td>6-11 yrs</td>
<td>≤26</td>
</tr>
<tr>
<td>≥12 yrs</td>
<td>≤23</td>
</tr>
<tr>
<td><strong>2. Auscultation</strong></td>
<td>No Wheezes</td>
</tr>
<tr>
<td>Auscultate anterior and posterior lung fields. Assess air entry and presence of wheezing.</td>
<td></td>
</tr>
<tr>
<td><strong>3. Work of Breathing</strong></td>
<td>≤ 1 sign</td>
</tr>
<tr>
<td>Assess for nasal flaring or retractions. (suprasternal, intercostal, subcostal)</td>
<td></td>
</tr>
<tr>
<td><strong>4. Dyspnea</strong></td>
<td>Speaks full sentences, playful, AND takes PO well</td>
</tr>
<tr>
<td>As developmentally appropriate.</td>
<td></td>
</tr>
<tr>
<td>*If sleeping AND not showing physical signs of respiratory distress, score the patient 0 (zero) for this category.</td>
<td></td>
</tr>
<tr>
<td><strong>5. O₂ Requirement</strong></td>
<td>≥ 92% on RA</td>
</tr>
<tr>
<td><strong>Do not take patients off supplemental oxygen to obtain score.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Management of asthma exacerbations: Emergency department and hospital-based care

Initial assessment
- S&O, physical examination ( Auscultation, use of accessory muscles, heart rate, respiratory rate, 
  PEF, or FEV1, oxygen saturation, and other tests as indicated)

PEF, or FEV1 < 40% (mild to moderate)
- Oxygen to achieve SaO2 ≥ 94%
- Inhaled SABA for rapid or MDI with spacer holder chambers, up to three doses in first hour
- Oral systemic glucocorticoids
- Incremental oral systemic glucocorticoids if no satisfactory response or if patient requires two oral systemic glucocorticoids

PEF, or FEV1 ≤ 40% (severe)
- Oxygen to achieve SaO2 ≥ 94%
- High-dose inhaled SABA plus nebulized or MDI plus spacer holder chambers every 20 minutes or continuously for one hour
- Oral systemic glucocorticoids
- Consider adjunct therapies

Impending or actual respiratory arrest
- Intubation and mechanical ventilation with 100% oxygen
- Nebulized SABA and ipratropium
- Intravenous glucocorticoids
- Consider adjunct therapies

Repeat assessment
- Symptoms, physical examination, PEF, O2 saturation, other tests as needed

Admit to hospital intensive care (see below)

Moderate exacerbation
- FEV1 or PEF 60 to 85% predicted/personal best
- Physical exam: moderate symptoms
- Inhaled beta 2 agonist every 8 hours
- Oral systemic glucocorticoids
- Incremental dose if no improvement after initial treatment
- Nebulized SABA 4-6 times, hourly or continuous
- Oral systemic glucocorticoids
- Consider adjunct therapies

Severe exacerbation
- FEV1 or PEF < 40% predicted/personal best
- Physical exam: severe symptoms at rest, accessory muscle use, chest retraction
- History: high-risk patient
- BP improvement after initial treatment
- Nebulized SABA (4-6 times, hourly or continuous)
- Oral systemic glucocorticoids
- Consider adjunct therapies

Good response
- FEV1 or PEF > 70% 
- Response sustained 60 minutes after last treatment
- No dyspnea
- Physical exam: normal

Incomplete response
- FEV1 or PEF 60 to 85%
- MILD to moderate symptoms

Discharge home
- Continue treatment with inhaled SABA
- Continue course of oral systemic glucocorticoids
- Consider initiation of inhaled glucocorticoids
- Patient education
- Review medications, including inhaler technique
- Bronchodilator action plan
- Follow-up in one to four weeks

Admit to hospital ward
- Oxygen
- Nebulized SABA
- Oral systemic glucocorticoids
- Consider adjunct therapies
- Improve

Individualized decision regarding hospitalization

Admit to hospital intensive care
- Oxygen
- Inhaled SABA hourly or continuously
- Intravenous glucocorticoids
- Consider adjunct therapies
- Possible intubation and mechanical ventilation

Poor response
- FEV1 or PEF < 40%
- PCO2 > 44 mmHg
- Physical exam: severe symptoms, duskyness, confusion

Discharge home
- Continue treatment with inhaled SABA
- Continue course of oral systemic glucocorticoids
- Continue inhaled glucocorticoids
- For those not on long-term control therapy, consider initiation of inhaled glucocorticoids
- Patient education: review medications, including inhaler techniques, and, whenever possible, environmental control measures; review/revise action plan; set up follow-up
- Before discharge, schedule follow-up appointment with primary care provider and/or asthma specialist in one to four weeks

PEF: peak expiratory flow; FEV1: forced expiratory volume in 1 second; SaO2: oxygen saturation; SABA: short-acting beta2 agonist; POC2: partial pressure carbon dioxide; MDS: metered-dose inhaler

Management of asthma exacerbations: Emergency department and hospital-based care

Initial assessment
Brief history, physical examination (auscultation, use of accessory muscles, heart rate, respiratory rate), PEF or FEV₁, oxygen saturation, and other tests as indicated.

FEV₁ or PEF ≥40% (mild-to-moderate)
- Oxygen to achieve SaO₂ ≥90%
- Inhaled SABA by nebulizer or MDI with valved holding chamber, up to three doses in first hour
- Oral systemic glucocorticoids if no immediate response or if patient recently took oral systemic glucocorticoids

FEV₁ or PEF <40% (severe)
- Oxygen to achieve SaO₂ ≥90%
- High-dose inhaled SABA plus ipratropium by nebulizer or MDI plus valved holding chamber, every 20 minutes or continuously for one hour
- Oral systemic glucocorticoids

Impending or actual respiratory arrest
- Intubation and mechanical ventilation with 100% oxygen
- Nebulized SABA and ipratropium
- Intravenous glucocorticoids
- Consider adjunct therapies

Repeat assessment
Symptoms, physical examination, PEF, O₂ saturation, other tests as needed

Moderate exacerbation
FEV₁ or PEF 40 to 69% predicted/personal best
- Physical exam: moderate symptoms
  - Inhaled SABA every 60 minutes
  - Oral systemic glucocorticoids
  - Continue treatment one to three hours, provided there is improvement; make admit decision in <4 hours

Severe exacerbation
FEV₁ or PEF <40% predicted/personal best
- Physical exam: severe symptoms at rest, accessory muscle use, chest retraction
- History: high-risk patient
- No improvement after initial treatment
  - Oxygen
  - Nebulized SABA + ipratropium, hourly or continuous
  - Oral systemic glucocorticoids
  - Consider adjunct therapies

Admit to hospital intensive care (see box below)
Corticosteroids

- Can be given oral (preferred), intravenously or intramuscularly
- Prednisone, prednisolone, methylprednisolone, dexamethasone
- Dexamethasone 0.6 mg/kg for 2 doses
- Using double of the ICS dose not recommended
- Reverses desensitization and downregulation of beta receptors
  - Improves effect of bronchodilation of SABA
Putative intracellular mechanisms for interaction between β agonists and corticosteroids.
Care pathway example

- Seattle Children’s
- Nebulizer and Inhaler
SABA Delivery

**Nebulizer**
- Can administer with oxygen
- Can add ipratropium
- Do not need to coordinate breaths

**Inhaler with spacer**
- Faster to use
- Precise medication delivery
- No power source
- No reliance on machine
Case - Admission

- Kevin’s work of breathing and wheezing improve but still present
  - Ipratropium given appropriately

- Plan for admission
Admission Criteria

- **Illness severity**
  - Frequency of albuterol more often than q4h
    - Oxygen requirement/low oxygen saturation on pulse oximetry after 1 hour

- **Increased risk**
  - Severe explosive
  - Poor adherence
  - Frequent SABA at home

- **Social concerns**
  - Difficulty with transportation
  - Concerns for appropriate medical care at home
Inpatient Management

- Inhaled short-acting selective beta-2 adrenergic agonists (SABA)
- Systemic glucocorticoids
- Oxygen
- Asthma education
- Controllers
Admit to Hospital

**Good response**
- FEV₁ or PEF ≥70%
- Response sustained 60 minutes after last treatment
- No distress
- Physical exam: normal

**Discharge home**
- Continue treatment with inhaled SABA
- Continue course of oral systemic glucocorticoids
- Consider initiation of inhaled glucocorticoids
- Patient education
- Review medications, including inhaler technique
- Review/initiate action plan
- Recommend close medical follow-up

**Incomplete response**
- FEV₁ or PEF 40 to 69%
- Mild-to-moderate symptoms

**Individualized decision regarding hospitalization**

**Poor response**
- FEV₁ or PEF <40%
- PCO₂ ≥42 mmHg
- Physical exam: symptoms severe, drowsiness, confusion

**Admit to hospital intensive care**
- Oxygen
- Inhaled SABA hourly or continuously
- Intravenous glucocorticoids
- Consider adjunct therapies
- Possible intubation and mechanical ventilation

**Admit to hospital ward**
- Oxygen
- Inhaled SABA
- Systemic (oral or intravenous) glucocorticoids
- Consider adjunct therapies
- Monitor vital signs, FEV₁ or PEF, SaO₂

**Discharge home**
- Continue treatment with inhaled SABAs
- Continue course of oral systemic glucocorticoids
- Continue on inhaled glucocorticoids. For those not on long-term control therapy, consider initiation of inhaled glucocorticoids.
- Patient education (e.g., review medications, including inhaler technique and, whenever possible, environmental control measures; review/initiate action plan; recommend close medical follow-up)
- Before discharge, schedule follow-up appointment with primary care provider and/or asthma specialist in one to four weeks

PEF: peak expiratory flow; FEV₁: forced expiratory volume in 1 second; SaO₂: oxygen saturation; SABA: short-acting beta₂-agonist; PCO₂: partial pressure carbon dioxide; MDI: metered-dose inhaler.

Administration of SABA

- Albuterol
- Nebulizer
  - <30kg = 2.5 mg
  - >30kg = 5 mg
- MDI with spacer
  - Skill to use
  - Dose: 4 (2.5)-8 (5) puffs
- Bronchodilation and Vasodilation
- Nebulized with oxygen at 6-8 L/min
  - V/Q mismatch
V/Q Mismatch

- Matched
  - Increased blood flow to better ventilated areas
  - Decreased blood flow to obstructed alveoli
- After albuterol, vasodilation to obstructed alveoli

Oxygen Saturation Monitoring

- Check 5-10 minutes after changing flow rate
- Prior to SABA
- While sleeping
Frequency of SABA

- Based on severity or asthma score
  - PRAM, PIS, PS, RAD
- Institutional clinical pathways
  - Improve length of stay and hospital costs
- Every 2-4 or 6 hours consistently given
- Space as tolerated, do not discontinue
Case - Admitted

- Friend who had cat watches Kevin while mom takes a break
- Mom comes back smelling like cigarettes

- Kevin starts coughing and wheezing again with increased distress not improved with PRN albuterol with start of symptoms

- Pox now at 88%
**When to worry**

### Signs of Clinical Deterioration

- **Worsening hypoxia**
- **Chest pain**
- **Absence of breath sounds on one side**

The following are *red flags* that a patient may have impending respiratory failure:

<table>
<thead>
<tr>
<th><strong>Sign</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inadequate response to therapy:</strong></td>
<td>Characterized by a patient who receives optimal therapy and does not improve clinically.</td>
</tr>
<tr>
<td><strong>Failure to progress along the pathway:</strong></td>
<td>This is defined as 12 hours in any phase.</td>
</tr>
<tr>
<td><strong>Drowsiness:</strong></td>
<td>Drowsiness is highly associated with acute respiratory acidosis. (100)</td>
</tr>
<tr>
<td><strong>Silent chest exam:</strong></td>
<td>The absence of breath sounds in a patient with respiratory distress.</td>
</tr>
<tr>
<td><strong>Hypercapnea:</strong></td>
<td>Values cited for hypercapnea in an asthmatic range from a pCO2 of &gt;40-45. (1,4,5,100-104)</td>
</tr>
<tr>
<td><strong>Confusion:</strong></td>
<td>Altered mental status</td>
</tr>
</tbody>
</table>
Continuous SABA

- Dose 0.5 mg/kg (adults 10-15 mg/hour)
- Use if requiring SABA more than q2h
- Monitor for hypokalemia, hypomagnesemia, hypophosphatemia
- Lactic acidosis, hyperglycemia
- Tachycardia, anxiety
Supplemental Oxygen

- Clinical Protocol from Cincinnati via UpToDate
  - ≥94 percent – Decrease the flow rate by one-quarter L/minute for children who weigh <15 kg and by one-half L/minute for children who weigh ≥15 kg
  - ≤90 percent – Increase the flow rate to achieve a saturation of 91 to 94 percent
  - 91 to 94 percent – Continue the same flow rate
- Nasal cannula or ventimask
- Ventilation-perfusion mismatch after SABA up to 30 minutes
Magnesium Sulfate

- When not responding to albuterol
- Usually in ED or PICU
- Dose: 50 mg/kg IV
- Hypotension
Epinephrine Subcutaneous

- Anaphylaxis
- Dose 0.01 mg/kg
- Use with severe explosive asthma
  - IM pens for home
- Tachycardia/arrhythmia
Other medications

- Terbutaline (systemic beta agonist)
- Aminophylline (methylxantines)
- Ipratropium bromide

- Leukotriene receptor antagonists not given during exacerbation
Chest Xray

- Acute worsening
  - Atelectasis, pneumothorax
  - Pneumomediastinum, pneumonia
- Not responding appropriately
  - Vascular ring, foreign body
Chest Physiotherapy

- Not recommended
- Could be used for atelectasis
Pulmonary Function

- FEV1 assessed
  - By spirometry or peak expiratory flow rate (PEFR)
  - At admission, 15-20 minutes after SABA then daily
  - > 5 years old
Flattened inspiratory flow curve

Inspiration

Expiration

Gas trapping:
Flow curve does not return to zero before the next breath

“scooped out” expiratory flow

Reduced peak expiratory flow rate

Case - Admission

- After intervention and removing triggers, Kevin improves
- He is weaning down on albuterol and tolerating food
- What is an appropriate dose for discharge?
Transition of Care
Discharge Criteria

- Mild respiratory scores
- No oxygen
  - How long to monitor on room air?
- SABA q4-6 hours
- Access to home medications
- Ability to follow up
- Asthma Education/Action Plan
Home Medications

- SABA q4-6 hours for 1-5 days ***
- Corticosteroid
- Controller Medication
Figure 4-1a. Stepwise Approach for Managing Asthma in Children 0-4 Years of Age

**Step 1** Preferred: SABA PRN

**Step 2** Preferred: Low-dose ICS

**Step 3** Preferred: Medium-dose ICS

**Step 4** Preferred: High-dose ICS + either LABA or Montelukast

**Step 5** Preferred: High-dose ICS + either LABA or Montelukast

**Step 6** Step up if needed (first, check adherence, inhaler technique, and environmental control)

- Assess control
- Step down if possible (and asthma is well controlled at least 3 months)

**Patient Education and Environmental Control at Each Step**

- Quick Relief Medication for All Patients:
  - SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms.
  - With viral respiratory infection: SABA q 4-6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if exacerbation is severe or patient has history of previous severe exacerbations.
  - Caution: Frequent use of SABA may indicate the need to step up treatment. See text for recommendations on initiating daily long-term control therapy.
FIGURE 4-1b. STEPWISE APPROACH FOR MANAGING ASTHMA IN CHILDREN 5–11 YEARS OF AGE

**Persistent Asthma: Daily Medication**
Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.

**Step 1**
Preferred: Low-dose ICS
Alternative: Cromolyn, LTRA, Nedocromil, or Theophylline
Preferred: SABA PRN

**Step 2**
Preferred: Medium-dose ICS + LTRA
Alternative: High-dose ICS + either LTRA or Theophylline
Preferred: Low-dose ICS + either LABA, LTRA, or Theophylline
Alternative: Medium-dose ICS + either LTRA or Theophylline

**Step 3**
Preferred: Medium-dose ICS + LABA
Alternative: High-dose ICS + either LTRA or Theophylline

**Step 4**
Preferred: High-dose ICS + LABA
Alternative: Medium-dose ICS + either LTRA or Theophylline

**Step 5**
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

**Step 6**
Preferred: High-dose ICS + LABA + oral systemic corticosteroid
Alternative: High-dose ICS + either LTRA or Theophylline + oral systemic corticosteroid

Step up if needed (first, check adherence, inhaler technique, environmental control, and comorbid conditions)
Assess control
Step down if possible (and asthma is well controlled at least 3 months)

Each step: Patient education, environmental control, and management of comorbidities.
Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have allergic asthma (see notes).

Quick-Relief Medication for All Patients
- SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed.
- Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.
**Figure 4–2a. Classifying Asthma Severity and Initiating Treatment in Children 0–4 Years of Age**

Assessing severity and initiating therapy in children who are not currently taking long-term control medication

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (0–4 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>0</td>
</tr>
<tr>
<td>Short-acting beta; agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week but not daily</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Risk</td>
<td>0–1/year</td>
</tr>
<tr>
<td>Recommended Step for Initiating Therapy</td>
<td>Step 1</td>
</tr>
</tbody>
</table>

(See figure 4–1a for treatment steps.)

Exacerbations of any severity may occur in patients in any severity category.
**Figure 4-2b. Classifying Asthma Severity and Initiating Treatment in Children 5–11 Years of Age**

Assessing severity and initiating therapy in children who are not currently taking long-term control medication.

<table>
<thead>
<tr>
<th>Components of Severity</th>
<th>Classification of Asthma Severity (5–11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intermittent</td>
</tr>
<tr>
<td>Impairment</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2/week</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal FEV₁ between exacerbations</td>
</tr>
<tr>
<td></td>
<td>FEV₁/FVC &gt;85%</td>
</tr>
</tbody>
</table>

**Risk**

- Exacerbations requiring oral systemic corticosteroids:
  - 1/year (see note)
  - ≥2/year (see note)

**Relative annual risk of exacerbations may be related to FEV₁**.

**Recommended Step for Initiating Therapy**

(See figure 4-1b for treatment steps.)

- Step 1: Step 2: Step 3, medium-dose ICS option and consider short course of oral systemic corticosteroids

In 2–6 weeks, evaluate level of asthma control that is achieved, and adjust therapy accordingly.
### Figure 4-3a. Assessing Asthma Control and Adjusting Therapy in Children 0-4 Years of Age

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Classification of Asthma Control (0-4 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td><strong>Impairment</strong></td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤1x/month</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>None</td>
</tr>
<tr>
<td>Interference with</td>
<td></td>
</tr>
<tr>
<td>normal activity</td>
<td></td>
</tr>
<tr>
<td>Short-acting beta-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td><strong>Risk</strong></td>
<td></td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0-1/year</td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
</tr>
</tbody>
</table>

#### Recommended Action for Treatment

- Maintain current treatment.
- Regular followup every 1-6 months.
- Consider step down if well controlled for at least 3 months.

- Step up (1 step) and Reevaluate in 2-6 weeks.
- If no clear benefit in 4-6 weeks, consider alternative diagnoses or adjusting therapy.
- For side effects, consider alternative treatment options.

- Consider short course of oral systemic corticosteroids.
- Step up (1-2 steps), and Reevaluate in 2 weeks.
- If no clear benefit in 4-6 weeks, consider alternative diagnoses or adjusting therapy.
- For side effects, consider alternative treatment options.
### Figure 4–3b. Assessing Asthma Control and Adjusting Therapy in Children 5–11 Years of Age

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Classification of Asthma Control (5–11 years of age)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>≤2 days/week but not more than once on each day</td>
</tr>
<tr>
<td><strong>Nighttime awakenings</strong></td>
<td>≤1x/month</td>
</tr>
<tr>
<td><strong>Interference with normal activity</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Impairment</strong></td>
<td></td>
</tr>
<tr>
<td>Short-acting beta-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Lung function</td>
<td></td>
</tr>
<tr>
<td>• FEV1, or peak flow</td>
<td>&gt;80% predicted/personal best</td>
</tr>
<tr>
<td>• FEV1/FVC</td>
<td>&gt;60%</td>
</tr>
<tr>
<td>Risk</td>
<td></td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0–1/year</td>
</tr>
<tr>
<td>Reduction in lung growth</td>
<td>Evaluation requires long-term followup.</td>
</tr>
<tr>
<td>Treatment-related adverse effects</td>
<td>Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.</td>
</tr>
</tbody>
</table>

**Recommended Action for Treatment**

(See figure 4–1b for treatment steps.)

- **Maintain current step.**
- **Regular followup every 1–6 months.**
- **Consider step down if well controlled for at least 3 months.**
- **Step up at least 1 step and reevaluate in 2–6 weeks.**
- For side effects: consider alternative treatment options.
- **Consider short course of oral systemic corticosteroids,**
- Step up 1–2 steps, and reevaluate in 2 weeks.
- For side effects: consider alternative treatment options.
Inhalers

Some metered dose inhalers have built-in dose counters. When the counter reads 0 (zero), there is no medicine left in the inhaler.

These pictures show different types of spacers, with and without a face mask. A spacer makes it easier to use an inhaler and helps more of the medicine reach the lungs. Picture A shows an AeroChamber spacer. Picture B shows an AeroChamber spacer with a face mask. Picture C shows an InspiEase spacer.
Dry powder inhalers

Single-dose devices

Multiple-dose devices

These are pictures of different dry powder inhalers. The inhalers shown are: (A) Aerolizer, (B) HandiHaler, (C) NeoHaler, (D) Tobi Podhaler, (E) Flexhaler, (F) Diskus, (G) Twisthaler, and (H) Breo Ellipta. There are two main types of dry powder inhalers, called single-dose inhalers and multiple-dose inhalers. The Aerolizer, HandiHaler, NeoHaler, and Tobi Podhaler are single-dose inhalers. The others in the picture are multiple-dose inhalers.

Panels A, B, E, F, and G: Courtesy of Dean Hess, RRT, PhD.
Panel C: Image used with permission. Copyright © 2012 Novartis Pharmaceuticals Corporation.
Panel D: Image used with permission. Copyright © 2013 Novartis Pharmaceuticals Corporation.
Panel H: Reproduced with permission. Copyright © 2014 GlaxoSmithKline. All rights reserved.
Choosing The Best AeroChamber® For Your Patient

The Aerochamber® spacer ensures that inhaled medicine gets deeper into the smaller airways of the lungs. Proper fit and technique are critical for efficient aerosol delivery through holding chamber devices.

**Infant fits 0-18mths**
- Should seal on face over the bridge of nose and cleft of chin
- May be too small for some larger infants/toddlers
- Maintain seal for 5 good breaths

**Child fits 12mths-5yrs.**
- Should seal on face over the bridge of nose and cleft of chin
- Maintain seal for 5 good breaths
- Not appropriate for most children 6 years and older

**Adult fits >5yrs.**
- Most children, age 5-6 years old should be able to use
- One slow deep inspiration and hold for 10 seconds
- It is acceptable for children to take 5 breaths and exhale into the spacer if unable to hold breath for 10 seconds.
Peak Flow
Symptom identification

- Diary
- Close follow up with
  - PCP
  - Allergist/Pulmonologist
- Identifying triggers
Asthma Education

Tell me and I forget.
Teach me and I remember.
Involve me and I LEARN.

- Benjamin Franklin
Information

Function and use of medication
Pathophysiology of asthma
Issues in prevention and treatment of asthma

National Asthma Education and Prevention Program guidelines for the diagnosis and management of asthma: The content of patient teaching

- Definition of asthma
- Key points about signs and symptoms of asthma
- Characteristic changes in the airways of asthma patients and the role of medication
- Asthma triggers and how to avoid or control them
- Treatment
- Patient fears concerning medication
- Use of written guidelines
- Use of written diaries
- Correct use of inhalers
- Criteria for premedicating to prevent onset of symptoms
- Optimal use of home peak expiratory flow rate monitoring
- Evaluation of results of treatment plan
- Fears and misconceptions
- Family understanding and support
- Communication with the child’s school (by parents and clinician)
- Feelings about asthma
Tools for Kids

- https://iggyandtheinhalers.com
- http://www.cdc.gov/asthma/children.htm

Asthma FAST FACTS for Kids

What is Asthma?
Asthma (az-ma) is when air can’t get into your lungs and you have trouble breathing.

What causes an asthma attack?
An asthma attack is when you have trouble catching your breath. Many different asthma “triggers” can cause this to happen. Some common “triggers” are:

- Colds
- Pets
- Fumes
- Mold
- Dust
- Smoke
- Exercise
- Weather

The tubes that take air to your lungs get too tight (like a pinched straw) and this makes it hard for you to breathe.

ACTIVITY: Do you know the difference between a normal airway and an airway with asthma?

- Normal Airway: Look how wide open it is! Air flows easily in and out.
- Airway with Asthma: The inside of the airway is swollen and inflamed! Color it red.

- When everything’s okay, there’s no swelling inside the airway.
- Color the normal lining of the airway orange.
- Now let’s take a look at an airway with asthma!
- Color the mucus plugs up the airway! Color it green.
- The mucus is plugging up the airway! Color it green!

Centers for Disease Control and Prevention’s (CDC) National Asthma Control Program
Teach Back

- Recommended by National Quality Forum and The Joint Commission to assess for and ensure understanding of discharge instructions with patients and their caregivers.
Figure 1. “Teach-back” project intervention.
Kornburger C et al
“I want to make sure I explained this correctly…”

“I want to make sure I did a good job explaining this…”

“Can you tell me in your own words when you will follow up with the doctor?”

“Can you tell me in your own words how often you will be giving this medication at home?”

“Can you show me how you will do this dressing change at home?”

“Can you explain to me how you will be giving this medication at home?”

“What other questions do you have?”

Front side

Figure 2. “Teach-back” script card. Kornburger C et al
Adherence for ICS 44-72% in studies

Increased education with only small improvement

Patient monitoring symptoms helps, some
  - Diary
  - Peak Flow

Self-management discussions help with 5.5 hours of patient contact

Borreli et al
Motivational Interviewing

- Evidence-based approach of talking to people about change
- Patient-centered to build motivation and adherence
- OARS
  - Open questions
  - Affirmation
  - Compassion
  - Evocation (ideas from patient)
- Borrelli et al
- https://www.youtube.com/watch?v=lvxa64imMiY
Prochaska and DiClemente's Stage of Change Model

“If you were to take your medication consistently, what might be the best results you can imagine?”

“What worries you most about your asthma?”

“How does asthma stop you from doing the things you want to do?”

Borreli et al.

Riekhart et al performed pilot study with inner-city African-American adolescents with increased motivation. Caregivers with reported improved asthma symptoms and adherence. Adolescents did not report change. No control. Another study in the school system did improve reported symptoms.
Tell me and I
forget.
Teach me and I
remember.
Involve me and I
LEARN.

- Benjamin Franklin
Objectives

- Discuss guidelines for inpatient management of status asthmaticus
  - Recognize variability in asthma scoring tools, asthma pathways and mode of medication delivery
  - Understand types and interactions of therapies/medications provided
- Discuss how to improve transitions of care for patients with asthma
  - Identify discharge criteria
  - Assess ability to use home going medications
- Discuss inpatient asthma education
  - List what areas of education should be provided
  - Describe 1 new tool to augment asthma education
References


- Bailey W. What do patients need to know about their asthma? In: UpToDate. Hollingsworth H (Ed) UpToDate, Waltham, MA, 2015.


References


References


