The current practical issues in the management of pediatric allergic rhinitis and asthma

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Conflicts of Interest

• Speaker’s Bureau: AstraZeneca, Sanofi-Aventis, Merck, GSK, Alcon, Teva, Sunovium, Nycomed, Alcon, ISTA

• Consultant: AstraZeneca, Sanofi-Aventis, Merck, Alcon, Teva, Sunovium, Proctor & Gamble, Nycomed, Vectura, ISTA, Lupin
Learning Objectives

• To make familiar the specifics of treatment of rhinitis and asthma in children, especially in relation to safety, efficacy and easy administration for better compliance in pediatric populations

• Understand the use of spacers in asthma management in children
Epidemiology of allergic rhinitis and asthma

**Allergic Rhinitis**
- Occurs in up to 20% of the general population
- Occurs in approximately **85%** of asthmatics
- AR patients have a 3-fold risk of developing asthma

**Asthma**
- Occurs in roughly 5% of the general population
- Occurs in up to **50%** of AR patients

Allergic Rhinitis Management
Management of AR

• Avoidance Measures
• Proper Pharmacologic Therapy
• Allergen Immunotherapy
• Proper Education of the Patient/Caregiver

Pharmacologic Management Options for the Treatment of AR

- Oral Antihistamines
  - 1st Generation
  - 2nd Generation
- Intranasal Antihistamines
- Intranasal Corticosteroids
- Leukotriene-Receptor Antagonists (LTRAs)
- Oral Decongestants
- Intranasal Decongestants
- Intranasal Anticholinergics
Guidelines for the Treatment of Allergic Rhinitis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Joint Task Force on Practice Parameters for Rhinitis</th>
<th>Eur. Academy of Allergy and Clinical Immunology</th>
<th>ARIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergen avoidance</td>
<td>Indicated for all</td>
<td>Indicated for all</td>
<td>Indicated for all</td>
</tr>
<tr>
<td>1st-generation antihistamines</td>
<td>Not recommended</td>
<td>Not recommended</td>
<td>Not recommended</td>
</tr>
<tr>
<td>2nd-generation antihistamines</td>
<td>Safe and effective</td>
<td>First-line therapy</td>
<td>First-line therapy</td>
</tr>
<tr>
<td>Nasal corticosteroids</td>
<td>Most effective medication class</td>
<td>First line in moderate or severe persistent disease</td>
<td>First line in moderate or severe persistent disease</td>
</tr>
<tr>
<td>Mast-cell stabilizer</td>
<td>Safe and effective</td>
<td>Safe and effective, but less effective than antihistamines</td>
<td>Safe and effective, but less effective than antihistamines</td>
</tr>
<tr>
<td>Leukotriene-receptor antagonist</td>
<td>Equal efficacy to oral antihistamines (loratadine)</td>
<td>No comment</td>
<td>Indicated with modest evidence of efficacy</td>
</tr>
</tbody>
</table>

Adapted from Bousquet J, et al. Allergy. 2008;63(Suppl. 86):8-160; with permission from Blackwell Publishing LTD; Joint Task Force. Presentation presented at: The Annual Scientific Meeting of The American College of Allergy, Asthma & Immunology; November 8-14, 2007; Dallas, TX.
Antihistamines

Oral Antihistamines

1ST GENERATION
• Diphenhydramine
• Promethazine
• Triprolidine
• Chlorpheniramine
• Hydroxyzine

2ND GENERATION
• Cetirizine
• Loratadine
• Desloratadine
• Fexofenadine
• Levocetirizine

Intranasal Antihistamines
• Azelastine
• Olopatadine
First-Generation Antihistamines

• Characteristics
  – Highly lipophilic and readily cross the blood-brain barrier, significantly impairing CNS function
  – Short-acting
  – Poor selectivity; can also block adrenergic, serotonergic, dopaminergic receptors

• Safety
  – Adverse events due to their lack of selectivity, resulting in anticholinergic effects such as
    • dry mouth, tachycardia, urinary retention, and gastrointestinal disturbances
  – Adverse events caused by the ability to cross the blood-brain barrier, result in sedation and impairment of psychomotor and cognitive function.

Second-Generation Antihistamines:

- **Characteristics**
  - Long-acting
  - Greater selectivity
  - Little or no CNS penetration—large molecules, lipophobic
  - Equal or greater efficacy than first-generation antihistamines
  - Effective for sneezing, nasal itching, and rhinorrhea
  - Minimal decongestant effect

- **Safety**
  - Less sedation than first-generation antihistamines
  - With some products, dose escalation may increase likelihood of sedation

CNS = central nervous system.

Pharmacologic Agents

- Second-generation antihistamines are generally preferred over first-generation antihistamines for the treatment of allergic rhinitis.
- Intranasal antihistamines may be considered for use as first-line treatment for allergic and nonallergic rhinitis.
Therapeutic Decisions in Pediatric Patients with Allergic Rhinitis

- “When choosing treatment for children with AR, consideration must be given to the side effects of medications”
- “All first-generation and some second-generation antihistamines can be associated with adverse effects on cognitive function and learning, as a result of their sedative properties”
- “Treatment with a non-sedating second-generation antihistamine has been shown to improve learning potential and is a better choice for treatment in this population”

AR = allergic rhinitis.

Intranasal Antihistamines

- Intranasal antihistamines are efficacious and equal to or superior to oral second-generation antihistamines for treatment of seasonal allergic rhinitis.
- Intranasal antihistamines have been associated with a clinically significant effect on nasal congestion.
- Intranasal antihistamines are generally less effective than intranasal corticosteroids for treatment of allergic rhinitis.
Intranasal Corticosteroids

- Intranasal corticosteroids are the most effective medication class for controlling symptoms of allergic rhinitis.
- In most studies, intranasal corticosteroids have been shown to be more effective than the combined use of an antihistamine and leukotriene (LT) antagonist in the treatment of seasonal allergic rhinitis.
- Intranasal corticosteroids may provide significant relief of symptoms of seasonal allergic rhinitis when used not only on a regular basis but also on an as-needed basis.
Correct use

1. Shake bottle well
2. Look down
3. Use right hand for left nostril; put nozzle inside nose, aiming towards outside wall
4. Squirt one or twice (two different directions)
5. Change hands and repeat on other side
6. Do not sniff hard

Leukotriene Receptor Antagonists

- LTRAs are effective in the treatment of seasonal and perennial allergic rhinitis
- There is no significant difference in efficacy between LTRA and antihistamines (with loratadine as the usual comparator), and their concomitant use may be additive
- Although the concomitant administration of a LTRA and an antihistamine can have an additive effect, in general this approach is less efficacious than administering ICS as monotherapy
- However, such combination therapy may provide an alternative treatment for patients who are unresponsive to or not compliant with ICS
Joint Task Force AR Action Plan Model

Rhinitis Steps

- **Step 1:** Episodic
- **Step 2:** Mild (eg, 1 medication)
- **Step 3:** Mild to moderate (eg, 2 medications or change to another medication)
- **Step 4:** Moderate to severe (eg, 2–3 medications and/or change of 1 or more medications)
- **Step 5:** Severe (Oral corticosteroids)

Listed Pharmacologic Agents

- Prednisone
- Prednisolone
- Nasal corticosteroid
- Oral antihistamine
- Decongestant
- Nasal antihistamine
- Montelukast sodium
- Ipratropium bromide
- Nasal corticosteroid
- Oral antihistamine
- Decongestant
- Nasal antihistamine
- Montelukast sodium
- Ipratropium bromide
- Decongestant (oral or nasal)
- Antihistamine (oral or nasal)
- Eye drops
- Cromolyn sodium
- Nasal corticosteroid
- Ipratropium bromide

For symptom changes, step up or down as needed.

Immunotherapy

• Highly effective and disease modifying
• Candidates:
  – Moderate to severe symptoms
  – Lack of improvement with other modalities
  – Presence of comorbid conditions
  – Evidence of specific IgE sensitization based on testing
• Compliance in children higher with sublingual
• Subcutaneous probably more efficacious than sublingual
• Risk of anaphylaxis with subcutaneous
Asthma Management
• Recommended treatment approach focused on asthma severity and control
  – Assess asthma severity in patients who are not on long term control medication
    and begin treatment that is appropriate to the level of asthma severity
  – After initiating treatment, assess asthma control and determine if goals for
    therapy have been met
  – If necessary, consider adjustments to therapy (step up or step down)

• The most effective long-term control medications attenuate the underlying
  inflammation

• The Expert Panel concluded that inhaled corticosteroid (ICS) agents are
  the most consistently effective long-term control medications at all steps
  of care for persistent asthma
# 2007 NIH Asthma Guidelines: Patients 5-11 Years of Age
*(For patients newly diagnosed or on SABA alone)*

<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><strong>Interruption</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤2x/month</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Lung function</td>
<td>Normal FEV₁ between exacerbations</td>
</tr>
<tr>
<td></td>
<td>FEV₁ &gt;80% predicted</td>
</tr>
<tr>
<td></td>
<td>FEV₁/FVC &gt;85%</td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0–1/year</td>
</tr>
<tr>
<td><strong>Risk</strong></td>
<td>Relative annual risk of exacerbations may be related to FEV₁</td>
</tr>
</tbody>
</table>

**Recommended step for initiating therapy**

- **Step 1**
- **Step 2**
- **Step 3**, medium-dose ICS option and consider short course of systemic oral corticosteroids
- **Step 3**, medium-dose ICS option, or **step 4**

In 2–6 weeks, evaluate level of asthma control achieved; adjust therapy accordingly.

### Components of Control

<table>
<thead>
<tr>
<th>Impairment</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></td>
<td>≤2 days/week but not more than once on each day</td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤1x/month</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>None</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Short-acting β₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤2 days/week</td>
</tr>
<tr>
<td>Lung function: • FEV₁ or peak flow</td>
<td>&gt;80% predicted or personal best &gt;80% predicted</td>
</tr>
<tr>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0–1 per year</td>
</tr>
</tbody>
</table>

### Risk

<table>
<thead>
<tr>
<th>Treatment-related adverse effects</th>
<th>Evaluation requires long-term follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<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>
<td></td>
</tr>
</tbody>
</table>

### Recommended action for treatment

- Maintain current step
- Regular follow-up 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 systemic oral corticosteroids
- Step up 1–2 steps and reevaluate in 2 weeks
- For side effects: consider alternative treatment options

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### Components of Severity

<table>
<thead>
<tr>
<th>Impairment</th>
<th>Intermittent</th>
<th>Persistent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal FEV₁ / FVC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-19 yr 85%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-39 yr 80%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-59 yr 75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-80 yr 70%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤ 2 days / week</td>
<td>&gt; 2 days / week but not daily</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤ 2x / month</td>
<td>3-4x / month</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤ 2 days / week</td>
<td>&gt;2 days /week But not daily, and not more than 1x on any day</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
<td>Minor limitation</td>
</tr>
<tr>
<td>Lung Function</td>
<td>• Normal FEV₁ between exacerbations</td>
<td>• FEV₁ &gt;80% predicted</td>
</tr>
<tr>
<td></td>
<td>• FEV₁ / FVC normal</td>
<td>• FEV₁ / FVC normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• FEV₁ &gt;60% but &lt; 80% predicted</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• FEV₁ / FVC reduced 5%</td>
</tr>
<tr>
<td>Risk</td>
<td>Exacerbations requiring oral systemic corticosteroids</td>
<td>0-1 year</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

### Classification of Asthma Severity

<table>
<thead>
<tr>
<th>&gt; 12 years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intermittent</strong></td>
</tr>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

### Risk

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
<th>Step 4 or 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>and consider short course of oral systemic corticosteroids</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In 2-6 weeks, evaluate level of asthma control that is achieved and adjust to therapy accordingly.

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Key: EIB, exercise-induced bronchospasm; FEV₁, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit.

# Assessing Asthma Control in Youths >12 Years of Age and Adults

<table>
<thead>
<tr>
<th>Components of Control</th>
<th>Classification of Asthma Control &gt; 12 years of age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Well Controlled</td>
</tr>
<tr>
<td><strong>Impairment</strong></td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>Nighttime awakenings</td>
<td>≤ 2x/month</td>
</tr>
<tr>
<td>Interference with normal activity</td>
<td>None</td>
</tr>
<tr>
<td>Short-acting beta₂-agonist use for symptom control (not prevention of EIB)</td>
<td>≤ 2 days/week</td>
</tr>
<tr>
<td>FEV₁ or peak flow</td>
<td>&gt; 80% of predicted / personal best</td>
</tr>
<tr>
<td>Validated questionnaires</td>
<td></td>
</tr>
<tr>
<td>ATAQ</td>
<td>0</td>
</tr>
<tr>
<td>ACQ</td>
<td>≤ 0.75*</td>
</tr>
<tr>
<td>ACT</td>
<td>≥ 20</td>
</tr>
</tbody>
</table>

| Risk                  |                  |                    |                         |
| Exacerbations         | 0 – 1 / year     | > 2 / year         | Consider severity and interval since last exacerbation |
| required oral systemic corticosteroids |                  |                    |                         |
| Progressive loss of lung function | Evaluation requires long-term follow-up care | | |
| Treatment-related adverse effects | 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 | | |

**Recommended Action for Treatment**

(See “stepwise Approach for Managing Asthma” for treatment steps)

- **Well Controlled**
  - Maintain current step
  - Regular follow-up at every 1 – 6 months to maintain control
  - Consider step down if well controlled for at least 3 months

- **Not Well Controlled**
  - Step up 1 step
  - Reevaluate in 2 – 6 weeks
  - For side effects consider alternative treatment options

- **Very Poorly Controlled**
  - Consider short course of oral systemic corticosteroids
  - Step up 1 - 2 steps
  - Reevaluate in 2 weeks
  - For side effects consider alternative treatment options

*ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma. Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit

NIH Step Care Guidelines Recommend ICS as Preferred Long-Term Controller Therapy for Persistent Asthma

ICS = inhaled corticosteroid; LABA = long-acting $\beta_2$-agonist; LTRA = leukotriene receptor antagonist; SABA = short-acting $\beta_2$-agonist.


- Each step should include patient education, environmental control, and management of comorbidities
- Provide quick-relief medication for all patients
  - Use of SABA >2 days a week for symptom relief generally indicates inadequate control and the need to step up treatment
- Assess control and step down if possible
- LABAs in combination are not suggested before Step 3
### 2008 FDA meta-analysis of 110 studies evaluating the use of LABAs in 60,954 patients with asthma

**Number of Patients Experiencing an Event**

<table>
<thead>
<tr>
<th>Patient Population</th>
<th>LABA Patients Experiencing an Event</th>
<th>Non-LABA Patients Experiencing an Event</th>
<th>Risk Difference Estimate per 1,000 Treated Patients</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Patients</td>
<td>381</td>
<td>304</td>
<td>2.80</td>
<td>1.11 – 4.49</td>
</tr>
<tr>
<td>n=30,148 LABA Patients</td>
<td>n=30,806 Non-LABA Patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients Ages 12 to 17 Years of Age</td>
<td>48</td>
<td>30</td>
<td>5.57</td>
<td>0.21 – 10.92</td>
</tr>
<tr>
<td>n=3,103 LABA Patients</td>
<td>n=3,289 Non-LABA Patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients Ages 4 to 11 Years of Age</td>
<td>61</td>
<td>39</td>
<td>14.83</td>
<td>3.24 – 26.43</td>
</tr>
<tr>
<td>n=1,626 LABA Patients</td>
<td>n=1,789 Non-LABA Patients</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Event defined as the composite endpoint (asthma-related death, intubation, and hospitalization)

Step-up Therapy for Children with Uncontrolled Asthma Receiving Inhaled Corticosteroids

Introduction

• 182 children (6 to 17 years of age), who had uncontrolled asthma while receiving 100 μg of fluticasone twice daily, to receive each of three blinded step-up therapies in random order for 16 weeks:
  – 250 μg of fluticasone twice daily
  – 100 μg of fluticasone plus 50 μg of a long-acting beta-agonist twice daily
  – 100 μg of fluticasone twice daily plus 5 or 10 mg of a leukotriene-receptor antagonist daily

• Triple-cross-over design and a composite of three outcomes (exacerbations, asthma-control days, and the forced expiratory volume in 1 second) to determine whether the frequency of a differential response to the step-up regimens was more than 25%.
Pairwise Comparison of Three Step-up Therapies and the Overall Probability of Best Response

Conclusion

• Nearly all the children had a differential response to each step-up therapy.
• LABA step-up was significantly more likely to provide the best response than either ICS or LTRA step-up.
• However, many children had a best response to ICS or LTRA step-up therapy, highlighting the need to regularly monitor and appropriately adjust each child’s asthma therapy.
Aerosol Delivery Devices

- Nebulizers
  - Jet
  - Ultrasonic
- Pressurized metered-dose inhalers (MDI)
- Breath-actuated MDI
- MDI + spacer/holding chamber
- Dry powder inhalers (DPI)

Each device has its own advantages and disadvantages.
Spacers and Holding Chambers
Spacers and Holding Chambers

• No need to coordinate inhaling and actuating
• Decreased deposition of medication in oropharynx
• Decreased side effects
  – Important with inhaled corticosteroids
    • Oral candidiasis
    • Dysphonia
Points about spacers and MDIs

• Flow characteristics
  – Each MDI and spacer has different flow dynamics

• Spacer volume

• Number of actuations
  • More actuations in spacer, the less respirable dose

• Delay in actuation and inhalation
  – A 20 second delay reduce fine particle size 80%

• Static charge
Static charge

- Plastic spacers collect static electricity charge on their walls
  - This attracts the drug particles to them, reducing availability of the drug
  - Washing regularly removes the charge
- Polycarbonate spacers made of non electrostatic material are also available now
- Metal spacers do not collect static electricity, but are not very common
## Spacer Devices

<table>
<thead>
<tr>
<th>Device</th>
<th>Use in Small Children</th>
<th>Volume</th>
<th>Valved Chamber</th>
<th>Flow rate signal</th>
<th>Inhaler adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE</td>
<td>Yes (with mask)</td>
<td>170 ml</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A**</td>
</tr>
<tr>
<td>Aerochamber</td>
<td>Yes (with mask)</td>
<td>145 ml</td>
<td>Yes</td>
<td>Yes</td>
<td>Universal</td>
</tr>
<tr>
<td>Easivent</td>
<td>Yes (with mask)</td>
<td>140 ml</td>
<td>Yes</td>
<td>Yes</td>
<td>Universal</td>
</tr>
<tr>
<td>Ellipse</td>
<td>No</td>
<td>175 ml</td>
<td>No</td>
<td>No</td>
<td>Ovoid</td>
</tr>
<tr>
<td>E-Z Spacer #</td>
<td>Yes (with mask)</td>
<td>700 ml</td>
<td>No*</td>
<td>No</td>
<td>N/A**</td>
</tr>
<tr>
<td>Inspirease</td>
<td>No</td>
<td>700 ml</td>
<td>No*</td>
<td>Yes</td>
<td>N/A**</td>
</tr>
<tr>
<td>Medispace</td>
<td>Yes (with mask)</td>
<td>175 ml</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A**</td>
</tr>
<tr>
<td>LiteAire^</td>
<td>No</td>
<td>158 ml</td>
<td>Yes</td>
<td>No</td>
<td>Universal</td>
</tr>
<tr>
<td>Optichamber</td>
<td>Yes (with mask)</td>
<td>218 ml</td>
<td>Yes</td>
<td>Yes</td>
<td>Universal</td>
</tr>
<tr>
<td>Nebuhaler</td>
<td>No</td>
<td>750 ml</td>
<td>Yes</td>
<td>No</td>
<td>Oral</td>
</tr>
<tr>
<td>Ventahaler</td>
<td>No</td>
<td>750 ml</td>
<td>Yes</td>
<td>No</td>
<td>Oral</td>
</tr>
<tr>
<td>RiteFlo†</td>
<td>No</td>
<td>140 ml</td>
<td>No</td>
<td>No</td>
<td>Universal</td>
</tr>
</tbody>
</table>

* collapsible chamber
** inhaler canister fits directly into the spacer device
^ collapsible - fits in shirt pocket
† compact
† flow rate limited to the recommended 15-30 L/min, obviating need for a flow rate signal
Effect of Multiple MDI Actuations into Spacer

From O’Callaghan et al. Thorax 1993
Nebulizers vs MDIs with spacer and face mask

• Some studies show equal efficacy, while others show one device is better than the other

• My opinion: Parent preference
MDI with spacers

- Vangveeravong M. A comparative study of efficacy of salbutamol via metered dose inhaler with volumatic spacer and via dry powder inhaler, easyhaler, to nebulization in mild to moderate severity acute asthma exacerbation in childhood. *J Med Assoc Thai. 2008;91 Suppl 3:S115-123*
- Lodha R et al. Metered dose inhaler with spacer versus dry powder inhaler for delivery of salbutamol in acute exacerbations of asthma: a randomized controlled trial. *Indian Pediatr. 2004;41:15-20.*
High-Dose Albuterol by Metered-Dose Inhaler Plus a Spacer Device Versus Nebulization in Preschool Children With Recurrent Wheezing: A Double-Blind, Randomized Equivalence Trial

Dominique Floin, MD, PhD; François R. Chapuis, MD, MPH, PhD; Didier Stamm, MD; Jacques Robert, MD; Louis David, MD; Pierre G. Chatelain, MD; Guy Dutau, MD; and Daniel Floret, MD

- Ped ED study in children from 1 to 5 years of age with wheezing
- Ultrasonic neb vs MDI with spacer and face mask
- Albuterol by neb: 50 mg/10 ml at 0.03 ml/kg
- Albuterol by MDI: 1 puff/2 kg to max 10 puffs

Pediatrics 2000
TABLE 1. Pulmonary Index

<table>
<thead>
<tr>
<th>Score</th>
<th>Respiratory rate (breaths/min)</th>
<th>Wheezing</th>
<th>I/E Ratio</th>
<th>Use of Accessory Respiratory Muscles†</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>≤30</td>
<td>None</td>
<td>2:1</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>31-45</td>
<td>End expiration</td>
<td>1:1</td>
<td>Minimal use</td>
</tr>
<tr>
<td>2</td>
<td>46-60</td>
<td>Entire expiration</td>
<td>1:2</td>
<td>Moderate use</td>
</tr>
<tr>
<td>3</td>
<td>&gt;60</td>
<td>Inspiration and expiration</td>
<td>1:3</td>
<td>Marked use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>without stethoscope</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The pulmonary index is the sum of the score for each of the 4 sections.\(^{10}\)
† Assessed by observing jugular, supraclavicular, intercostal, and subcostal areas.

Fig 4. Median decrease from baseline in pulmonary index after each of the 3 treatment administrations (intent-to-treat population). \(^{*}\)MDI + ASD.
Age for Correct Use of Device

<table>
<thead>
<tr>
<th>Aerosol Method</th>
<th>Minimum Age (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nebulizer</td>
<td>≤ 2</td>
</tr>
<tr>
<td>pMDI</td>
<td>&gt; 5</td>
</tr>
<tr>
<td>pMDI with spacer</td>
<td>&gt; 4</td>
</tr>
<tr>
<td>pMDI with spacer and mask</td>
<td>≤ 4</td>
</tr>
<tr>
<td>Breath-actuated MDI</td>
<td>&gt; 5</td>
</tr>
<tr>
<td>DPI</td>
<td>≥ 4</td>
</tr>
</tbody>
</table>
The Effect of Crying on Lung Deposition

G Murakami  Ann Allergy 1990; 64:383-7
Conclusions

- Allergic rhinitis and asthma are 2 very common conditions in the US population.
- Though controversy exists in areas of management of these conditions, it is clear that inhaled corticosteroids for asthma and intranasal corticosteroids for allergic rhinitis are the most effective therapies for sufferers of these disorders.