Preschool Asthma
What you need to know in 10 minutes

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Faculty/Presenter Disclosure

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- **Relationships with commercial interests:**
  - **Grants/Research Support**: none
  - **Speakers Bureau/Honoraria**: Astra Zeneca, Boehringer Ingelheim, Griffols, Pfizer, Purdue, Merck Frosst, Novartis, Sanofi, Takeda.
  - **Consulting Fees**: Aerocrine, Novartis, Takeda, Purdue, Pfizer
  - **Other**:
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    Member of Public Health Agency of Canada section on Respiratory Surveillance
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• This program has received no financial support.
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  – A) there are no organizations supporting this program
  – B) The following companies make respiratory products that I may mention in this talk including: Aerocrine, Astra Zeneca, Boehringer Ingelheim, Griffols, GSK, Merck Frosst, Pfizer, Purdue, Novartis, Sanofi, Takeda,
  – There are no organizations supporting a product that will be discussed in this program.
Mitigating Potential Bias

• We will mitigate any bias by discussing appropriately all treatment and diagnostic options for respiratory care in my talk today
Evidence Base:

SPECIAL ARTICLE

Diagnosis and management of asthma in preschoolers: A Canadian Thoracic Society and Canadian Paediatric Society position paper

Francine M Ducharme MD MSc, Sharon D Dell MD, Dheenuka Radhakrishnan MD MSc, Roland M Grad MD MSc FCP, Wade TA Watson MD MSc, Connie L Yang MD MSc, Mitchell Zelman MD MSc

In the absence of lung function tests, the diagnosis of asthma should be considered in children aged five years or younger with frequent (≥2 days/month) asthma-like symptoms or recurrent (≥2 episodes) exacerbations (episodes with asthma-like signs). The diagnosis requires the objective documentation of signs or symptoms suggestive of airflow obstruction (improvement in these signs or symptoms with asthma therapy) and no clinical suspicion of an alternate diagnosis. The characteristic feature of asthma obstruction is wheezing commonly accompanied by difficulty breathing and cough. Reversibility with short-acting inhaled bronchodilators is defined as direct observation of improvement in wheezing within 20 minutes. Using the reliever (SABA) (with or without oral corticosteroids) by a trained health care practitioner during an acute exacerbation (preferred method). However, in children with no wheezing or no signs of airflow obstruction on presentation, reversibility may be determined by convincing parental report of a symptomatic response to a three-month therapeutic trial of a medium dose of inhaled corticosteroids with or without a long-acting β2-agonist (SABA) (alternative method), or even SABA alone (weaker alternative method). The authors provide key messages regarding whom to consider the diagnosis, terms to be abandoned, and the initial management strategy. Finally, dissemination plans and priority areas for research are identified.

Key Words: Asthma; Child; Criteria; Diagnosis; Disease management;

Le diagnostic et la prise en charge de l’asthme chez les enfants d’âge préscolaire : document de principes de la Société canadienne de thoracologie et de la Société canadienne de pédiatrie

L’asthme fait souvent son apparition avant l’âge de six ans. Cependant, il est important de noter que l’asthme peut être diagnostiqué chez les enfants de six ans ou plus. La prise en charge de l’asthme chez les enfants de six ans ou plus doit être adaptée par rapport à celle de l’adulte.

En l’absence de mesures de la fonction pulmonaire, le diagnostic d’asthme devrait être envisagé chez les enfants de six ans ou plus présentant des symptômes de type asthmatique fréquents (<2 épisodes par mois) ou des exacerbations récurrentes (<2 épisodes) (épisodes accompagnés de symptômes respiratoires). Le diagnostic nécessite la documentation objective des signes ou des symptômes suggestifs de restriction de l’obstruction aérodigestive (amélioration de ces signes ou symptômes avec l’asthme therapy) et d’absence de suspicion d’une autre affection. La caractéristique de l’obstruction de l’asthme est le bruit de bruits et de toux. La réversibilité avec les inhalants est définie par une amélioration directe de l’obstruction aérodigestive (meilleur d’action) dans les 20 minutes. L’administration du SABA (alternative méthode) est recommandée dans les situations où l’asthme est confirmé. Enfin, les mesures de prévention et les priorités pour la recherche sont identifiées.
Pediatric Asthma: Prevalence and Impact

• Most common chronic disease among children
  – 10-15% affected

• Major cause of pediatric hospital admissions and ED visits

• 26-45% of children with asthma still have inadequate control

Kovesi et al. CMAJ 2009
Presentations of Wheezing

- The most common *cause* of wheezing in young children is viral respiratory infection

*BUT*

- The strongest *predictor* for wheezing that develops into asthma is ATOPY
  - About 70–90% of children with asthma are atopic (i.e., positive skin tests)
Presentations of Wheezing
Two different syndromes during 1st 3 years

- Of patients who wheezed before age 3, wheezing *persisted* through age 6 in about **40%**

**Transient wheezing**
- Smaller airway caliber
- No bronchial hyperresponsiveness
- Wheezing resolved by age 6

**Persistent Early-onset Asthma**
- Atopy
- Bronchial hyperresponsiveness
- Significant deterioration in lung function by age 6

- **Transient Viral Wheezer**
- **Multi-Trigger Wheezer**

Wheezing in Childhood

Transient early wheezers

Non-atopic wheezers

IgE-associated wheeze/asthma

Persistent wheezers

Age (years)

Wheezing Prevalence

Pediatric Asthma: Diagnosis and Patterns

• In patients <6 y, in whom conventional pulmonary function testing is not feasible, asthma diagnosis based on:
  – Typical symptom pattern
    • Wheezing cough or dyspnea of varying severity
  – Therapy response – acutely to bronchodilators or over several weeks to anti-inflammatories
  – Absence of “warning signs” for alternative diagnoses
### TABLE 3
Therapeutic trial for documenting reversibility of airflow obstruction

<table>
<thead>
<tr>
<th>Child presentation</th>
<th>Agent</th>
<th>Dose</th>
<th>Doses/day</th>
<th>Time to reassessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Signs of airflow obstruction (preferred)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild clinical findings*</td>
<td>Inhaled salbutamol</td>
<td>≥4 puffs†</td>
<td>1st dose</td>
<td>30 min</td>
</tr>
<tr>
<td>Moderate or severe exacerbation*</td>
<td>Inhaled salbutamol</td>
<td>≥4 puffs†</td>
<td>2–3 doses within 60 min</td>
<td>80 min</td>
</tr>
<tr>
<td>Oral corticosteroids‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prednisone/prednisolone (oral)</td>
<td>1–2 mg/kg (maximum 50 mg)‡</td>
<td>1st dose</td>
<td>3 h to 4 h</td>
<td></td>
</tr>
<tr>
<td>Dexamethasone</td>
<td>0.15–0.80 mg/kg (maximum 10 mg)‡</td>
<td>1st dose</td>
<td>3 h to 4 h</td>
<td></td>
</tr>
<tr>
<td><strong>No signs of airflow obstruction (alternative)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild intermittent symptoms or exacerbations§</td>
<td>Inhaled salbutamol</td>
<td>2 puffs every 4 h to 6 h</td>
<td>As needed</td>
<td>30 min</td>
</tr>
<tr>
<td>Frequent symptoms or moderate or severe exacerbations§</td>
<td>Inhaled salbutamol</td>
<td>2 puffs every 4 h to 6 h</td>
<td>As needed</td>
<td>30 min**</td>
</tr>
<tr>
<td>Daily inhaled corticosteroids</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beclomethasone dipropionate</td>
<td>100 μg</td>
<td>Twice daily</td>
<td>3 months††</td>
<td></td>
</tr>
<tr>
<td>Ciclesonide</td>
<td>200 μg</td>
<td>Daily</td>
<td>3 months††</td>
<td></td>
</tr>
<tr>
<td>Fluticasone propionate</td>
<td>100–125 μg</td>
<td>Twice daily</td>
<td>3 months††</td>
<td></td>
</tr>
</tbody>
</table>

Unless indicated otherwise, all medications are administered by metered-dose inhaler (MDI) with an age-appropriate valved spacer under health care professional supervision.
# Pediatric Asthma: Alternative Diagnoses

<table>
<thead>
<tr>
<th>Clinical finding</th>
<th>Potential diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to thrive, steatorrhea</td>
<td>Cystic fibrosis</td>
</tr>
<tr>
<td>Frequent, persistent, or unusual infections</td>
<td>Immunodeficiency</td>
</tr>
<tr>
<td>Chronic rhinitis and severe recurrent otitis media, +/- situs inversus</td>
<td>Primary ciliary dyskinesia</td>
</tr>
<tr>
<td>Severe regurgitation or vomiting</td>
<td>Gastroesophageal reflux</td>
</tr>
<tr>
<td>Persistent wheezing</td>
<td>Fixed obstructive lesion of the airway (e.g., hilar adenopathy, vascular ring, aspirated foreign body)</td>
</tr>
<tr>
<td>Heart murmur or known congenital heart disease</td>
<td>Wheezing caused by congestive heart failure</td>
</tr>
<tr>
<td>Noisy breathing caused by retained upper airway secretions, aspiration</td>
<td>Swallowing disorder (particularly if an underlying neurologic disorder or developmental delay)</td>
</tr>
</tbody>
</table>
Pediatric Asthma:
Determining Risk for Persistent Asthma

*Modified Asthma Predictive Index*

- Wheezing on ≥4 occasions during first 3 years of life, ≥1 episode observed by physician
- Combined with ≥1 major risk factor(s):
  - Parental history of asthma
  - Physician-diagnosed atopic dermatitis
  - Allergic sensitization to ≥1 aeroallergen (e.g.: house dust mite, cockroach, dog, cat, mold, grass, tree)
- OR combined with ≥2 minor risk factors:
  - Wheezing unrelated to colds
  - Allergic sensitization to milk, eggs, or peanuts
  - Blood eosinophils >4%

*A positive result indicates a child who is at the highest risk of persistent asthma
Kovesi et al. CMAJ 2009*
Here is true inhaler technique!
NON-PHARMACOLOGICAL MANAGEMENT OF ASTHMA

• Trigger avoidance
• Stop adult smoking in the family
• Exercise
• Education
• Self-management

Canadian Thoracic Society Asthma Management Continuum-2010 Summary for children six years of age and older, and adults
Effects of Inhaled Corticosteroids on Inflammation

E = Epithelium  BM = Basement Membrane

Pre- and post- 3 month treatment with budesonide (BUD) 600 mcg BID

Pediatric Daily ICS Dose (mcg)

(Age 6-11 years)

<table>
<thead>
<tr>
<th>Product – (Trade Name)</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beclomethasone dipropionate HFA (QVAR®)</td>
<td>≤ 200</td>
<td>201-400</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Budesonide (Pulmicort® Turbuhaler®)</td>
<td>≤ 400</td>
<td>401-800</td>
<td>&gt;800</td>
</tr>
<tr>
<td>Ciclesonide (Alvesco®)</td>
<td>≤ 200</td>
<td>201-400</td>
<td>&gt;400</td>
</tr>
<tr>
<td>Fluticasone (Flovent® MDI and spacer; Flovent® Diskus®)</td>
<td>≤ 200</td>
<td>201-500</td>
<td>&gt;500</td>
</tr>
</tbody>
</table>

Mometasone (Asmanex twist-haler) 200 400 >400

Low to Moderate Dose ICS is Safe and Effective in Young Children with Asthma

**Decreases**
- Asthma symptoms
- Rescue medication use
- Exacerbations
- Prednisone use
- Emergency health service use
- Hospitalizations
- Inflammatory markers
- Bronchial Hyperreactivity

**Increases**
- Quality of Life
- Pulmonary Function

Low to Moderate Dose ICS Side Effects:

ICS growth effect
- Limited, small, apparently transient reduction in growth velocity
- Projected final height by bone age similar to placebo

Other safety issues
- No adverse effect on bone density
- No association with cataracts
- No adverse effect on sexual maturation
- No adverse effect on psychological growth
- Decreased thrush with mouth rinsing and use of aerochamber
- Adrenal suppression
Pediatric Asthma:
Management of Persistent Asthma

• ICS first choice for persistent asthma
  – Administer daily (including between exacerbations) for minimum of one season at a time

• ICS very effective when used optimally; therefore, if unsuccessful:
  – Question asthma diagnosis
  – Consider possible comorbid conditions
  – Review technique of drug delivery

• If asthma control remains inadequate with moderate ICS dose:
  – Increase dose or add LTRA

• Role of adding LABA to ICS:
  – Evidence to support use in adolescents
  – Minimal evidence for preschool and school-aged children

• Referral to pediatric asthma specialist should be considered for patients requiring add-on therapy

ICS: inhaled corticosteroid; LABA: long-acting β-agonist; LTRA: leukotriene receptor antagonist

Kovesi et al. CMAJ 2009
Asthma continuum

2012 Asthma Management Continuum
Children (6 years and over) and Adult

Regularly Reassess
• Control
• Spirometry or PEF
• Inhaler technique
• Adherence
• Triggers
• Comorbidities
• Sputum eosinophils

Adjust Therapy to Achieve Control and Prevent Future Risk

Inhaled Corticosteroid (ICS)*
*Second-Line: Leukotriene Receptor Antagonist (LTRA)

Low Dose
≥12 yrs: ≤250 mcg/day
6-11 yrs: ≤200 mcg/day

Medium Dose
251 – 500 mcg/day
201 – 400 mcg/day

High Dose
≥500 mcg/day
>400 mcg/day

SABA on Demand
SABA or ICS/LABA‡ on Demand

Environmental Control, Education and Written Action Plan
Confirm Diagnosis

Controlled
Uncontrolled

† HFA Beclometasone or equivalent; ‡ Second-line: LTRA; ‡ Approved for 12 years and over; § Using a formulation approved for use as a reliever;

## Minimum Criteria for Acceptable Control of Asthma in Preschoolers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency or Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime Symptoms</td>
<td>&lt; 4 days per week</td>
</tr>
<tr>
<td>Nighttime Symptoms</td>
<td>&lt; 1 night/week</td>
</tr>
<tr>
<td>Physical Activity</td>
<td>Normal</td>
</tr>
<tr>
<td>Use of rapid-acting bronchodilator</td>
<td>&lt; 4 times per week (unless before exercise only)</td>
</tr>
<tr>
<td>Exacerbations</td>
<td>Mild, infrequent (no more than once a year)</td>
</tr>
<tr>
<td>School, preschool or child care</td>
<td>None missed</td>
</tr>
</tbody>
</table>

## Levels of Asthma Control

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Controlled (All of the following)</th>
<th>Partly controlled (Any present in any week)</th>
<th>Uncontrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daytime symptoms</td>
<td>None (2 or less / week)</td>
<td>More than twice / week</td>
<td></td>
</tr>
<tr>
<td>Limitations of activities</td>
<td>None</td>
<td>Any</td>
<td>3 or more features of partly controlled asthma present in any week</td>
</tr>
<tr>
<td>Nocturnal symptoms / awakening</td>
<td>None</td>
<td>Any</td>
<td></td>
</tr>
<tr>
<td>Need for rescue / “reliever” treatment</td>
<td>None (2 or less / week)</td>
<td>More than twice / week</td>
<td></td>
</tr>
<tr>
<td>Lung function (PEF or FEV₁)</td>
<td>Normal</td>
<td>&lt; 80% predicted or personal best (if known) on any day</td>
<td></td>
</tr>
<tr>
<td>Exacerbations</td>
<td>None</td>
<td>One or more / year</td>
<td>1 in any week</td>
</tr>
</tbody>
</table>
# Pediatric Asthma Action Plan Sample

**Peak Flow**

<table>
<thead>
<tr>
<th>100% (Personal Best)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
</tr>
<tr>
<td>70%</td>
</tr>
<tr>
<td>50%</td>
</tr>
</tbody>
</table>

## MY ASTHMA ACTION PLAN

**The most common trigger in children is Colds. You should avoid cigarette smoke and may need to avoid dust, mold, cats, dogs, or cold air.**

**Comments:**

<table>
<thead>
<tr>
<th>Physician's Signature</th>
<th>Date</th>
<th>Reviewed by</th>
<th>Date</th>
<th>Space for child identification</th>
</tr>
</thead>
</table>

### GREEN ZONE: Doing well
- Breathing is good
- Cough or wheeze is only occasional (less than 4 times a week)
- Can run and play normally

- **Controller:**
  - **Medication(s):**
    - **puff(s), time(s) a day**

- **Quick Relief:**
  - **Medication(s):**
    - **puff(s), less than 4 times a week**

### YELLOW ZONE: Caution
- **Signs of a cold**
- Cough or wheezing
- **Tight chest**
- Waking up at night because of asthma

- **Controller:**
  - **Increase**
  - **Medication(s):**
    - **puff(s), times a day, for day(s)**
  - **Take**
  - **Other:**

### RED ZONE: Medical Alert
- Very short of breath
- "Pulling in" of skin between ribs
- Cannot do usual activities
- Quick relief medication not helping or helping for less than 4 hours

- **Take**
  - **Medication(s):**
    - **Quick relief**
    - **puff(s) every 4-6 hours until better**

- **Seek medical attention NOW and follow EMERGENCY plan:**
  - You are still in red zone after 15 minutes OR
  - You have not reached your doctor

### EMERGENCY:
- Severe trouble breathing, walking, or talking
- Blueness of lips or skin
- Tired because of the effort of breathing

- **GO TO THE NEAREST EMERGENCY DEPARTMENT NOW**
  - **Take your quick relief medication as necessary**
    - (even every 10-20 minutes if you are not improving)
    - on your way to the hospital.
  - **In Ottawa, you can call 911 in case of emergency.**
Inhaled Corticosteroids: Side Effects

• **Growth:**
  – 1 cm less growth during 1st year only
  – Subsequent growth velocity on therapy and final adult height usually normal
  – Long-term ICS: monitor with stadiometer, growth chart

• **Adrenal Axis:**
  – Suppression uncommon; less suppression than 4 courses/year prednisone
  – Very high doses (fluticasone) can cause symptomatic adrenal suppression, hypoglycemia
  – High ICS doses: avoid or have expert prescribe

Silverstein M. J Allergy Clin Immunol 1997;99:466;
Dolan L. J Allergy Clin Immunol 1987;80:81;
Todd G. Arch Dis Child 2002;87:457
How severe is that attack??

TABLE 4
Pediatric Respiratory Assessment Measure (PRAM) scoring table

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen saturation</td>
<td>≥95%</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>92%—94%</td>
</tr>
<tr>
<td></td>
<td>&lt;92%</td>
</tr>
<tr>
<td>Suprasternal retraction</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td>Scalen muscle contraction</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Present</td>
</tr>
<tr>
<td>Air entry*</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>↓ At the base</td>
</tr>
<tr>
<td></td>
<td>↓ At the apex and the base</td>
</tr>
<tr>
<td></td>
<td>Minimal or absent</td>
</tr>
<tr>
<td>Wheezing†</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Expiratory only</td>
</tr>
<tr>
<td></td>
<td>Inspiratory (± expiratory)</td>
</tr>
<tr>
<td></td>
<td>Audible without stethoscope or silent chest (minimal or no air entry)</td>
</tr>
</tbody>
</table>

PRAM score (maximum 12)

<table>
<thead>
<tr>
<th>Score</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0—3</td>
<td>Mild</td>
</tr>
<tr>
<td>4—7</td>
<td>Moderate</td>
</tr>
<tr>
<td>8—12</td>
<td>Severe</td>
</tr>
</tbody>
</table>

Observing retractions

When you observe retractions in infants and children, be sure to note their exact location—
an important clue to the cause and severity of respiratory distress. For example, substernal and substernal retractions usually result from lower respiratory tract disorders; suprasternal retractions, from upper respiratory tract disorders.

Mild intercostal retractions alone may be normal. However, intercostal retractions accompanied by substernal and substernal retractions may indicate moderate respiratory distress. Deep suprasternal retractions typically indicate severe distress.
Video of intercostal retractions
We have come a long way!!

Dr. Batty's

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Asthma Cigarettes

Since 1882

For the temporary relief of paroxysms of asthma

Effectively treats:
Asthma, Hay Fever, Foul Breath
All Diseases of the Throat,
Head Colds, Canker Sores
Bronchial Irritations

Not Recommended for Children under 6.
I look forward to being able to assist you in your respiratory needs!

www.fpagc.com

for4kids@gmail.com