Diagnosis and Management of Pediatric Asthma

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Faculty/Presenter Disclosure

- **Faculty:** Alan Kaplan MD CCFP(EM) FCFP
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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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  - **Other: n/a**

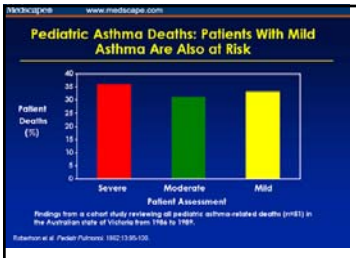
Disclosure of Commercial Support

- **This program has received no financial support .**
- **This program has received no in-kind support.**

- **<u>Potential for conflict(s) of interest</u>:**
  - 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



This is where we were!
ICS not being used
High dose Beta agonists being used then in Australia
We have done better, using ICS appropriately, but…
There is still ++ morbidity from this disease.
This talk is to highlight how we can separate those that Need persistent therapy from those who do not, and how to do so

Objectives

- **Diagnose true pre-school asthma as distinguished from "viral wheezing"**
- **Effectively treat the pediatric asthma patient**
- **Formulate a systematic follow up plan for pediatric asthma patients**

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

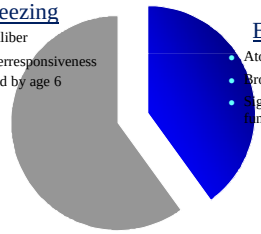
- The most common ***cause*** of wheezing in young children is viral respiratory infection *BUT*
- The strongest ***predictor*** for wheezing that develops into asthma is ATOPY
  - About 70–90% of children with asthma are atopic (i.e., positive skin tests)

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**

Martinez et al. *N Engl J Med* 332:133–138, 1995.

CATEGORIES OF WHEEZING

1. Transient early wheezing
2. Persistent early-onset wheezing
3. Late-onset wheezing

From the Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2011. Available from: http://www.ginasthma.org/.

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Transient Early Wheezing

- Starts before age 3 and often outgrown by 3 years
- Later asthma is rare
- Often associated with
  - Prematurity
  - Parental smoking
- Symptoms are intermittent/ seasonal
- Include wheeze and shortness of breath

From the Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2011. Available from: http://www.ginasthma.org/.

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Persistent Early-Onset Wheezing

- Starts before age 3, may develop into asthma
- Recurrent episodes associated with acute viral respiratory infections
- No evidence of atopy
- No family history of atopy
- Usually caused respiratory syncytial virus (RSV) in children under 2
- Symptoms persist through school age to age 12

From the Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2011. Available from: http://www.ginasthma.org/.

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Late-Onset Wheezing

- Begins after age 3
- Patient commonly atopic
- Associated with eczema
- Airway pathology characteristic of asthma
- Wheeze persists after 6 years with other symptoms of asthma

From the Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2011. Available from: http://www.ginasthma.org/.

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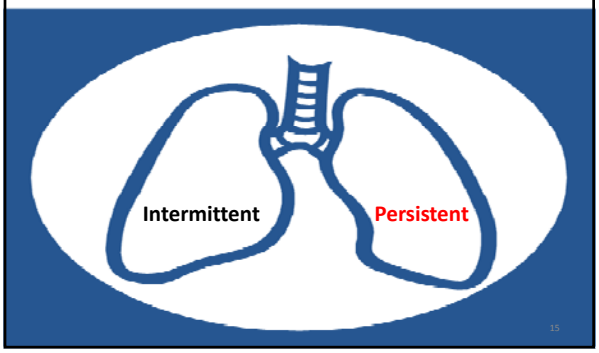
PHENOTYPES OF ASTHMA



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Billy: Presentation

- 2-y-o, presents with 4th episode of wheezing in past 18 months
- Medical history
  - At 6 months old:
    - Admitted with bronchiolitis caused by respiratory syncytial virus
  - At 9 months old:
    - Seen in ED with cold complicated by wheezing and severe cough
    - Rx: short-acting β_2-adrenergic receptor agonist (MDI with chamber) + antibiotic x 7 days
  - At 11 months old:
    - Another ED visit, similar episode as 9 months
    - Rx: an ICS b.i.d. x 2 wks for upper RTIs

MDI: metered-dose inhaler

Kovesi et al. *CMAJ* 2009

Billy: Presentation (cont.)

- Medical history (cont.)
  - 4 more colds complicated by wheezing, cough, and dyspnea since last ED visit
    - During 2 episodes, "bronchitis" diagnosed, given azithromycin
    - Wheezing typically improves for 2 h after receiving short-acting β_2-adrenergic receptor agonist
    - Asymptomatic between colds
- Other/family history
  - No other medical problems, growth normal
  - Born at term, but small for gestational age (Mother smoked 10 cigarettes/day through pregnancy)
- *What diagnoses would you consider at this point?*

Kovesi et al. *CMAJ* 2009

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

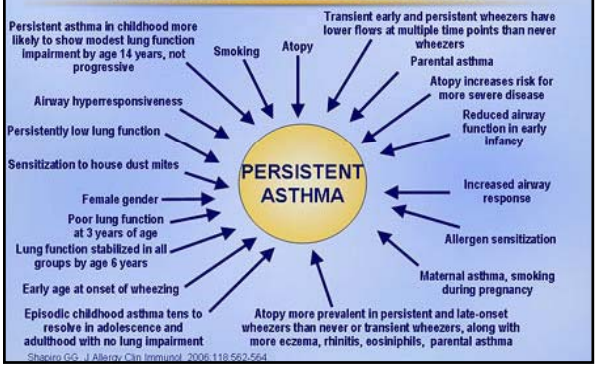
Kovesi et al. *CMAJ* 2009

Pediatric Asthma: Alternative Diagnoses

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

Kovesi et al. *CMAJ* 2009

Summary of Factors that Correlate with Childhood Asthma Persistence



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

New simpler predictive index

informa

A Simple Tool to Identify Infants at High Risk of *Mild* to *Severe* Childhood Asthma: The *Persistent* Asthma Predictive Score

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[2]*Unité de Pneumo-Allergologie de l'Enfant, CHU Estaing, Clermont-Ferrand, France.*

Background: Recurrent wheezing in infants is a recognized risk factor for the development of childhood asthma. We sought to develop an easy-to-use persistent asthma predictive score (PAPS) in a population of young recurrent wheezers. *Methods:* We retrospectively studied clinical and biological data of infants under 2 years of age presenting recurrent wheezing and evaluated current asthma at 6 years of age using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. Multivariate analysis was performed to select predictive variables to generate a PAPS. The score was then tested on another cohort for independent validation. *Results:* Two hundred infants were included in the cohort used to create the PAPS, and 227 in the validation cohort. In the first population, 47% of the children had developed asthma at 6 years of age, including 33% with mild to severe persistent asthma. Three parameters independently predicted persistent asthma: family history of asthma, personal atopic dermatitis, and multiple allergen sensitizations. Based on these variables, the PAPS showed 42% sensitivity, 90% specificity, 67% positive predictive value, and 76% negative predictive value for the prediction of persistent asthma. It was able to discriminate future persistent asthmatic from nonfuture persistent asthmatic children, with an accuracy of 74% in the initial population and 67% in the validation population. *Conclusions:* The PAPS, based on three easy-to-obtain variables, could help the physician in clinical practice to identify infants at high risk for persistent childhood asthma, and thus better evaluate the need for secondary preventive measures.

Keywords allergy, asthma, infant

INTRODUCTION

Asthma remains a significant public health problem in ... also avoid long-term treatments for children whose symptoms will remit spontaneously (5, 11).

TABLE 3.—Multiple logistic regression analysis of variables associated with *persistent* asthma at 6 years of age.

Variables	Regression coefficient	OR	OR 95% CI		*P*-value	Points used for the score
Atopic dermatitis	0.84 ± 0.34	2.3	1.2 – 4.5		.01	1
Familial asthma	0.86 ± 0.32	2.4	1.3 – 4.5		.007	1
IgE polysensitization	1.80 ± 0.65	6.1	1.7 – 21.6		.003	2

Notes: Initial multivariate model included family history of atopy, family history of asthma, atopic dermatitis, IgE polysensitization, IgE sensitization to food allergen, IgE sensitization to inhalant allergen, eosinophilia, and elevated total IgE. OR, odds ratio; 95% CI, 95% confidence interval. *P*-values were obtained by likelihood ratio statistics. Points for the score correspond to rounded regression coefficient for each predictor variable. IgE, immunoglobulin E.

TABLE 4.—Sensitivity, specificity, predictive values, and likelihood ratios for risk scoring system.

Risk score strata	Number of infants	Sensitivity	Specificity	PPV	NPV	+LR	–LR
≥1	124	74.2	44.0	39.5	77.6	1.33	0.59
≥2	42	42.5	89.6	66.7	75.9	4.06	0.64
≥3	9	12.1	99.3	88.9	69.6	16.2	0.88
≥4	7	10.6	100	100	69.4	IL	0.89

Note: PPV, positive predictive value; NPV, negative predictive value; +LR, positive likelihood ratio (sensitivity/1 – specificity); –LR, negative likelihood ratio (1 – sensitivity/specificity); IL, infinitely large.

Three things:
1) Atopic dermatitis(1)
2) Familial asthma (1)
3) IGE polysenstization (2)

Score /4

Dupuy A et al, A simple tool to identify mild to severe childhood asthma. Journal of Asthma, 2011

PERSISTENT ASTHMA PREDICTIVE SCORE IN WHEEZY INFANTS 5

TABLE 5.—The performance of the PAPS for the prediction of *persistent* asthma at 6 years of age in a population of recurrent wheezing infants.

Persistent asthma	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	PPV (%) (95% CI)	NPV (%) (95% CI)	Area under ROC curve	Youden index	Overall correctly predicted (%)
PAPS (≥2)	42.4 (30.3 – 55.2)	89.6 (83.1 – 94.2)	66.7 (50.5 – 80.4)	75.9 (68.5 – 82.4)	0.660	0.320	74

Note: PAPS, *persistent* asthma predictive score; ROC, receiver operating characteristic; PPV, predictive positive value; NPV, negative predictive value; Youden index = sensitivity + specificity – 1.

TABLE 6.—Independent validation of the PAPS for the prediction of *persistent* asthma at 13 years of age in another population of recurrent wheezing infants.

Persistent asthma	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	PPV (%) (95% CI)	NPV (%) (95% CI)	Area under ROC curve	Youden index	Overall correctly predicted (%)
PAPS (≥2)	62.8 (46.7 – 77.0)	67.4 (60.1 – 74.1)	31.0 (21.5 – 41.9)	88.6 (82.1 – 93.3)	0.651	0.302	67

Note: PAPS, *persistent* asthma predictive score; ROC, receiver operating characteristic; PPV, predictive positive value; NPV, negative predictive value; Youden index = sensitivity + specificity – 1.

Dupuy A et al, A simple tool to identify mild to severe childhood asthma. Journal of Asthma, 2011

Pediatric Asthma: Management of **Intermittent** Asthma

- Intermittent ICS use NOT recommended
  - Ineffective for treatment of intermittent wheezing
- Regular ICS therapy should be used for children:
  - With severe or prolonged symptoms
  - Who have visited ED or been admitted
- Although ICS can be used to control symptoms, does not prevent progression to persistent asthma
- LTRAs can be used continuously during viral season, or at onset of viral infection
  - Reduce symptoms and visits to health care providers

ICS: inhaled corticosteroid; LTRA: leukotriene receptor antagonist

Kovesi et al. *CMAJ* 2009

Billy: Diagnosis and Management

- Diagnosis of severe intermittent asthma
- Modified Asthma Predictive Index result negative
- Family told he has ~2/3 chance of eventually "outgrowing" asthma, probably by school age
- Prescribed regular treatment with and ICS b.i.d. by valved holding chamber and short-acting β_2-adrenergic receptor agonist p.r.n.
- 5 months later:
  - 5 colds over this period
  - No asthma-related symptoms; ICS dose halved
- 9 months later:
  - No difficulties with colds after first 5 months; ICS discontinued

Kovesi et al. *CMAJ* 2009

Choosing an Inhaler Device for Children with Asthma

MDI plus a Valved Holding chamber with mask/ Wet Nebulization	Infants
MDI plus a Valved Holding chamber with mask	Infants (2-5 yrs)
MDI plus a Valved Holding chamber with mouthpiece	5+ yrs
Dry powder inhalers	6+ yrs

Chantal: Presentation

- 4-y-o, with 1 year history of asthma
- Medical history:
  - Wheezing in association with colds beginning at 11 months
  - At 3 years of age:
    - Nighttime cough even between colds
    - Sustained activity led to wheezing and dyspnea
    - Asthma diagnosed
      - Prescribed an ICS b.i.d. by spacer + short-acting β_2-adrenergic receptor agonist p.r.n.
    - Parents worried about adverse effects and gave meds only when child was especially unwell
  - Over past year:
    - 2 ED visits, received oral corticosteroid
    - Never admitted
  - Eczema
- Family history:
  - Both parents have allergic rhinitis
- *How would you optimize management of Chantal's asthma?*

Kovesi et al. *CMAJ* 2009

NON-PHARMACOLOGICAL MANAGEMENT OF ASTHMA

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

CanadianThoracic Society Asthma Management Continuum-2010 Summary for children six years of age and older, and adults Lougheed , MD et al , Can Respir J 2010;17(1):15-24.

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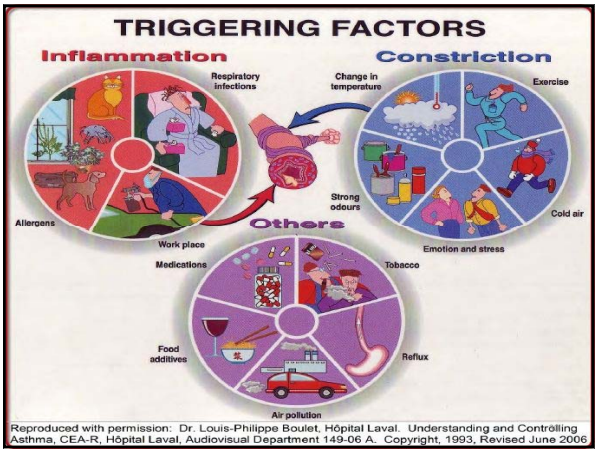


Reproduced with permission: Dr. Louis-Philippe Boulet, Hôpital Laval. Understanding and Controlling Asthma, CEA-R, Hôpital Laval, Audiovisual Department 149-06 A. Copyright, 1993, Revised June 2006

Pediatric Asthma: Management of Persistent Asthma

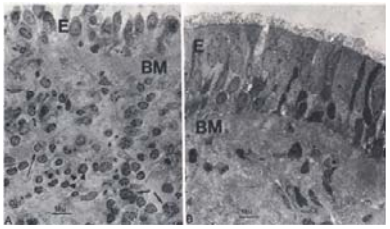
- ICS first choice for persistent asthma
  - Administer daily (including between exacerbations) for minimum of one season at a time

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

Kovesi et al. CMAJ 2009

Effects of Inhaled Corticosteroids on Inflammation

E = Epithelium BM = Basement Membrane



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

Laitinen. *J Allergy Clin Immunol.* 1992;90:32-42.

Pediatric Daily ICS Dose (mcg)

(Age 6-11 years)

Product – (Trade Name)	Low	Medium	High
Beclomethasone dipropionate HFA (QVAR®)	≤ 200	201-400	>400
Budesonide (Pulmicort® Turbuhaler®)	≤ 400	401-800	>800
Ciclesonide (Alvesco®)	≤ 200	201-400	>400
Fluticasone (Flovent® MDI and spacer; Flovent® Diskus®)	≤ 200	201-500	>500

Achieving asthma control in preschoolers, CMAJ 2009; Kovesi et al. doi: 10.1503/cmaj.071638.

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

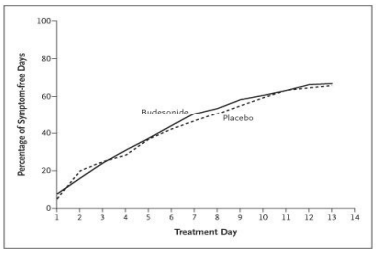
CMAJ 2009; Kovesi et al. doi: 10.1503/cmaj.071638.

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

Effectiveness of Intermittent ICS Therapy in Preschoolers



Percentage of Symptom-free Days during the Two-Week Treatment Periods for All 294 Children Who Received at Least One Study Treatment

N Engl J Med 2006;354:1998-2005. *Copyright © 2006 Massachusetts Medical Society.*

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

Chantal: Management and Follow-up

- Parents agree to continue the ICS b.i.d. long-term
- Then, family begins to care for sick grandmother's dog & insist they can't give the dog up
  - Previous skin prick tests indicated Chantal allergic to cats and dogs
- Chantal begins awakening with night-time cough
  - 3 nights/wk
- Dyspnea on exertion - stops preschool gymnastics program
- *How could you improve her asthma control?*

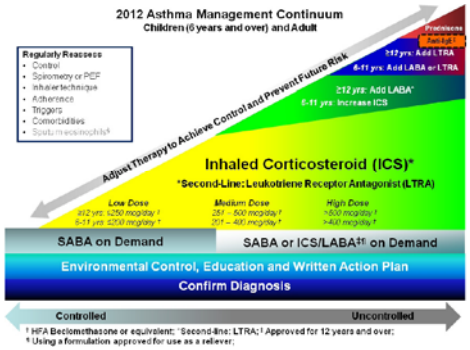
Kovesi et al. *CMAJ* 2009

Chantal: Further Management

- Chantal has poor control and is at risk for a severe exacerbation
- Assess medication adherence, inhaler technique
- Consider:
  - Increasing ICS dose 50-100%
  - Adding an LTRA
    - Reduces symptoms, risk of an exacerbation
  - Evidence for adjunctive LABA is meager in children
    - Efficacy of LABA in adolescents is probably similar to that in adults

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

Asthma continuum 2012



MD Lougheed, C Lemiere, FM Ducharme, et al; Canadian Thoracic Society Asthma Clinical Assembly. Canadian Thoracic Society 2012 guideline update: Diagnosis and management of asthma in preschoolers, children and adults. Can Respir J 2012;19(2):127-164.

Chantal: Long-Term Management

- 6 months later
  - The family dog is run over by a garbage truck, and Chantal's asthma seems to settle down

  - Following your advice, the family does not replace the dog. They steam-clean the carpets & upholstery, and clean their heating ducts
- A year later
  - The plant where Chantal's father works closes. He finds a job at a fast-food restaurant, but no longer has health benefits
  - He can't afford Chantal's inhalers, and asks whether you can cut back on her therapy
- *How would you assess whether you can taper her therapy? If it's feasible, how would you do it?*

Chantal: Assessing and Tapering Therapy

- Assess asthma control using guidelines criteria:
  - Day and night symptoms, physical activity, bronchodilator use, number of exacerbations, spirometry if ≥6 yrs[1]

ICS: inhaled corticosteroid; LTRA: leukotriene receptor antagonist

1. Kovesi et al. *CMAJ* 2009

Minimum Criteria for Acceptable Control of Asthma in Preschoolers

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

Achieving asthma control in preschoolers, CMAJ 2009; Kovesi et al. doi: 10.1503/cmaj.071638.

Levels of Asthma Control

Characteristic	Controlled (All of the following)	Partly controlled (Any present in any week)	Uncontrolled
Daytime symptoms	None (2 or less / week)	More than twice / week	3 or more features of partly controlled asthma present in any week
Limitations of activities	None	Any	
Nocturnal symptoms / awakening	None	Any	
Need for rescue / "reliever" treatment	None (2 or less / week)	More than twice / week	
Lung function (PEF or FEV_1)	Normal	< 80% predicted or personal best (if known) on any day	
Exacerbations	None	One or more / year	1 in any week

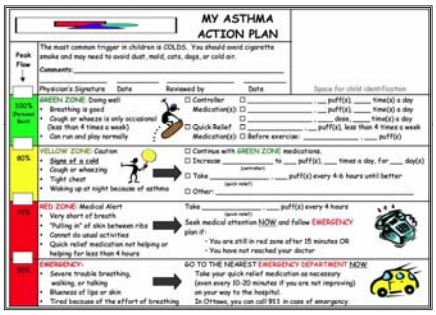
Chantal: Assessing and Tapering Therapy

- Assess asthma control using guidelines criteria:
  - Day and night symptoms, physical activity, bronchodilator use, number of exacerbations, spirometry if ≥6 yrs[1]
- If good control, try stopping LTRA (to save money) & re-assess in ~2 months
  - If control worsens: re-start LTRA
  - If control maintained: try decreasing ICS dose every 2-3 months by 30-50%; resume prior dose if control worsens

ICS: inhaled corticosteroid; LTRA: leukotriene receptor antagonist

1. Kovesi et al. *CMAJ* 2009

Pediatric Asthma Action Plan Sample



www.cheo.on.ca/english/pdf/asthma_action_plan.pdf

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Developmental Issues in Pediatric Asthma

- A clinical diagnosis in a preschooler should be reevaluated as the child reaches school age
- Triggers need to be reevaluated as the child grows
- Growth should be measured and plotted at follow-up visits
- Inhalation device choice needs to be developmentally appropriate and will change as the child grows
- Family and child need asthma education and responsibility for care needs to shift to child as they approach adolescence

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

Childhood Asthma Management Program Research Group. N Engl J Med 2000;343:1054;
Agertoft L. N Engl J Med 2000;343:1064;
Silverstein M. J Allergy Clin Immunol 1997;99:466;
Dolan L. J Allergy Clin Immunol 1987;80:81;
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Key Differences between Pediatric and Adult Asthma Management

Medication Differences:

- Most children will achieve control on a low-dose ICS.
- If a low-dose ICS is not adequate to maintain asthma control:
  - in children 6 to 11 years: increase ICS to a moderate dose or add LTRA
  - in patients 12 years and over: add a LABA to the low dose ICS, ideally in the form of a combination inhaler.
- High doses of ICS may be associated with significant side effects in children and should only be used by asthma specialists.
- The use of a single inhaler therapy combination of budesonide and formoterol is not approved in children less than 12 years old.
- Most children 6 years and over should be able to use a holding chamber with a mouthpiece or a dry powder inhaler.

Key Messages: Diagnosis and Management of Pediatric Asthma

- Pattern of asthma
  - Determine if transient or persistent
  - Most children with transient pattern (e.g. intermittent asthma) will "outgrow" their asthma
- Management of **intermittent** asthma
  - Intermittent ICS not recommended
  - Regular ICS for children with severe or prolonged symptoms and those who have ED visits or hospital admissions
  - LTRA can be used continuously during the viral season, or at the onset of viral infections

ICS: inhaled corticosteroid; LTRA: leukotriene receptor antagonist
Kovesi et al. CMAJ 2009

Key Messages: Management of Pediatric Asthma

- Management of **persistent** asthma
  - Daily ICS preferred therapy
    - Treat for at least a season at a time
  - If ICS unsuccessful consider:
    - Question diagnosis of asthma
    - Comorbid conditions
  - If asthma uncontrolled with moderate dose ICS
    - Increase ICS dose or add LTRA
    - Minimal evidence for LABA in preschool and school-aged children
  - Refer patients requiring add-on therapy
- Assess asthma control (guidelines criteria) every visit
  - Monitor growth with growth chart if on ICS at each visit

ICS: inhaled corticosteroid; LABA: long-acting β-agonist; LTRA: leukotriene receptor antagonist;
Kovesi et al. CMAJ 2009
MDI: metered-dose inhaler

We have come a long way!!