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- Measures have been taken, by the Utah Department of Health, Bureau of Health Promotions, to ensure no conflict of interest in this activity

# ASTHMA: WHAT'S NEW IN 2014

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# Peds Asthma Statistics

- 9 million children diagnosed with asthma
- 75% increase in prevalence from 1980-1994
- 160% increase in prevalence in children <5 yo
- 12.8 million missed school days annually
- 12.7 million physician office visits
  - 5000 deaths annually (8-10/day in U.S.), ~40 per year in Utah.
  - 1.9 million ER visits
- Direct Health care costs >\$11.5 billion
- Indirect costs \$4.6 billion

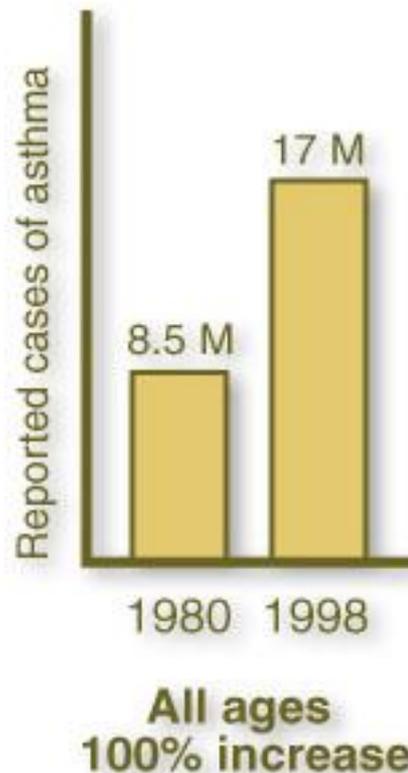
# Too many people have asthma

- 1:12 (25 million, 8% have asthma) in 2009 compared to 1:14 (7%) in 2001
- 10% kids, 8% adults – asthma 2009
  - ▣ 17% African American kids w/ asthma 2009
- 51% asthmatic adults – asthma attack
- 57% asthmatic kids – asthma attack 2008
- 185 kids, 3262 adults died asthma 2007

# 17 million have asthma –

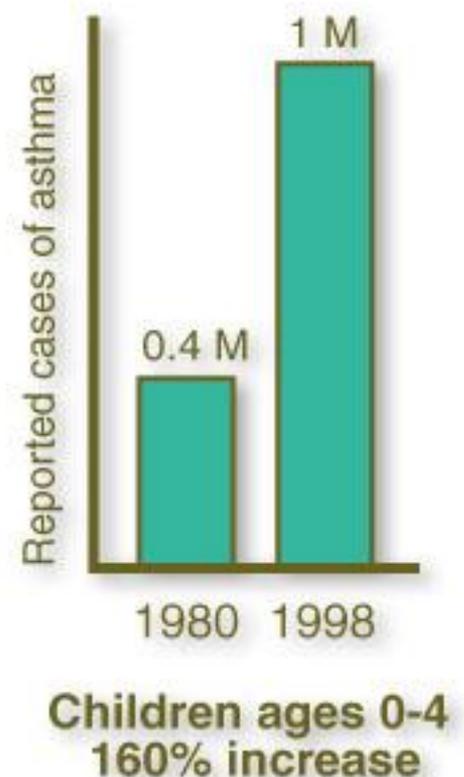
a serious allergic disease caused by inflammation of the lung airways.

Between 1980 and 1998, reported cases of asthma doubled.



The epidemic is most serious in children.

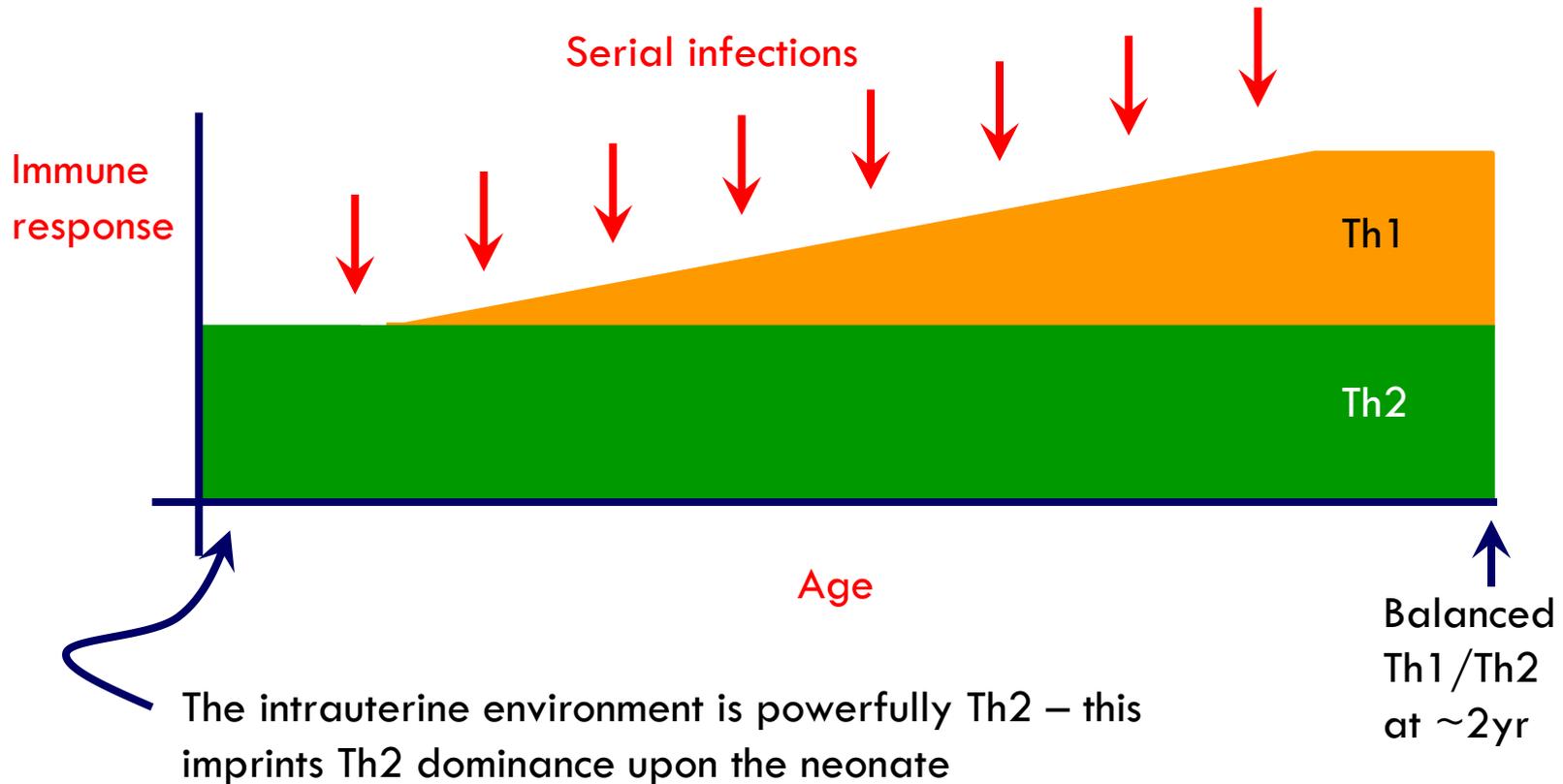
Asthma cases rose 160% between 1980 and 1998 in children ages 0-4.



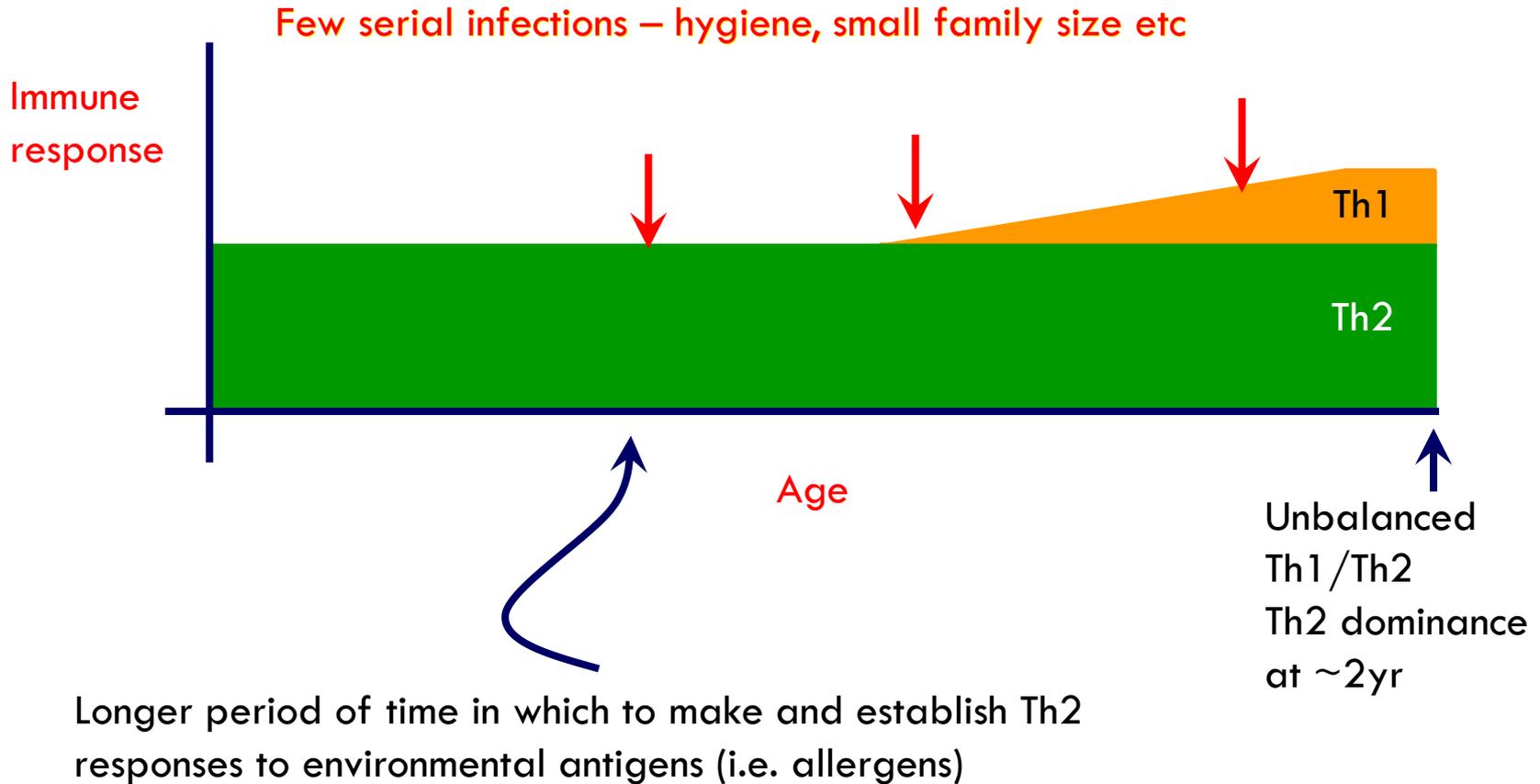
# Why is there so much more asthma?

- Leading theory is Hygiene Hypothesis – we are too clean and do not have enough exposure to bacteria/ virus, etc. Diversity seems to be good.
- What can I do to potentially reduce the risk of asthma in my kids?
  - Grow up on a farm with large animals.
  - Have a large family
  - Clean your kids pacifier in your mouth
- Most of these risk factors are modestly viable options, what can be done?
  - Allergy shots, new homes for pets, identify early, no smoking, PEAK study failed but showed meds work.

# Neonatal & infant immune systems



# Delayed maturation of Th1 capacity



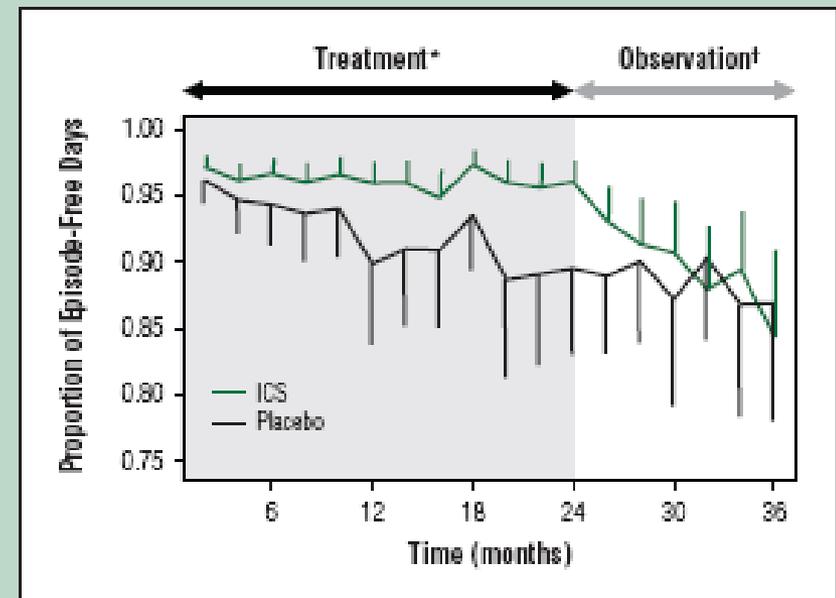
# What does not prevent asthma: PEAK showed early ICS do not alter the natural history of asthma.

**Aims:** To determine if early tx with ICS could alter the course of asthma.

**Methods:** ID high risk kids (API) then tx/ placebo and compare.

**Results:** Kids did well on tx (Flut 44 mcg 2p bid) but worsened off med. No lasting effect of ICS on the natural history of the disease.

**FIGURE 5**  
**EPIISODE-FREE DAYS DURING THE PREVENTION OF EARLY ASTHMA IN KIDS STUDY<sup>41</sup>**



\*P=.006; †P=.78.

ICS = inhaled corticosteroid.

Adapted with permission from Guilbert TW et al. Long-term inhaled corticosteroids in preschool children at high risk for asthma. *N Engl J Med*. 2006;354:1985-1997. Copyright © 2006 Massachusetts Medical Society. All rights reserved.

# Maternal exposure to farm life decreases asthma risk (ORs)

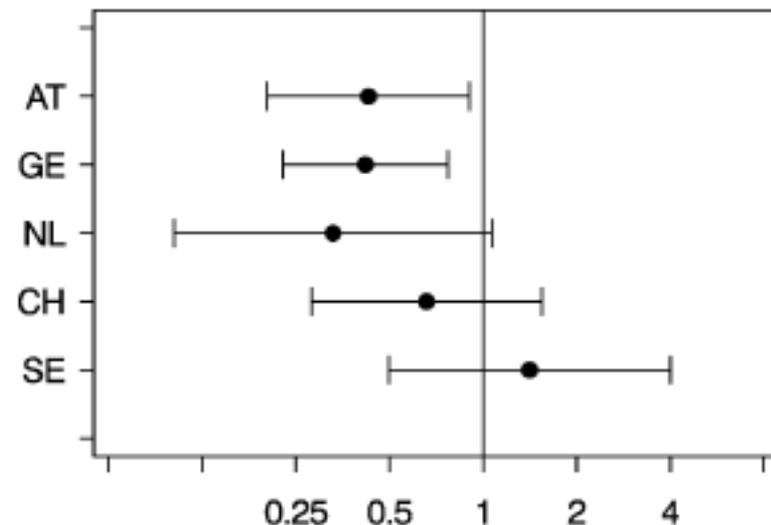
**TABLE I. Mutually adjusted ORs for associations of farm-related exposures with health outcomes**

	Atopic sensitization ( $\geq 3.5$ kU/L) (n = 285/2086)	Rhinoconjunctivitis symptoms (n = 507/8174)	Physician's diagnosis of rhinoconjunctivitis (n = 343/8130)	Wheezing (n = 552/8169)	Diagnosis of asthma (n = 656/8080)
Current farm exposure*	0.96 (0.63-1.46), <i>P</i> = .854	0.63 (0.45-0.88), <i>P</i> = .007	0.66 (0.41-1.07), <i>P</i> = .090	0.88 (0.65-1.19), <i>P</i> = .403	0.82 (0.62-1.09), <i>P</i> = .172
Regular contact with farm animals ever	0.76 (0.51-1.15) <i>P</i> = .194	0.87 (0.67-1.14), <i>P</i> = .321	0.69 (0.47-1.00), <i>P</i> = .049	0.97 (0.75-1.26), <i>P</i> = .822	0.94 (0.75-1.19), <i>P</i> = .629
Farm milk consumption ever	0.76 (0.52-1.11), <i>P</i> = .162	0.77 (0.58-1.03), <i>P</i> = .079	0.63 (0.42-0.93), <i>P</i> = .022	0.77 (0.58-1.02), <i>P</i> = .065	0.76 (0.59-0.99), <i>P</i> = .038
Stable exposure in pregnancy†	0.58 (0.39-0.86), <i>P</i> = .007	0.74 (0.50-1.09), <i>P</i> = .126	0.77 (0.44-1.36), <i>P</i> = .371	0.76 (0.54-1.07), <i>P</i> = .120	0.86 (0.63-1.16), <i>P</i> = .325

ORs are given with 95% CIs in parentheses and *P* values. The models are adjusted for age, sex, family history of atopy, parental education, environmental tobacco smoking, maternal smoking during pregnancy, number of older siblings, contact with pets ever presented in the table.

\*Current regular exposure to stable or barn or regular participation in haying.

†Mother worked regularly in stable during pregnancy.



# Pacifier cleaning & risk of allergy

**TABLE 1** Characteristics of the Infant Cohort

Characteristic	n (%) <sup>a</sup>
Male	93 (50)
At least 1 parent with a history of allergy <sup>b</sup>	148 (80)
Mother with a history of allergy	91 (49)
Father with a history of allergy	75 (41)
Cesarean delivery	25 (14)
Siblings at time of birth	90 (49)
Exclusively breastfed for >4 mo <sup>c</sup>	65 (35)
Use of pacifier in the first 6 mo of life <sup>c</sup>	136 (74)

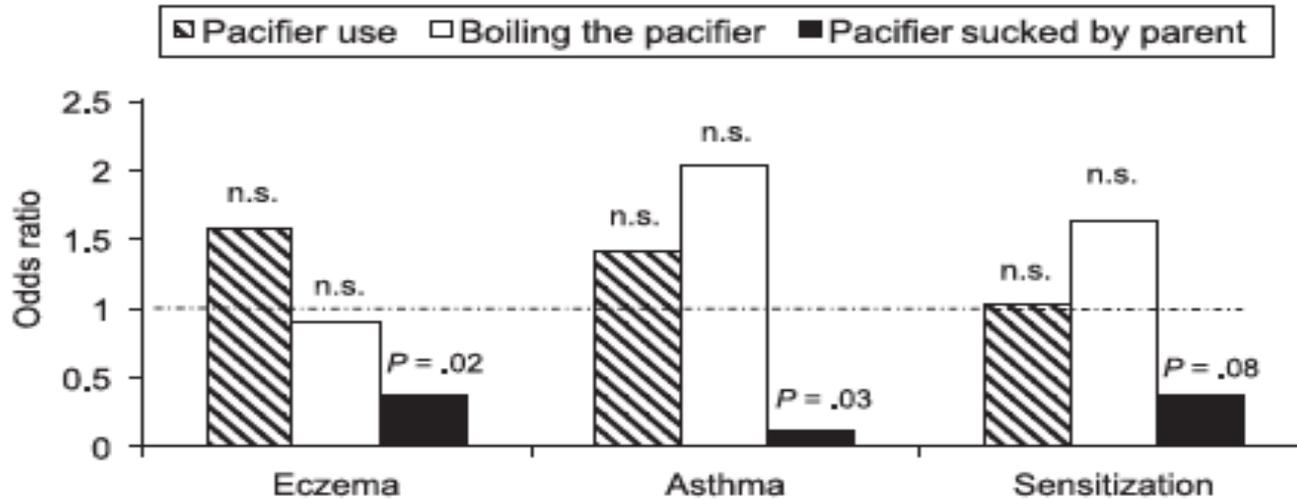
**TABLE 2** Pacifier Cleaning Practices Among the 136 Infants Using a Pacifier During the First 6 mo of Life

Technique	No. of children	%
Rinsing in tap water	113	83
Boiling	74	54
Parental sucking of the pacifier	65	48
Not reported	13	10
Total	136	100

□ Notably allergic group with 80% having one parent with allergy.

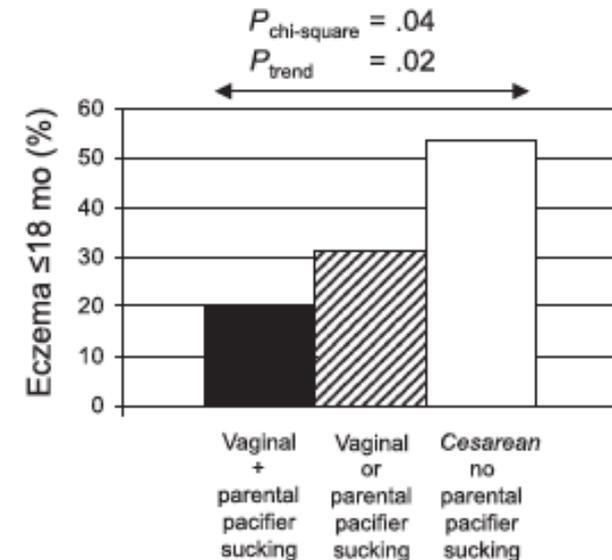
□ Pacifier cleaning practices

# Pacifier cleaning & risk of allergy



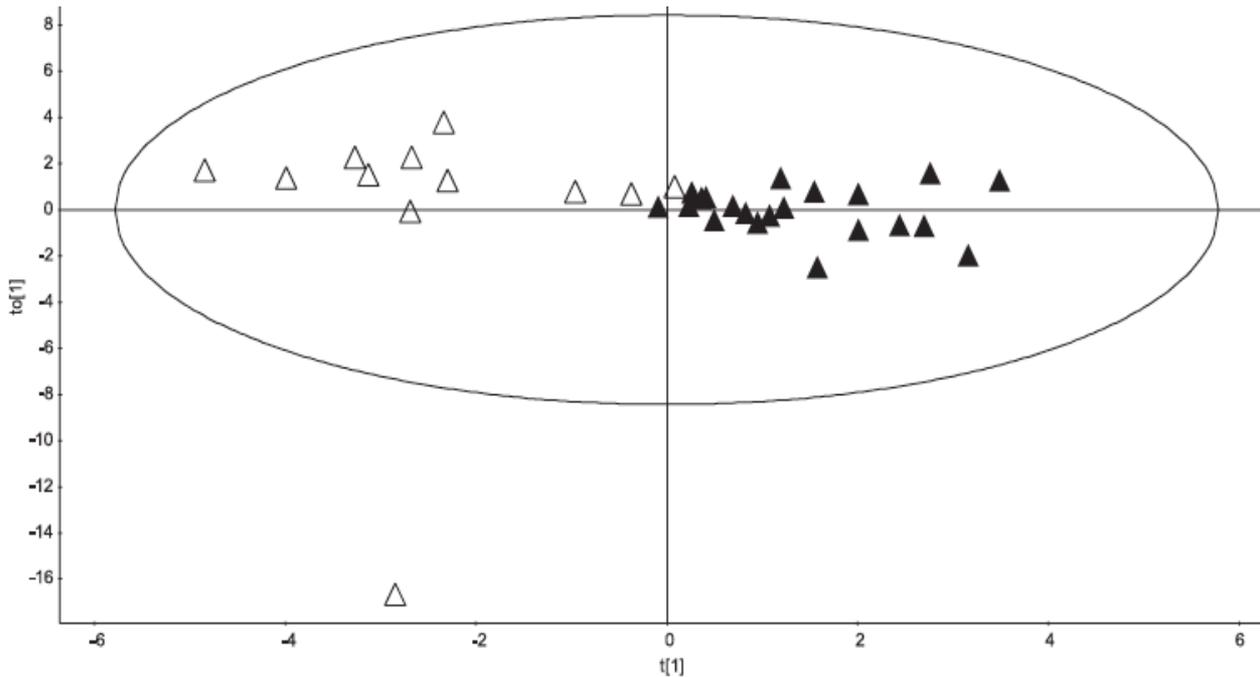
Pacifier cleaning by parental sucking significantly decreased asthma/eczema risk

Vaginal birth + parental pacifier sucking worked even better



# Pacifier cleaning & risk of allergy

Oral microbiota diversity



- △ Child whose parents did not suck their pacifier
- ▲ Child whose parents “cleaned” their pacifier by sucking it

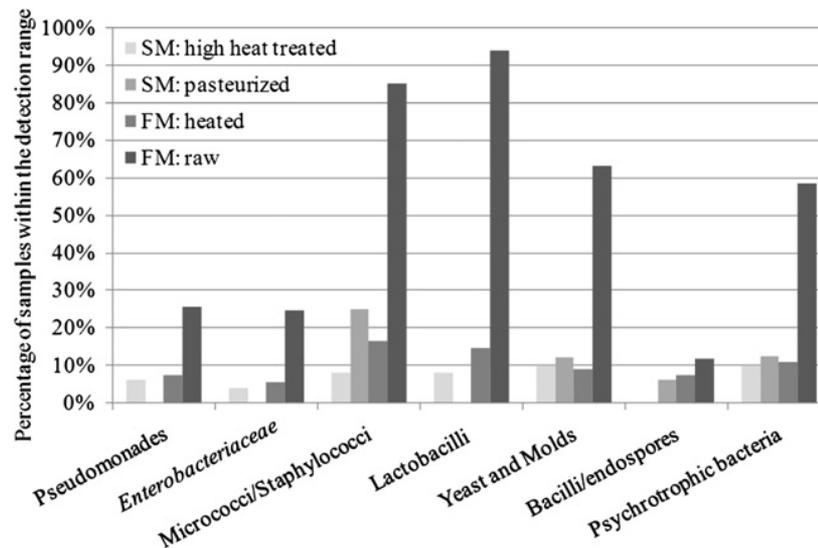
Children whose parents sucked their child’s pacifier were less likely to get asthma (OR 0.12), eczema (OR 0.37). Vaginal delivery provided additional benefit.

# Raw farm milk protective against asthma/ atopy

JACI 2011;128:766-73

Note greatly increased diversity of bacteria/ yeast in raw milk.

## Results



- No improvement with boiled milk & certainly not with pasteurized.
- Asthma aOR 0.59
- Atopy aOR 0.71
- Hay fever aOR 0.51

Not saying that we should all drink non-pasteurized farm milk as we do that for a reason but this does teach a concept that diversity in immune exposure matters.

# Epigenetics likely explains asthma inheritance & immunobiology of asthma.

Jia, JACI 2012

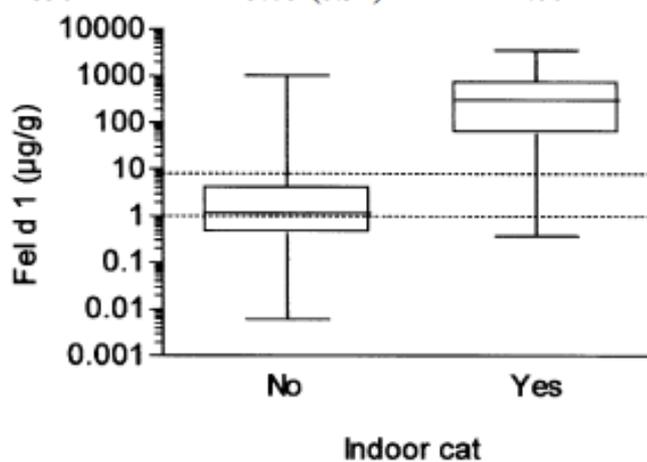
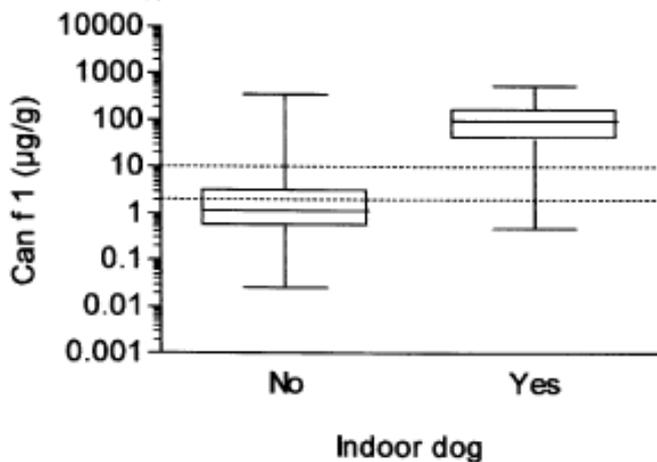
- More and more it appears epigenetics is the key to predicting asthma.
  1. No clear Mendelian inheritance patterns.
  2. 80% of asthma exacerbations triggered by infections of which 2/3 are rhinovirus (HRV)
  3. But HRV does not cause wheeze in all children nor does HRV & wheezing cause asthma in all children
  4. Study below that indicates that TT-SNPs expression at 17q21 is varied with HRV infection but not by RSV and increases risk of asthma from OR 0.8 to 26.2.

# Cat/ Dog allergy in US homes

JACI 2004;114-111-7

TABLE I. (Continued)

Characteristic	N	Geometric Mean (SE) Concentration in $\mu\text{g/g}$			
		Can f 1	P	Fel d 1	P
Summer	285	5.08 (0.91)		4.09 (0.73)	
Fall	345	3.84 (0.71)	.427	4.40 (0.65)	.316
Dog currently living in the home					
Yes	247	69.23 (7.88)		7.33 (1.41)	
No	570	1.33 (0.12)	<.001	3.84 (0.55)	.020
Cat currently living in the home					
Yes	187	9.42 (2.24)		199.70 (31.22)	
No	630	3.78 (0.51)	.001	1.47 (0.09)	<.001



Cat/ dog allergy were found in 99.9 % 100% of homes in the U.S.

FIG 2. Distributions of Can f 1 and Fel d 1 house indices in US homes with and without a dog or cat living in the home at the time of the survey. Box plots represent the 0, 25th, 50th, 75th, and 100th percentiles. The dotted lines represent the proposed thresholds of exposure that have been associated with an increased risk of sensitization (>2  $\mu\text{g/g}$  for Can f 1 and >1  $\mu\text{g/g}$  for Fel d 1) and asthma symptoms in allergic patients (>10  $\mu\text{g/g}$  for Can f 1 and >8  $\mu\text{g/g}$  for Fel d 1).

# Influence of cat characteristics on Fel d 1 levels in the home

Charlotte Nicholas, MPH\*; Ganesa Wegienka, PhD\*; Suzanne Havstad, MA\*; Dennis Ownby, MD†; and Christine Cole Johnson, PhD\*

*Ann Allergy Asthma Immunol.* 2008;101:47-50.

Table 1. Fel d 1 Levels by Household Cat Ownership,\* WHEALS Cohort, Detroit

	Households, No.	Fel d 1, $\mu\text{g/g}$			P value
		GM	GSD	Range	
Any cats in home					<.01 <sup>b</sup>
No	577	0.43	5.60	0.05-878.00	
Yes	104	32.88	13.12	0.05-2314.79	
No. of cats in home <sup>c</sup>					<.01 <sup>d</sup>
0	577	0.43	5.60	0.05-878.00	
1	59	20.80	11.63	0.06-2314.79	
$\geq 2$	44	68.91	12.05	0.05-2262.85	
In 1-cat homes					
Length of cat hair <sup>e</sup>					.51 <sup>b</sup>
Short	29	17.02	13.58	0.06-2314.79	
Long	11	22.39	8.31	0.25-973.18	
Sex of cat					.76 <sup>b</sup>
M	35	22.42	13.47	0.06-2314.79	
F	24	18.64	9.69	0.30-1275.84	
All cats					.02 <sup>b</sup>
Unaltered	15	5.16	10.36	0.06-151.68	
Altered	44	33.45	10.28	0.30-2314.79	
Male cats					.03 <sup>b</sup>
Unaltered	9	3.53	13.49	0.06-98.86	
Neutered	26	42.51	10.16	0.52-2314.79	
Female cats					.42 <sup>b</sup>
Unaltered	6	9.12	7.06	0.85-151.68	
Spayed	18	23.66	10.70	0.30-1275.84	
Time cat indoors (daily)					.70 <sup>b</sup>
0-12 h	9	16.05	7.44	0.80-602.12	
13-24 h	50	21.79	12.68	0.06-2314.79	

	No cats in the home				Any cats in the home					
	Households, No.	Fel d 1, $\mu\text{g/g}$			P value <sup>a</sup>	Households, No.	Fel d 1, $\mu\text{g/g}$			P value <sup>a</sup>
		GM	GSD	Range			GM	GSD	Range	
Flooring type										
Bare	123	0.30	6.36	0.05-878.00	<.01	31	13.33	11.69	0.06-602.12	.02
Carpeted	419	0.46	5.34	0.05-578.06		63	48.49	13.72	0.05-2314.79	
Environment					<.01					.08
Urban	325	0.31	4.91	0.05-878.00		31	16.99	11.67	0.06-471.51	
Suburban	252	0.65	6.05	0.05-578.06		73	43.52	13.30	0.05-2314.79	

# Do hypoallergenic pets exist?

Dog/ cat allergen is in saliva, parotid and perianal glands primarily

Characteristics of cat and dog allergen

Common name	Scientific name	Major allergen(s)	Minor allergen(s)	Allergen size	Source of allergen	Primary reservoirs of allergens	Areas of high concentration
Cat	<i>Felis domesticus</i>	Fel d 1	Fel d 2 Fel d 3 Fel d 4	20 – 25 kD	Feline salivary, sebaceous and perianal glands	Epidermis Fur	Bedding Upholstered Furniture Carpeting
Dog	<i>Canis familiaris</i>	Can f 1 Can f 2	Can f 3 Can f 4 Can f 5	19 – 27 kD	Tongue and parotid glands	Saliva Dander Fur	Bedding Upholstery Furniture Carpeting

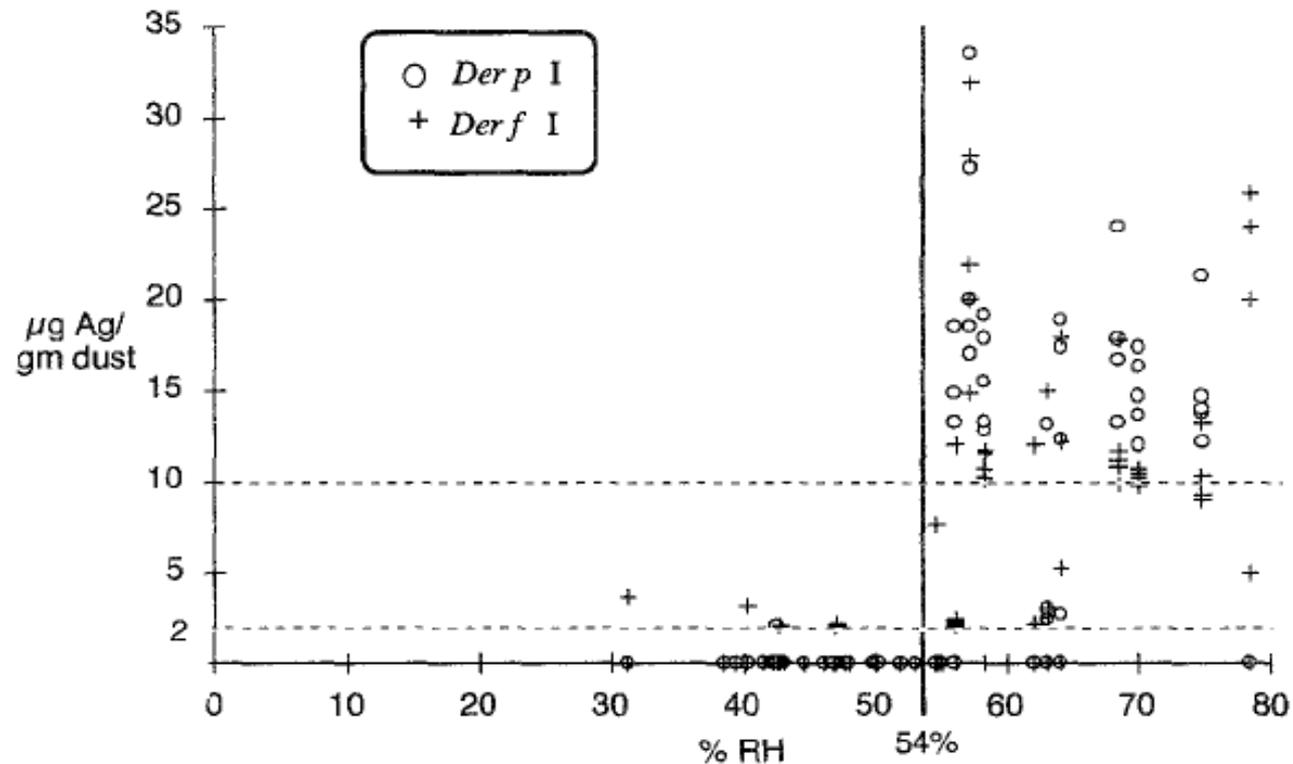
- Bathing can help as deposited on hair/ fur through licking, works better in dog and studies show minimum twice a week to help with allergy.
- Modest benefit at best with bathing/ HEPA filters/ etc.

Big picture if someone has an allergy to pets and asthma both, the only way to help control their asthma in regards to the pet allergy is: 1. getting rid of the pets, 2. increased medication: more ICS/ omalizumab (Xolair) or 3. allergy immunotherapy (allergy shots) and very rarely does anyone get rid of their pets (<10%).

# Dust mite in Colorado

JACI 1995;96:473-9

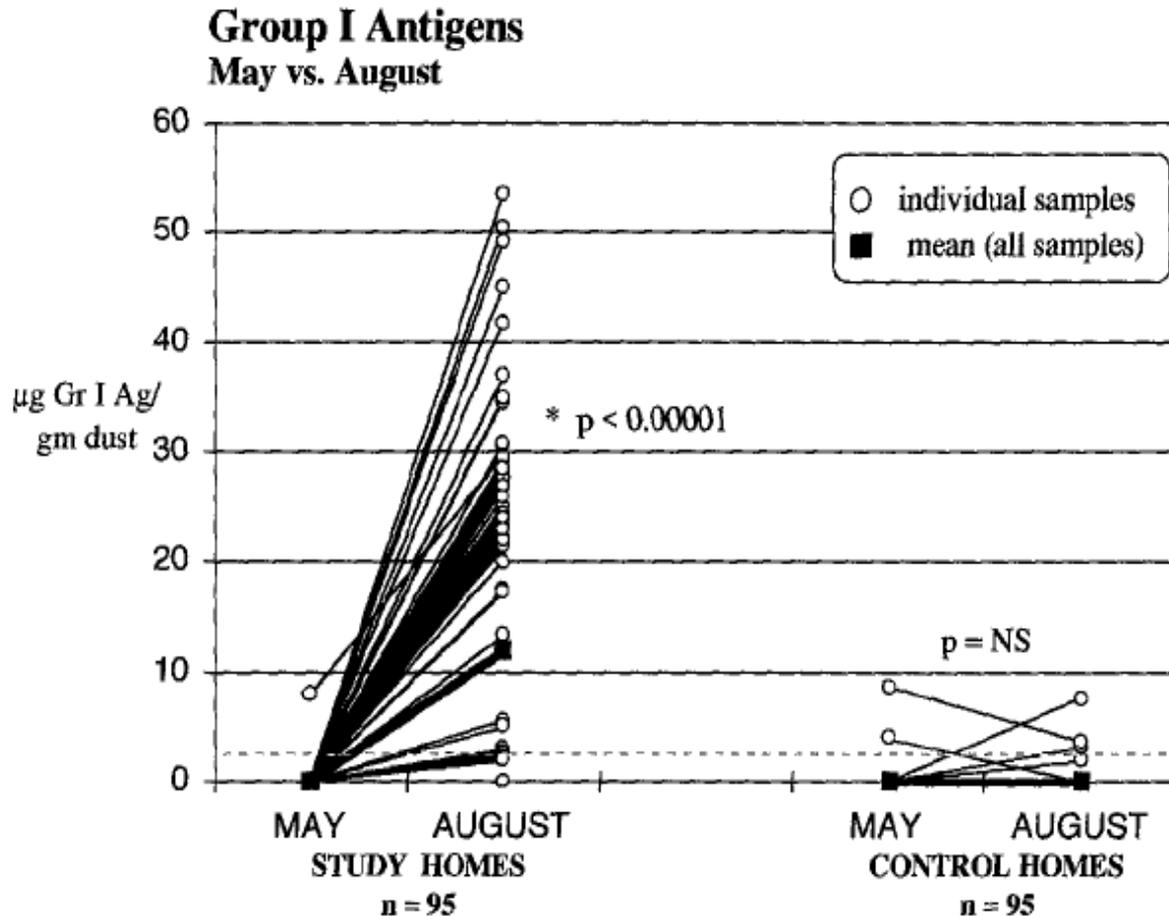
## Mite Allergen vs Relative Humidity



**FIG. 2.** Relationship between concentration of mite allergen (*Ag*) in dust samples and average relative humidity (*RH*) in August.

# Dust mite in Colorado

JACI 1995;96:473-9



Swamp cooler –  
65% have dust mite

A/C – 26% with dust  
mite & less

So in Utah dust mite prevention measures not that important. Generally no swamp cooler = no dust mites unless someone really uses a humidifier. Dust mite covers, etc do not work that well anyway.

# Key Asthma/ Environmental ideas

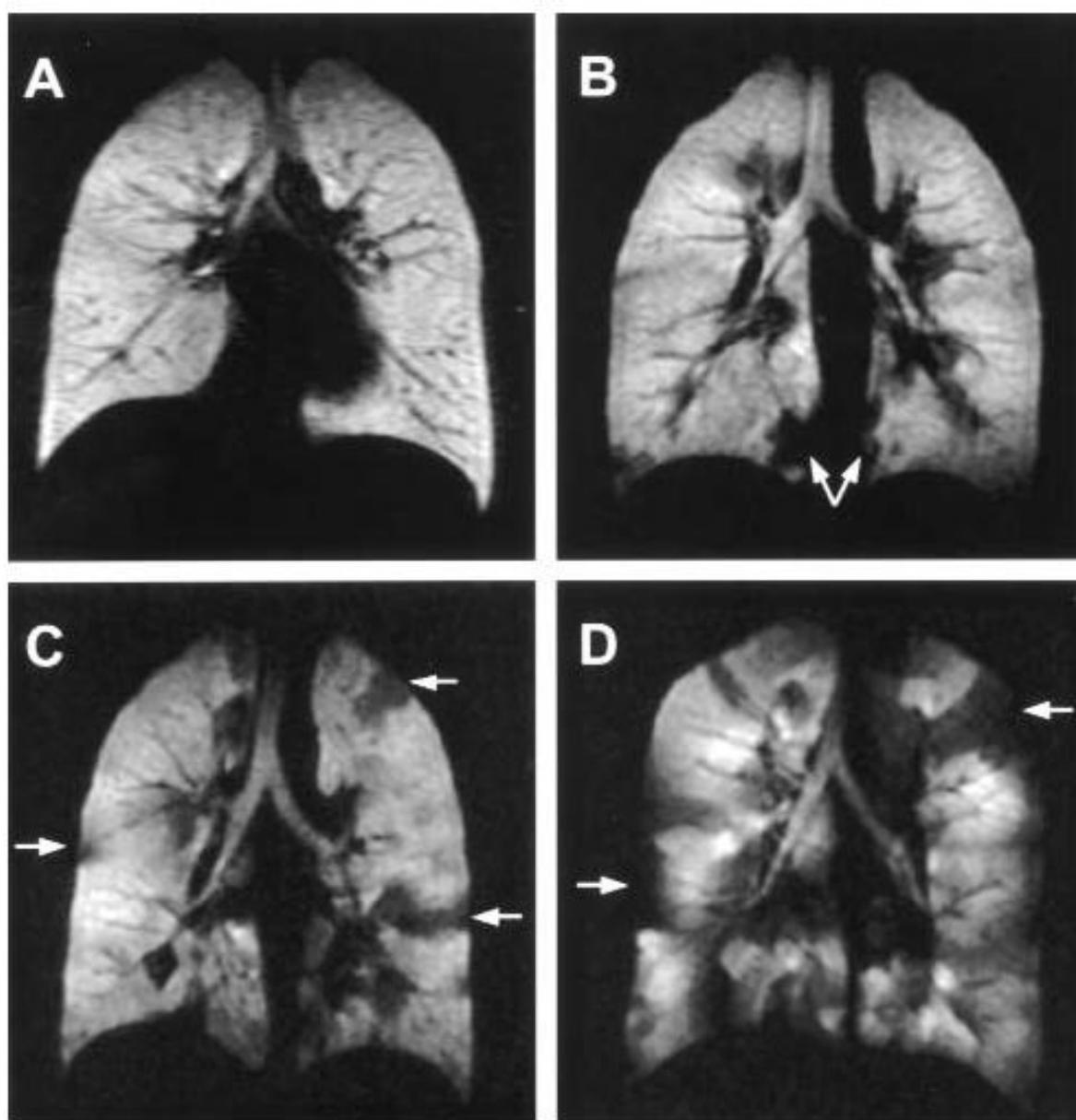
1. Minimal risk of dust mite in Utah –too dry.
2. Humidifiers are not recommended (increase risk of dust mite/ mold).
3. No such thing as a hypoallergenic cat/ dog.
4. HEPA filters are generally unhelpful unless there is a dog/ cat in the home and then it makes sense in bedroom.
4. Pollution (PM2.5 & 10) makes asthma worse & makes allergen more potent ( JACI 2012;129:228-31 but no JACI 2012;129:240-8 ↑ atopy).
5. Tobacco/ THC smoke is bad for kids asthma no matter how you look at it. Lung function is lost faster here than any other.
6. Like everything else, climate change will potentially make this worse.

# Asthma is expensive

- Average \$3300/ person/ year
- \$50.1 billion in US in 2007
  - ▣ 40% uninsured cannot afford meds
  - ▣ 11% insured cannot afford meds
- Minimal generic meds (montelukast)
  - ▣ Patents are on molecules are 14 years
  - ▣ Patents on devices 50 years (asthma is both)
- 59% kids/ 33% adults missed work/ school in 2009

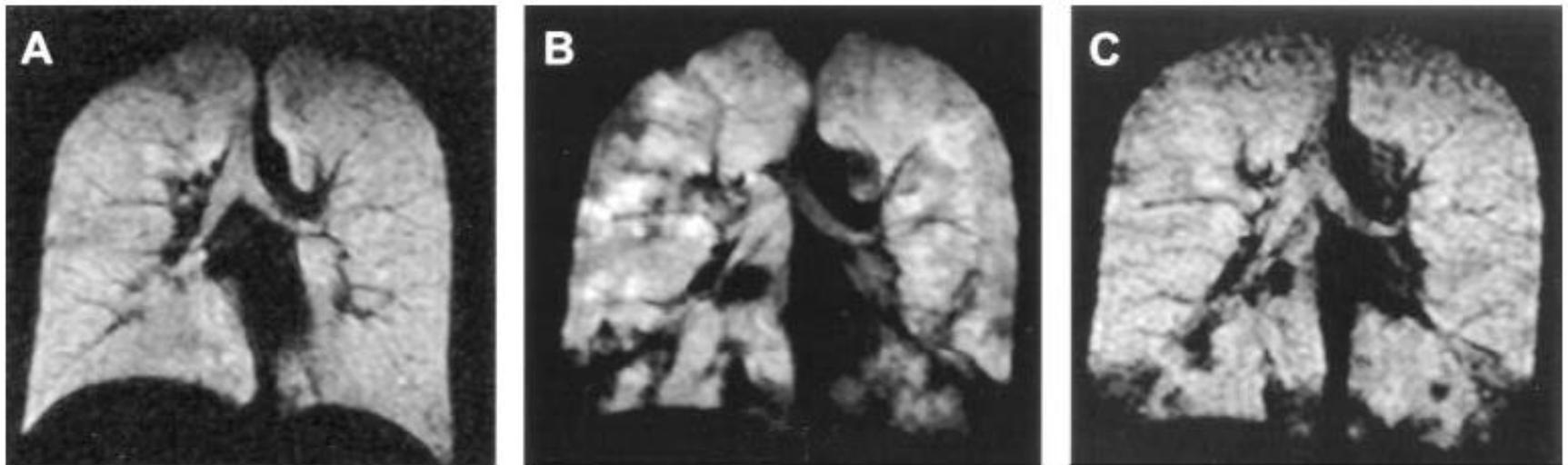
# QOL and peds asthma

- 504 children w/ parent in outpt peds asthma clinic
- Assessed for QOL measures – 2 cohorts of asthmatics
  - 1<sup>st</sup> – mean age 5.3 years
  - 2<sup>nd</sup> – mean age 10.8 years
- The only major predictor of poor QOL was how well controlled their asthma was (less OCS, ER/urgent care visits the better QOL)
- \*\*Happy life in asthmatics = well controlled asthma



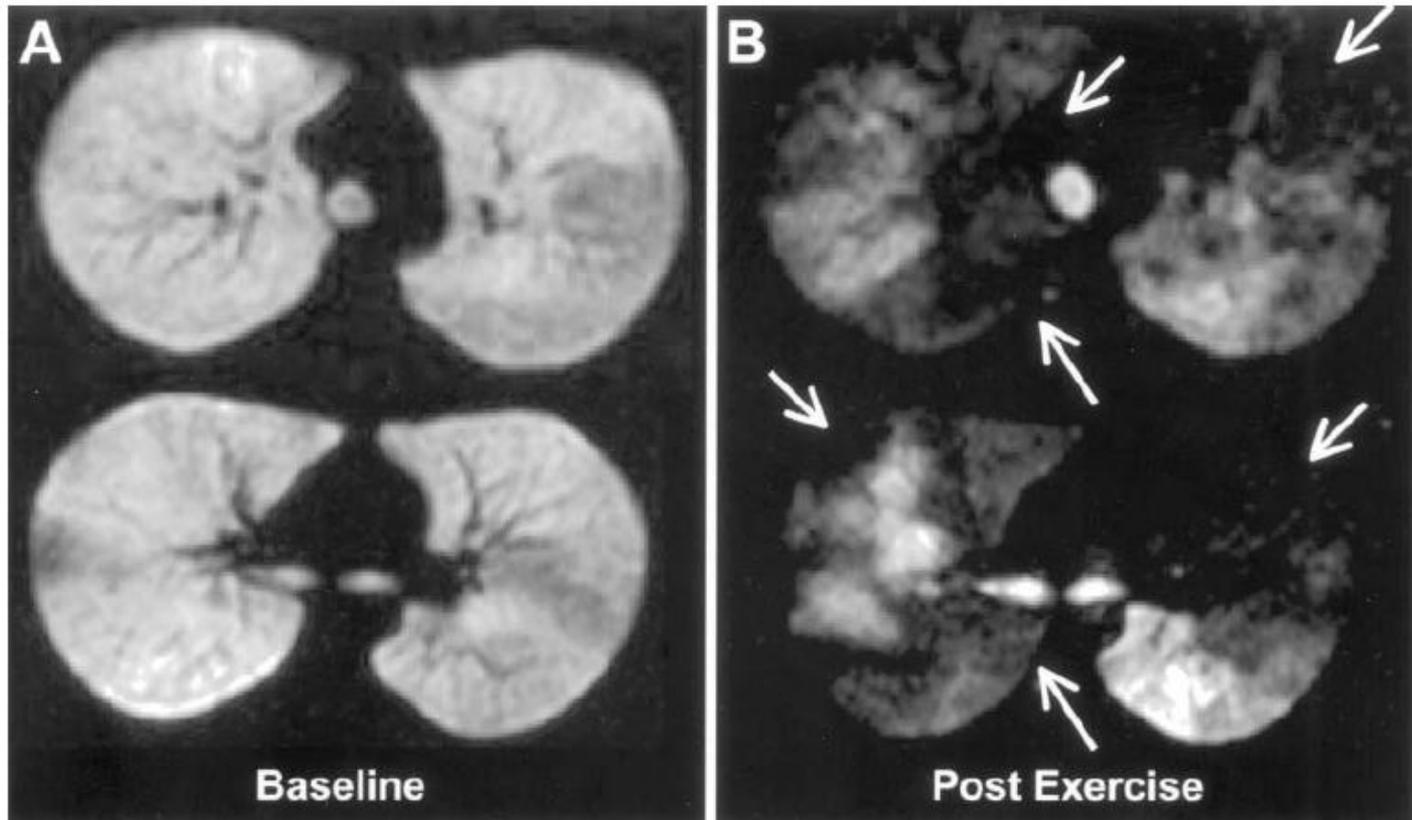
**FIG 1.** Coronal MR images obtained immediately after inhalation of HHe3 gas in a healthy normal volunteer (A) and in patients with mild (FEV<sub>1</sub> of 132% of predicted value; B), moderate (FEV<sub>1</sub> of 83% of predicted value; C), and severe (FEV<sub>1</sub> of 34% of predicted value; D) asthma. The distribution of the gas is homogenous in the normal volunteer, and ventilation defects are seen with increasing numbers in the asthmatic patients with increasing severity (arrows pointing at several defects).

# MRI Imaging – methacholine



**FIG 2.** Methacholine challenge. **A**, Baseline coronal HHe3 MR image of the lungs in a patient with mild asthma ( $FEV_1$  of 118% of predicted value) shows relative homogenous distribution of the gas in the lungs. **B**, Image obtained after methacholine challenge testing ( $FEV_1$  of 73% of predicted value) demonstrates a large number of ventilation defects. **C**, Image obtained after inhalation of albuterol shows improvement of the ventilation defects.

# MRI imaging – Exercise challenge



**FIG 3. A,** Axial HHe3 MR image of patient with mild asthma at baseline (FEV<sub>1</sub> of 103% of predicted value) shows mildly heterogeneous distribution of the gas in the lungs. **B,** After exercise (FEV<sub>1</sub> of 39% of predicted value), very extensive ventilation defects have developed. Two levels of the lung are shown for subject 395.

# Asthma predictive index (API)

**TABLE I. mAPI\* versus original API<sup>14</sup>**

1. A history of  $\geq 4$  wheezing episodes with  $\geq 1$  physician's diagnosis.
2. In addition, the child must meet  $\geq 1$  of the following major criteria or  $\geq 2$  of the following minor criteria:

mAPI: major criteria

- Parental history of asthma
- Doctor-diagnosed atopic dermatitis
- Allergic sensitization to  $\geq 1$  aeroallergen

mAPI: minor criteria

- Allergic sensitization to milk, egg, or peanut
- Wheezing unrelated to colds
- Blood eosinophils  $\geq 4\%$

Original API: major criteria

- Parental history of asthma
- Doctor-diagnosed atopic dermatitis

Original API: minor criteria

- **Doctor-diagnosed allergic rhinitis**
- Wheezing unrelated to colds
- Blood eosinophils  $\geq 4\%$

Reproduced with permission from Guilbert.<sup>17</sup>

\*Differences in indices are shown in boldface.

# Growth of preschool children at high risk for asthma 2 years after discontinuation of fluticasone

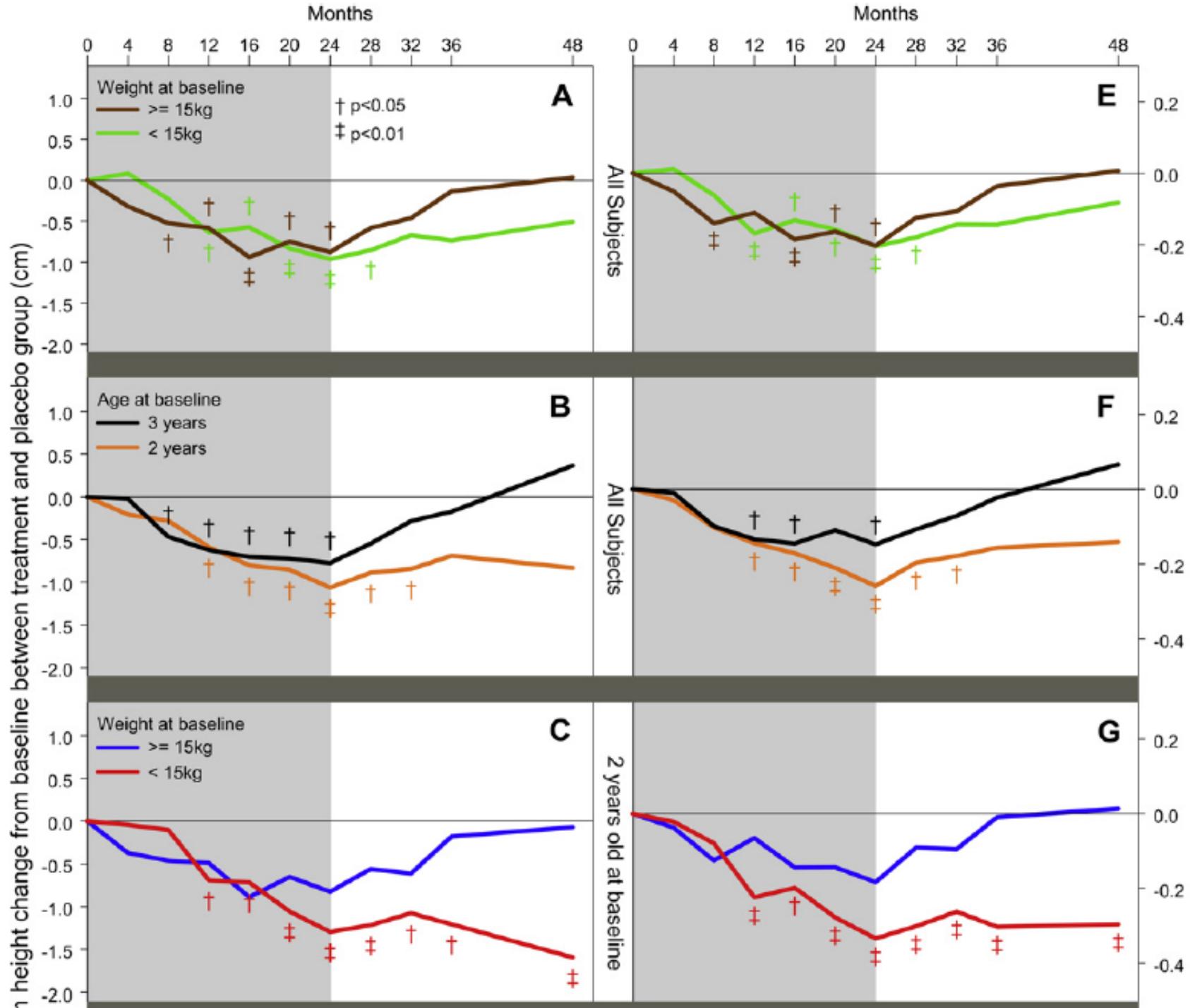
JACI 2011;128:956-63

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PEAK study in 2007 showed that fluticasone 44mcg 2p bid with spacer worked but decreased growth velocity. This is the follow up.

It appears age and size matters.

If younger and smaller and likely higher relative ICS dose then more affect on height



# ICS affects height

- Loss of growth velocity is likely permanent.
- Loss of growth velocity is dose dependent
  - ▣ More ICS/ OCS more decrease in growth.
  - ▣ Earlier exposure to steroids, more growth loss
  - ▣ Ave 1.2cm (range <0.5cm to 4cm)
- <100 mcg Mometasone ICS does not show decrease in height.
- 176mcg fluticasone (44mcg 2p BID) did lose 1 cm
  - ▣ Less steroids, less loss of growth (use LABA, LTRA, PRN?)

# How to help parents get ICS vs OCS

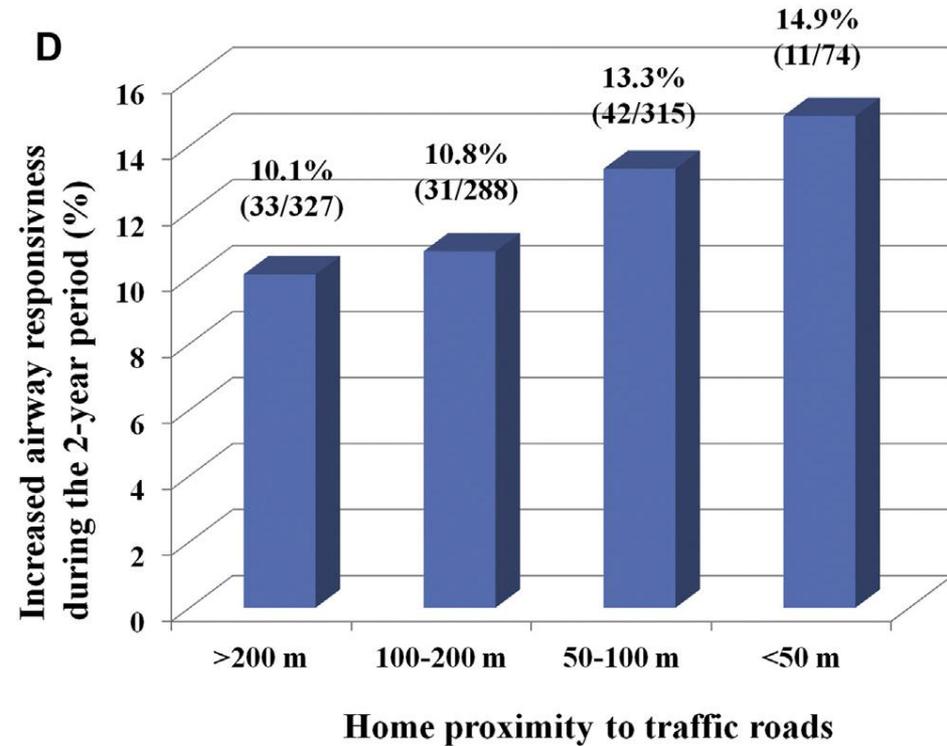
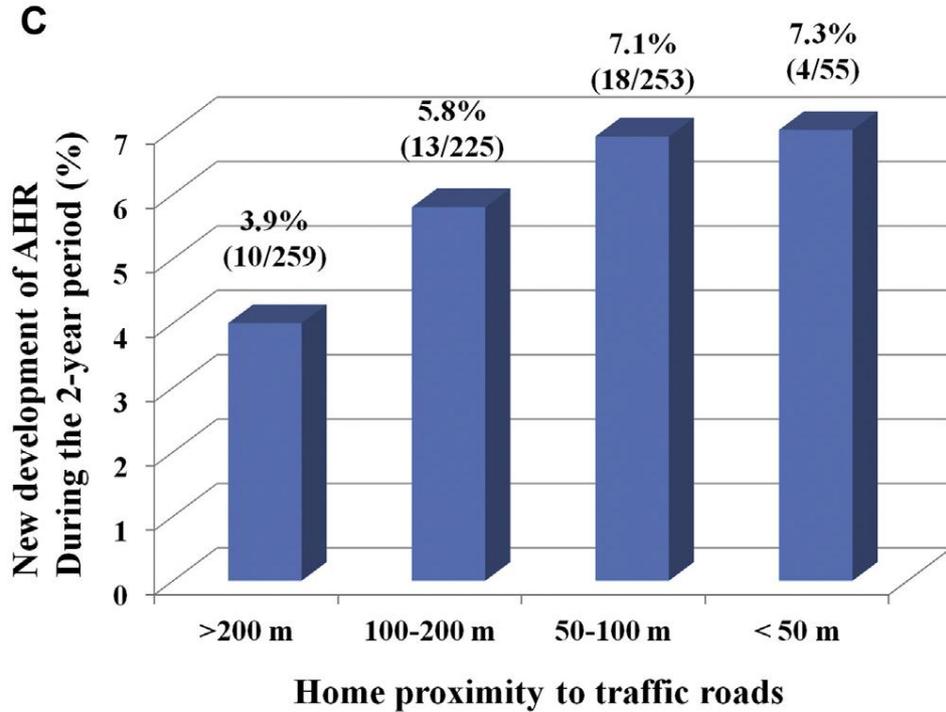
- I often teach parents my goal is to use as little drug as possible.
- ICS daily decreases chance of exacerbation
- Daily ICS uses less drug than PRN OCS
  - Flovent 44mcg 2p BID = 176mcg fluticasone/ day but MDIs/ DPIs poor efficiency so get 10%, ~20 mcg/day
- OCS of Prednisilone 15/5, 1 tsp BID for 5 days = 150mg of drug which = 150,000 mcg drug, all absorbed.
- $150,000\text{mcg} / 20\text{mcg} = 7500$  days of ICS to equal 1 course of OCS. Daily ICS is less med then PRN OCS.

# Air pollution & asthma/allergy

- 5-8% increase in ER visits from air pollution
- Atlanta 1996 Olympics, decreased asthma ER visits/ hospitalizations with decreased pollution
- Increased pollution = decreased lower lung growth in children
- Increased ozone = increased potency & number of pollen
- EPA estimates by 2020, costs of increased air pollution controls 65 billion, health costs saved 2 trillion

# Traffic-related air pollution is associated with airway hyperresponsiveness

JACI 2014 in press



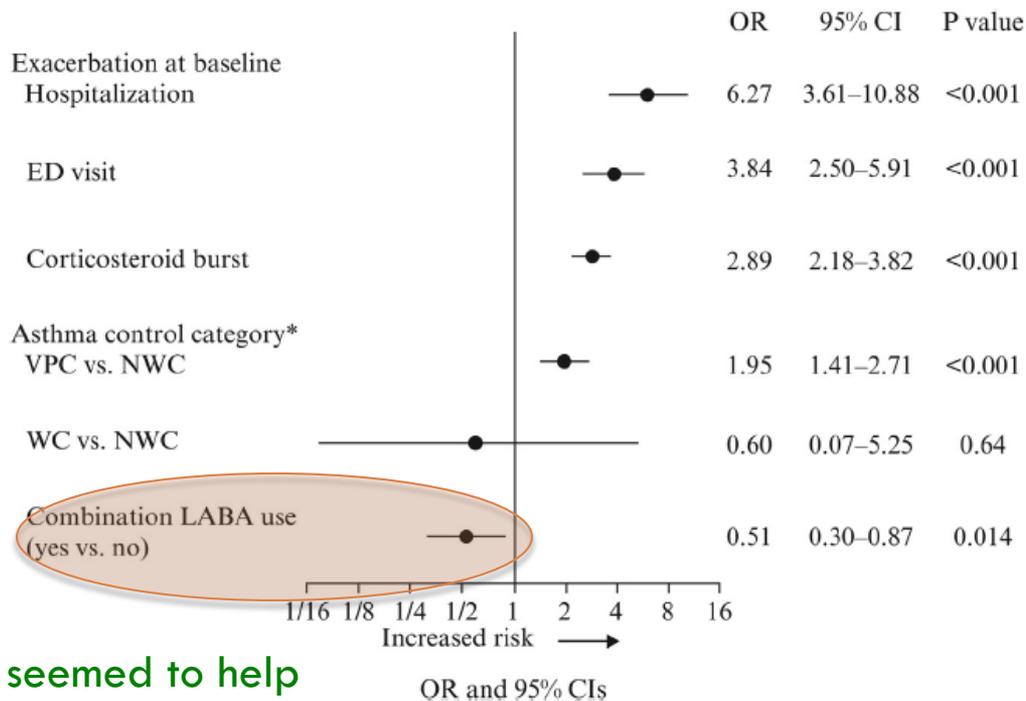
Prior study showed no affect on proximity to TRAP and AHR but done in adults.

This study supports TRAP being harmful to pediatric lungs however.

# Clinical Burden and Predictors of Asthma Exacerbations in Patients on Guideline-based Steps 4-6 Asthma Therapy in the TENOR Cohort

JACI Pract 2014;2:193-200

Step 4,5,6 patients in NHLBI guidelines are much more likely to exacerbate despite more aggressive therapy.



ICS/ LABA really seemed to help

FIGURE 3. Clinical predictors of asthma exacerbation at month 12. ORs and 95% CIs that assessed risk of asthma exacerbations at month 12 were generated by using stepwise multivariable logistic regression. Candidate predictor variables included in the model were prespecified based on prior analyses (Table E1).<sup>19</sup> COPD, Chronic obstructive pulmonary disease; NWC, not well controlled; WC, well controlled.

# Azithromycin or montelukast as inhaled corticosteroid-sparing agents in moderate-to-severe childhood asthma study

JACI 2008;122:1138-44

Question: Is daily azithromycin or montelukast or placebo better as an add-on agent to ICS/ LABA in severe Peds asthma (6-18 yo)?

TABLE I. Criteria for assigning status of control and inadequate control of asthma during both the run-in and the double-blind treatment periods

## Control

At-home measurements: symptoms, albuterol use, or PEF <80% of baseline value occurring  $\leq 3$  days on average per week over 2 weeks; nocturnal awakenings less than 2 days for the 2 weeks

In-clinic measurements: Prebronchodilator FEV<sub>1</sub> value >80% of best prebronchodilator value obtained during the run-in period

## Inadequate control

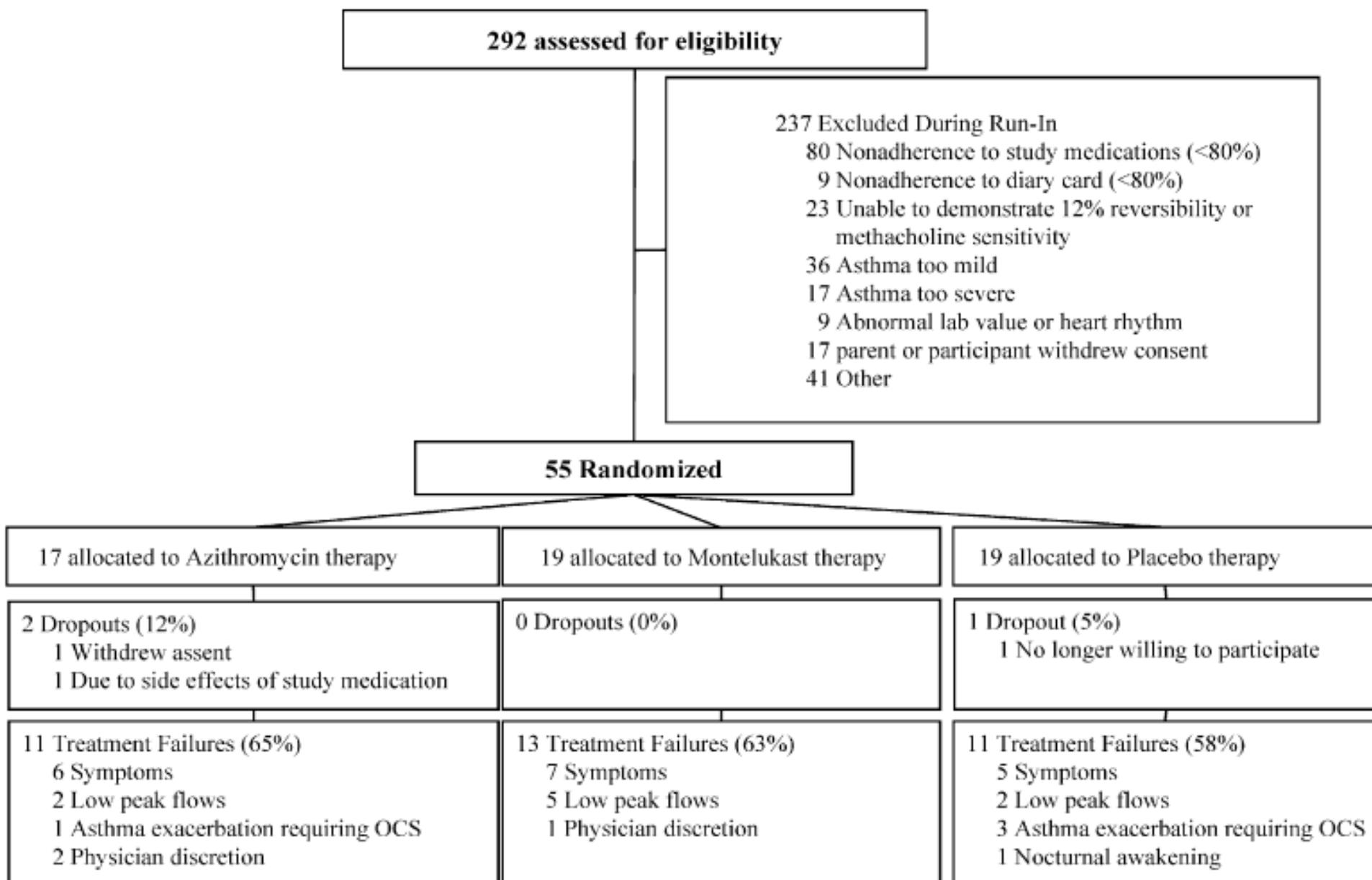
1. Appearance of increased symptoms or decreased pulmonary function:

At-home measurements: Days with symptoms, albuterol use for symptoms or low PEF, or PEF <80% of baseline value >3 days/week on average over 2 weeks; nocturnal awakening  $\geq 2$  nights over 2 weeks

In-clinic measurements: Prebronchodilator FEV<sub>1</sub> values on 2 consecutive sets of spirometric determinations 1 to 4 days apart that are less than 80% of the best prebronchodilator value obtained before randomization

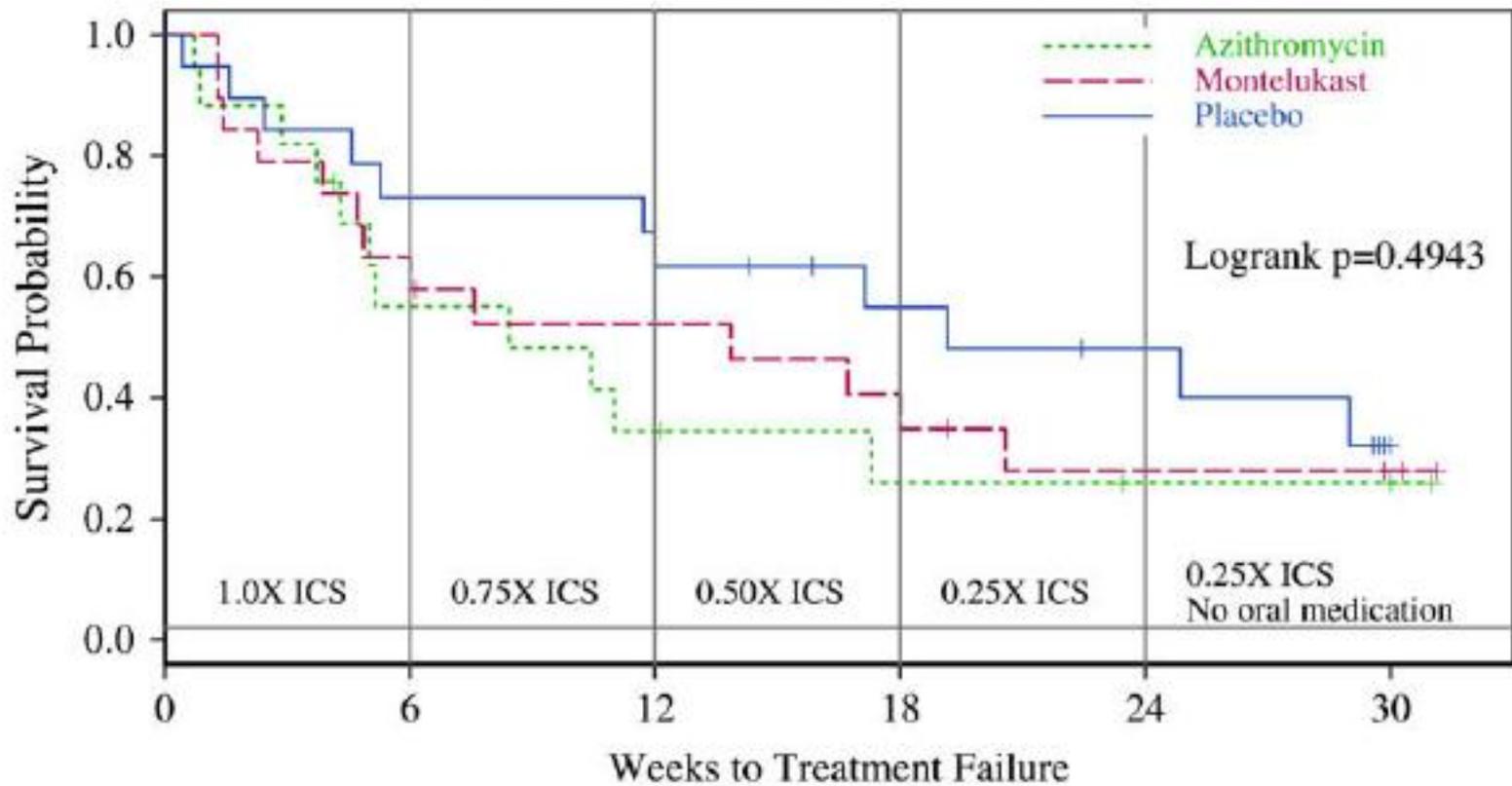
2. Exacerbation of asthma as determined by symptoms of cough, dyspnea, chest tightness, wheeze, and/or PEF <80% of personal best not responding to an increase in inhaled short-acting bronchodilator with need for oral corticosteroid therapy

Goal: NIH sponsored study, 200 peds asthmatics uncontrolled on combo therapy with ICS/ LABA and figure out best therapy as add on, azithro or montelukast.



**FIG 1.** Cascade of enrollment. *OCS*, Oral corticosteroid.

### Product-Limit Survival Function Estimates



	No. of Subjects	Event	Censored	Median Survival (95% CI)
Azithromycin	17	65% (11)	35% (6)	8.43 (4.29, 17.29)
Montelukast	19	68% (13)	32% (6)	13.86 (4.71, 20.57)
Placebo	19	58% (11)	42% (8)	19.14 (11.71, NA)

**FIG 3.** Product-limit survival function estimates for time to return of inadequate control for children assigned to the azithromycin (n = 17), montelukast (n = 19), and placebo (n = 19) groups.

# Conclusions

1. As add-on agents to ICS/ LABA no difference between azithromycin or montelukast or placebo.
2. Note, goal was to recruit 200 kids at 6 national pediatric asthma specialty centers across the country and only 55 kids enrolled. Why????
3. Once these kids got research level care for their asthma they were controlled and their asthma was too mild for the study!!!!
4. If a child's asthma is doing poorly: they are not taking their meds right or there is a pet/ smoker in the home most of the time.

# Test for Respiratory and Asthma Control in Kids (TRACK): Clinically meaningful changes in score

JACI 2011;128:983-8

**TABLE IV.** TRACK scores (physicians' control rating) of less than 80 used to screen patients with uncontrolled asthma or respiratory symptoms

TRACK score	Physicians' control table rating			
	Baseline		Follow-up	
	OR*	95% CI	OR*	95% CI
75 points	1.35	1.33-1.37	1.45	1.43-1.47
70 points	1.82	1.80-1.84	2.10	2.08-2.12
65 points	2.45	2.41-2.49	3.05	3.03-3.07
60 points	3.30	3.26-3.34	4.42	4.40-4.44
55 points	4.46	4.43-4.49	6.41	6.39-6.43
50 points	6.01	5.97-6.05	9.29	9.27-9.31

Another asthma questionnaire this time for kids 0-4 years old.

I still think the NHLBI guidelines got it the best.

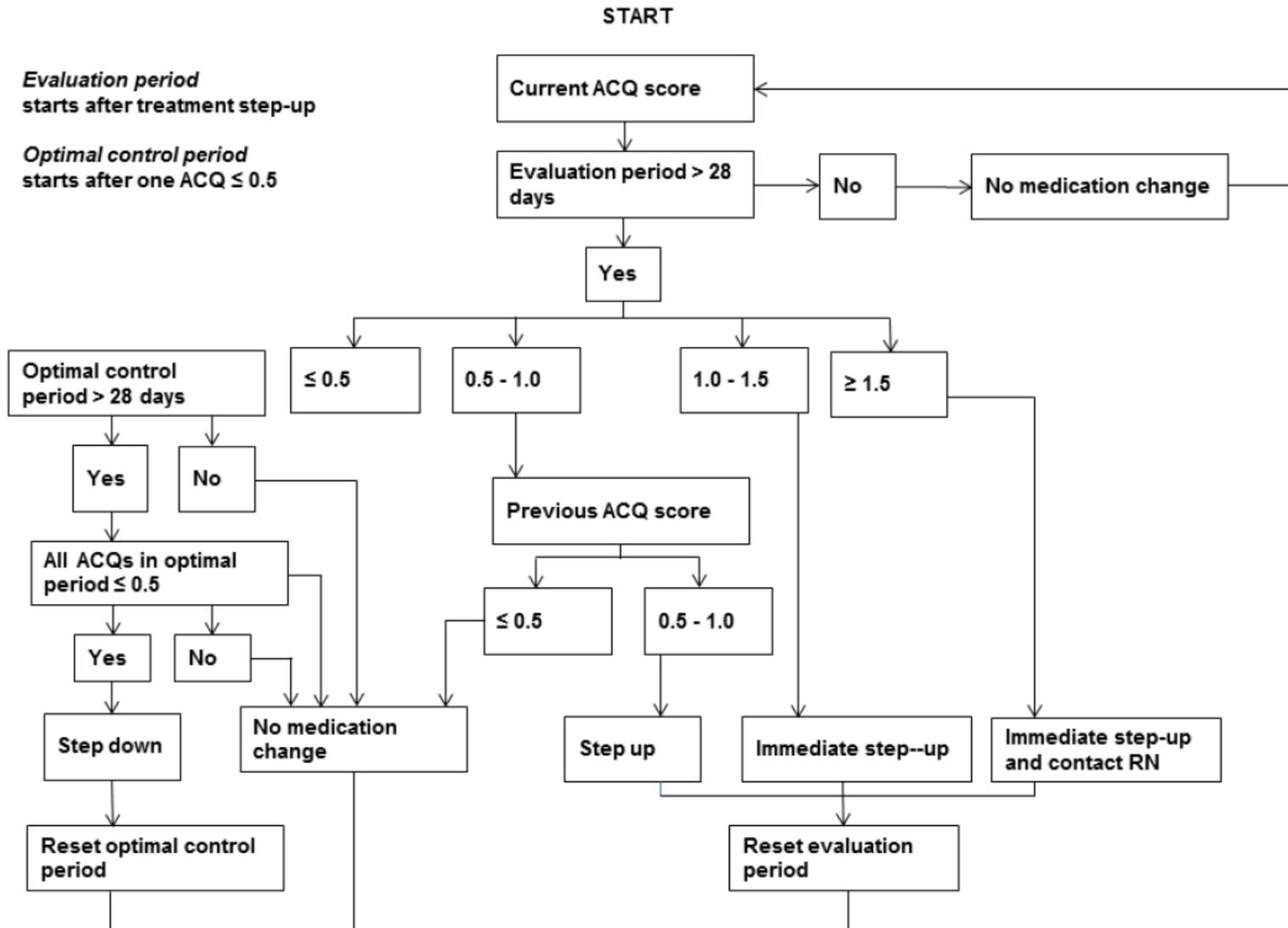
						Score
<b>1</b>	During the <u>past 4 weeks</u> , how often was your child bothered by breathing problems, such as wheezing, coughing, or shortness of breath?					<input type="text"/>
	Not at all <input type="checkbox"/> 20	Once or twice <input type="checkbox"/> 15	Once every week <input type="checkbox"/> 10	2 or 3 times a week <input type="checkbox"/> 5	4 or more times a week <input type="checkbox"/> 0	
<b>2</b>	During the <u>past 4 weeks</u> , how often did your child's breathing problems (wheezing, coughing, shortness of breath) wake him or her up at night?					<input type="text"/>
	Not at all <input type="checkbox"/> 20	Once or twice <input type="checkbox"/> 15	Once every week <input type="checkbox"/> 10	2 or 3 times a week <input type="checkbox"/> 5	4 or more times a week <input type="checkbox"/> 0	
<b>3</b>	During the <u>past 4 weeks</u> , to what extent did your child's breathing problems, such as wheezing, coughing, or shortness of breath, interfere with his or her ability to play, go to school, or engage in usual activities that a child should be doing at his or her age?					<input type="text"/>
	Not at all <input type="checkbox"/> 20	Once or twice <input type="checkbox"/> 15	Once every week <input type="checkbox"/> 10	2 or 3 times a week <input type="checkbox"/> 5	4 or more times a week <input type="checkbox"/> 0	
<b>4</b>	During the <u>past 3 months</u> , how often did you need to treat your child's breathing problems (wheezing, coughing, shortness of breath) with quick-relief medications (albuterol, Ventolin <sup>®</sup> , Proventil <sup>®</sup> , Maxair <sup>®</sup> , ProAir <sup>®</sup> , Xopenex <sup>®</sup> , or Primatene <sup>®</sup> Mist)?					<input type="text"/>
	Not at all <input type="checkbox"/> 20	Once or twice <input type="checkbox"/> 15	Once every week <input type="checkbox"/> 10	2 or 3 times a week <input type="checkbox"/> 5	4 or more times a week <input type="checkbox"/> 0	
<b>5</b>	During the <u>past 12 months</u> , how often did your child need to take oral corticosteroids (prednisone, prednisolone, Orapred <sup>®</sup> , Prelone <sup>®</sup> , or Decadron <sup>®</sup> ) for breathing problems not controlled by other medications?					<input type="text"/>
	Not at all <input type="checkbox"/> 20	Once or twice <input type="checkbox"/> 15	Once every week <input type="checkbox"/> 10	2 or 3 times a week <input type="checkbox"/> 5	4 or more times a week <input type="checkbox"/> 0	
						<b>Total</b>
						<input type="text"/>

The brands mentioned herein are trademarks of their respective owners and are not trademarks of the AstraZeneca group of companies. The makers of these brands are not affiliated with and do not endorse AstraZeneca or its products.

**FIG 1. TRACK questionnaire.** TRACK is a trademark of the AstraZeneca group of companies. ©2009 AstraZeneca LP. All rights reserved 278650 5/09. Reprinted with permission from AstraZeneca Pharmaceuticals.

# Long-Term Outcomes of Internet-Based Self-Management Support in Adults With Asthma: Randomized Controlled Trial

J Med Internet Res 2013;15:e188





### User menu

- ▢ measurements
- ▢ private messages
- ▢ forum
- ▢ F.A.Q.
- ▢ contact
- ▢ log out

### Asthma information

- ▼ all about asthma
  - ▢ what is asthma?
  - ▢ monitoring
  - ▶ treatment
  - ▢ self-management
- ▢ presentations
- ▢ video instruction about inhaler technique
- ▢ useful links

Start

### Measurements and questionnaires

Enter lung function

Enter ACQ

Show results

Print

ACQ score: 1.4

Date: 15-11-2007

Your asthma is not well controlled. Increase your medication to step 3.

#### Step

0 Salbutamol as needed

1 Fluticasone 100 2 1 200

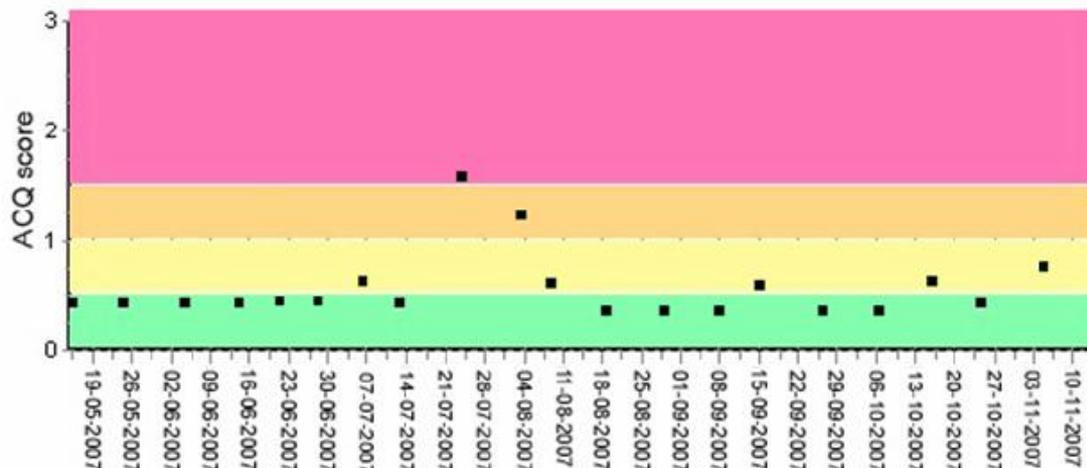
2 Fluticasone 250 2 1 500

**3 Salmeterol/fluticasone 50/250 2 1 100/500**

4 Salmeterol/fluticasone 50/250 2 2 200/1000

5 Contact asthma nurse: consider addition of montelukast

6 Contact asthma nurse: consider addition of prednisone



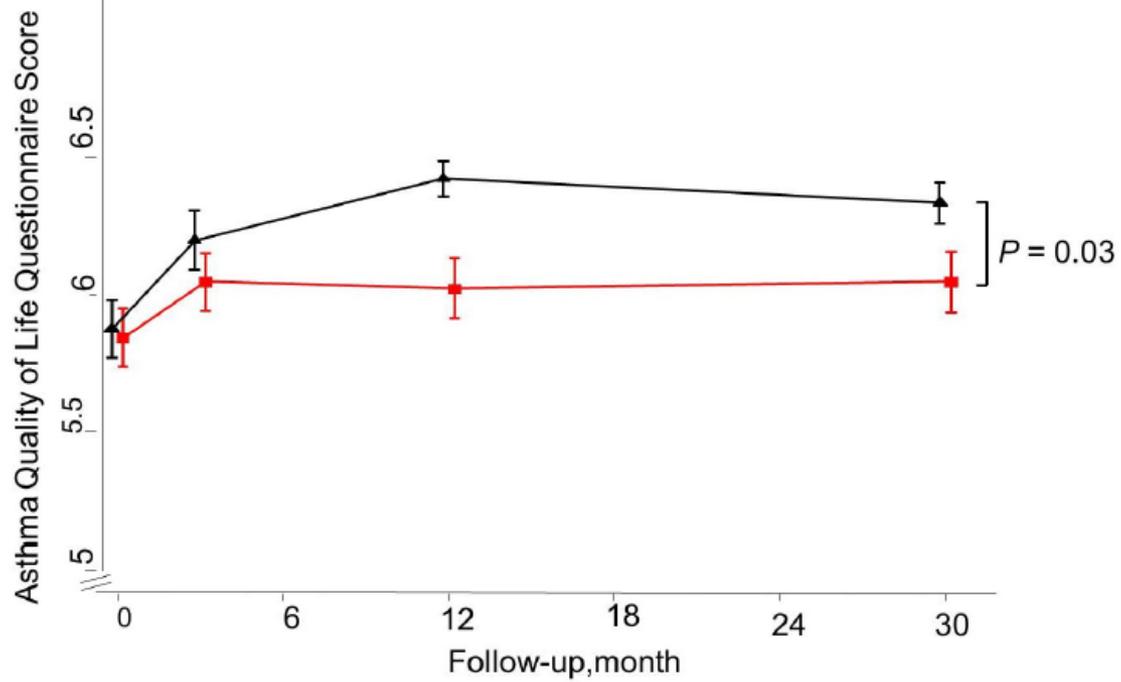
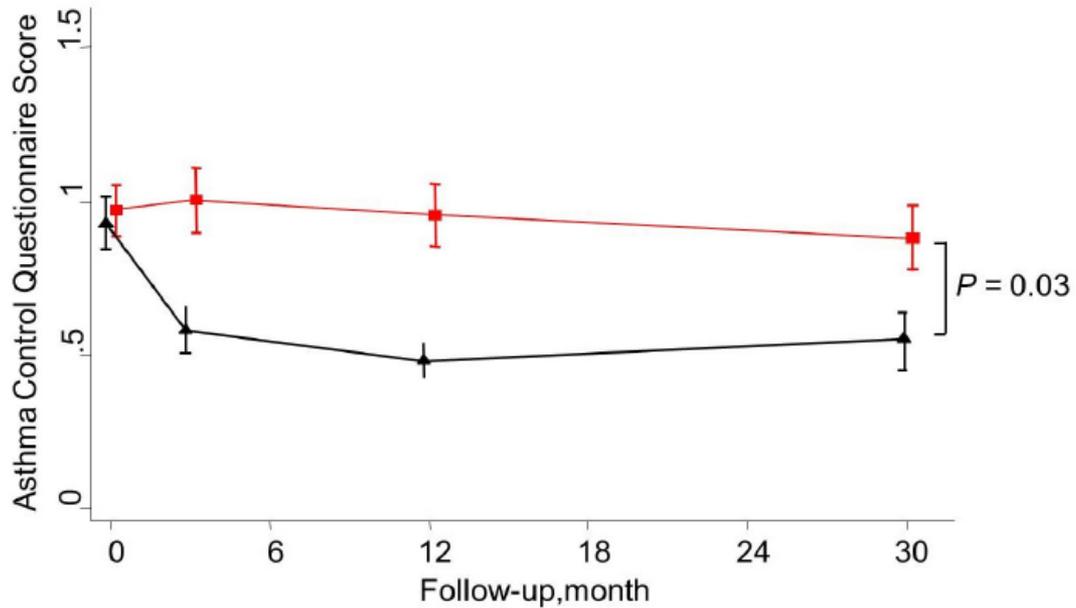


Figure 5. Mean Asthma Control Questionnaire score for the Internet and Usual care group as measured at 0, 3, 12, and 30 months of follow-up.



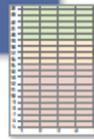
# Asthma Tracker

Every day, follow your  
Asthma Action Plan.



Avoid your triggers, take your daily controller medication, and watch your symptoms. Build good habits for better asthma control.

Once a week, use this  
Asthma Tracker.



Track the trends in your asthma control by using this Asthma Tracker. Based on your score, take the recommended steps to keep heading in the right direction.



**WHY track asthma control?** Tracking your Weekly ACT scores helps you and your doctor see your asthma control over time. This information helps you know when you need a doctor's visit or a change in your asthma treatment.

## HOW to track your asthma control?

Follow these steps each week on Sunday Monday Tuesday Wednesday Thursday Friday Saturday

- 1 Answer each question in the **Weekly ACT** at right, then add up the scores to get your **TOTAL**.
- 2 Plot your **TOTAL Weekly ACT** score on the colored tracker chart below. In the lines below each plotted score, write the date and the number of days (0 to 7) that you used your **daily controller medication** during the previous week.

## What to do based on your Weekly ACT Score:

### Weekly ACT score 19 or more:

Your chronic asthma control is **good**. Continue following your Asthma Action Plan. See your doctor for your next routine visit (every 6 months).

### Weekly ACT score 15 to 18:

Your asthma control **should be better**. Continue following all parts of your Asthma Action Plan. If your score stays in the yellow zone for 2 more weeks, schedule a visit with your doctor. Bring this Tracker chart to your doctor visit.

### Weekly ACT score is less than 15:

Your asthma control is **poor**. See your doctor this week. Bring this Tracker chart with you. In the meantime, continue following all parts of your Asthma Action Plan.

## Weekly ACT (Asthma Control Test)

Once a week, answer the ACT questions below and plot your total score on the colored **ASTHMA TRACKER** chart.

### During the past week:

- 1 How much of time did your asthma keep you from getting as much done at home, school, or work?  
1 - All of the time 2 - Most of the time 3 - Some of the time 4 - A little of the time 5 - None of the time
- 2 How often have you had shortness of breath?  
1 - More than once a day 2 - Once a day 3 - 3 to 6 times 4 - Once or twice 5 - Not at all
- 3 How often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?  
1 - 4 or more nights 2 - 3 nights 3 - 2 nights 4 - 1 night 5 - Not at all
- 4 How often have you used your quick-relief medication (such as albuterol, Ventolin<sup>®</sup>, Proventil<sup>®</sup>, Maxair<sup>®</sup> or Primatone Mist<sup>®</sup>)?  
1 - 3 or more times per day 2 - 1 or 2 times per day 3 - 2 or 3 times during the week 4 - Once this week 5 - Not at all
- 5 How would you rate your asthma control?  
1 - Not controlled at all 2 - Poorly controlled 3 - Somewhat controlled 4 - Well controlled 5 - Completely controlled

SCORE

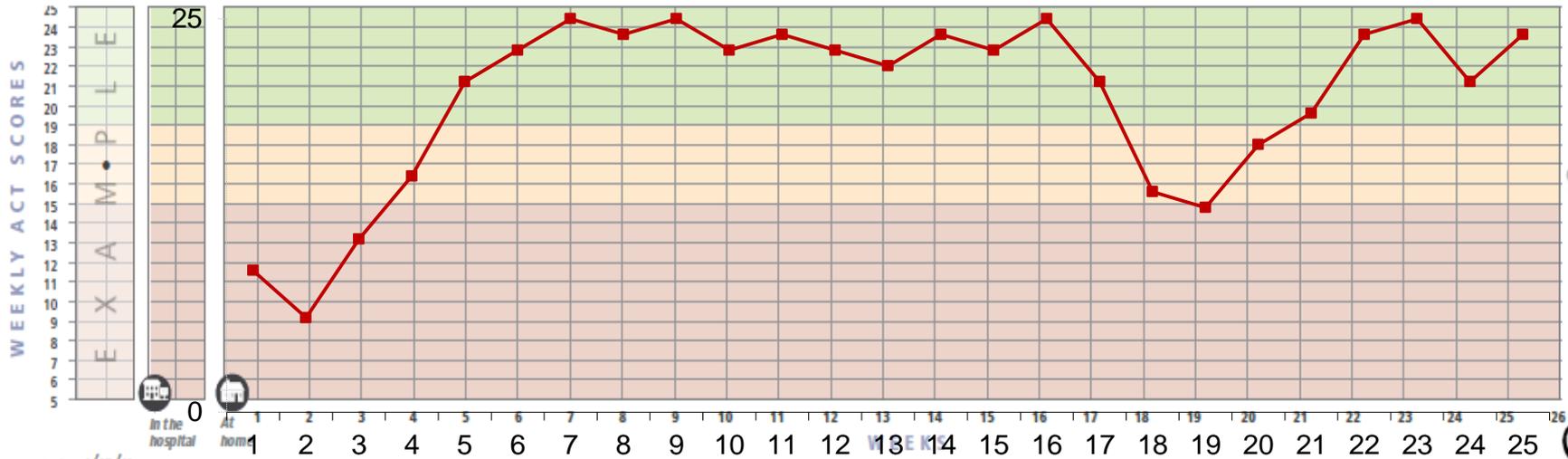





TOTAL

Asthma Control Test<sup>™</sup> copyright, QualityMetric Incorporated 2002, 2004. All Rights Reserved. Asthma Control Test<sup>™</sup> is a trademark of QualityMetric Incorporated.

Questions or comments about using this Asthma Tracker? Call Karmella at (801) 662-3518.



Date: 1/10/11

Number of days (0 to 7)  
controller medication  
used this week? 6

Check the weeks when  
you visited the doctor



# **Validation of Parental Reports of Asthma Trajectory, Burden, and Risk by Using the Pediatric Asthma Control and Communication Instrument**

JACI 2014;2:186-92

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Most asthma questionnaires assess only control (ACT, ATAQ, TRACK, etc)– this **NIH funded/ NHLBI** one assesses **adherence disease control, trajectory, burden & risk.**

**Pediatric Asthma Control & Communication Instrument**

Asthma also includes reactive airway disease, regular coughing, wheezing, or difficulty breathing with or without colds.

**Your child's name:** \_\_\_\_\_ **Today's Date:** \_\_\_\_\_

When was your child's last asthma visit? \_\_\_\_\_ If your child has never had an asthma visit, check here

Please check  one answer for each of the following questions.  
Your answers will help your doctor give you the best asthma care.

**Direction**

- |  |  |                                       |  |
|--|--|---------------------------------------|--|
| 1. Since your child's last visit to <b>this</b> doctor's office, how has your child's asthma been? | Better<br>▼<br><input checked="" type="checkbox"/> | Same<br>▼<br><input type="checkbox"/> | Worse<br>▼<br><input type="checkbox"/> |
|--|--|---------------------------------------|--|

If your child has not seen a doctor, please answer about the past 2 months.

**Bothered**

- |  |  |  |  |
|--|--|--|--|
| 2. Since your child's last visit to <b>this</b> doctor's office, how much have you been bothered by your child's asthma? | Not bothered<br>▼<br><input checked="" type="checkbox"/> | Somewhat bothered<br>▼<br><input type="checkbox"/> | Very bothered<br>▼<br><input type="checkbox"/> |
|--|--|--|--|

If your child has not seen a doctor, please answer about the past 2 months.

**Risk**

- |   |                                     |    |                          |
|---|-------------------------------------|----|--------------------------|
| 3-5. Since your child's last visit to <b>this</b> doctor's office, has your child:      |                                     | No | Yes                      |
| If your child has not seen a doctor, please answer about the past 2 months.             |                                     |    |                          |
| 3. Been to the emergency room for asthma?   | <input checked="" type="checkbox"/> |    | <input type="checkbox"/> |
| 4. Been hospitalized for asthma?  | <input checked="" type="checkbox"/> |    | <input type="checkbox"/> |
| 5. Used prednisone (Orapred, steroid pill, steroid liquid or steroid syrup) for asthma? | <input checked="" type="checkbox"/> |    | <input type="checkbox"/> |

**Forget to take medicine**

- |   |   |  |  |  |   |
|---|---|--|--|--|---|
| 6. How often do you <b>forget</b> to give your child's <b>daily</b> asthma medicine when he/she feels fine? | My child is not supposed to take a daily asthma medicine<br>▼<br><input type="checkbox"/> | None of the time<br>▼<br><input checked="" type="checkbox"/> | Some of the time<br>1-2 days/week<br>▼<br><input type="checkbox"/> | Most of the time<br>3-4 days/week<br>▼<br><input type="checkbox"/> | All of the time<br>5-7 days/week<br>▼<br><input type="checkbox"/> |
|---|---|--|--|--|---|

**Daily asthma medicines** include: Aerobid, Advair, Asmanex, Azmacort, Budesonide, Flovent, QVAR, Pulmicort, Singulair, Symbicort

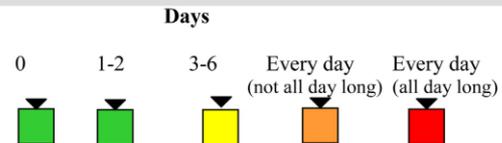
**FOR CLINICIAN USE**

If any of the answers farthest to the right or in red  are selected, this may be consistent with poorly controlled and/or undertreated asthma. Further assessment and **follow-up in 2-6 weeks** is recommended.

**(OVER)**

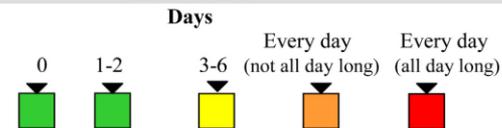
**Asthma Symptoms**

7. Over the **past week**, how many days has your child had asthma symptoms? For example:
- Cough
  - Chest tightness
  - Shortness of breath
  - Sputum (spit, mucous, phlegm when coughing)
  - Difficulty taking a deep breath
  - Wheezy or whistling sound in the chest



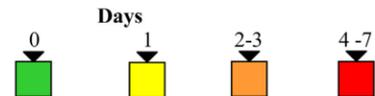
**Reliever use**

8. Over the **past week**, how many days have you had to give your child medicine to quickly relieve asthma symptoms? For example:
- Albuterol/Proventil/Proair/Ventolin/Xopenex via Inhaler/Spray/Pump or Machine/Nebulizer



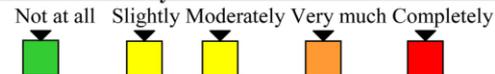
**Attacks**

9. Over the **past week**, how many days did your child have an asthma attack? For example:
- When it is harder to breathe for your child
  - When you give your child more quick-relief asthma medicine (e.g., Albuterol)
  - When the asthma medicine does not work



**Activity Limitation**

10. Over the **past week**, how much does asthma limit your child's activities?



**Nighttime Symptoms**

11. Over the **past TWO weeks**, how many nights did your child's asthma keep your child from sleeping or wake him/her up?



12. Please **write down any concerns or anything else** you would like your doctor to know about your child's asthma.

---



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**PLEASE GIVE THIS TO YOUR PROVIDER. Thank you.**

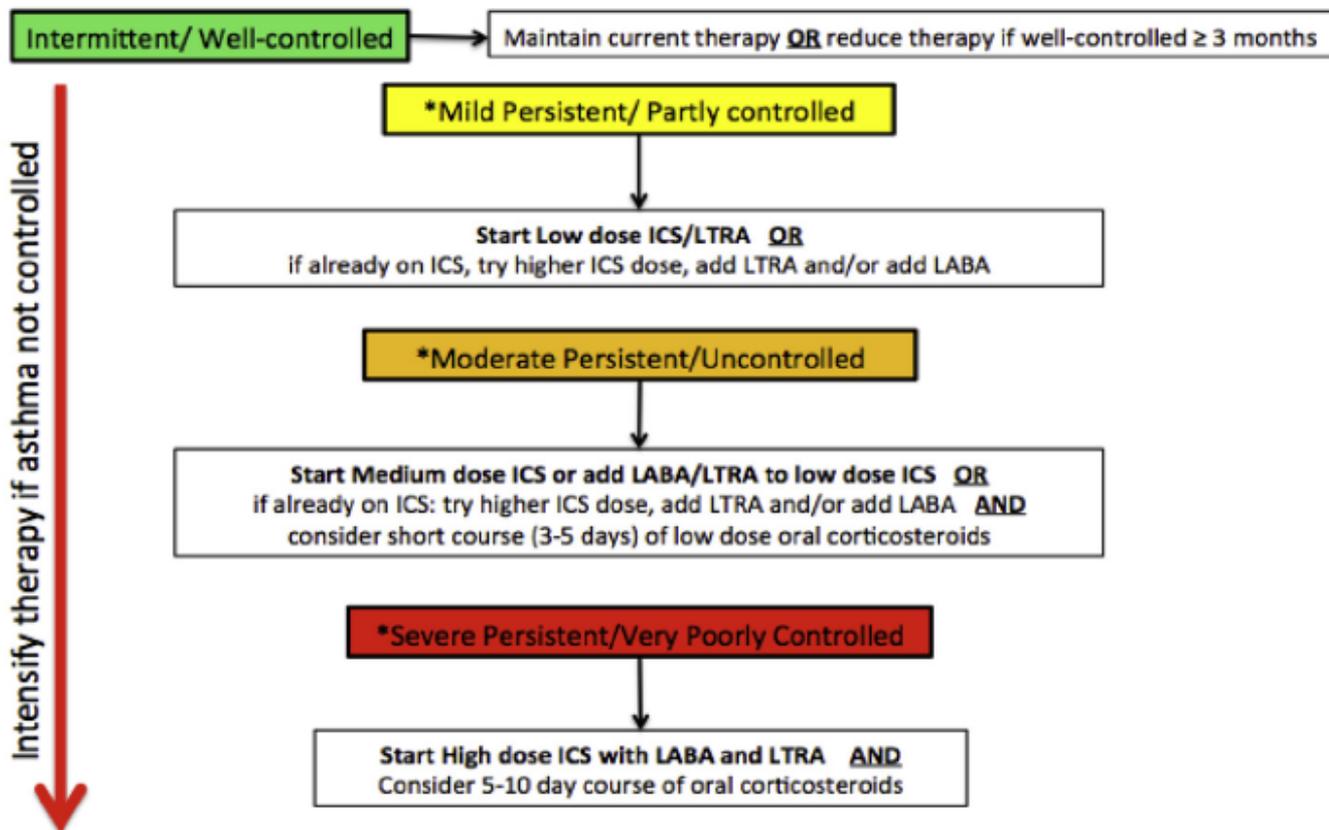
**FOR CLINICIAN USE ONLY: Control/Severity Assignment**

Assign patient's current level of asthma control by looking at the box checked *farthest to the right* on questions 7-11 and match the box color to the level of asthma control in this section.

			
Controlled/ Intermittent	Partly Controlled/ Mild Persistent	Uncontrolled/ Moderate Pers.	Poorly Controlled Severe Pers.

The goal for all patients is to have controlled/intermittent asthma. If asthma is uncontrolled/persistent, possible explanations include: under-treatment, poor inhaler technique, poor adherence, environmental allergies and/or exposures, comorbid conditions (see treatment algorithm). **Follow-up in 2 – 6 weeks** is recommended.

## Treatment Recommendations Based on Asthma Control or Severity Level



### \* IF ASTHMA IS NOT WELL-CONTROLLED/INTERMITTENT, ALSO CONSIDER EACH OF THE FOLLOWING:

**Inhaler technique:**  patient using spacer with MDI?  have patient demonstrate inhaler technique

**Medication adherence:**  review patient PACCI response to adherence question  review pharmacy record of filled prescriptions

**Environmental allergies and exposures:**  allergy tested?  secondhand smoke exposure?

**Comorbid conditions:**  gastro-esophageal reflux  allergic rhinitis  sinusitis  obesity  allergic bronchopulmonary aspergillosis

**Asthma specialist referral:**  systemic steroids ≥2 times/year  intubation/ICU admit  uncontrolled asthma on high dose ICS

So what about Asthma Action Plans and peak flow meters????

# A Novel Scoring System to Distinguish Vocal Cord Dysfunction From Asthma

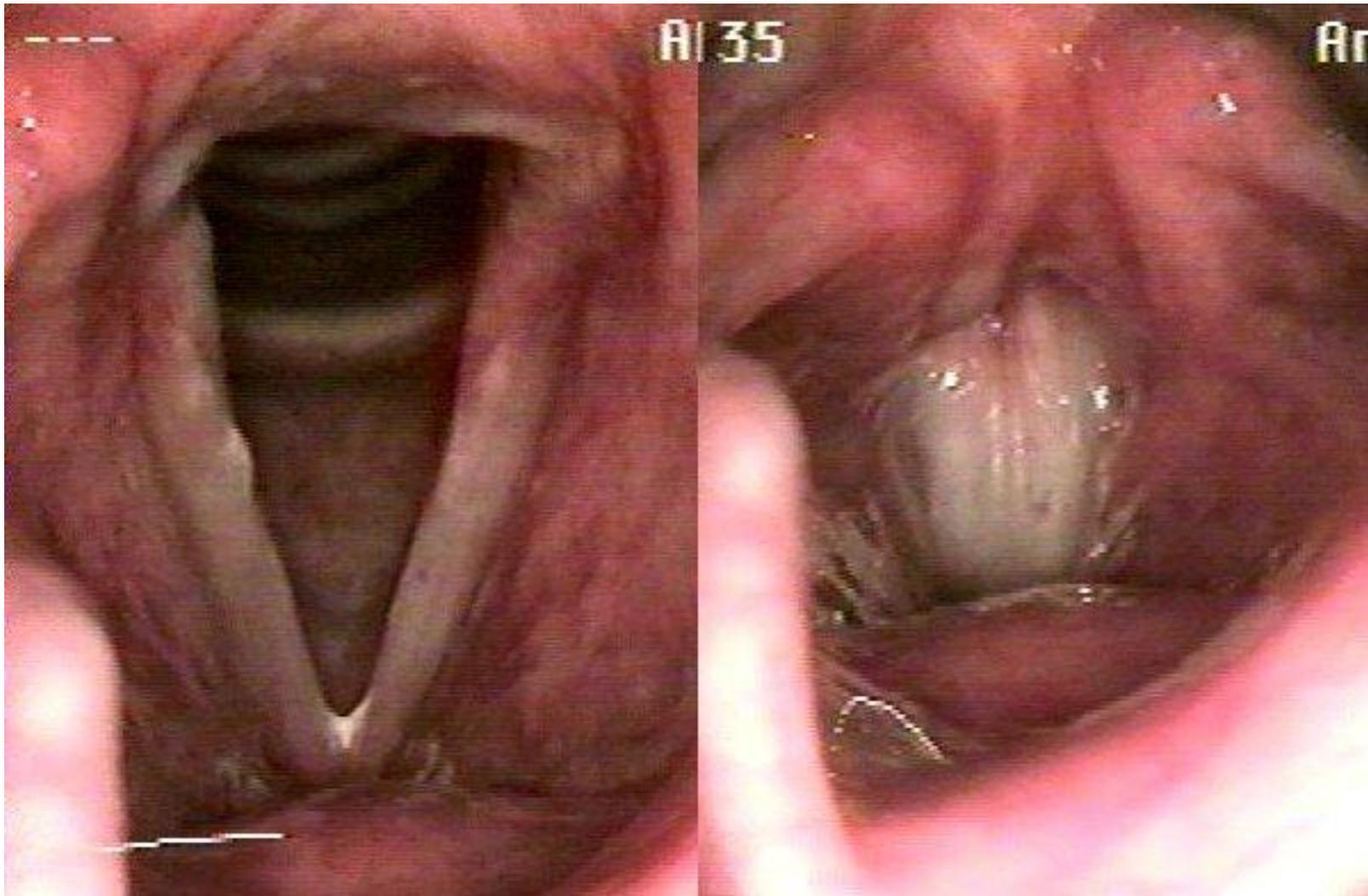
JACI Pract 2014;2:65-9

TABLE II. Analysis of demographics, comorbidities, symptoms, and triggers in the unadjusted and multivariable logistic regression model, and weights assigned in the final VCD score\*

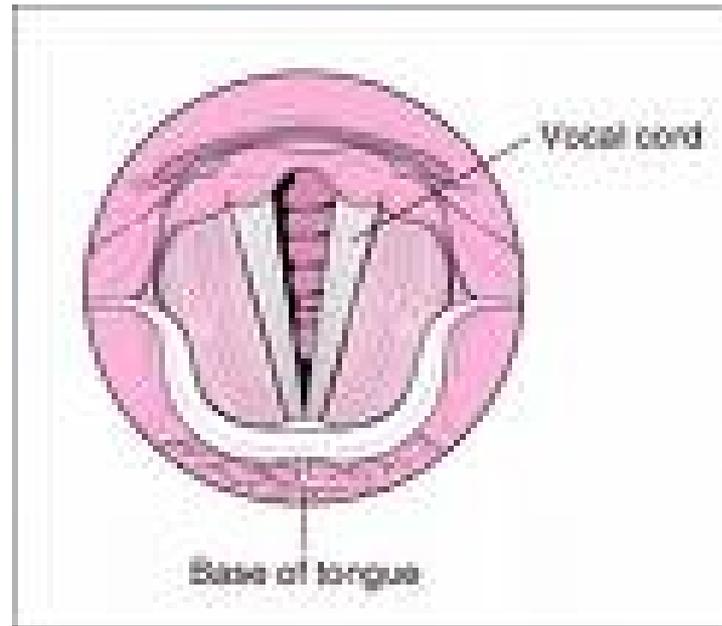
	VCD (n = 89)	Asthma (n = 59)	Crude OR	P value for crude OR	Adjusted OR	P value for adjusted OR	Score assigned
<b>Patient characteristics</b>							
No. of women/men	81/8	35/24	6.9 (2.9-17.9)	<.0001			
Age (y), median (IQR)	47 (37-56)	38 (29-53)	0.97 (0.95-1.0)	.02			
Height (cm), median (IQR)	163 (158-170)	168 (160-175)	1.05 (1.01-1.09)	.01			
No. of currently employed	57	40	2.1 (0.9-5.2)	.08			
<b>Comorbidities, no. of patients</b>							
Drug allergy	51	25	1.8 (0.9-3.6)	.07			
GERD	60	21	3.7 (1.9-7.6)	.002			
IBS	11	2	4.0 (1.0-26.6)	.045			
Psychiatric diagnosis	44	19	2.1 (1.0-4.1)	.04			
Chronic pain	22	9	1.8 (0.8-4.5)	.16			
<b>Symptoms, no. of patients</b>							
Cough	53	42	0.6 (0.3-1.1)	.11			
SOB	68	52	0.4 (0.2-1.1)	.07			
Heartburn	29	7	3.6 (1.5-9.5)	.003			
Dysphonia	32	4	8.0 (2.9-28.2)	<.0001	5.1 (1.1-27.8)	.04	2
Absence of wheezing	60	12	8.1 (3.8-18.2)	<.0001	6.0 (1.9-21.0)	.002	2
Throat tightness	59	1	114.1 (23.3-2063.9)	<.0001	43.5 (7.3-847.8)	<.0001	4
<b>Triggers, no. of patients</b>							
Stress	15	1	11.8 (2.3-215.6)	.001			
Exercise	26	32	0.4 (0.2-0.7)	.003			
Cold air	17	18	0.5 (0.2-1.2)	.11			
Odors	62	5	24.8 (9.7-77.4)	<.0001	16.6 (4.8-68.9)	<.0001	3

# Normal Larynx

Slide from Dale Gregore, MS, SLP

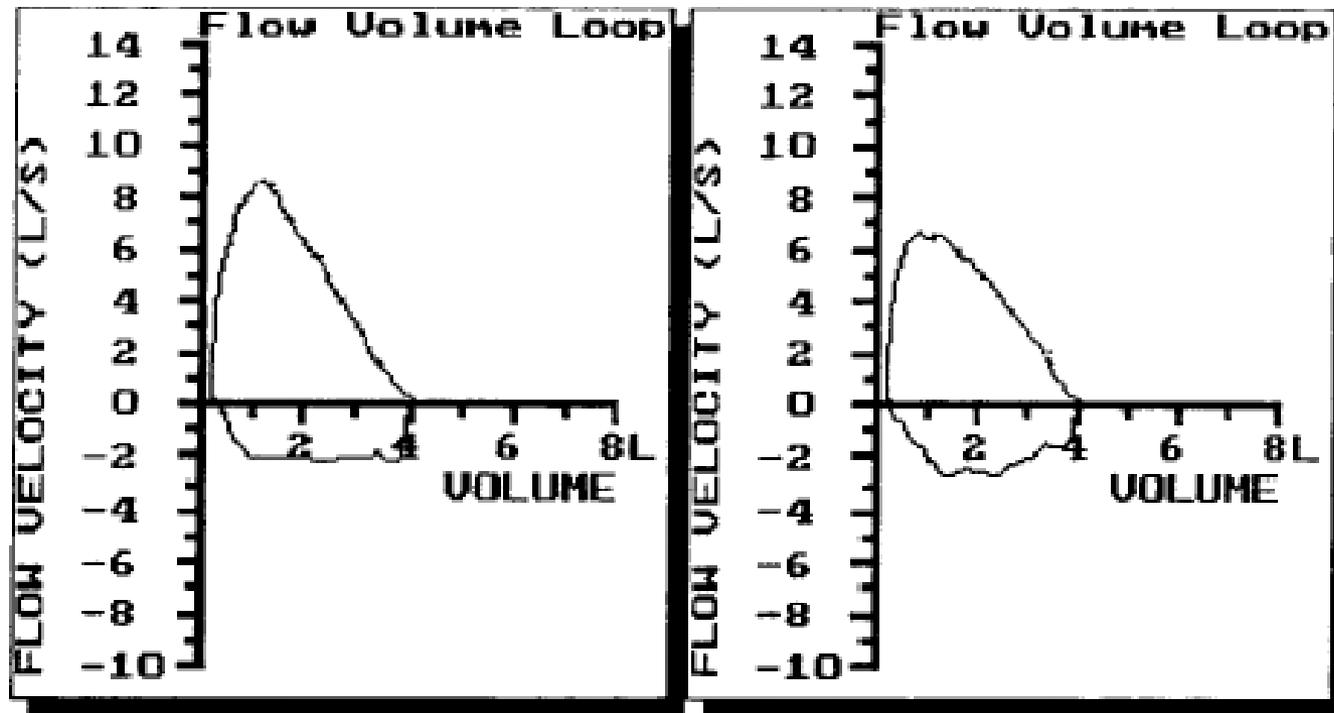


**Vocal fold ABDUCTION  
occurs during respiration**



# Inspiratory cut-off, flattening of the inspiratory limb (curve)

Slide from Dale Gregore, MS, SLP



NORMAL

VCD

# How do we test for VCD/ PVFM?

- Ideally use the same trigger in the office to trigger symptoms and visualize it via rhinolaryngoscopy.
  - Glade plug-ins
  - Roofing tar
  - Hair spray, perfumes, etc.
- Methacholine/ rhinolaryngoscopy
- Exercise/ rhinolaryngoscopy
  
- Once Diagnosed – teach breathing and refer to speech therapy

# Speech Therapy

Slide from Dale Gregore, MS, SLP

## □ Respiratory training

- Low “diaphragmatic” breathing versus “high” clavicular thoracic
- Rhythmic respiratory cycles
- Use resistance exhale (draw attention away from larynx and extend exhale)
- Prevention and coping strategies during episodes =  
Action Plan

# CASE DISCUSSION

- 14 year old female
- Sports: field hockey, soccer
- Travel soccer U-17 team/ midfiled
- Initial symptoms: 'throat closes' ~5 minutes in to game; hand on throat; signals coach; pulled from game; 20 minute recovery: lying on sideline

# Case Discussion #2

- 14 year old female
- Sports: cross country; basketball
- Initial Symptoms: 'throat closed' during CC trials; had to 'drop out'
- Secondary Symptoms: inspiratory stridor when wearing mouth guard/ basketball; felt 'faint'

# A Novel Scoring System to Distinguish Vocal Cord Dysfunction From Asthma

TABLE III. Performance characteristics of the Pittsburgh VCD Index at different cutoff points

Cutoff*	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
11	0.15 (0.09-0.25)	1.0 (0.92-1.0)	1.0 (0.72-1.0)	0.44 (0.36-0.53)
9	0.47 (0.36-0.58)	1.0 (0.92-1.0)	1.0 (0.89-1.0)	0.56 (0.46-0.65)
8	0.50 (0.39-0.61)	1.0 (0.92-1.0)	1.0 (0.92-1.0)	0.57 (0.47-0.67)
7	0.58 (0.47-0.69)	1.0 (0.92-1.0)	1.0 (0.91-1.0)	0.62 (0.51-0.71)
6	0.67 (0.56-0.77)	0.98 (0.90-1.0)	0.98 (0.90-1.0)	0.67 (0.56-0.77)
5	0.78 (0.67-0.86)	0.97 (0.87-0.99)	0.97 (0.89-0.99)	0.74 (0.63-0.84)
4†	0.83 (0.73-0.90)	0.95 (0.85-0.99)	0.96 (0.88-0.99)	0.77 (0.67-0.87)
3	0.88 (0.77-0.94)	0.88 (0.76-0.85)	0.92 (0.83-0.96)	0.84 (0.71-0.91)
2	0.97 (0.89-0.99)	0.67 (0.54-0.79)	0.81 (0.72-0.88)	0.93 (0.79-0.98)
0	1.00 (0.95-1.0)	0 (0.0-0.08)	0.60 (0.51-0.68)	N/A

TABLE IV. Probability of VCD or asthma at various cutoff points

Cutoff*	Probability of VCD	Probability of asthma
0	0.08	0.92
2	0.34	0.66
3	0.57	0.43
4†	0.77	0.23
5	0.89	0.11
6	0.95	0.05
7	0.98	0.02
8	0.99	0.01
9	0.997	0.003
11	0.9995	0.0005

\*A score of 1 or 10 is not possible when using the assigned values for each symptom or trigger.

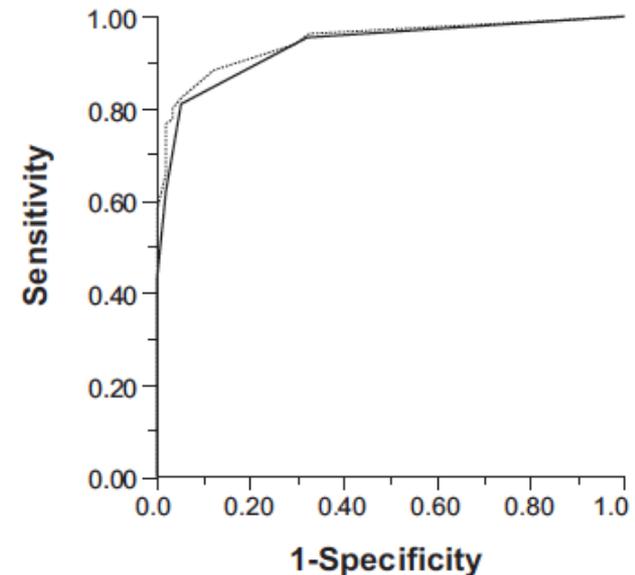
Details of ROC Curve and sensitivity/ specificity of questions.

Take home message:

If GERD, dysphonia, no wheeze &/or throat tightness

Triggered by: stress, exercise or odors.

Likely VCD and less likely asthma.



# Rhinix – the first nasal filter

**TABLE I.** Daily and maximum TNSSs and daily and maximum values for all 4 individual nasal symptoms

Outcome measure‡	Rhinix	Placebo	Rhinix		Placebo		Absolute difference*			P value§	Relative difference (%)†	
	Mean	Mean	Median	Range (25% to 75%)	Median	Range (25% to 75%)	Mean	95% CI	Median		Mean	Median
	TNSS, maximum (12)	4.67	5.43	4	4 to 6	6	4 to 7	0.76	-0.13 to 1.66		2	.140
TNSS, daily (108)	20.67	26.19	19	14 to 25	25	17 to 35	5.52	0.59 to 10.46	6	.049	21	24
Itch, maximum (3)	0.67	1.24	1	0 to 2	1	0 to 2	0.57	0.26 to 0.88	0	.004	46	—
Itch, daily (27)	2.76	4.33	2	0 to 4	3	1 to 8	1.57	-0.27 to 3.41	1	.234	36	33
Runny nose, maximum (3)	1.86	1.90	2	1 to 2	2	2 to 2	0.05	-0.19 to 0.29	0	.706	3	—
Runny nose, daily (27)	9.10	10.29	7	6 to 12	10	7 to 13	1.19	-0.51 to 2.89	3	.174	12	30
Sneeze, maximum (3)	0.95	1.52	1	1 to 1	2	1 to 2	0.57	0.20 to 0.94	1	.006	38	50
Sneeze, daily (27)	2.86	5.19	2	1 to 5	6	3 to 7	2.33	0.88 to 3.78	4	.011	45	67
Blocked nose, maximum (3)	1.43	1.43	1	1 to 2	2	1 to 2	0.00	-0.47 to 0.47	0	.928	—	50
Blocked nose, daily (27)	5.95	6.38	5	2 to 9	6	3 to 10	0.43	-2.12 to 2.98	1	.702	7	17

# Rhinix: somehow I don't see this one



Great pictures however



# Effect of ingestion of honey on symptoms of rhinoconjunctivitis

T. V. Rajan, MD, PhD\*<sup>†</sup>; Howard Tennen, PhD<sup>†</sup>; Richard L. Lindquist, MD\*<sup>‡</sup>; Leonard Cohen, MD, PhD<sup>‡</sup>; and J. Clive, PhD<sup>§</sup>

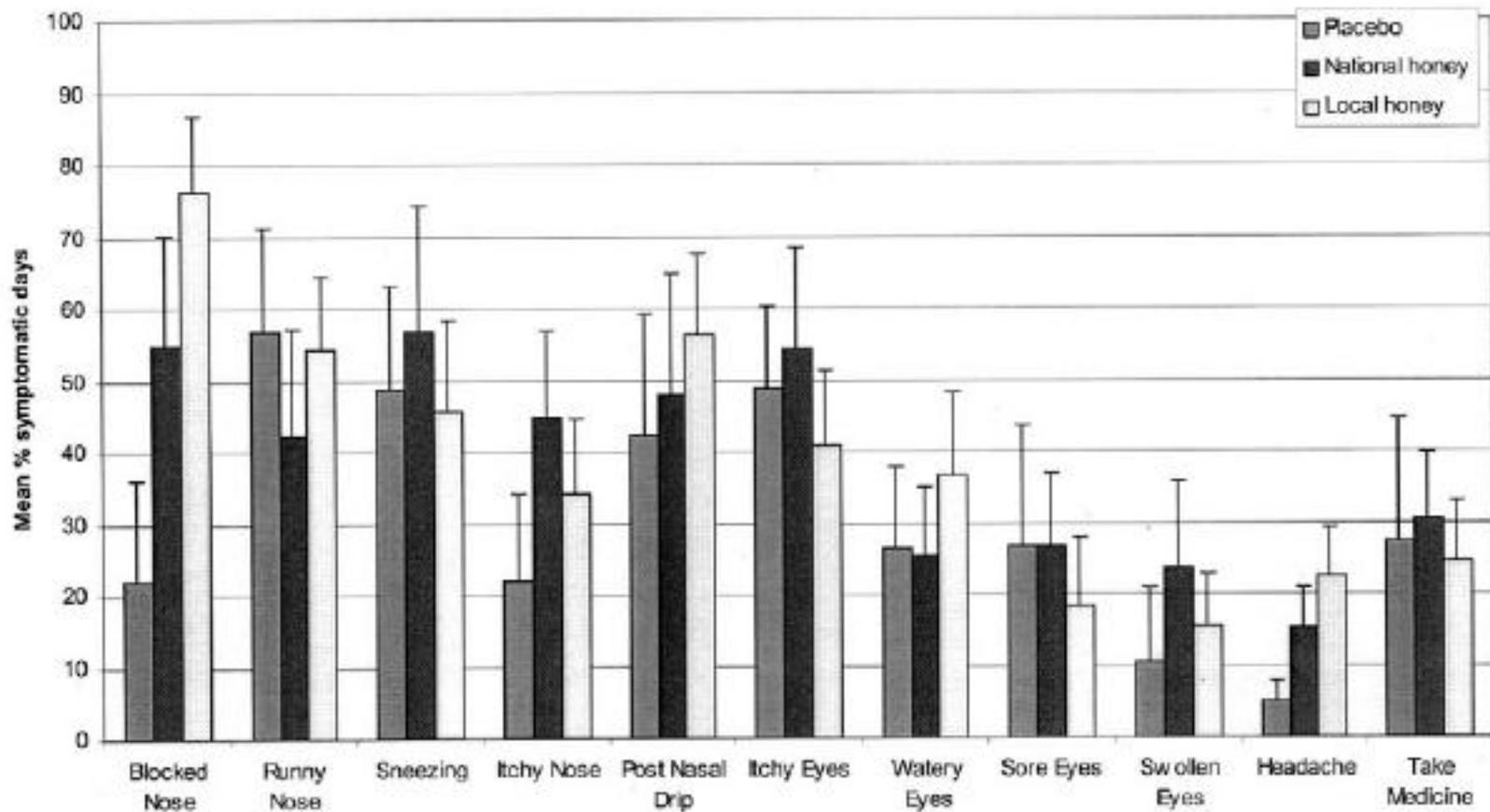


Figure 2. Grass-oak period mean % symptomatic days.

Local honey compared to corn syrup & national honey made no difference in allergy.

# Treatment

## . . . Valved Holding Chamber

- 1. Insert the inhaler into the back piece of the chamber**
- 2. Shake, exhale, squirt, inhale slowly, hold 10 seconds and then exhale slowly**
- 3. Clean your spacer initially and weekly, warm soapy water, rinse well, air dry only.**



# Aerochamber with mask

- 1. If using a mask, spend time getting the child used to it, seal it well over face, watch for flapper valve movement, generally 4-5 breaths gets the best results.**



# Conclusions:

- There are incremental improvements in asthma each year.
- Steroids have side effects: even ICS/ INS so minimize the dose by following NHLBI guided care.
- Pollutions is BAD for asthma.
- Early introduction of foods decreases risk of asthma/ allergic disease.