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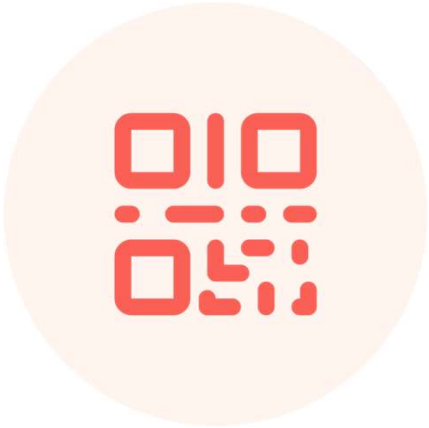

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#6420547

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Pediatric Asthma

Brian R Wingrove, MHS, PA-C, DFAAPA
Children's Physician Group – Pulmonology at Scottish Rite
Children's Healthcare of Atlanta

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Two Truths and One Lie

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- Non-Declaration Statement: I have no relevant relationships with ineligible companies to disclose within the past 24 months. (Note: Ineligible companies are defined as those whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.)

Objectives

- Become familiar with using diagnostic indices for asthma.
- Recognize high risk populations in children raising their risk for having asthma.
- Review how to interpret simple spirometry in children.

We Are Family

We Are Family

We Are Family

We Are Family

We Are Family

We Are Family

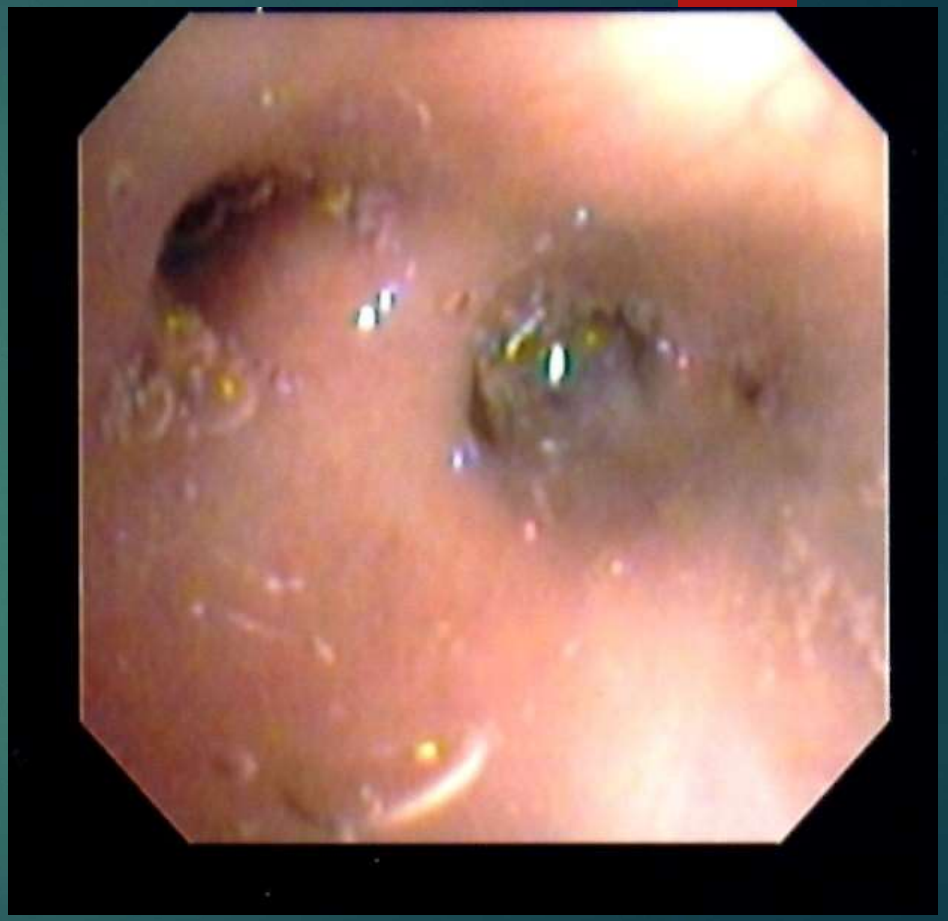
We Are Family

What is asthma?

Asthma is a chronic inflammatory disorder of the airways in which many cells and cellular elements play a role: in particular, mast cells, eosiniphils, T lymphocytes, macrophages, neutrophils, and epithelial cells. In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness, and coughing, particularly at night or in the early morning. These episodes are associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment. The inflammation also causes an associated increase in the existing bronchial hyperresponsiveness to a variety of stimuli. Reversibility of airflow limitation may be incomplete in some patients with asthma.

What is Asthma?

Asthma is chronic inflammation of the airways that causes symptoms like coughing or wheezing that gets better with a bronchodilator.



Asthma Prevalence

Prevalence among children – 7%

Highest among poor children – 11.8%

Boys – 8.4% (5.5% of girls)

Non-Hispanic black children – 13.5%

- 2019 CDC Data

Asthma is Underdiagnosed and therefore Undertreated in Infants and Children

- 122,829 children aged 12 to 14 years in 499 North Carolina public middle schools
- 17% had current asthma symptoms but no diagnosis

Asthma is Underdiagnosed and therefore Undertreated in Infants and Children

Of those 17% :

- 20% missed a half day or more of school per month
- 25% had limited activities
- 32% had sleep disturbances
- 7% had 1 or more emergency department visits for asthma-like symptoms
- 5% reported wheeze-related hospitalizations

Risk Factors – Asthma Predictive Index

2 – 3 episodes of wheezing in the past year

MAJOR

MINOR

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What are risk factors for developing asthma?

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Risk Factors – Asthma Predictive Index

2 – 3 episodes of wheezing in the past year

MAJOR

- Atopic dermatitis
- Food Allergy
- Family history of asthma

MINOR

- Allergic Rhinitis
- Eosinophilia
- Wheezing without colds

Asthma Predictive index

- 96% specificity
- 26% sensitivity
- Poor PPV
- High NPV

Pediatric Asthma Risk Score

PARS

- Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS)
- 762 infants born 2001-2003 in Cincinnati,OH and North Kentucky
- Parents with documented atopy (>1 allergy symptom and skin prick testing positive (SPT) to > 1 aeroallergen)
- Annual exams at ages 1,2,3,4, and 7 years-old
  - Monitored for allergy symptoms at each visit: wheezing apart from colds, eczema, rhinitis, skin prick testing
  - 7 year-old visit – objective evaluation for asthma

Skin Allergy Test

Pediatric Asthma Risk Score

	Nonasthmatic subjects (n = 494)	Asthmatic subjects (n = 95)	*P* value*
Clinical risk factors			
Eczema before age 3 y	24.0% (118)	42.6% (40)	.0004
Wheezing apart from colds	12.0% (59)	45.3% (43)	<.0001
Early wheezing (before age 3 y)	29.4% (145)	68.4% (65)	<.0001
Early frequent wheezing	10.3% (51)	37.9% (36)	<.0001
AR (clinician's diagnosis probable or definite)	35.1% (172)	52.7% (49)	.0016
Positive SPT response to ≥1 aeroallergen	53.5% (264)	71.6% (68)	.0009
Positive SPT response to ≥1 food allergen	16.2% (80)	26.3% (25)	.02
Positive SPT response to aeroallergens/food allergens (≥2 positive SPT response)	38.3% (189)	60.0% (57)	.0001
Personal risk factors			
Parental asthma	37.7% (186)	56.8% (54)	.0005
African American race	19.4% (96)	36.8% (35)	.0004
Male sex	53.6% (265)	61.1% (58)	.18

PARS

Pediatric Asthma Risk Score (PARS) Sheet

	Possible Scores		
	No	**Yes**	**Child's Score**
1. Parental Asthma	0	2	
2. Eczema before age 3 years	0	2	
3. Wheezing apart from colds	0	3	
4. Wheezing before age 3 years	0	3	
5. African-American Race	0	2	
6. SPT positive to ≥ 2 aero and/or food allergens	0	2	
Child's PARS (add lines 1-6 above):			

Patient Score Interpretation

Score	Risk of Asthma by age 7 years	Interpretation	
0	3%	LOW RISK	Children with these scores have a 1 in 33 [score of 0] to a 1 in 9 [score of 4] risk of developing asthma by age 7 years
2	6%		
3	8%		
4	11%		
5	15%	MODERATE RISK	Children with these scores have a 1 in 7 risk [Score of 5] to a 1 in 3 [Score of 8] risk of developing asthma by age 7 years
6	19%		
7	25%		
8	32%		
9	40%	HIGH RISK	Children with these scores have a 2 in 5 [Score of 9] to a 4 in 5 [Score of 14] risk of developing asthma by age 7 years
10	49%		
11	58%		
12	66%		
14	79%		

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How old do you have to be to diagnose asthma?

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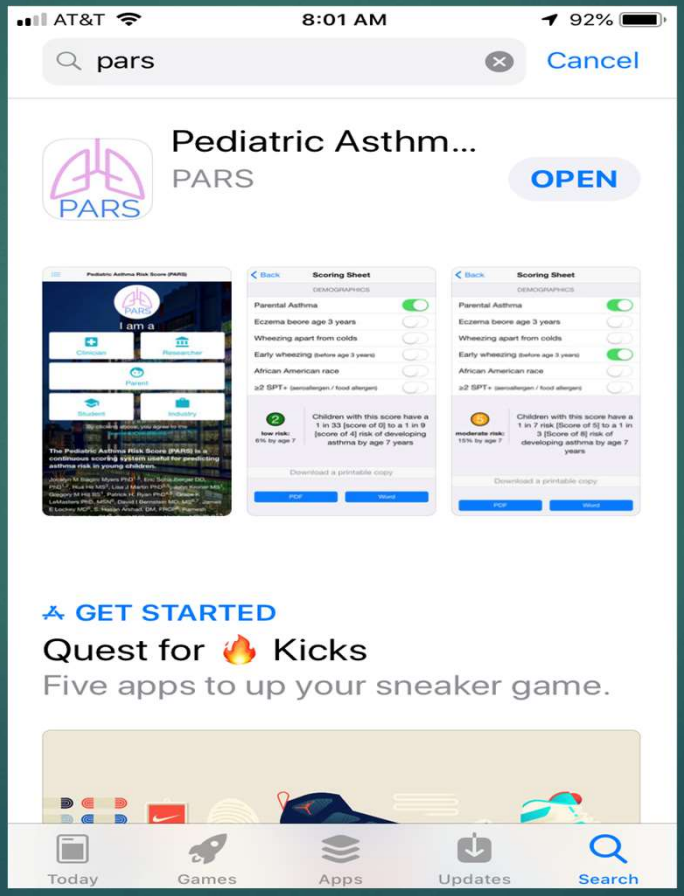
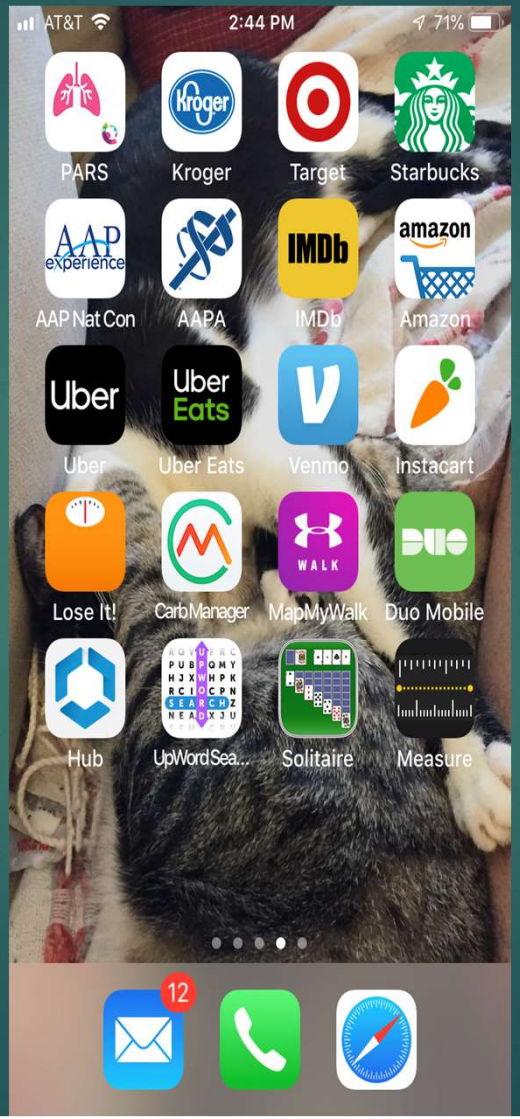
Pediatric Asthma Risk Score

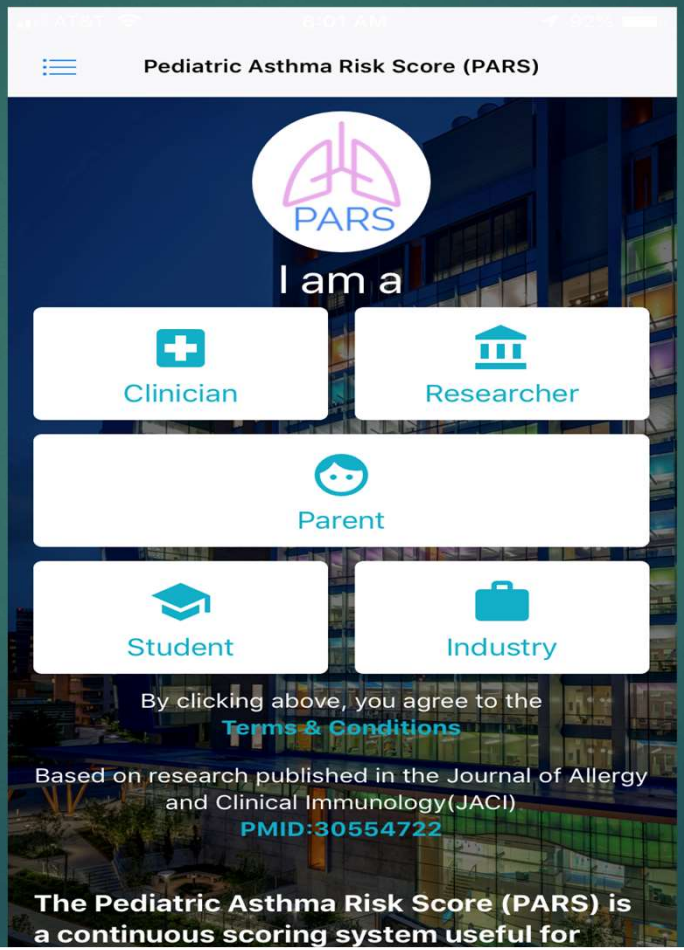
- PARS better for predicting likelihood of developing asthma vs Asthma Predictive Index
- Higher sensitivity and PPV
- Better predictor for mild-moderate asthma risk patients

Pediatric Asthma Risk Score

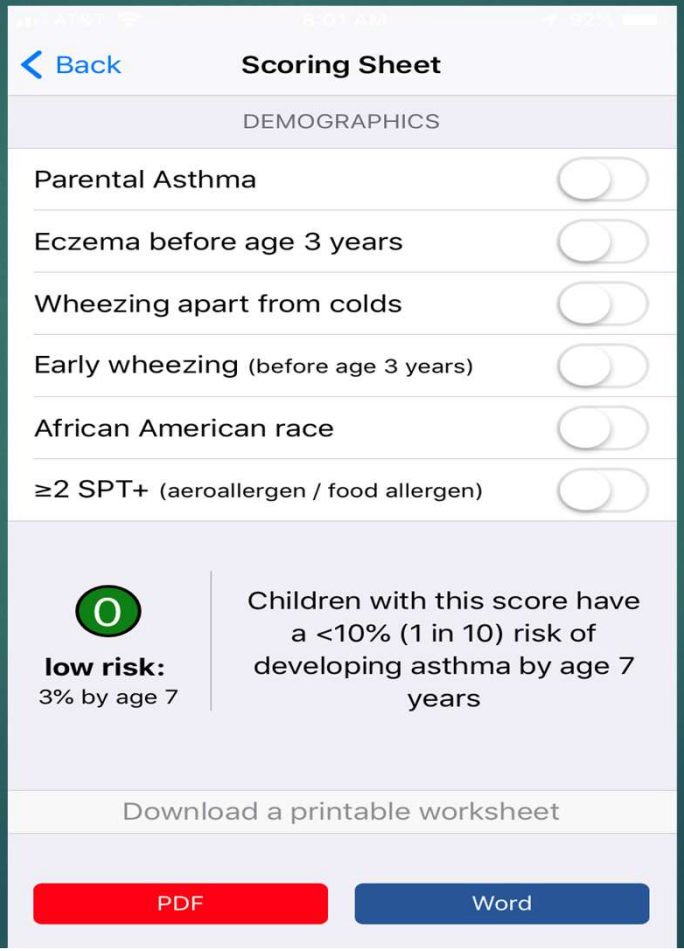



AT&T
2:44 PM
71%
PARS
Kroger
Target
Starbucks
AAP Nat Con
AAPA
IMDb
Amazon
Uber
Uber Eats
Venmo
Instacart
Lose It!
CarbManager
MapMyWalk
Duo Mobile
Hub
UpWordSea...
Solitaire
Measure
12

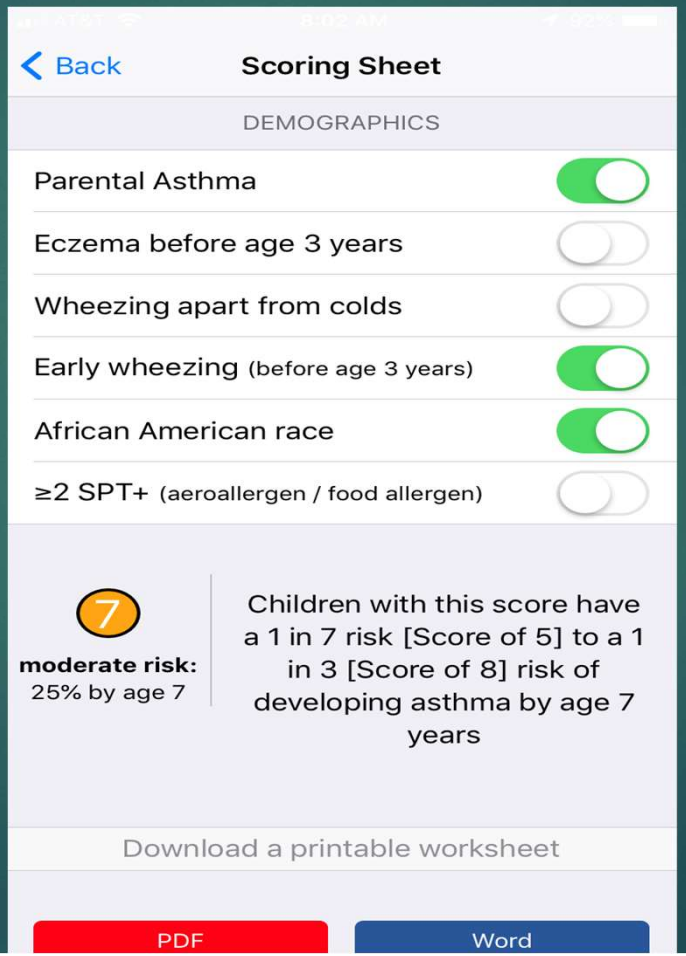
Pediatric Asthma Risk Score



Pediatric Asthma Risk Score



Pediatric Asthma Risk Score



Cough and Asthma

Nocturnal Cough

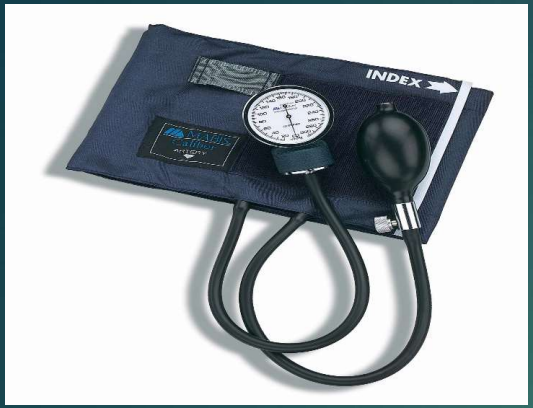
Cough first thing in the morning

Cough during or after exercise

Exercise Coughing : Uncontrolled asthma or Exercise Induced Asthma

Spirometry in Asthma

- Diagnosis
  - Detection of airway obstruction
  - Rule out differential diagnoses
- Management and Achieving control
  - Objective assessment
  - Identify obstruction in patients with low symptom awareness
  - Track disease progression and response to therapy


INDEX

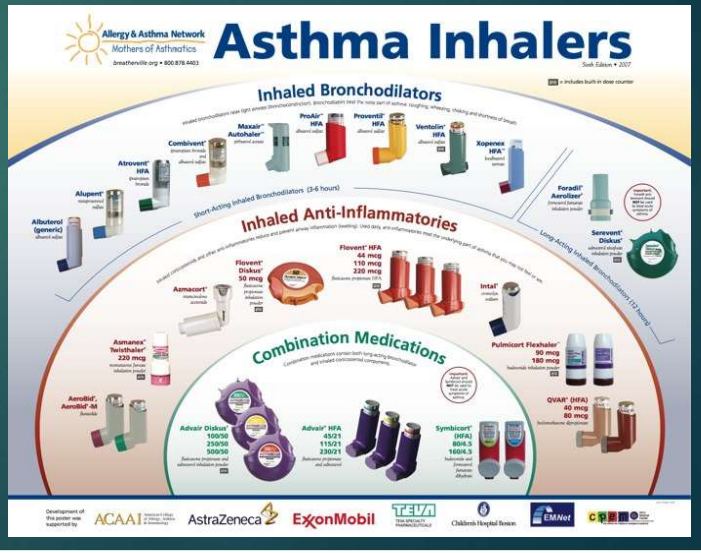
IS TO

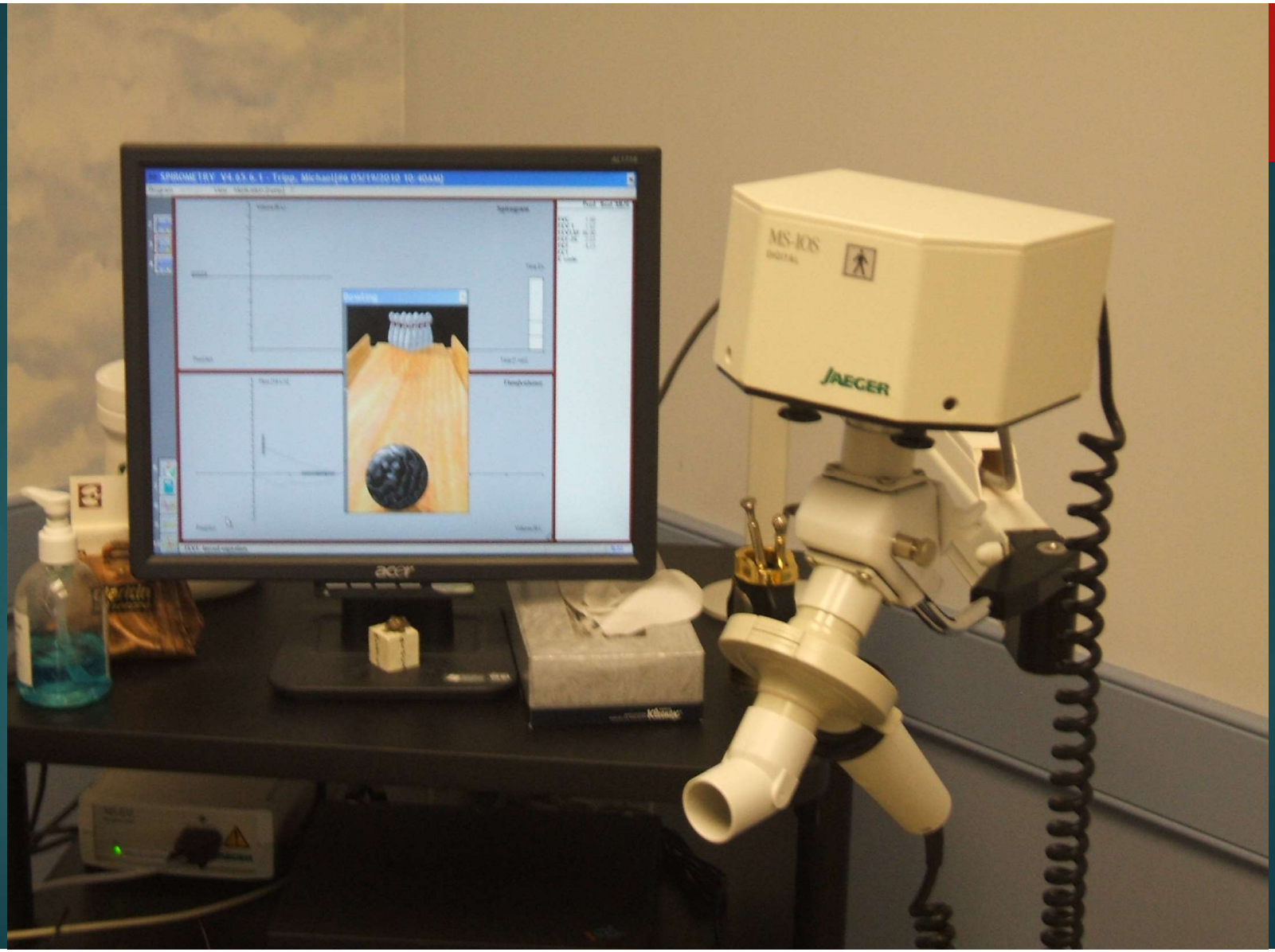

BETA-
BLOCKER


NDC 0781-5085-92
Fosinopril
Sodium Tablets
40 mg
90 Tablets
℞ only
SANDOZ
NDC 0143-1172-01
Captopril Tablets, USP
25 mg
℞ Only
100 TABLETS

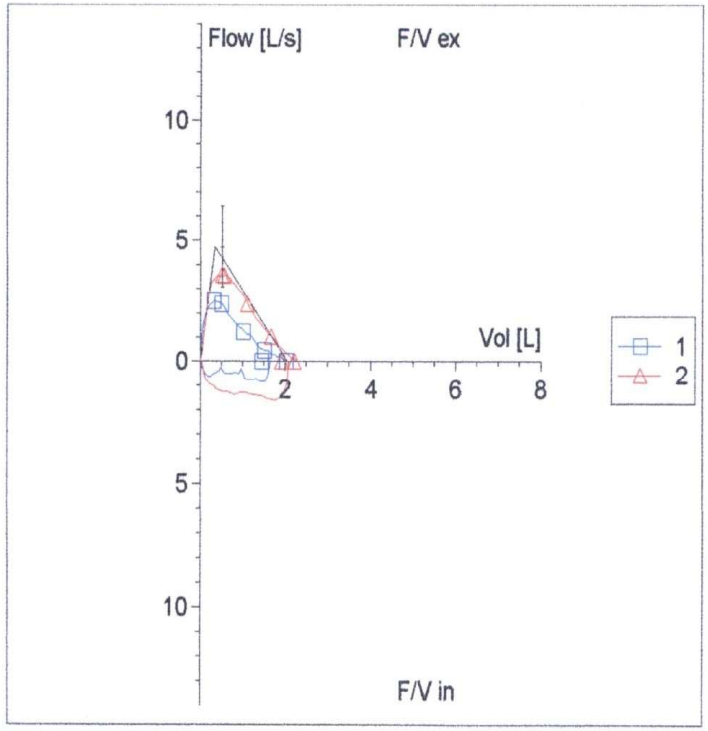
AS

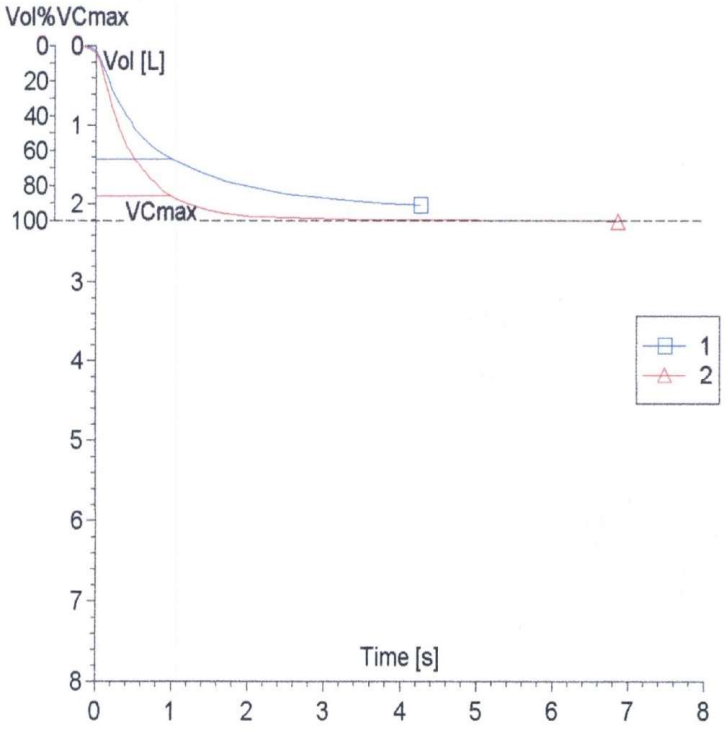
IS TO


Allergy & Asthma Network
Mothers of Asthmatics
Asthma Inhalers
Inhaled Bronchodilators
Inhaled Anti-Inflammatories
Combination Medications
Short-Acting Inhaled Bronchodilators (3-6 hours)
Albuterol (generic)
Alupent
Atrovent HFA
Combivent
Maxair Autohaler
ProAir HFA
Proventil HFA
Ventolin HFA
Xopenex HFA
Foradil Aerolizer
Serevent Diskus
Azmacort
Flovent Diskus 50 mcg
Flovent HFA 44 mcg 110 mcg 220 mcg
Intal
Pulmicort Flexhaler 90 mcg 180 mcg
Asmanex Twisthaler 220 mcg
AeroBid, AeroBid-M
Advair Diskus 100/50 250/50 500/50
Advair HFA 45/21 115/21 230/21
Symbicort (HFA) 80/4.5 160/4.5
QVAR (HFA) 40 mcg 80 mcg
AstraZeneca
ExxonMobil
TEVA
Children's Hospital Boston
EMNet


MS-IOS
JAEGER
acer

		Pred	Pre	%Pred	Post	%Pred	%Chg
Date			01/28/08		01/28/08		
Time			09:45:12A		09:55:42A		
FVC	[L]	2.04	2.02	99.0	2.22	108.8	10.0
FEV 1	[L]	1.83	1.44	78.7	1.91	104.3	32.5
FEV 1 % FVC	[%]		71.29		85.91		20.5
PEF	[L/s]	4.72	2.48	52.5	3.54	74.9	42.7
FEF 25-75	[L/s]	2.24	1.01	45.3	2.01	89.8	98.4
FET	[s]		4.30		6.91		60.7
ATS error code			13		3		-76.9





CASE 1

CASE 1

- 16 yr old Hispanic female
- Wheezing episode as an infant
- Presents with wheezing and difficulty breathing
- Rhinovirus positive
- Respiratory failure requiring HFNC, continuous albuterol, and methylprednisolone

CASE 1

- Not very physically active but coughs with laughter
- No cough or snoring at night, sometimes does in the morning
- Never allergy tested but got hives after eating peanuts and shrimp; sneezes around cats
- Eczema as a baby
- No family history of asthma
- No recurrent sinopulmonary infections
- FEV1/FVC ratio 72%, improves to 88% after bronchodilator

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Does this kid have asthma?

ⓘ Start presenting to display the poll results on this slide.

CASE 1

- Not very physically active but coughs with laughter
- No cough or snoring at night, sometimes does in the morning
- Never allergy tested but got hives after eating peanuts and shrimp; sneezes around cats
- Eczema as a baby
- No family history of asthma
- No recurrent sinopulmonary infections
- FEV1/FVC ratio 72%, improves to 88% after bronchodilator

CASE 2

CASE 2

- 6 month old African American female
- Hospitalized with RSV bronchiolitis at 4 months of age
- Now hospitalized with respiratory failure requiring full face mask Bipap, continuous albuterol, ipratropium bromide, methylprednisolone, and magnesium sulfate
- Rhinovirus positive


DummyPatName!
Oct-17-2021
12:26:23 AM
1
DummySeriesDesc!
MA: 200.0
KV: 62.0
3
PORTABLE
EI : 244
EIt : 100
DI : 3.87
W:4096
C:2048
Zoom:0.5
Absorbed Dose : --

CASE 2

- Mother had bronchitis as a child and her older brother is the same way as mom was
- Never diagnosed with eczema but gets very dry skin that irritates her
- Got a rash around her lips after eating eggs; haven't introduced peanut butter
- No cough when she gets excited or cries, no cough at night
- No choking or coughing with feeds
- No recurrent sinopulmonary infections

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Does this kid have asthma?

ⓘ Start presenting to display the poll results on this slide.

CASE 2

- Mother had bronchitis as a child and her older brother is the same way as mom was
- Never diagnosed with eczema but gets very dry skin that irritates her
- Got a rash around her lips after eating eggs; haven't introduced peanut butter
- No cough when she gets excited or cries, no cough at night
- No recurrent sinopulmonary infections

Pediatric Asthma Management

- Trigger identification and avoidance
  - If no sensitization, then no need to intervene
- Allergy testing is recommended
- Conditional recommendation for SCIT as an adjunct if sensitized
- Conditional recommendation against SLIT
- Vaccines

Treatment Options

- Short-acting Beta Agonists
- Inhaled Corticosteroids
- Leukotriene Modifiers
- Long-acting Beta Agonists
- Long-acting Muscarinic Antagonists
- Systemic Corticosteroids
- Injectable Biologics

Inhaled Corticosteroids

Nebulized	Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)
Budesonide (Pulmicort)	Fluticasone (Flovent and Arnuity)	Fluticasone (Flovent)
	Mometasone (Asmanex)	Mometasone (Asmanex)
	Beclomethasone (Qvar)	Budesonide (Pulmicort)
	Ciclesonide (Alvesco)	

Nebulized

- Simple to use
- Takes 10 – 20 minutes
- Relies on tidal breathing
- Blow by does NOT work
- Crying decreases lung deposition
- No real difference between effectiveness of MDIs versus nebulizer *if used correctly*

Metered Dose Inhalers

- Medication propelled at 100 meters per second
- Must use spacing device
- Very technique dependent
- 30 – 60 seconds to use
- More flexible dosing options
- Easily portable

Spacers

- Increase fine particle size
- Increase deposition by 3 fold
- Technique is crucial
- Face masks rely on tidal breathing
- Mouthpiece devices require inspiratory force and breath holding


AeroChamber


MICROSPACER


PHILIPS

Dry Powder Inhalers

- Molecules not suspended in solution
- Direct epithelial interaction
- Often superior potency
- No difference in efficacy found between MDI/spacer and DPIs
- Technique dependent
- Most easily portable

Leukotriene Receptor Antagonists

- Montelukast (Singulair)
- Block leukotrienes from binding to their receptors in the inflammatory cascade
- Improvement in pulmonary function and in symptomatic control
- Only 15% of patients show a greater response to montelukast than to ICS
- Black Box Warning

Long Acting Beta Agonists

- Inhaled Corticosteroid / Long Acting Beta Agonist
- 3 commercially available formulations
  - Fluticasone / Salmeterol (Advair/AirDuo/Wixela)
  - Mometasone / Formoterol (Dulera)
  - Budesonide / Formoterol (Symbicort)

Long-acting Muscarinic Antagonists

- Only one approved for children – tiotropium
- Approved down to age 6
- Should be used as an add on to an ICS/LABA in uncontrolled asthma
- If used with ICS alone, recommend also increasing dose of ICS
- Handihaler is not approved for children or asthma, the Respimat is!

Injectable Biologics

- Omalizumab (Xolair)
  - Inhibits IgE binding to mast cells and basophils
  - Given every 2 – 4 weeks
  - Age 6 yrs and older
  - Lowers rate of exacerbations
- Mepolizumab (Nucala)
  - Binds IL-5 reducing production and survival of eosinophils
  - Given every 4 weeks
  - Age 6 yrs and older
  - Reduces exacerbations AND improve FEV1
- Benralizumab (Fasenra)
  - Binds IL-5 and attracts natural killer cells resulting in depletion of eosinophils
  - Given every 4 weeks x 3 doses, then every 8 weeks
  - Age 12 yrs and older
  - Reduce exacerbations and improve FEV1

Injectable Bioligics

- Dupilumab (Dupixent)
  - Binds IL-4 and IL-13 – reduces inflammation but MOA not established
  - Given every 2 weeks
  - Age 6 yrs and older
  - Reduce exacerbations and improve FEV1
- Tezepelumab-ekko (Tezspire)
  - MOA not established
  - Blocks TSLP at the lung epithelial layer
  - Given every 4 weeks
  - Age 12 yrs and older
  - Reduce exacerbations and improves FEV1

Newest Guidelines for Pediatric Asthma

- National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group
- 2020 Focused Updates to the Asthma Management Guidelines
- PRN ICS
- SMART
- LABA vs LAMA

Newest Guidelines for Pediatric Asthma

As needed use of ICS along with short acting beta agonist

- Ages 0 – 4 years with recurrent wheezing associated only with respiratory infections but NO outside symptoms
- Ages 12 years and older with mild persistent asthma versus daily low dose ICS

Newest Guidelines for Pediatric Asthma

Single Maintenance and Rescue Therapy (SMART)

- Ages 4 yrs and older with moderate to severe persistent asthma
- Increase ICS/LABA administration to eight puffs for those 5 to 11 years old and 12 puff for children 12 and older
- LABA component should be formoterol, not salmeterol
- ICS/LABA combination preffered over addng LAMA to ICS

Exacerbations

- Signs and symptoms
  - Frequent, staccato cough
  - Dyspnea
  - Positioning
- Rapid progression
- “Severe intermittents”

Exacerbations

- Interventions
  - Dexamethasone vs Prednisolone
    - < 12 kg : 4 mg
    - 12 – 15 kg : 8 mg
    - 15 – 25 kg : 12 mg
    - > 25 kg : 16 mg
  - Bronchodilators
    - 4 puffs every 20 minutes x 3
  - Magnesium sulfate / NS bolus
  - Terbutaline
  - HFNC vs NIPPV

Take Home Points

- Asthma is very common in children so don't forget to screen for it and keep it in your differential for cough.
- There are a number of screening tools that can be used to diagnose asthma, but if you keep in mind those risk factors you will do fine.
- Refer any child in whom the diagnosis is not clear or who is not responding to therapy.

Questions?

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