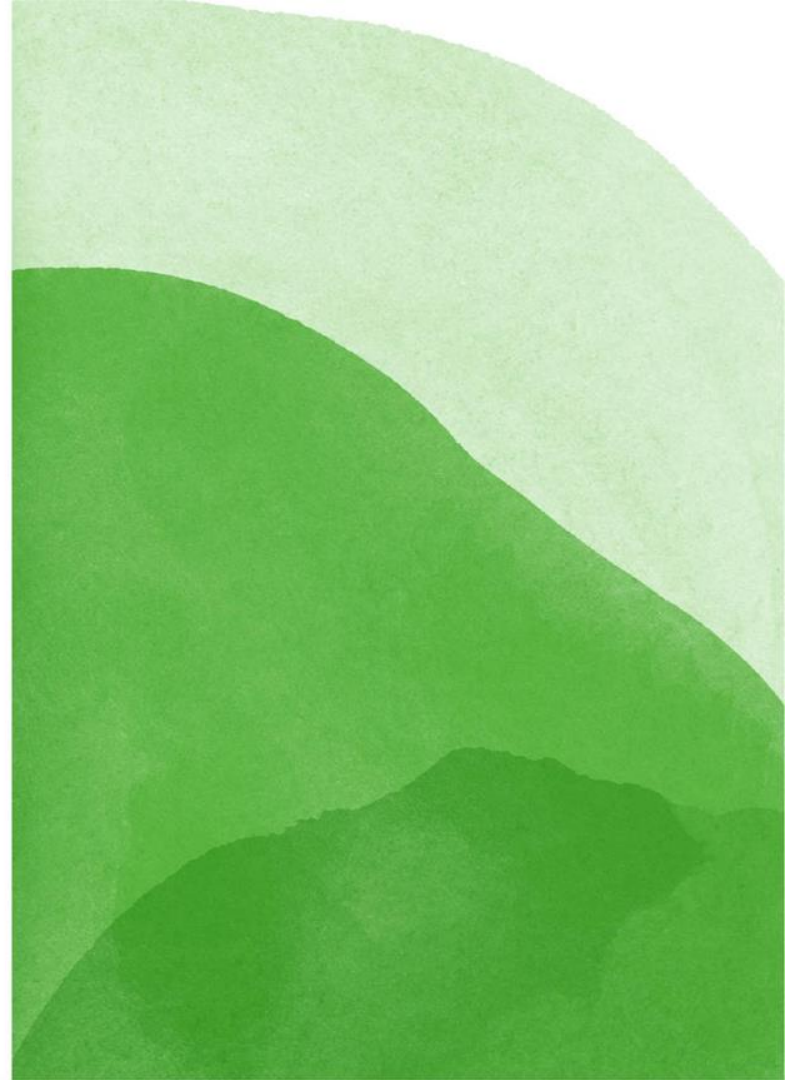


# Asthma 2023: Simplifying New Complexities in Treatment

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September 9, 2023



# Disclosure

None

# Outline

## Highlights in baseline treatment

- Basis of treatment - ICS
- ACT

## Post Viral Asthma

- What it is (A review of asthma triggers)
- How to treat (3 months – ACT)
- Setting expectations

## Biologics

- Classes
- Side effects
- Special considerations

## Bonus Pearls

# Case

81 y/o M with very distant past 10 pack year smoking history (quit in 1975) presents with exertional dyspnea. Stress echo shows no concern for ischemia with normal wall motion and LVEF 65%. He was sent to see Pulmonary to make sure nothing else was going on. He has a known elevated left hemidiaphragm and has for years.

He feels winded while talking sometimes. He wakes up at night sometimes (1/week) coughing and then feeling short of breath. Has some morning sputum. He also admits to some anxiety feeling when he feels like he cannot catch his breath. Benzos have helped with some of the daytime symptoms in the past, but not the night wakening and night cough.

# Case

Spirometry	Ref	Pre BD (L)	Pre % ref	Post BD (L)	Post % ref	% change
FEV1/FVC	0.75 (LLN 0.67)	0.65		0.68		
FVC	4.42	1.70	38%	1.90	43%	13%
FEV1	3.29	1.11	34%	1.28	39%	15%

# What inhaler would you trial first

SABA (Short-acting beta-agonist – albuterol)

LAMA (Long-acting muscarinic antagonist – Spiriva)

ICS-Famoterol Schedule (Inhaled corticosteroid – Long-acting beta-agonist)

ICS-Famoterol PRN

ICS + SABA

# Fundamentals of treatment

# The Diagnosis of Asthma

Symptoms: wheeze, SOB, chest tightness, cough- vary over time and can often be associated w provoking exposures

- Airflow obstruction, which is fully reversible
- Normal spirometry doesn't rule out asthma

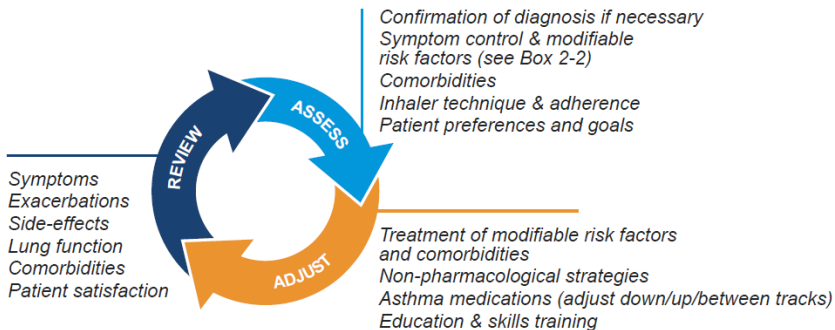
Spirometry	BD reversibility: FEV1 or FVC >10% improvement Or Large variability on airflow obstruction over time
Peak flow diary	1-2 weeks twice-daily PEF >20%
Therapeutic trial	"significant" increase in FEV1 or PEF after 4 weeks <b>controller</b> therapy
Bronchoprovocation	Methacholine or mannitol inhalation challenge. High negative predictive value



# GINA 2023 – Adults & adolescents 12+ years

## Personalized asthma management

Assess, Adjust, Review  
for individual patient needs



### TRACK 1: PREFERRED CONTROLLER and RELIEVER

Using ICS-formoterol as the reliever\* reduces the risk of exacerbations compared with using a SABA reliever, and is a simpler regimen

#### STEPS 1 – 2

As-needed-only low dose ICS-formoterol

#### STEP 3

Low dose maintenance ICS-formoterol

#### STEP 4

Medium dose maintenance ICS-formoterol

#### STEP 5

Add-on LAMA  
Refer for assessment of phenotype. Consider high dose maintenance ICS-formoterol, ± anti-IgE, anti-IL5/5R, anti-IL4Rα, anti-TSLP

RELIEVER: As-needed low-dose ICS-formoterol\*

See GINA severe asthma guide

### TRACK 2: Alternative CONTROLLER and RELIEVER

Before considering a regimen with SABA reliever, check if the patient is likely to adhere to daily controller treatment

#### STEP 1

Take ICS whenever SABA taken\*

#### STEP 2

Low dose maintenance ICS

#### STEP 3

Low dose maintenance ICS-LABA

#### STEP 4

Medium/high dose maintenance ICS-LABA

#### STEP 5

Add-on LAMA  
Refer for assessment of phenotype. Consider high dose maintenance ICS-LABA, ± anti-IgE, anti-IL5/5R, anti-IL4Rα, anti-TSLP

RELIEVER: as-needed ICS-SABA\*, or as-needed SABA

Other controller options (limited indications, or less evidence for efficacy or safety – see text)

Low dose ICS whenever SABA taken\*, or daily LTRA, or add HDM SLIT

Medium dose ICS, or add LTRA, or add HDM SLIT

Add LAMA or LTRA or HDM SLIT, or switch to high dose ICS

Add azithromycin (adults) or LTRA. As last resort consider adding low dose OCS but consider side-effects

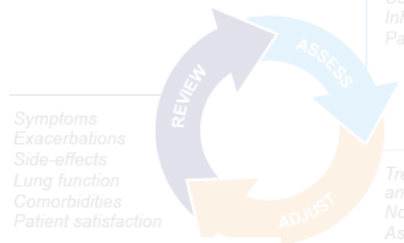
\*Anti-inflammatory reliever (AIR)

# GINA 2023 – Adults and adolescents

## Track 1

Personalized asthma management  
Assess, Adjust, Review  
for individual patient needs

Confirmation of diagnosis if necessary  
Symptom control & modifiable risk factors (see Box 2-2)  
Comorbidities  
Inhaler technique & adherence  
Patient preferences and goals



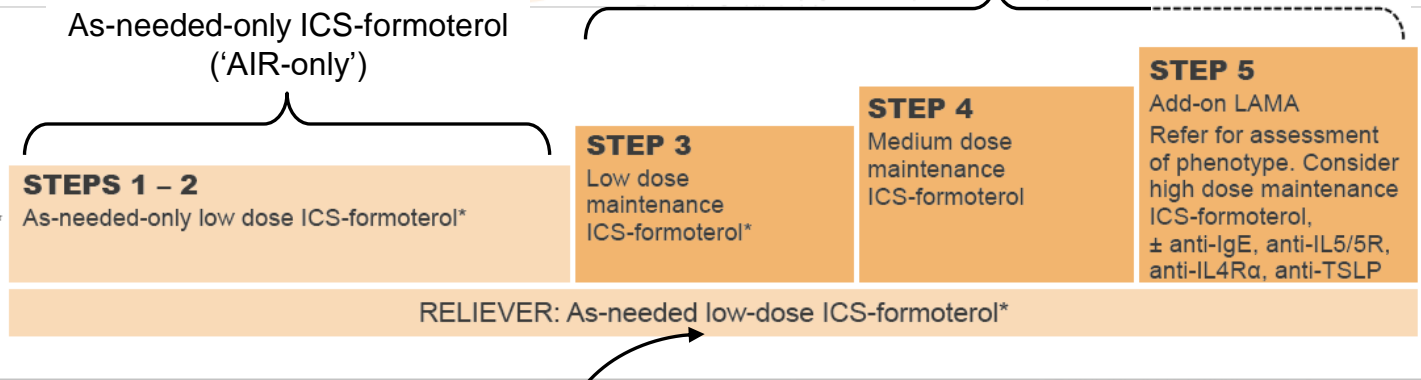
Symptoms  
Exacerbations  
Side-effects  
Lung function  
Comorbidities  
Patient satisfaction

Treatment of modifiable risk factors and comorbidities  
Non-pharmacological strategies  
Asthma medications (adjust down/up/between tracks)

### Maintenance and reliever therapy (MART) with ICS-formoterol

#### As-needed-only ICS-formoterol ('AIR-only')

**TRACK 1: PREFERRED CONTROLLER and RELIEVER**  
Using ICS-formoterol as the reliever\* reduces the risk of exacerbations compared with using a SABA reliever, and is a simpler regimen



**TRACK 2: Alternative CONTROLLER and RELIEVER**  
Before considering a regimen with SABA reliever, check if the patient is likely to adhere to daily controller treatment

**STEP 1**  
Take ICS whenever SABA taken\*

\*An anti-inflammatory reliever (AIR)

Medium/high dose maintenance ICS-LABA  
Add-on LAMA or LTRA or HDM SLIT, or switch to high dose ICS  
Refer for assessment of phenotype. Consider high dose maintenance ICS-LABA, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP

Other controller options (limited indications, or less evidence for efficacy or safety – see text)

Low dose ICS whenever SABA taken\*, or daily LTRA, or add HDM SLIT

Medium dose ICS, or add LTRA, or add HDM SLIT

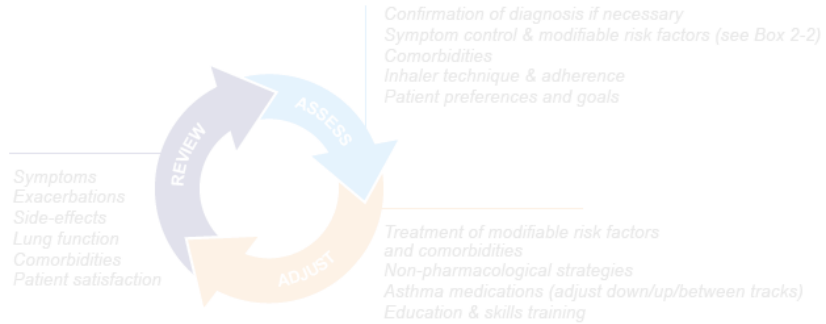
Add LAMA or LTRA or HDM SLIT, or switch to high dose ICS

Add azithromycin (adults) or LTRA. As last resort consider adding low dose OCS but consider side-effects

# GINA 2023 – Adults and adolescents

## Track 2

Personalized asthma management  
Assess, Adjust, Review  
for individual patient needs



**TRACK 1: PREFERRED CONTROLLER and RELIEVER**  
Using ICS-formoterol as the reliever\*

**STEPS 1 – 2**  
As-needed-only low dose ICS-formoterol\*

**STEP 3**  
Low dose maintenance ICS-formoterol\*

**STEP 4**  
Medium dose maintenance ICS-formoterol

**STEP 5**  
Add-on LAMA  
Refer for assessment of phenotype. Consider high dose maintenance ICS-formoterol, ± anti-IgE, anti-IL5/5R, anti-IL4Rα, anti-TSLP

**TRACK 2: Alternative CONTROLLER and RELIEVER**  
Before considering a regimen with SABA reliever, check if the patient is likely to adhere to daily controller treatment

**STEP 1**  
Take ICS whenever SABA taken\*

**STEP 2**  
Low dose maintenance ICS

**STEP 3**  
Low dose maintenance ICS-LABA

**STEP 4**  
Medium/high dose maintenance ICS-LABA

**STEP 5**  
Add-on LAMA  
Refer for assessment of phenotype. Consider high dose maintenance ICS-LABA, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP

RELIEVER: as-needed ICS-SABA\*, or as-needed SABA

\*An anti-inflammatory reliever (Steps 3–5)

Other controller options (limited indications, or less evidence for efficacy or safety – see text)

Low dose ICS whenever SABA taken\*, or daily LTRA, or add HDM SLIT

Medium dose ICS, or add LTRA, or add HDM SLIT

high dose ICS

consider side-effects

# The risks of SABA only

## Regular or frequent use of SABA is associated with adverse effects

- $\beta$ -receptor downregulation, decreased bronchoprotection, rebound hyperresponsiveness, decreased bronchodilator response (*Hancox, Respir Med 2000*)
- Increased allergic response, and increased eosinophilic airway inflammation (*Aldridge, AJRCCM 2000*)

## Higher use of SABA is associated with adverse clinical outcomes

- Dispensing of  $\geq 3$  canisters per year (average 1.7 puffs/day) is associated with higher risk of emergency department presentations (*Stanford, AAI 2012*)
- Dispensing of  $\geq 12$  canisters per year is associated with higher risk of death (*Suissa, AJRCCM 1994*)

# GINA 2019 – landmark changes in asthma management

For safety, GINA no longer recommends SABA-only treatment for Step 1

- This decision was based on evidence that **SABA-only treatment increases the risk of severe exacerbations**, and that **adding any ICS significantly reduces the risk**

GINA now recommends that all adults and adolescents with asthma should receive

ICS-containing controller treatment, to reduce the risk of serious exacerbations

- The ICS can be delivered by regular daily treatment or, in mild asthma, by as-needed low dose ICS-formoterol

This is a population-level risk reduction strategy

- Other examples: statins, anti-hypertensives
- Individual patients may not necessarily experience (or be aware of) short-term clinical benefit
- The aim is to reduce the probability of serious adverse outcomes at a population level

# Track 1, Steps 1–2: As-needed-only low-dose ICS-formoterol

## COMPARED WITH AS-NEEDED SABA

- Two studies (*SYGMA 1, O’Byrne et al, NEJM 2018, n=3836; Novel START, Beasley et al, NEJM 2019, n=668*)
- Risk of severe exacerbations was reduced by 60–64% (*SYGMA 1, Novel START*)

## COMPARED WITH MAINTENANCE LOW DOSE ICS plus as-needed SABA

- Four studies (*SYGMA 1; SYGMA 2, Bateman et al, NEJM 2018, n=4176; Novel START; PRACTICAL, Hardy et al, Lancet 2019, n=885*)
- Risk of severe exacerbations similar (*SYGMA 1 & 2*), or lower (*Novel START, PRACTICAL*)
- Symptoms very slightly more, e.g. ACQ-5 0.15 (vs 0.5 MCID), not worsening over 12 months
- Pre-BD FEV<sub>1</sub> slightly lower (~54 mL), not worsening over 12 months
- FeNO slightly higher (10ppb), not increasing over 12 months (*Novel START, PRACTICAL*)
- As-needed ICS-formoterol used on ~ 30% of days → average ICS dose ~50–100mcg budesonide/day
- Benefit independent of T2 status, lung function, exacerbation history (*Novel START, PRACTICAL*)
- Qualitative research: most patients preferred as-needed ICS-formoterol (*Baggott Thorax 2020, ERJ 2020; Foster Respir Med 2020, BMJ Open 2022*)

# Caveats about intermittent therapy and MART

Majority of studies with budesonide-formoterol.

Max dose 12 puffs/day for age >12.

Cannot do with ICS/salmeterol

Cannot do intermittent with ICS-vilanterol DPI (Breo) or other DPI's due to short shelf life.

Patients must be able to recognize and respond to asthma symptoms

- “Just in time”
- The patient that never takes their SABA because “I’m never that bad” is not a good candidate.

# ICS/Formoterol $\neq$ ICS/Salmeterol

Symbicort = Budesonide/formoterol

Dulera = Mometasone/formoterol

Advair = Fluticasone/Salmeterol

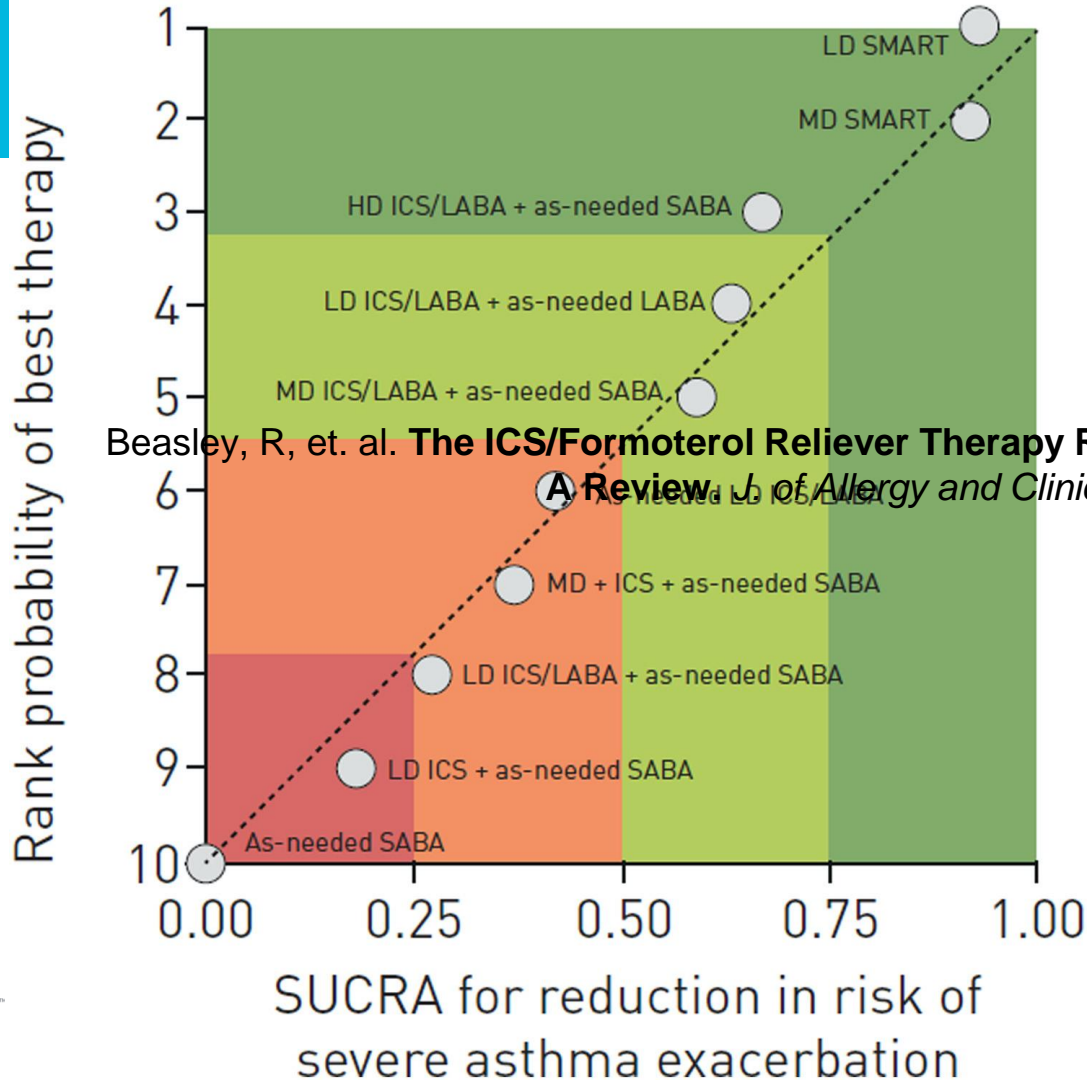




**Intermittent Asthma**

**Management of Persistent Asthma in Individuals Ages 12+ Years**

Treatment	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6 <sup>†</sup>
<b>Preferred</b>	PRN SABA	Daily low-dose ICS and PRN SABA or PRN concomitant ICS and SABA <sup>▲</sup>	Daily and PRN combination low-dose ICS-formoterol <sup>▲</sup>	Daily and PRN combination medium-dose ICS-formoterol <sup>▲</sup>	Daily medium-high dose ICS-LABA + LAMA and PRN SABA <sup>▲</sup>	Daily high-dose ICS-LABA + oral systemic corticosteroids + PRN SABA
<b>Alternative</b>		Daily LTRA* and PRN SABA or Cromolyn,* or Nedocromil,* or Zileuton,* or Theophylline,* and PRN SABA	Daily medium-dose ICS and PRN SABA or Daily low-dose ICS-LABA, or daily low-dose ICS + LAMA, <sup>▲</sup> or daily low-dose ICS + LTRA,* and PRN SABA or Daily low-dose ICS + Theophylline* or Zileuton,* and PRN SABA	Daily medium-dose ICS-LABA or daily medium-dose ICS + LAMA, and PRN SABA <sup>▲</sup> or Daily medium-dose ICS + LTRA,* or daily medium-dose ICS + Theophylline,* or daily medium-dose ICS + Zileuton,* and PRN SABA	Daily medium-high dose ICS-LABA or daily high-dose ICS + LTRA,* and PRN SABA	
		Steps 2-4: Conditionally recommend the use of subcutaneous immunotherapy as an adjunct treatment to standard pharmacotherapy in individuals ≥ 5 years of age whose asthma is controlled at the initiation, build up, and maintenance phases of immunotherapy <sup>▲</sup>			Consider adding Asthma Biologics (e.g., anti-IgE, anti-IL5, anti-IL5R, anti-IL4/IL13)**	



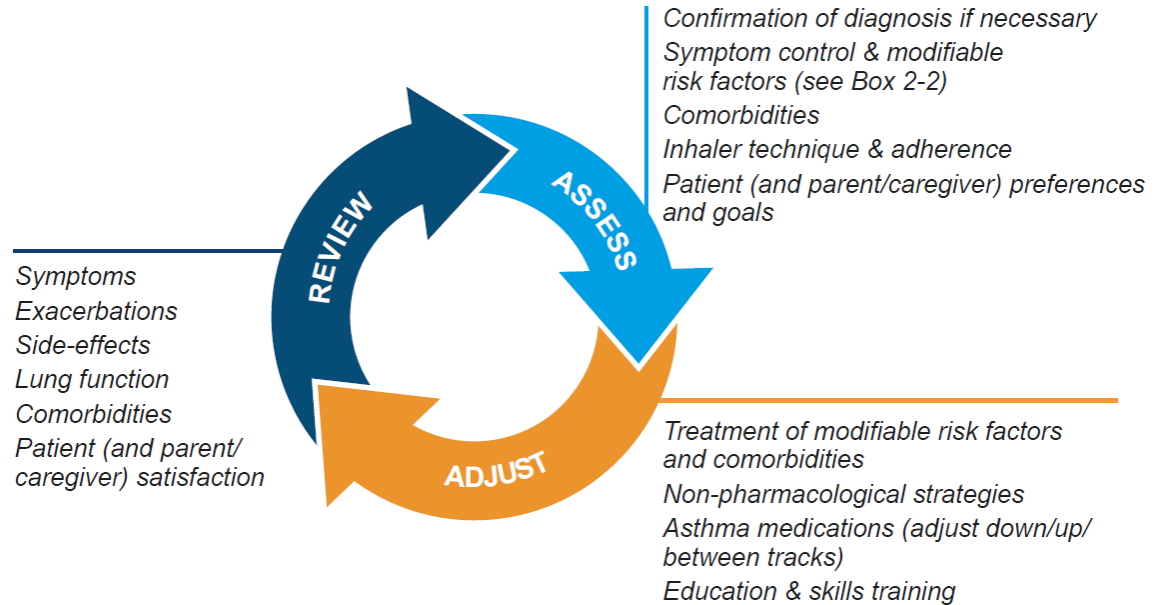
Beasley, R, et. al. **The ICS/Formoterol Reliever Therapy Regime in Asthma: A Review.** *J of Allergy and Clinical Immunology.* 2023

# What I do in practice.

- I prescribe ICS-LABA or ICS for each patient.
  - If use SABA during the day → take their ICS or ICS-LABA as well.
- Running out of inhalers:
  - Step 1-3 asthmatics don't tend to run out. (they forget to use).
  - Step 4-5 asthmatics - Rx TWO ICS/LABA [ie. I Rx Advair (maintenance) and Symbicort (reliever)]

# Reassess

- Uncontrolled: 2-4 week check in
- Controlled: 3 month check in for step down



## Asthma Control Test®

This survey was designed to help you describe your asthma and how your asthma affects how you feel and what you are able to do. To complete it, please mark an X in the box that best describes your answer.

1. In the **past 4 weeks**, how much of the time did your asthma keep you from getting as much done at work or at home?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

2. During the **past 4 weeks**, how often have you had shortness of breath?

More than once a day	Once a day	3 to 6 times a week	Once or twice a week	Not at all
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

3. In the **past 4 weeks**, 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?

4 or more nights a week	2 to 3 nights a week	Once a week	Once or twice	Not at all
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

4. In the **past 4 weeks**, how often have you used your rescue inhaler or nebulizer medication (such as Albuterol, Ventolin®, Proventil®, Maxair®, or Primatene Mist®)?

3 or more times per day	1 or 2 times per day	2 or 3 times per week	Once a week or less	Not at all
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

5. How would you rate your asthma control during the **past 4 weeks**?

Not controlled at all	Poorly controlled	Somewhat controlled	Well controlled	Completely controlled
<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

1. Did asthma keep you from getting much done at home or at work?
  2. Did you have shortness of breath?
  3. How often have you had symptoms that wake you up at night or early in the AM?
  4. How often have you used your rescue inhaler or nebulizer machine?
  5. How do you rate your asthma control?
- 

3 or more  
Times per day

1

1 or 2  
times per day

2

2 or 3  
times per day

3

Once a wee  
or less

4

Not at all

5

# Rescue inhaler use

4. In the past 4 weeks how often have you used your rescue inhaler or nebulizer machine?

3 or more  
Times per day

1

1 or 2  
times per day

2

2 or 3  
times per day

3

Once a wee  
or less

4

Not at all

5

# When do we step up/down – ACT

Step Up: After 2-4 weeks if still poor control

Step Down: **After no less than 3 months of good control**

Well Controlled =  $ACT \geq 20$

Poorly Controlled (need Step Up) =  $ACT \leq 19$



# Post – Viral Asthma

And other consideration for triggers...

# Case

46 y/o M, Firefighter. He is otherwise healthy, however in August 2022 he got COVID. He had airflow obstruction on his PFTs since 2021, but never had any respiratory limitation or diagnosis of asthma. Since his August 2022 COVID infection he has had 3 months of persistent cough with exertion, chest tightness with exertion, increased fatigue at work.

He is a never smoker. He does have occupational smoke exposures as a firefighter. He works as a rescue diver as well and has never had any issues with scuba-diving even in extreme conditions with underwater exertion.

# Case 8/18/21 and 2/28/22

Spirometry	Ref	Pre BD (L)	Pre % ref
FEV1/FVC	0.80 (LLN 0.72)	0.65	
FVC	3.89	3.17	80%
FEV1	4.89	4.70	95%

# Case 5/23/23

Spirometry	Ref	Pre BD (L)	Pre % ref
FEV1/FVC	0.81 (LLN 0.73)	0.72	
FVC	4.78	4.78	100%
FEV1	3.91	3.46	92%

# Triggers for Exacerbations

## Environment

Pathogens (Bacteria / Viral) \*\*\* **Most prominent trigger is viral URI**

Allergens, Pollution, Smoking

## Host

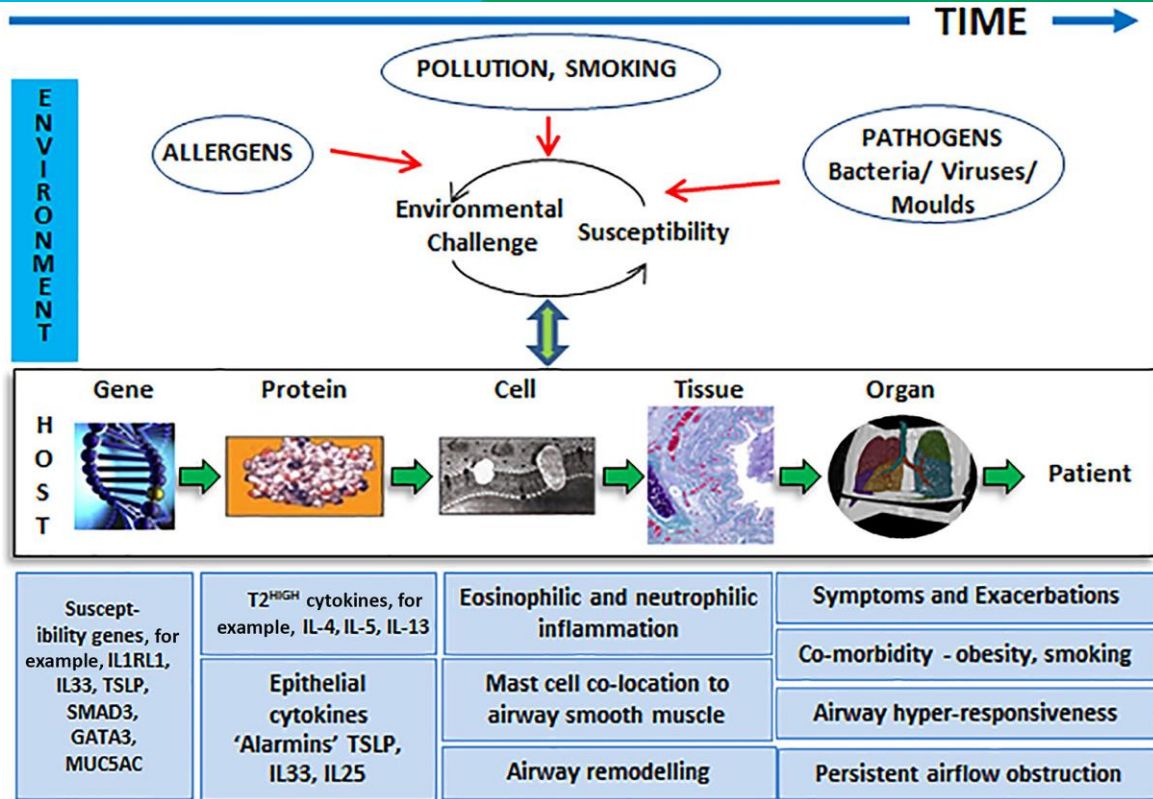
Co-morbidities (obesity, smoking, GERD, Rhinosinusitis)

Airway reactivity (i.e. frequent exacerbator)

Fixed airflow obstruction (i.e. underlying COPD)

NSAIDs (for some patients)

# Asthma Pathogenesis



# When do we step up – ACT

Step Up: After 2-4 weeks if still poor control

Step Down: **After no less than 3 months of good control**

Well Controlled =  $ACT \geq 20$

Poorly Controlled (need Step Up) =  $ACT \leq 19$

# Indoor allergens



Mold



Cockroaches



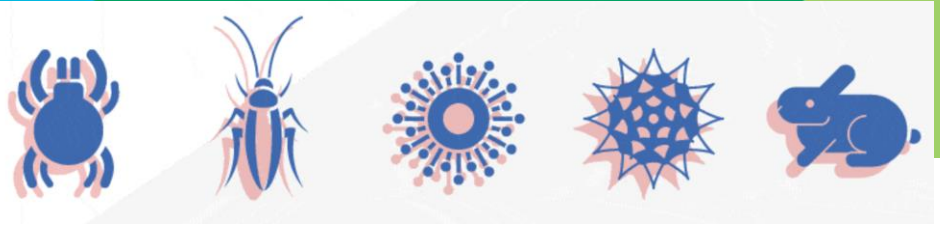
Animal dander



Dust mites



# Indoor allergens



Remove specific allergen exposure **ONLY** when there is evidence of sensitization and exposure.

Use removal strategies as part of a multicomponent allergen-specific mitigation

If History is Negative – Do Nothing more

History of asthma symptoms aggravated by mold, dust, seasonal changes, or furry animals?

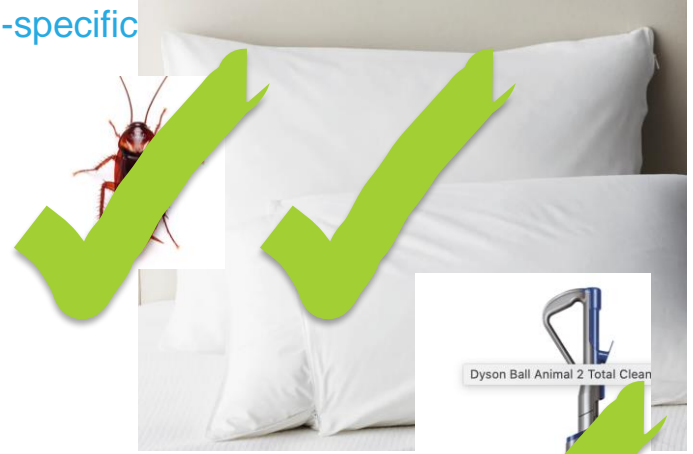
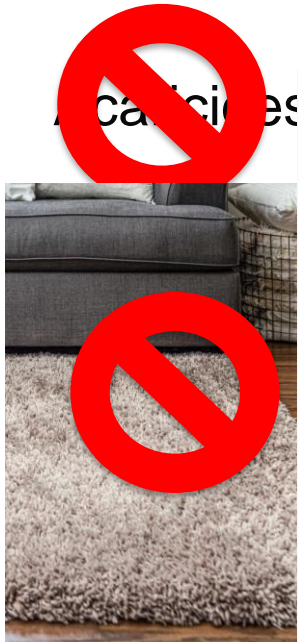
→ Allergy Testing

# Indoor allergens



Remove specific allergen exposure ONLY when there is evidence of sensitization and exposure.

Use removal strategies as part of a multicomponent allergen-specific



# Fire Season: recs for patients

Use of controller meds

Avoiding outdoors during times of high outdoor air pollution

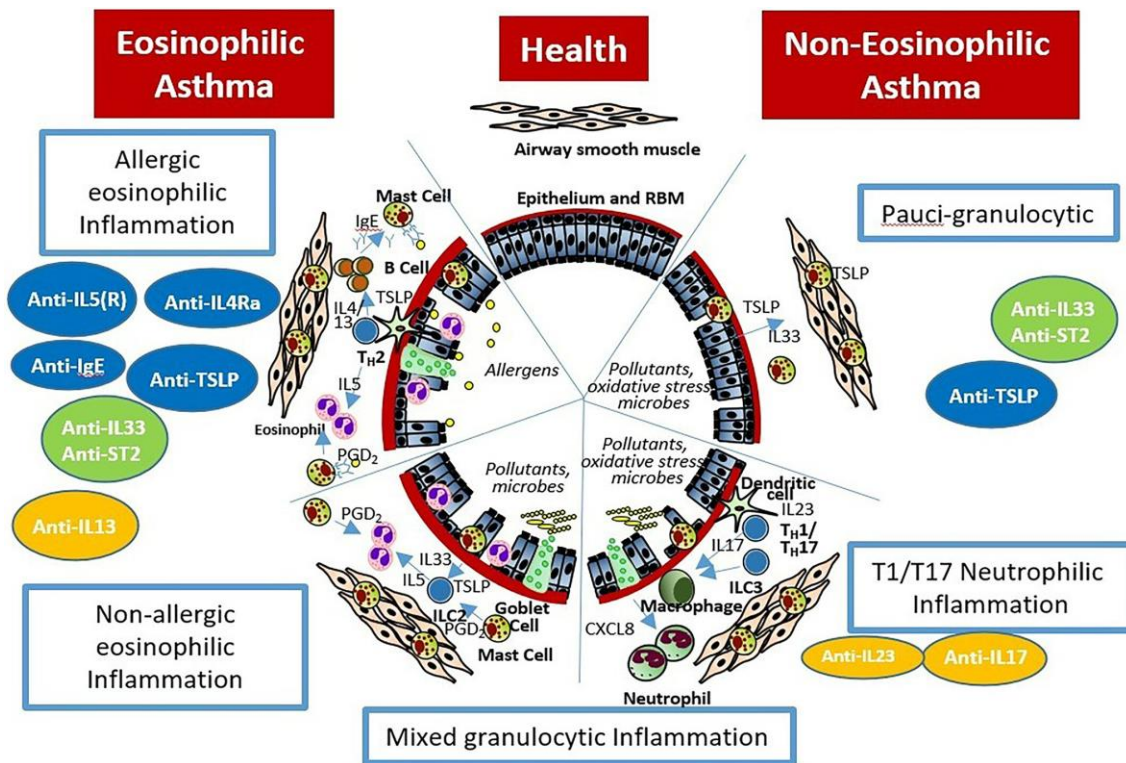
- Review how to look at AQI

Optimize indoor air quality

- Clean cooking/heating options
- Recognizing vacuuming causes acute increase in indoor air pollution for up to 4 hours after vacuuming

N95 **can** help with PM if well fitted, does not help with gas pollution

# Biologics



# Biologics

Type	Names	Pathways
IgE	Omalizumab (Xolair)	-> reduction in Mast cell degranulation -> evidence for reduced fall season asthma exacerbation in children which are likely driven by respiratory viral infections
Eos	Mepolisumab: anti-IL-5 Reslizumab: anti-IL-5 Benralizumab: anti-iL-5Ra Dupilumab: anti-IL-4Ra	strongest data: - reducing exacerbations Strongest data: - improvement in lung function Strongest data: - reduce daily oral steroids Strongest data: - nasal congestion, nasal polyposis
No Eos	Tezepelumab	A human monoclonal antibody that blocks thymic stromal lymphopoietin, an epithelial-cell-derived cytokine implicated in the pathogenesis of asthma.

# Blood work with high Eos

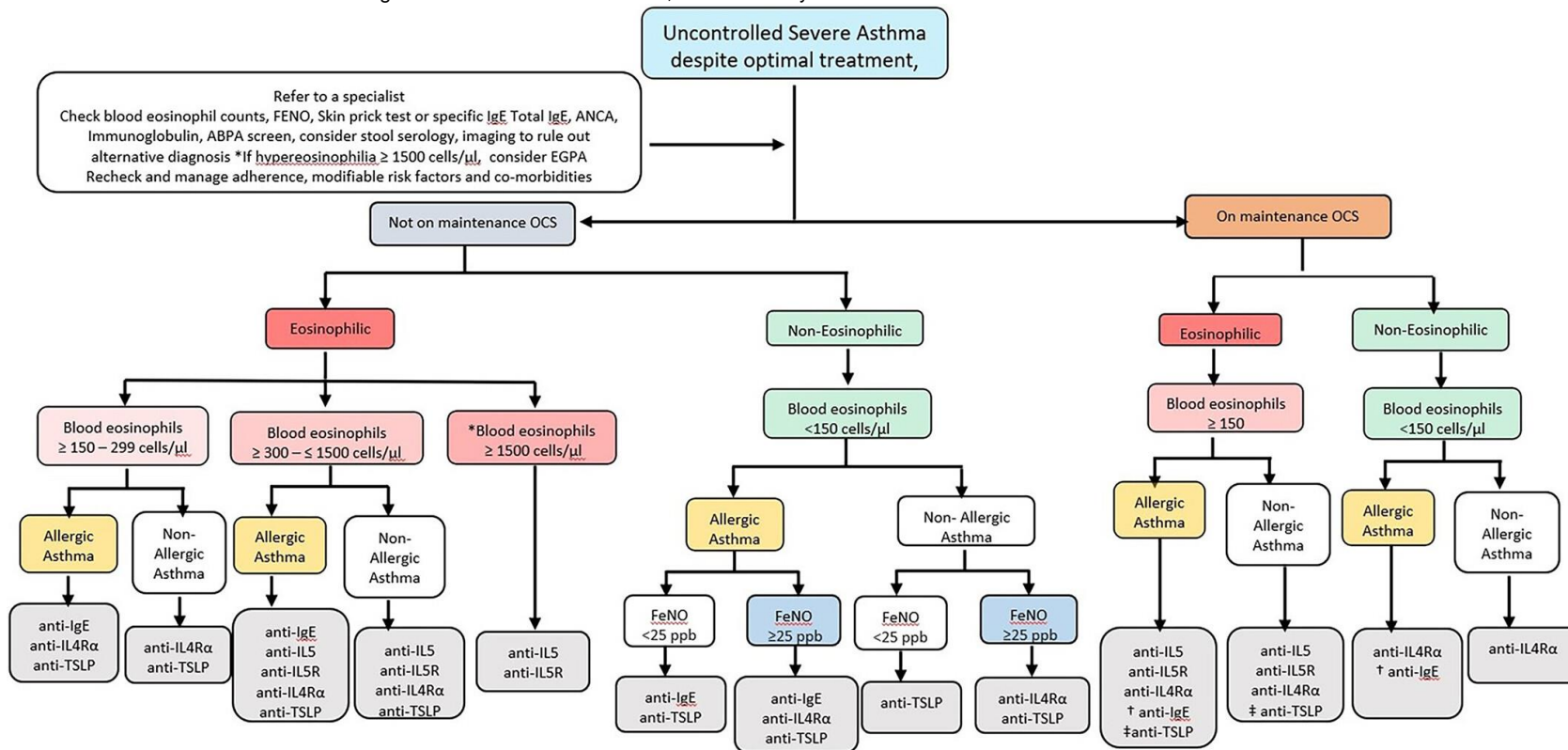
Differential: Absolute Count (Automated)	
<input type="checkbox"/> Lymphocytes, Absolute Count	2.40 x10(9)/L
<input type="checkbox"/> Monocytes, Absolute Count	0.61 x10(9)/L
<input type="checkbox"/> Neutrophils, Absolute Count	5.13 x10(9)/L
<input type="checkbox"/> Eosinophils, Absolute Count	(H) 0.97 x10(9)/L
<input type="checkbox"/> Basophils, Absolute Count	0.15 x10(9)/L
<input type="checkbox"/> Immature Granulocytes (IG), absolute	* 0.03 x10(9)/L
<input type="checkbox"/> Nucleated RBC, Absolute	0.00 x10(9)/L

# Blood work with high Eos

Differential: Absolute Count (Automated)	
<input type="checkbox"/> Lymphocytes, Absolute Count	1.53 x10(9)/L
<input type="checkbox"/> Monocytes, Absolute Count	0.61 x10(9)/L
<input type="checkbox"/> Neutrophils, Absolute Count	5.95 x10(9)/L
<input type="checkbox"/> Eosinophils, Absolute Count	0.47 x10(9)/L
<input type="checkbox"/> Basophils, Absolute Count	0.04 x10(9)/L
<input type="checkbox"/> Immature Granulocytes (IG), absolute	* 0.03 x10(9)/L
<input type="checkbox"/> Nucleated RBC, Absolute	0.00 x10(9)/L



## Biologics for severe asthma—Which, when and why?



$\dagger$  Possible benefit as a meta-analysis evaluating real-world effectiveness of Omalizumab showed a 41% reduction in maintenance OCS at 12 months in proportion of severe asthma patients receiving OCS.(50)

$\ddagger$  Possible benefit of Tezepelumab in OCS reduction in eosinophilic patient as per the SOURCE study.(86)

# Biologics

Biologic	Type	Indication	Route	Frequency
Benralizumab (Fasenra)	Anti-IL-5R $\alpha$	$\geq$ 12 yrs, Blood Eos 150 cells/ $\mu$ L	Sub-Q (Pen or Injection)	Q 4 weeks $\rightarrow$ Q 8 weeks
Dupilumab (Dupixent)	Anti-IL4R $\alpha$	$\geq$ 6 yrs, Blood Eos 150 cells/ $\mu$ L. uncontrolled moderate to severe eosinophilic asthma. Sinus disease, COPD.	Sub-Q (Pen or Injection)	Q 2 weeks
Mepolisumab (Nucala)	Anti-IL5	$\geq$ 6 yrs, Blood Eos 150 cells/ $\mu$ L. Severe uncontrolled <b>eosinophilic asthma</b> , Vasculitis (EGPA)	Sub-Q (Pen or Injection)	Q 4 weeks
Omalizumab (Xolair)	Anti-IgE	$\geq$ 6 yrs, IgE of 50 – 1500 IU/mL, <b>and severe aeroallergens</b> . uncontrolled Moderate – severe allergic asthma.	Sub-Q (Pen or Injection)	Q 2 - 4 weeks
Tezepelumab (Tezspire)	Anti-TSLP	$\geq$ 12 yrs uncontrolled severe asthma	Sub-Q (Pen or injection)	Q 4 weeks

# When Can Biologics be administered?

	Biologic			
	Xolair (omalizumab)	Fasenra (benralizumab)	Nucala (mepolizumab)	Dupixent (dupilumab)
Patient's condition, treatment/vaccine, or timing				
Hypertension	✓	✓	✓	✓
Fever	✓	✓	✓	✓
Chronic chest pain	✓	✓	✓	✓
Pneumonia or other respiratory illness	✓	✓	✓	✓
Antibiotics	✓	✓	✓	✓
Active parasitic (helminth) infection	Hold until treatment is completed	Do not give	Do not give	Do not give
Before or after surgery	✓	✓	✓	✓
Headache	✓	✓	✓	✓
Pregnancy <sup>a</sup> and breastfeeding	✓	✓	✓	✓
Inactivated vaccine	✓	✓	✓	✓ <sup>b</sup>
Live-attenuated vaccines	✓	✓	✓	Do not give

# Pregnancy and Breastfeeding

Biologics should not be initiated during pregnancy but are ok to continue during pregnancy and breastfeeding.

# Vaccines

TABLE 2: Types of vaccines and whether to administer with a biologic [4, 5, 6, 8, 9, 45].

Vaccine type	Examples of available vaccines <sup>a</sup>	OK to receive a vaccine with continued biologic use?
Inactivated	Influenza, hepatitis A, rabies	✓
Live-attenuated	MMR, rotavirus, varicella	✓ Except dupixent and cinqair <sup>b</sup>
mRNA	Pfizer-BioNTech COVID-19, Moderna COVID-19	✓
Conjugate, subunit, recombinant, polysaccharide	Hepatitis B, HPV, pneumococcal, meningococcal, shingles	✓
Toxoid	Diphtheria, tetanus	✓
Viral vector	Johnson & Johnson COVID-19, Oxford-AstraZeneca COVID-19, Verity Pharmaceuticals-Serum Institute of India COVID-19	✓

HPV: human papillomavirus; MMR: measles, mumps, and rubella; mRNA: messenger ribonucleic acid. <sup>a</sup>Table is not comprehensive; review all vaccine product information before administering. <sup>b</sup>Dupixent and Cinqair doses should be held for 1 month before the live vaccine administration and reinitiated at least 2 weeks postvaccination.

# Bonus Pearls



**Virginia Mason Medical Center  
Pulmonary Function Laboratory  
Seattle, WA**

Device: VMAX 6910

Smoker: No

Last Cigarette:

Date: 06/17/05

Name:

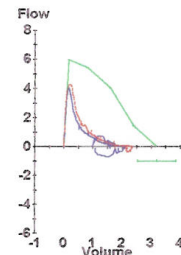
Age: 67 Height(in): 66

Weight(lb): 215 Gender: Female

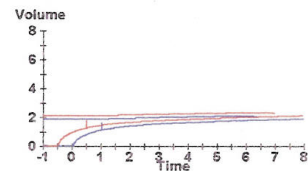
Technician: G. Lembo, RRT

Physician: D. Kregenow, MD

		Ref	Pre	% Ref	Post	% Ref	%Chg
<b>Spirometry</b>							
FVC	Liters	3.21	(2.11)	(66)	(2.35)	(73)	11
FEV1	Liters	2.46	(1.16)	(47)	(1.27)	(52)	10
FEV1/FVC	%	76	(55)		(54)		
FEV3	Liters	2.96	(1.55)	(53)	(1.73)	(59)	12
FEF25-75%	L/sec	2.19	(0.35)	(16)	(0.38)	(17)	10
IsoFEF25-75	L/sec	2.19	(0.35)	(16)	(0.57)	(26)	66
FEF50%	L/sec	4.01	0.53	13	0.59	15	12
FEF75%	L/sec	1.42	0.10	7	0.10	7	-2
PEF	L/sec	5.96	4.19	70	4.29	72	2
<b>Lung Volumes</b>							
TLC	Liters	5.37	5.26	98			
VC	Liters	3.21	(2.20)	(69)	(2.35)	(73)	7
IC	Liters		1.90				
FRC PL	Liters	3.07	3.36	109			
ERV	Liters		0.36				
RV	Liters	2.24	(3.06)	(137)			
RV/TLC	%	42	(58)				
<b>Diffusing Capacity (Hb 11.3)</b>							
DLCO	mL/mmHg/min	25.0	(8.5)	(34)			
DL Adj	mL/mmHg/min	25.0	(9.1)	(37)			
DLCO/VA	mL/mHg/min/L	4.91	(2.19)	(45)			
DL/VA Adj	mL/mHg/min/L		2.36				
VA	Liters	5.37	3.87	72			
IVC	Liters		2.11				



PRED \_\_\_\_\_  
PRE \_\_\_\_\_  
POST \_\_\_\_\_



# PFTs: What Test do I Order?

Test	Details	Uses
<b>Spirometry</b> Flow Volume Curve Flow Volume Loop	Assess bronchodilator responsiveness first time	<ul style="list-style-type: none"><li>- Asthma</li><li>- COPD</li><li>- Unexplained dyspnea</li><li>- Upper airway obstruction</li></ul>
<b>Lung Volumes</b>	Measures total lung capacity, residual volume	<ul style="list-style-type: none"><li>- Emphysema</li><li>- Restrictive lung disease</li><li>- Obesity</li></ul>
<b>Diffusion Capacity</b>	Correct for hemoglobin	<ul style="list-style-type: none"><li>- Unexplained dyspnea</li><li>- ILD diagnosis and f/u</li><li>- Asthma vs. emphysema</li></ul>



# Respiratory Inhalers

## At a Glance 2016

Allergy & Asthma Network is a national non-profit organization dedicated to ending needless death and suffering due to asthma, allergies and related conditions through outreach, education, advocacy and research.



AllergyAsthmaNetwork.org

800.878.4403

**Short-acting beta<sub>2</sub>-agonist bronchodilators** relax tight muscles in airways and offer quick relief of symptoms such as coughing, wheezing and shortness of breath for 3-6 hours

**ProAir<sup>®</sup>**  
HFA  
albuterol sulfate  
DIN A



**ProAir<sup>®</sup>**  
RespiClick  
albuterol sulfate inhalation powder  
DIN A



**Proventil<sup>®</sup>**  
HFA  
albuterol sulfate  
A



**Ventolin<sup>®</sup>**  
HFA  
albuterol sulfate  
DIN A



**Xopenex HFA<sup>®</sup>**  
levalbuterol tartrate  
A



**Long-acting beta<sub>2</sub>-agonist bronchodilators** relax tight muscles in airways and offer lasting relief of symptoms such as coughing, wheezing and shortness of breath for at least 12 hours

**Arcapta<sup>™</sup>**  
Neohaler<sup>™</sup>  
indacaterol inhalation powder  
C



**Serevent<sup>®</sup>**  
Diskus<sup>®</sup>  
salmeterol xinafoate inhalation powder  
DIN A C E



**Striverdi<sup>®</sup>**  
Respimat<sup>®</sup>  
olodaterol hydrochloride  
DIN C



**Inhaled corticosteroids** reduce and prevent swelling of airway tissue; they do not relieve sudden symptoms of coughing, wheezing or shortness of breath

**Aerospin<sup>®</sup>**  
80 mcg  
flunisolide  
★ A



**Alvesco<sup>®</sup>** HFA  
80 mcg, 160 mcg  
ciclesonide  
DIN A



**Arnuity<sup>®</sup>** Ellipta<sup>®</sup>  
100 mcg, 200 mcg  
fluticasone furoate inhalation powder  
DIN A



**Asmanex<sup>®</sup>** HFA  
mometasone furoate  
DIN A



**Asmanex<sup>®</sup>** Twisthaler<sup>®</sup>  
110 mcg, 220 mcg  
mometasone furoate inhalation powder  
DIN A



**Flovent<sup>®</sup>** Diskus<sup>®</sup>  
50 mcg, 100 mcg, 250 mcg  
fluticasone propionate inhalation powder  
DIN A



**Flovent<sup>®</sup>** HFA  
44 mcg, 110 mcg, 220 mcg  
fluticasone propionate  
DIN A



**Pulmicort Flexhaler<sup>®</sup>**  
90 mcg, 180 mcg  
budesonide inhalation powder  
DIN A



**QVAR<sup>®</sup>** (HFA)  
40 mcg, 80 mcg  
beclomethasone dipropionate  
DIN A

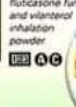


**Combination medications** contain both inhaled corticosteroid and long-acting beta<sub>2</sub>-agonist (LABA)

**Advair Diskus<sup>®</sup>**  
100/50, 250/50, 500/50  
fluticasone propionate and salmeterol inhalation powder  
DIN A C E



**Advair<sup>®</sup>** HFA  
45/21, 115/21, 225/21  
fluticasone propionate and salmeterol inhalation powder  
DIN A C E



**Breo<sup>®</sup>** Ellipta<sup>®</sup>  
100/25 mcg, 200/25 mcg  
fluticasone furoate and vilanterol inhalation powder  
DIN A C E



**Dulera<sup>®</sup>**  
100/5, 200/5  
mometasone furoate and formoterol fumarate dihydrate  
DIN A C



**Symbicort<sup>®</sup>** (HFA)  
80/4.5, 160/4.5  
budesonide and formoterol fumarate dihydrate  
DIN A C E



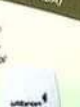
**Anoro<sup>®</sup>** Ellipta<sup>®</sup>  
salmeterol and vilanterol inhalation powder  
DIN C



**Stiolto<sup>®</sup>**  
Respimat<sup>®</sup>  
tiotropium bromide and olodaterol  
DIN C



**Utibron<sup>®</sup>**  
Neohaler<sup>®</sup>  
glycopyrrolate and indacaterol inhalation powder  
DIN C



**Muscarinic antagonist (anticholinergic) bronchodilators** relieve cough, sputum production, wheeze and chest tightness associated with chronic lung diseases

**Short-acting**  
**Atrovent<sup>®</sup>** HFA  
ornitropium bromide  
DIN C



**Long-acting**  
**Seebri<sup>™</sup>** Neohaler<sup>®</sup>  
glycopyrrolate inhalation powder  
C



**Increase<sup>®</sup>** Ellipta<sup>®</sup>  
umecidinium inhalation powder  
DIN C



**Spiriva<sup>®</sup>** HandiHaler<sup>®</sup>  
tiotropium bromide inhalation powder  
C



**Spiriva<sup>®</sup>** Respimat<sup>®</sup>  
2.5, 2.5 mcg  
tiotropium bromide  
DIN A C E



**Tudorza<sup>™</sup>** Pressair<sup>®</sup>  
acridinium bromide inhalation powder  
DIN C



**Combination** muscarinic antagonist and beta<sub>2</sub>-agonist  
**Short-acting**

**Combivent<sup>®</sup>**  
Respimat<sup>®</sup>  
glatropium bromide and albuterol  
DIN C



# Inhaler Nomenclature

DPI – dry powder inhalers – good delivery, powder hardens within 3 months. Short half life.

HFA – (hydrofluoroalkane) - liquid. Should use spacer.

Dulera, Symbicort, and albuterol HFA can last up to 3 years. However they should be replaced at least annually.

# Maximize Impact of the Inhalers

- Demonstrate inhaler technique
- Prescribe inhaler that patients' can afford
- Dispense spacer
  - Increases drug delivery of MDI
  - Decreases side effects



# Low Cost Inhaler Alternatives

- AirDuo Resplick 113 mcg (DPI) –  
[www.goodrx.com](http://www.goodrx.com) for \$40-60
- Advair 250/50 (fluticasone / Salmeterol) –  
[www.costplusdrugs.com](http://www.costplusdrugs.com) for \$60
- [Amazon.com](http://Amazon.com) and [nebulizer.com](http://nebulizer.com) for nebulizer machine and kits.

# Asthma in the Elderly

## **Symptoms are the same, but harder to diagnose**

- dyspnea might be attributed to aging
- Ddx: COPD/emphysema, heart failure
- Importance of spirometry pre/post bronchodilator

## **Comorbidities complicate diagnosis and treatment**

## **Inhaled corticosteroids first choice pharmacotherapy**

- inhalers can be challenging to use for elderly individuals
- concern for side effects: oral candidiasis, hoarse voice, bone density

# Covid-19 and Asthma

## Summary of systemic reviews:

Patients with well-controlled mild-moderate asthma:

- DO NOT seem to be at risk of getting covid
- Not at increased risk of severe covid or covid related death

\*\*\*Risk of death due to covid WAS increased for people who had recently needed oral steroids for asthma

There have not been more asthma exacerbations during the pandemic

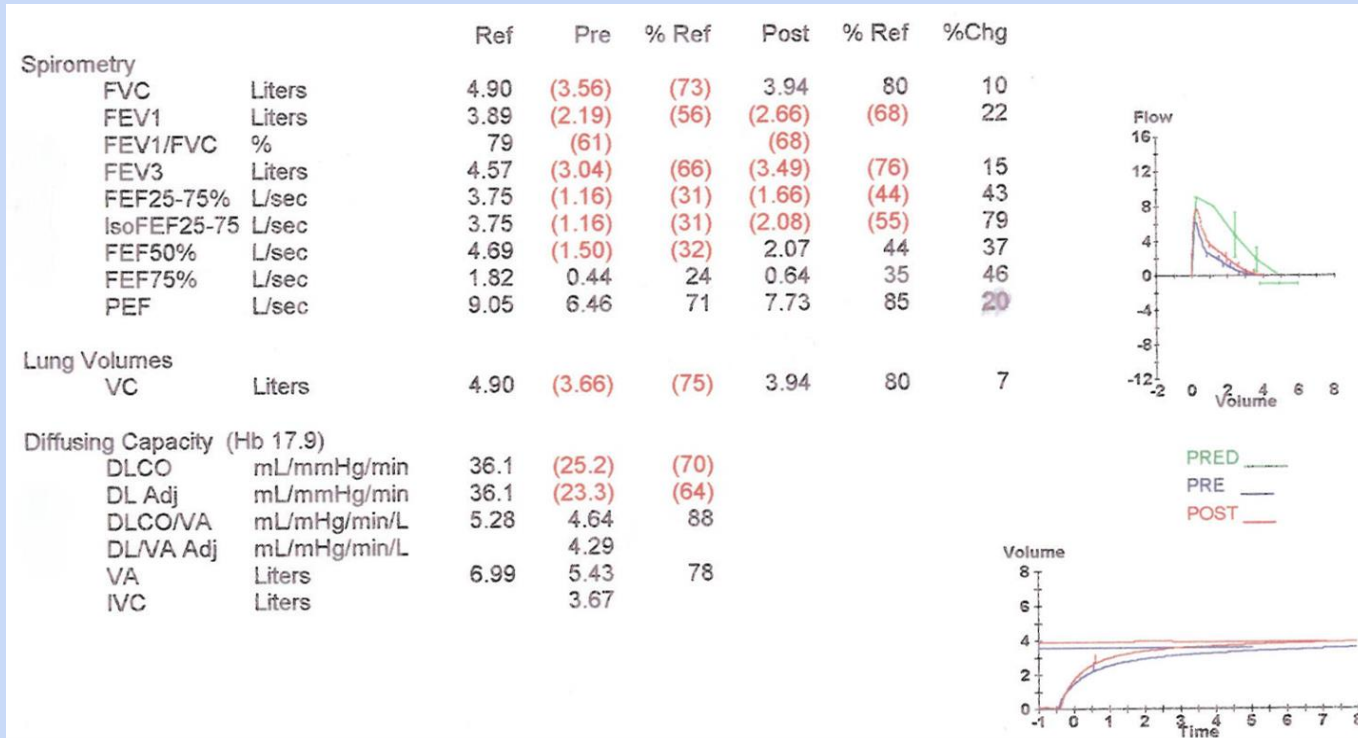
-in Nov 2020-21, many countries saw decrease in asthma exacerbations

Recommendations for patients with asthma: continue taking all prescribed medicines, including ICS

# Cough Variant Asthma

- Differential diagnosis of the chronic cough: smoking, UACS, meds, GER, COPD/asthma
- Other asthma symptoms not present
- PFTs normal
  
- Diagnosis: Methacholine challenge test can be helpful vs. empiric treatment w ICS
  
- Treatment follows same principles as for asthma; may be enhanced role for leukotriene inhibitors

# Asthma, or COPD?





# Asthma COPD overlap

Persistent airflow limitation with several features usually associated with asthma and several features usually associated with COPD

- female, higher BMI, age >40, h/o asthma, smokers

- persistent airflow limitation- PFTs that show improvement but not complete reversibility with bronchodilators

Frequent exacerbations and poor quality of life

Treatment: smoking cessation, exercise, pulmonary rehab program

- Inhalers: ICS/LABA

- avoidance of LAMA or LABA monotherapy

# Exercise induced asthma

- SABA ok if exercise is infrequent.
- ICS if exercise is frequent to avoid unopposed SABA
  - This would mean ICS daily and SABA before exercise – or –
  - I tend to use ICS-LABA
- If cannot tolerate SABA
  - Try LTRA (Singulair)
  - Try LAMA

# Asthma and Exercise

RCT of 131 normal weight subjects w mild-moderate asthma and 24 week exercise intervention (Jaakkola et al, Sci Reports 2019)

Exercise group had 25% improvement in ACT scores

No weight change

Weight loss interventions for obese asthma patients show improvements in asthma control, asthma related QoL, and lung function with 5% weight loss

# When to Refer to Pulmonology

Difficulty establishing a diagnosis of asthma

Treatment isn't working

Abnormal chest imaging

Severe asthma: hospitalizations, frequent exacerbations, steroid dependency

# Questions

Contact:

[Catherine.miele@commonspirit.org](mailto:Catherine.miele@commonspirit.org)