

# Updates in Asthma

including GINA guidelines and  
SMART (Single Maintenance And  
Rescue Therapy)

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## Disclosures

- Author, UpToDate chapters on asthma

## Learning Objectives / Outline

Upon completion of this activity, participants will be able to:

- Describe “AIR” anti-inflammatory reliever
  - Discuss the use of biologics in severe asthma
  - Recognize changes to interpretation of PFTs
- 

## Abbreviations

- **SABA:** short-acting beta agonist
    - albuterol, salbutamol, terbutaline
  - **LABA:** long-acting beta agonist
    - salmeterol, formoterol, vilanterol
  - **FABA: FAST acting beta agonist**
    - albuterol, formoterol
  - **ICS:** inhaled corticosteroid
    - budesonide, fluticasone, beclomethasone, mometasone
  - **AIR:** Anti-Inflammatory Reliever/Rescue
  - **SMART:** Single Maintenance And Reliever Therapy
  - **LAMA:** long-acting anti-muscarinic
    - tiotropium, umeclidinium
  - **FeNO:** fractional exhaled nitric oxide
  - **AEC:** absolute eosinophil count
-

## Asthma Burden

- Over 260 million worldwide
  - In US Adults: 20 million; 8% (2021)
  - In US Children: 5.1 million; 6.5%
- Health care utilization
  - 5.8 million physician office visits
  - 1.2 million emergency department visits
  - 40% with asthma report asthma “attack” in last year
- Deaths
  - >400,000 worldwide; in US >4,000 (2020)
  - 1.3 per 100,000 population



who.int  
 cdc.gov/nchs/fastats/asthma.htm  
 Aafa.org/asthma/asthma-facts

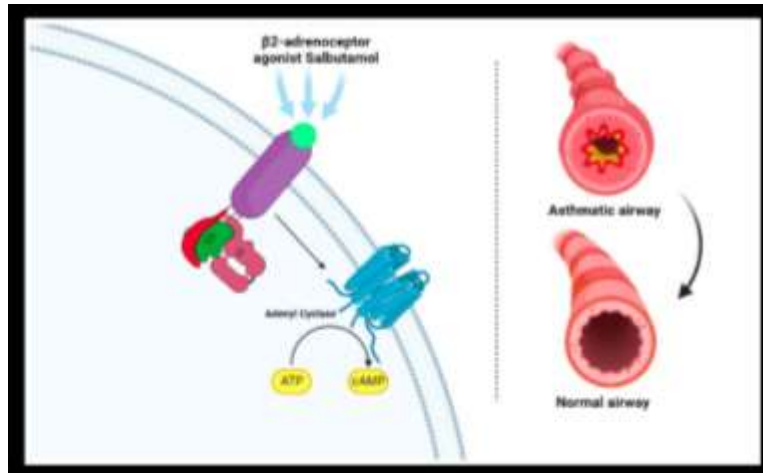
## Shift(ing) paradigm in asthma treatment



★ AIR: Anti-Inflammatory Rescue/ Reliever ★  
 (ICS/FABA as reliever)

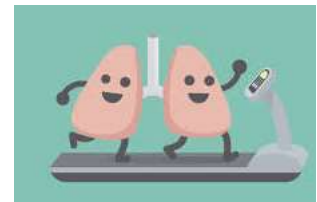


## Beta agonist: mechanism of action

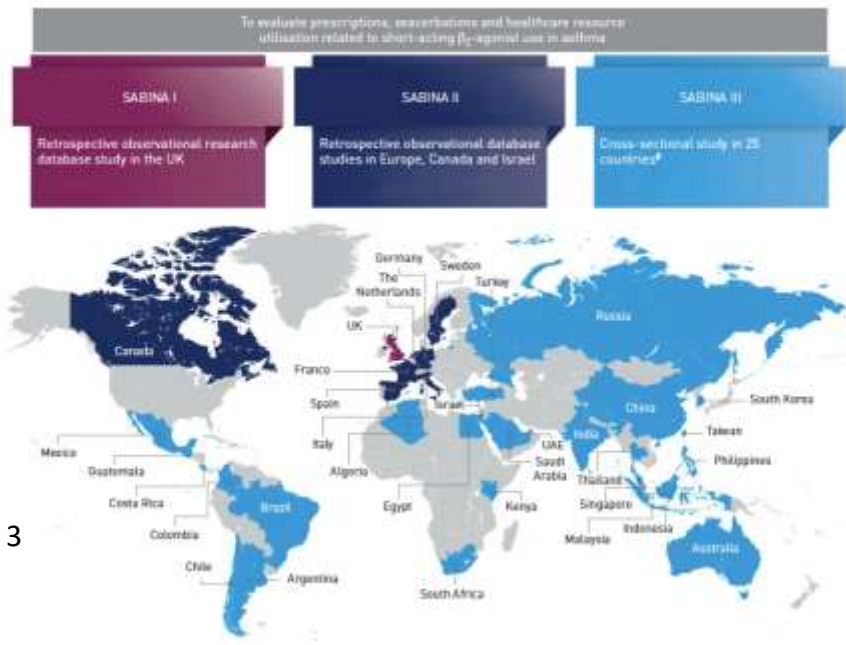


## Goals of asthma treatment

- Reduce mortality
- Reduce exacerbations:
  - hospitalizations / ED / UC / systemic steroids
- **Reduce symptoms**, interference with normal life / activity
  - Improve quality of life
- Minimize side effects of treatment

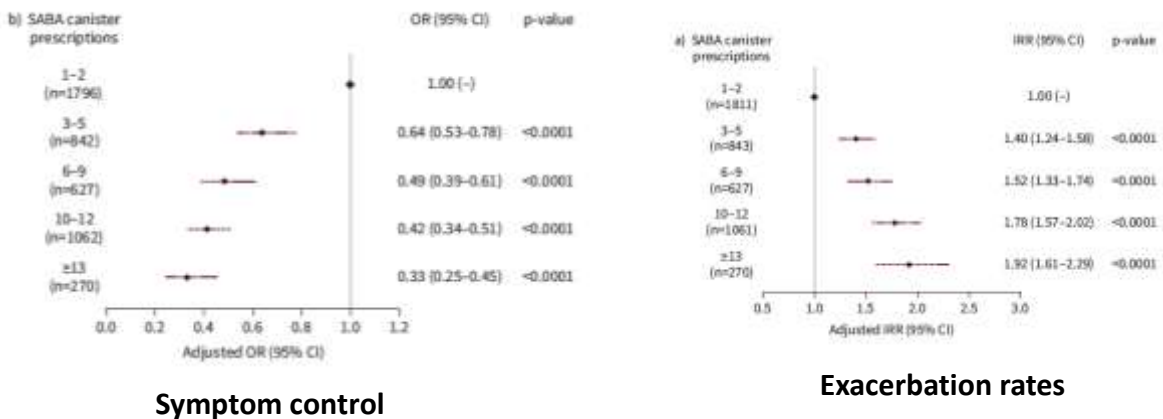


# SABINA program



- How common is SABA overuse?
- What is the association with asthma outcomes?
  - Exacerbations
  - Death
- Definition of overuse:  $\geq 3$  canisters/year

## SABA overuse: symptom control and exacerbations



# Survival and SABA overuse

↑# of SABA canisters / year

↑mortality (OVERALL and asthma-related)

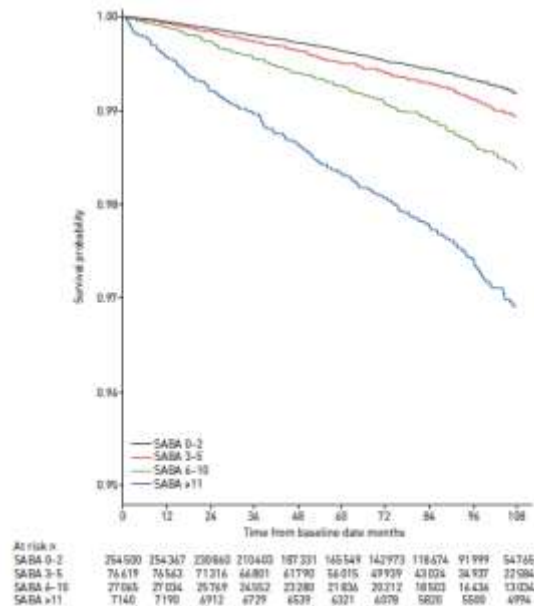


FIGURE 4 Kaplan-Meier plot of overall survival, by baseline short-acting beta-agonist (SABA) use.

Nwaru ERI 2019

## Downsides of Frequent SABA use

- Tachyphylaxis:
  - the more you use it, the less of an effect it has
- Rebound bronchoconstriction



### SABINA findings:

- SABA overuse is common

Associated with:

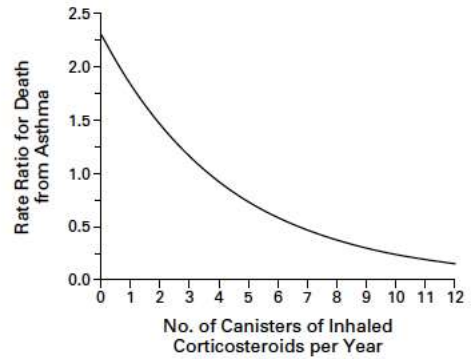
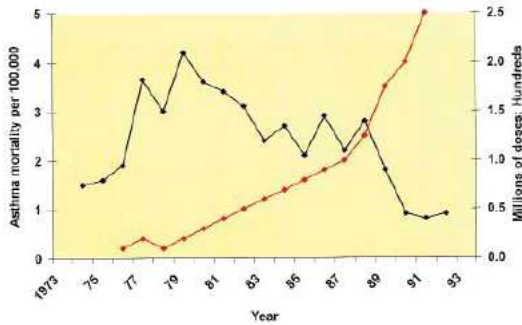
- Poor symptom control
- ↑ exacerbation rates
- ↑ mortality



Not necessarily causal → Could be an opportunity for PREVENTION:

AIR: anti-inflammatory rescue

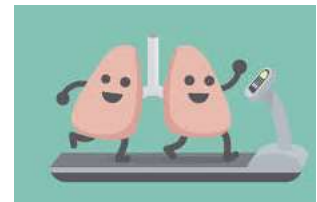
## ICS and asthma mortality



Suissa NEJM 2000  
Suissa JACI 2001

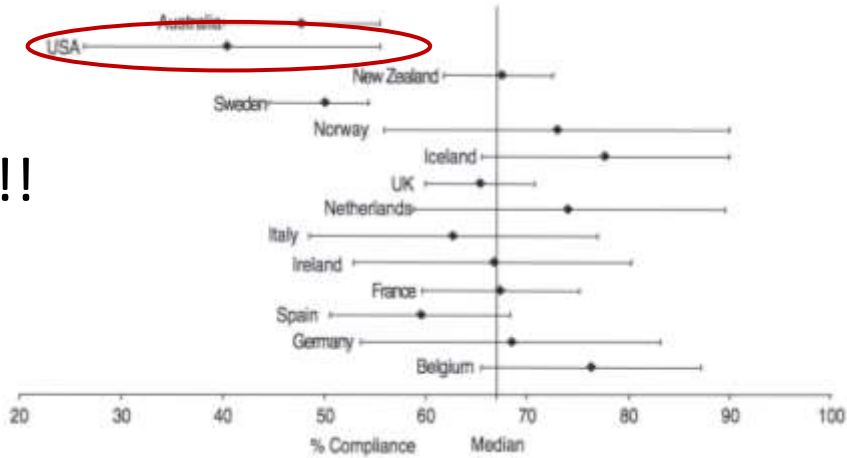
## Goals of asthma treatment

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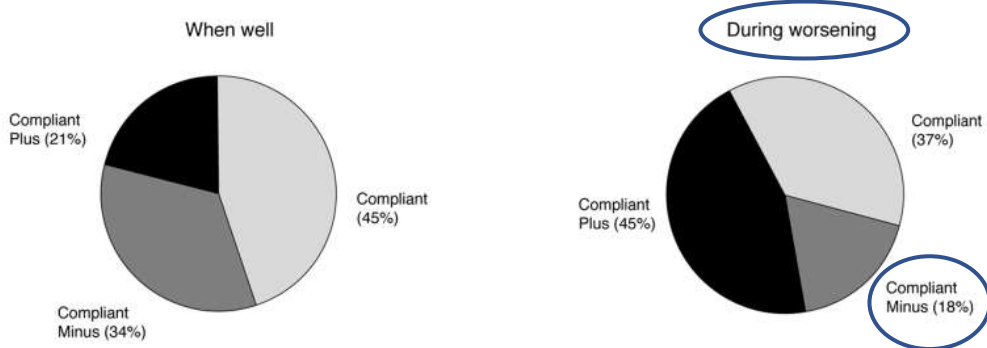
# Adherence is poor

40%!!



Cerveri ERJ 1999

# Patient behavior: INSPIRE study



Partridge BMC Pulm Med 2006

## Asthma: intermittent

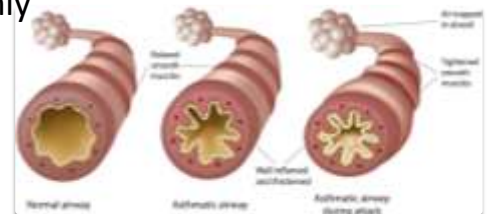
- Triggers are unpredictable
  - Viruses
  - Pollens
  - Pollution
- Oral steroids are effective BUT
  - ~ 4–5 lifetime courses
  - ↑ risk osteoporosis, diabetes, cataract



Price J Asthma 2018

## Rationale: AIR Anti-Inflammatory Reliever with ICS/FABA

- Asthma is a disease of **inflammation** and bronchoconstriction
- ICS very effective: decreasing symptoms, preventing exacerbations
  - But no immediate symptom relief from ICS only
  - Symptoms variable and intermittent
    - → poor adherence to controller medications



- **Almost all people DO take their inhaler when symptomatic (SABA)**
- SABA : ↓ symptoms BUT will not control inflammation
  - Anti-inflammatory AND FABA as reliever

## Implementing AIR (anti-inflammatory reliever)

Options:

1. "SMART" approach
2. ICS/SABA prn
3. Add ICS when taking SABA

An Analogy:



ICS



SABA or FABA

Solution: Give them at the same time!

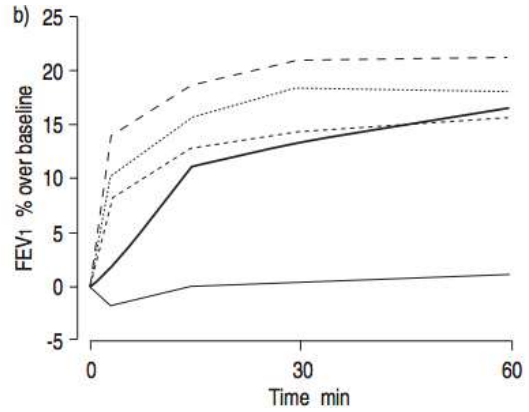


## “SMART” approach

- **Single Maintenance And Reliever Therapy**
- Treat symptoms AND underlying inflammation when worsening
- ICS-**FORMOTEROL only LABA for SMART**
  - Rapid-onset: Symbicort® (budesonide-formoterol), Dulera® (mometasone-formoterol)
- Dose
  - Maintenance: 1-2 puffs once to twice daily
  - Rescue: 1-2 puffs every 4 hours, maximum of 12 total puffs per day

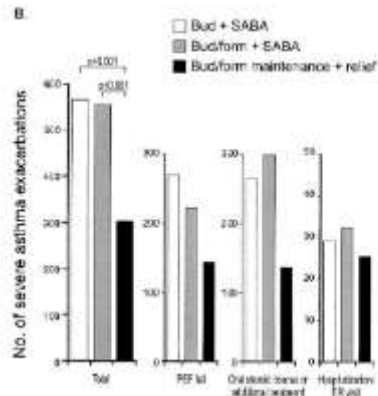
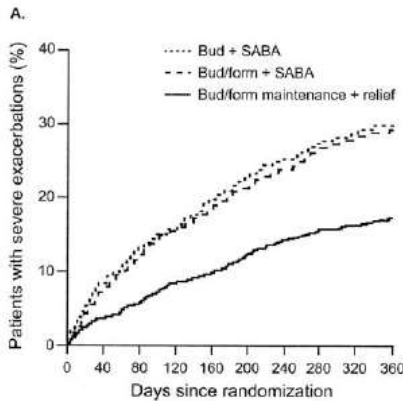
# LABA: Formoterol vs. Salmeterol

- Formoterol
  - 6mcg - - - - -
  - 12mcg - ······
  - 24mcg - - - - -
- Salmeterol ———
- **Formoterol:**
  - **More rapid onset** (like albuterol)
  - **Earlier peak**



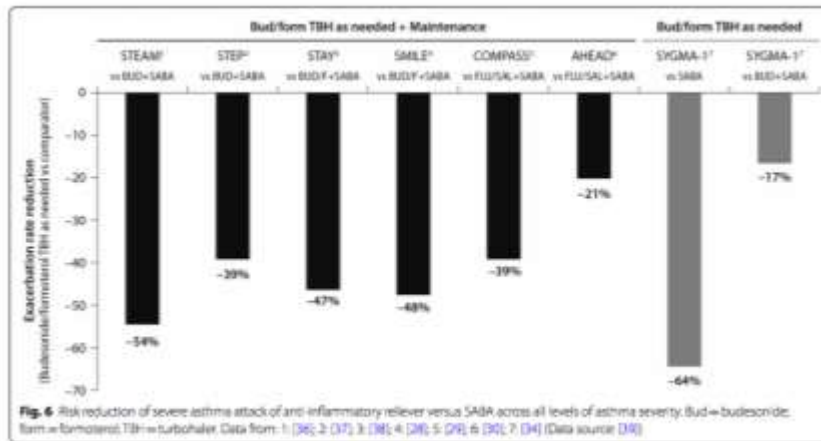
Palmqvist ERJ 1997

# SMART approach: persistent asthma



O'Byrne AJRCCM 2005

## SMART vs Controller + SABA as reliever



Papi All Asthma Clin Imm 2020

JAMA | Original Investigation

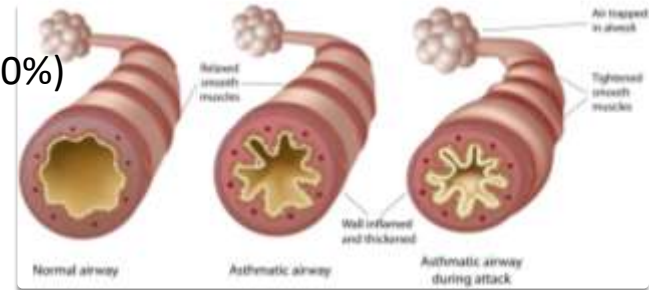
### Association of Inhaled Corticosteroids and Long-Acting $\beta$ -Agonists as Controller and Quick Relief Therapy With Exacerbations and Symptom Control in Persistent Asthma: A Systematic Review and Meta-analysis

- Persistent asthma (mild, moderate, severe) ; 22,000 patients
- SMART vs.
  - ICS + SABA
  - ICS/LABA +SABA
- **Lower risk of exacerbations**
  - ED, hospitalizations, oral steroids  $\geq 3$  days
- No significant associations:
  - ACQ-5, FEV<sub>1</sub>, mortality

Sobieraj JAMA 2018

## Mild Asthma is not “mild” risk!

- Majority of asthma patients (50-70%)
- Risk of adverse events
  - Acute and severe exacerbations
  - Emergency Department visits (30%)
  - Asthma death
- Inflammation and Bronchoconstriction
- SABA as needed
  - Symptom control, semblance of disease control
  - Not addressing underlying inflammation



Dusser Allergy 2007

## MILD asthma: use ICS/LABA prn (no maintenance)

Compared to SABA prn alone:

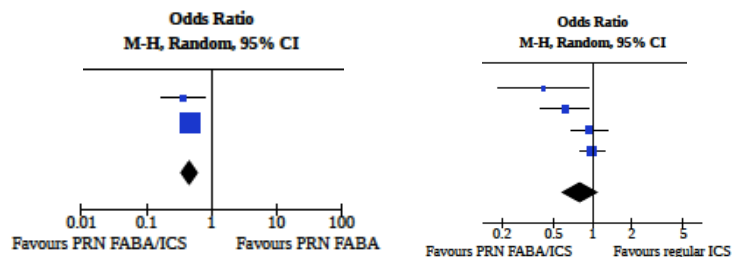
- LOWER exacerbation rates

Compared to ICS bid + SABA prn:

- No difference in exacerbations

AND

- **LOWER** overall steroid dose



Crossingham Cochrane Data Sys Rev 2021

## SMART approach: summary

Using ICS/LABA as maintenance and reliever (SMART)

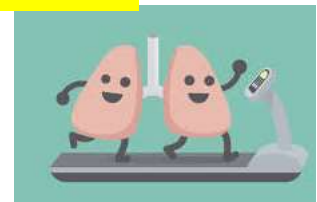
- MODERATE or SEVERE asthma
  - Reduced exacerbation rates compared to controller + SABA prn

Using ICS/LABA as reliever (no maintenance)

- MILD asthma
    - Reduced exacerbation rates compared to SABA prn
    - Similar rates to ICS maintenance but lower overall ICS dose
- 

## Goals of asthma treatment

- Reduce mortality
- Reduce exacerbations:
  - hospitalizations / ED / UC / systemic steroids
- Reduce symptoms
- **AND PEOPLE WILL USE IT!**
- Minimize side effects of treatment



## Barriers to SMART or ICS/LABA prn approach

- **Must** be ICS-formoterol
  - Symbicort<sup>®</sup>, ((Dulera<sup>®</sup>))
- Insurance barriers:
  - Correct Inhaler
  - Enough Inhalers
- NOT FDA approved as reliever

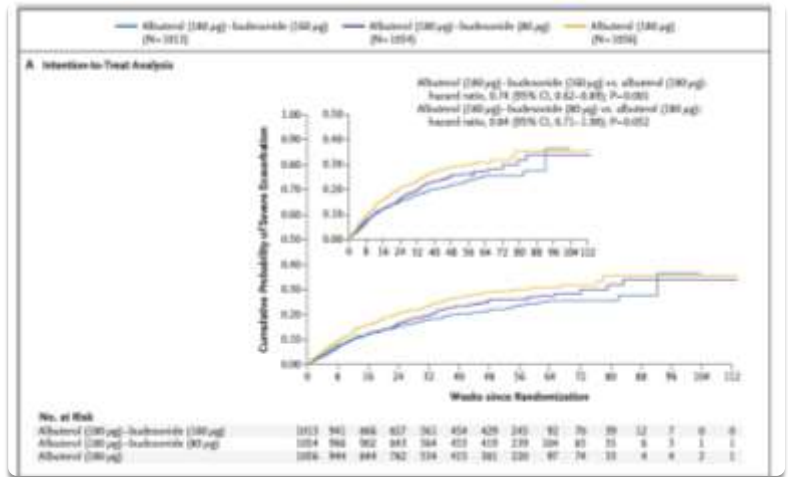


Other ways  
to  
implement  
“AIR”



## MANDALA trial

- Controller plus:
  - ICS/SABA
  - SABA as rescue
- Decreased exacerbations
- Annual dose of systemic steroids *50% lower* compared to SABA alone group



Papi NEJM 2022

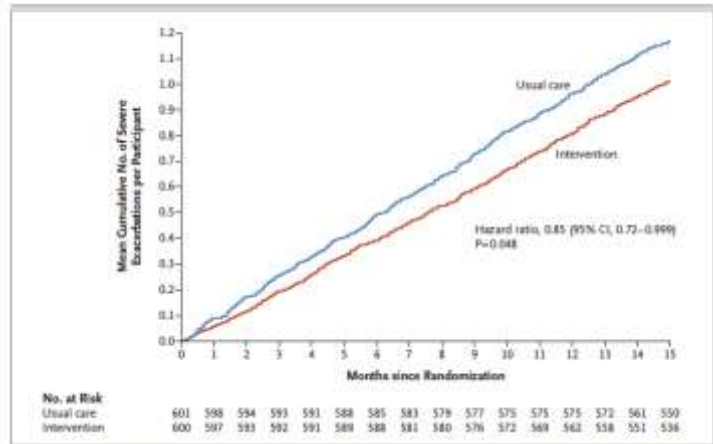


Albuterol/budesonide (80mcg) approved by FDA for use as rescue inhaler in people 18+ Jan 2023

- New FDA – approved reliever inhaler (ICS/SABA)
- No need to change baseline controller medication
- Not required to have ICS-formoterol to implement “AIR”

## PREPARE: PeRson EmPowered Asthma RELief trial

- Controller plus:
  - SABA vs
  - ICS at time of SABA
- ↓ exacerbation rates
- ↑ asthma control
- ↓ lost work / school days
- ↓ overall use of rescue medication



Israel NEJM 2022

## PREPARE trial and AIR

- No need to change baseline controller medication
- Not required to have ICS-formoterol to implement “AIR”
- Can be used for patients who prefer nebulized therapy
  - not included in prior trials
- Easy to implement
  - 1 time instructional meeting was effective
- Shown to be beneficial in groups disproportionately burdened with asthma morbidity

**\*\*\*KEY POINT: VEGGIE BROWNIES!\*\*\***

- **AIR : Use ICS at times of increased symptoms / need for reliever inhaler**
  - **THIS DECREASES EXACERBATIONS**

1. SMART: Single Maintenance And Reliever Therapy

- simpler since one overall inhaler
- BUT restricted to formoterol-containing ICS/LABA
  - financial, insurance coverage, change of controller regimen

2. MANDALA: ICS/SABA prn

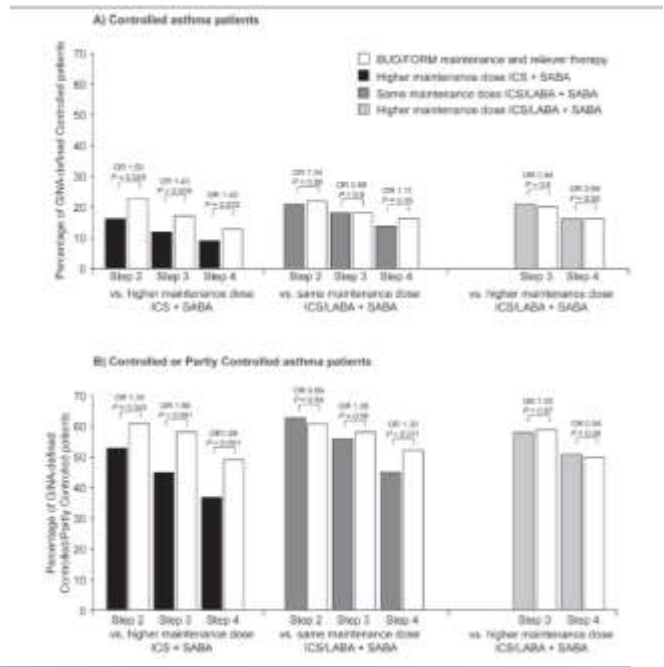
- **Similar to current controller + rescue idea**
- No need to change maintenance therapy (if contains other LABA)
- BUT 2 different inhalers, approval for NEW inhaler

3. PREPARE: Add ICS to SABA (MDI or neb)

- **improved flexibility**, use additional ICS when you need a nebulizer OR MDI for rescue
- BUT 2 different medications for rescue along with controller

Asthma control

- BUD/FORM maintenance and reliever therapy
- Higher maintenance dose ICS + SABA
- Same maintenance dose ICS/LABA + SABA
- Higher maintenance dose ICS/LABA + SABA



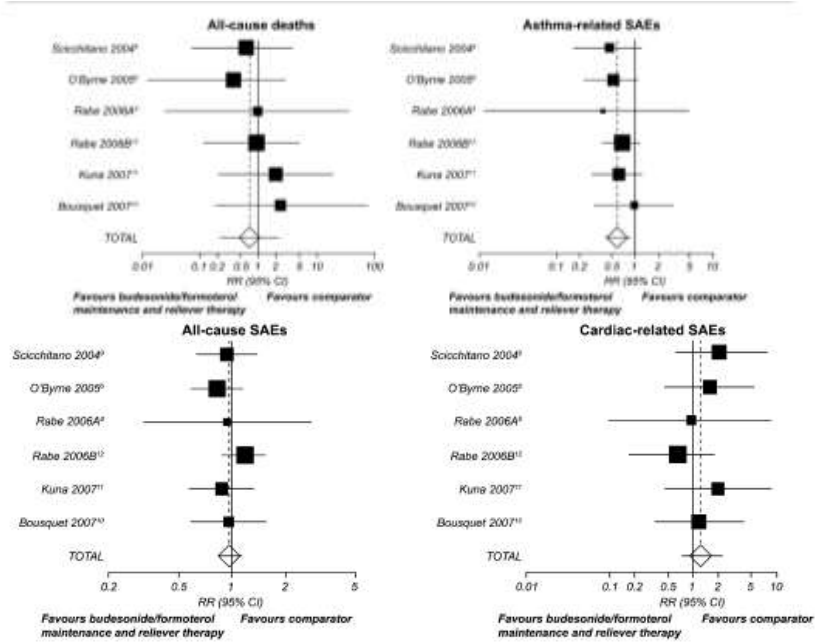
# Safety

Lower

- Asthma SAEs

Similar

- All-cause
  - Deaths
  - SAEs
- Cardiac SAEs



Sears Respi Res 2009

## GINA 2023 – Adults & adolescents 12+ years

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

# GINA 2023

(since 2019)



**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 ICS-formoterol.



RELIEVER: As-needed ICS-formoterol, or as-needed SABA

**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-IL4/13, 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 LTRA SLIT

Medium dose ICS or add LTRA, or add LTRA SLIT

add LABA or LTRA or add LTRA SLIT, or switch to high dose ICS

Add acetylcysteine (adults) or LTRA. As least resort controller adding low dose DCS but consider side-effects

See GINA severe asthma guide

\*Anti-inflammatory reliever (AIR)

# NAEPP 2020

		Management of Persistent Asthma in Individuals Ages 12+ Years					
		Intermittent Asthma		Management of Persistent Asthma in Individuals Ages 12+ Years			
Treatment		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6*
Preferred		PRN SABA 	Daily low-dose ICS and PRN SABA 	Daily and PRN 	Daily and PRN 	Daily medium-high dose ICS-LABA + LABA and PRN SABA*	Daily high-dose ICS-LABA + oral systemic corticosteroids + PRN SABA
Alternative			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 + LABA,* 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 + LABA, and PRN SABA* 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	

## Biologics for asthma

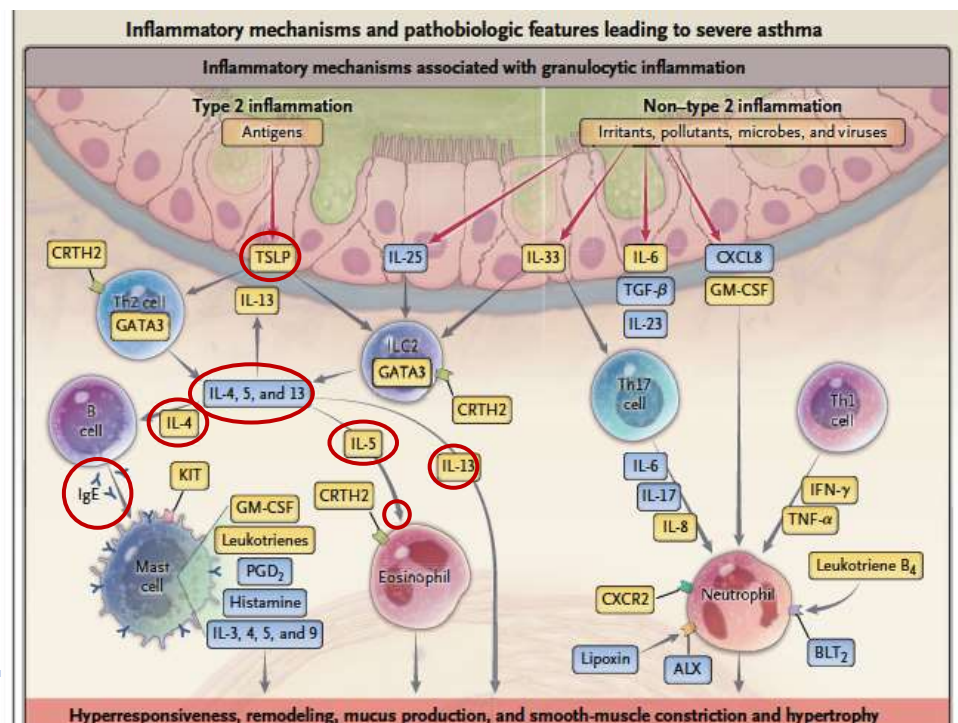
## Biologics for Asthma

- Severe asthma
  - 3-10% of asthma
  - > 60% costs
- Mostly “type 2” inflammation



## Asthma phenotype / endotype

- Type 2 high ( $T_H2$ )
  - Eosinophils
  - IgE
  - FeNO
  - IL-4, IL-5, IL-13
- Type 2 low / non-type 2
  - Neutrophil
  - $T_H1$  /  $T_H17$



Israel NEJM 2017

Drug	Target	Dosing	Patient Selection Criteria	Age	Outcomes	FDA approved comorbidities
Omalizumab (Xolair)	IgE	Based on IgE level SC q 2-4wks	Uncontrolled asthma IgE 30-700 IU/ml +allergen skin test or sIgE	6+	↓ exacerbations ↓ ICS dose ↓ asthma hosp	1) Urticaria (12+) 2) Chronic Rhinosinusitis with Nasal polyps (CRSwNP) (18+)
Mepolizumab (Nucala)	IL-5	100 mg SC q 4 wks	Uncontrolled asthma AEC* $\geq 150/\mu\text{L}$ (or $\geq 300$ better response)	6+	↓ exacerbations ↓ oral steroid dose ↓ asthma hosp	1) EGPA (18+) 2) CRSwNP (18+) 3) Hyper eosinophilic syndrome HES (12+)
Reslizumab (Cinqair)	IL-5	3mg/kg IV q 4 wks	Uncontrolled asthma AEC $\geq 400/\mu\text{L}$	18+	↓ exacerbations ↑ FEV <sub>1</sub> ↑ quality of life	none
Benralizumab (Fasenra)	IL5R	30mg SC q 4wks x3 then q 8wks	Uncontrolled asthma AEC $\geq 300/\mu\text{L}$	12+	↓ exacerbations ↓ oral steroid dose	none
Dupilumab (Dupixent)	IL4R	400mg SC x 1, 200mg SC q 2wks (or 600mg then 300mg)	Uncontrolled asthma (↑ AEC not required BUT ↑ response if AEC $\geq 300/\mu\text{L}$ )	6+	↓ exacerbations ↑ FEV <sub>1</sub> ↓ nasal polyps ↓ atopic dermatitis	1) Atopic dermatitis (6m) 2) CRSwNP (18+) 3) Eosinophilic esophagitis (12+) 4) Prurigo nodularis (18+) (5) COPD w eosinophilia ))
Tezepelumab (Tezspire)	TSLP	210mg SC q 4wks	Uncontrolled asthma No ↑ biomarkers needed	12+	↓ exacerbations ↑ FEV <sub>1</sub> ↑ quality of life ↓ symptoms	none

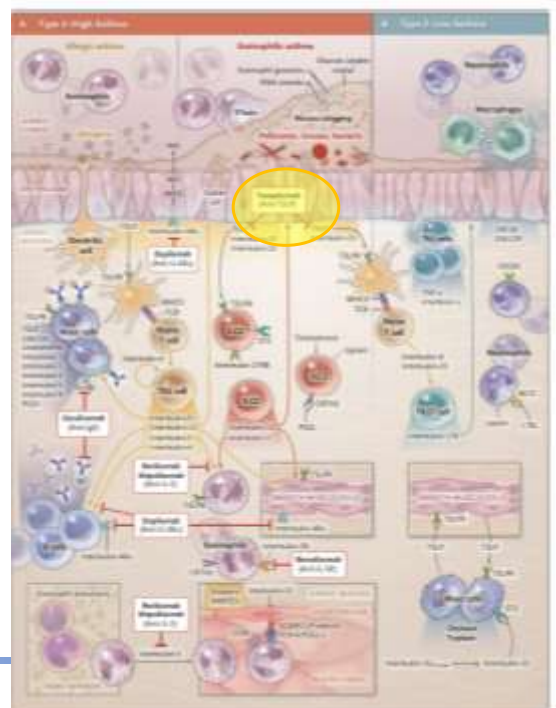
\*AEC absolute eosinophil count

## Type-2 low asthma

- Up to 50% of severe asthma
- Don't respond well to glucocorticoids

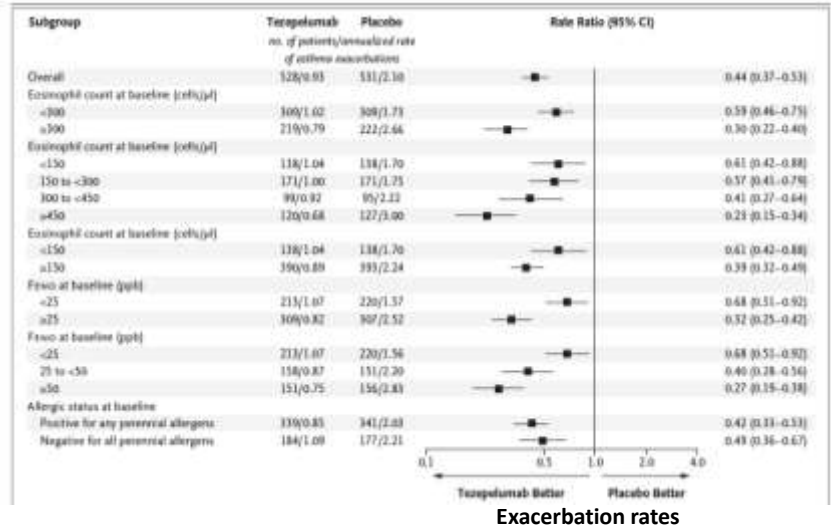
### Options:

- Anti-TSLP antibody
- Bronchial thermoplasty



# Tezepelumab: results

- Uncontrolled Asthma
- ↓ exacerbation rates (primary outcome)
- Also improved:
  - FEV<sub>1</sub>, symptoms, QOL
- **Regardless of baseline AEC, FeNO** but more pronounced if higher



Menzies-Gow NEJM 2021

PFTs:  
changes in  
interpretation



# Pulmonary Function Testing

- Spirometry
  - Lung volumes
  - Diffusing capacity (DLCO)
- 

## Purpose of PFTs

- Aid in diagnosis of lung disease
  - Evaluation of dyspnea
  - Monitoring
    - Disease progression
    - Treatment response
    - Drug toxicity
  - Estimation of risk (pre operative)
  - Eligibility
    - Jobs, disability
-

## Major Changes to PFTs

- Grading severity of lung function impairment
- Definition of Bronchodilator response
- Reference equations
  - Removal of race adjustment

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Stanojevic ERJ 2022

### Most Important Take Home Point:

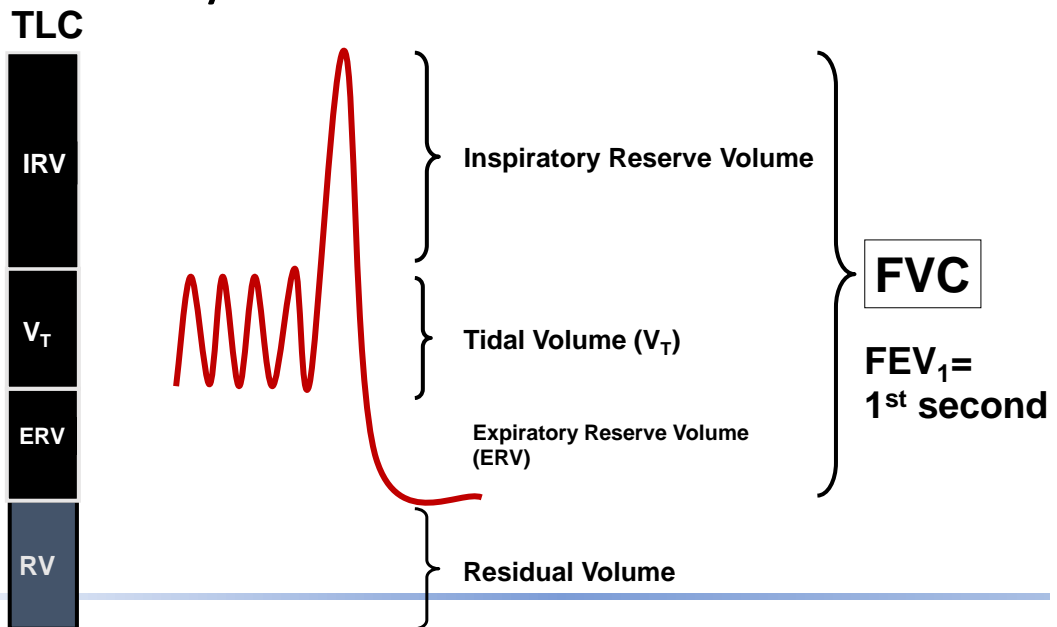
Recent updates may change the interpretation of your patients' results with ***NO ACTUAL CHANGE*** in the measurement of their lung function

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# Grading Severity of Impairment

Using  $FEV_1$  z score instead of % predicted

## Spirometry: what we measure



## PREVIOUSLY: FEV<sub>1</sub> % predicted

<b>TABLE 6</b> Severity of any spirometric abnormality based on the forced expiratory volume in one second (FEV <sub>1</sub> )	
<b>Degree of severity</b>	<b>FEV<sub>1</sub> % pred</b>
<b>Mild</b>	>70
<b>Moderate</b>	60-69
<b>Moderately severe</b>	50-59
<b>Severe</b>	35-49
<b>Very severe</b>	<35

% pred: % predicted.

Pellegrino AJRCM 2005

## NEW: FEV<sub>1</sub> Z score

<b>Z-score</b>	<b>Severity</b>
> -1.645	Normal
-1.65 to -2.5	Mild
-2.5 to -4	Moderate
< -4	Severe

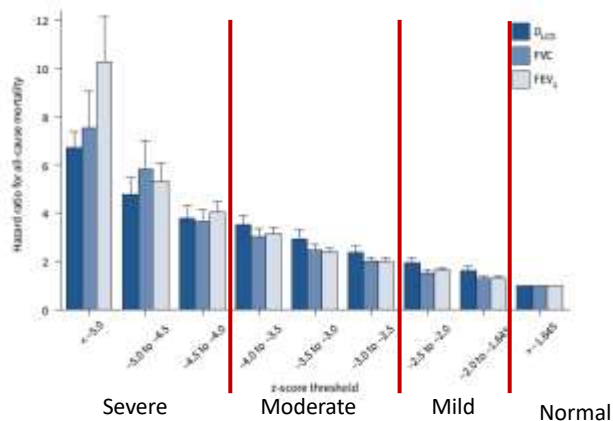
\*This also applies for grading severity of diffusing capacity deficit (DLCO)

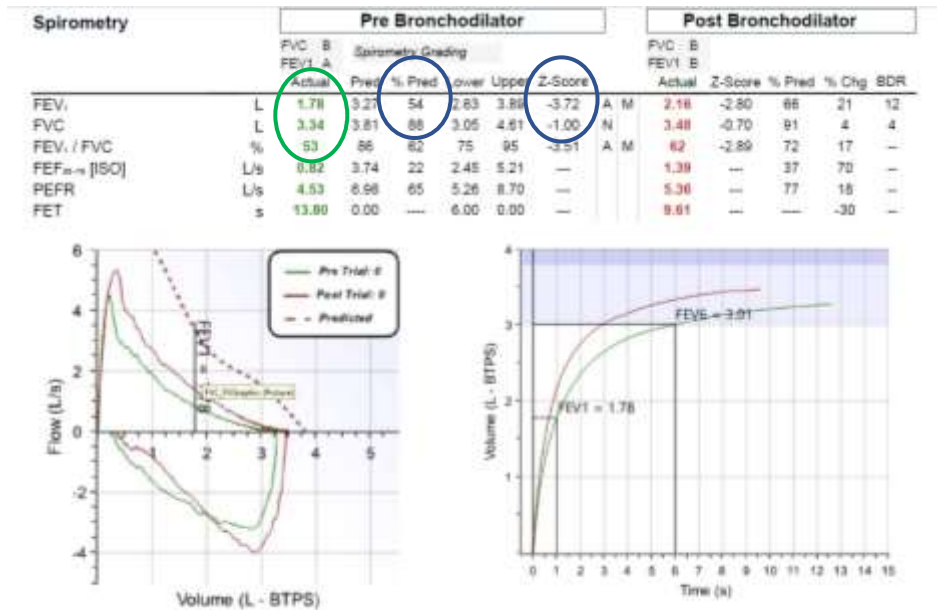
## Z score vs Percent predicted

- How far from the predicted value (based on reference population) in standard deviations
- Z score more consistent across age and sex vs. % predicted
- Overall based on correlation with survival
- **Severity of lung function impairment NOT disease severity**
  - Quality of life, functional impairment, symptoms etc.

## Lung function and overall mortality

Improved fit to correlation with mortality compared to grading based on percent predicted





## FEV<sub>1</sub> Z score

**(NOT FEV<sub>1</sub>/FVC, TLC or FVC!)**

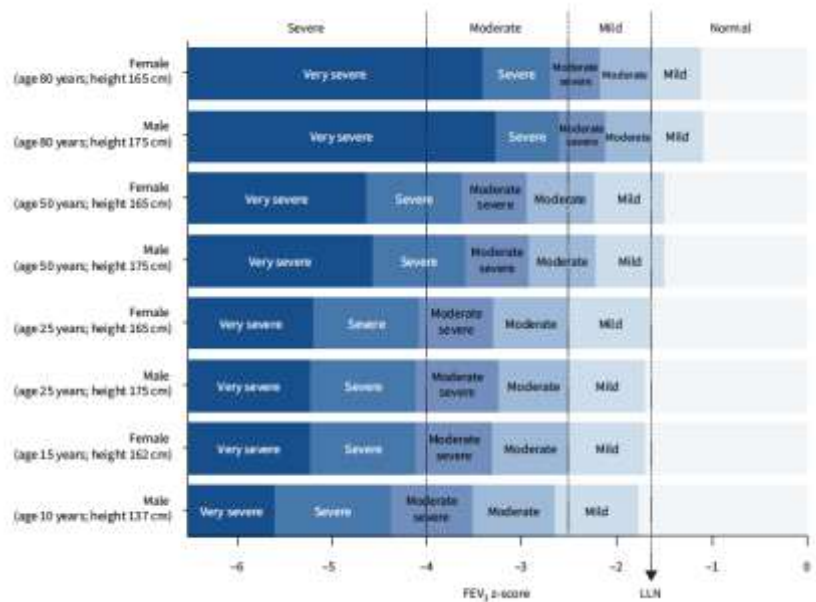
to grade severity

for any type of impairment

(obstruction, restriction, mixed, non-specific etc.)

## How might this affect your patient's results?

- Older subjects may go DOWN in severity
  - Former mod now mild
- Younger subjects
  - Grouping more stable
  - Mod and mod severe merged



When comparing:

Remember to look at **ABSOLUTE VALUES**  
(volume in liters)

...compared to any prior testing or testing at other labs/locations



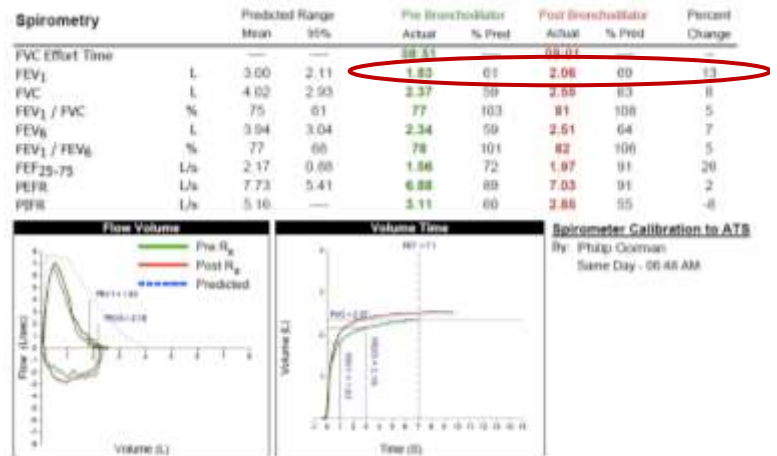
# Bronchodilator Response

## BDR: bronchodilator response

- PREVIOUSLY: 12% **AND** 200cc, relative to *measured* baseline FEV<sub>1</sub> or FVC
- **NEW: 10% change**
  - relative to ***predicted*** value of FEV<sub>1</sub> or FVC
- Better prediction / separation of subjects with asthma from normal or other lung diseases
- “Over-reliance on strict cut-offs for BDR should be avoided”
  - Not dichotomous trait

## BDR: Old vs New Criteria

- OLD:
  - $FEV_1$  13% 230cc ✓
- NEW:
  - $FEV_1$   $0.23 / 3.00 * 100 = 8\%$  ✗



MORE SPECIFIC, less sensitive  
Bottom Line:  
**FEWER** people will meet criteria  
 for +BDR

***AS ALWAYS, CONSIDER IN CLINICAL CONTEXT***



# Reference Equations

## Reference Equations

- **Age:** Growth during childhood, decline during adulthood
- **Height:** Proxy for chest size / torso length
- **Sex:** ATS/ERS recommend using to use biological sex not gender identity, though to be determined on case-by-case basis
  - Timing of hormonal therapy, if given, may affect lung growth (if during adolescence)
- **Race...**

The NEW ENGLAND JOURNAL of MEDICINE

MEDICINE AND SOCIETY

Debra Malina, Ph.D., Editor

**Hidden in Plain Sight — Reconsidering the Use  
of Race Correction in Clinical Algorithms**

Darshali A. Vyas, M.D., Leo G. Eisenstein, M.D., and David S. Jones, M.D., Ph.D.

Vyas NEJM 2020

## Issues with race-based adjustment

- Historically based on racist concepts, including justification of slavery
- Supports false idea of biological differences
  - Race is a social construct
- Normalizing differences contributes to harm
  - Delay/missing disease diagnoses
  - Adjusting for differences → mask/normalize differential exposures → reinforce health disparities
- Race-neutral equations
  - Correlate better with clinical outcomes including
    - Mortality
    - Disease-specific hospitalization

Bhakta AJRCCM 2023

# AMERICAN THORACIC SOCIETY DOCUMENTS

## Race and Ethnicity in Pulmonary Function Test Interpretation An Official American Thoracic Society Statement

Nirav R. Bhakta, Christian Bime, David A. Kaminsky, Meredith C. McCormack, Neeta Thakur, Sanja Stanojevic, Aaron D. Baugh, Lundy Braun, Stephanie Lovinsky-Desir, Rosemary Adamson, Jonathan Witonsky, Robert A. Wise, Sean D. Levy, Robert Brown, Erick Forno, Robyn T. Cohen, Meshell Johnson, John Balmes, Yolanda Mageto, Cathryn T. Lee, Refiloe Masekela, Daniel J. Weiner, Charlie G. Irvin, Erik R. Swenson, Margaret Rosenfeld, Richard M. Schwartzstein, Anurag Agrawal, Enid Neptune, Juan P. Wisnivesky, Victor E. Ortega, and Peter Burney; on behalf of the American Thoracic Society Committees on Pulmonary Function Testing and on Health Equity and Diversity

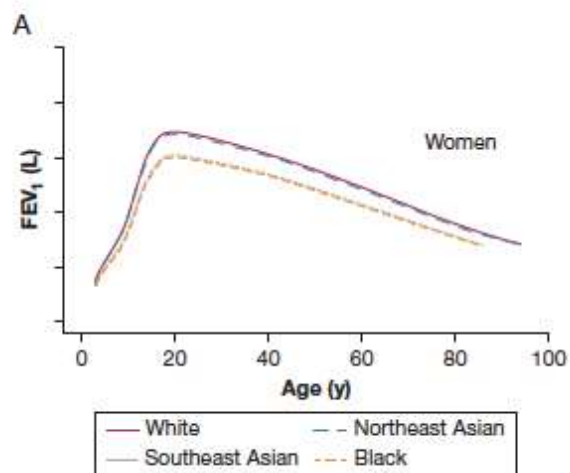
THIS OFFICIAL STATEMENT OF THE AMERICAN THORACIC SOCIETY WAS APPROVED FEBRUARY 2023

THE ATS STATEMENT WAS ENDORSED BY THE EUROPEAN RESPIRATORY SOCIETY ON MARCH 1, 2023

Bhakta AJRCCM 2023

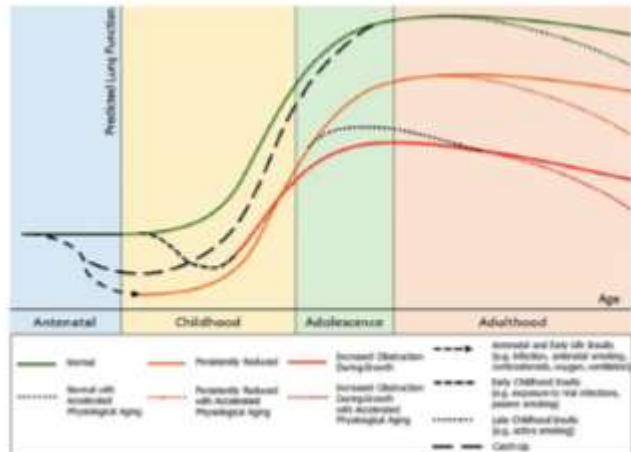
### Observed differences

- Falsely attributed to biological differences between races
- vs.
- Disproportionately experienced exposures



## Factors affecting lung growth

- Maternal smoking
- Prematurity
- Early life infections
- Poor nutrition
- Second-hand smoke
- Exposure to pollutants
- Indoor air exposures
- Allergens
- Systemic Racism

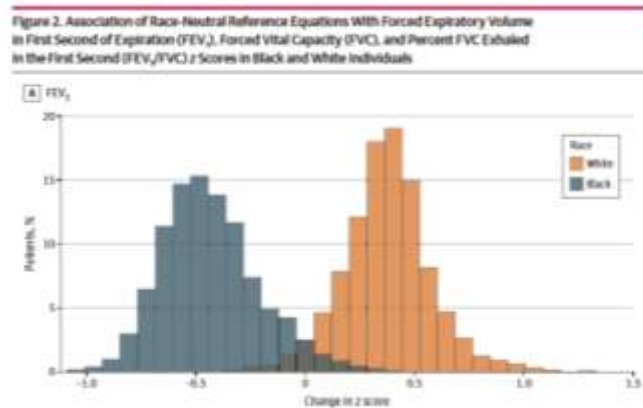


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## How will use of race-neutral equations affect interpretation:

- Whites:
- Predicted numbers will be LOWER than using race-specific equations
  - MORE results will be found to be NORMAL / above LLN than with race-specific equations
- AA, Asian, other racial and ethnic groups :
- Predicted numbers will be HIGHER than using race-specific equations
  - MORE results will be found to be ABNORMAL / below LLN than with race-specific equations

## Change in Z score with race-neutral equations



Moffett JAMA Network Open 2023

Some will change categories: normal ↔ abnormal

### Potential Benefits

- Early recognition of abnormalities / diagnosis of underlying disease in POC previously interpreted as wnl
  - Earlier treatment initiation
  - Clinical trial eligibility
- Potential recognition of / intervention for modifiable risk factors for poor lung function
  - Rather than adjusting these away
- Lung transplantation referral
  - Though not part of LAS
- Disability / worker's comp eligibility

### Potential Harms

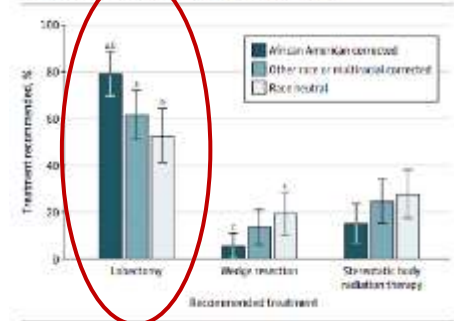
- Previously considered normal now are abnormal
  - Job eligibility (military, firefighter)
  - Surgery eligibility
  - Higher life insurance premiums

## Clinical Implications of Removing Race-Corrected Pulmonary Function Tests for African American Patients Requiring Surgery for Lung Cancer

Sidra N. Bonner, MD, MPH, MSc; Kiran Lagisetty, MD; Rashindra M. Reddy, MD, MBA; Yedonay Engeda, BA; Jennifer J. Griggs, MD, MPH; Thomas S. Valley, MD, MSc

- Case Vignette
  - 71 AA woman, 3.6cm mass
  - FEV<sub>1</sub> 1.2L
  - Evaluate for RUL lobectomy
- Surgeons: Randomized to 3 different values for % predicted post-op FEV<sub>1</sub>
  - AA Race-adj 49% predicted
  - GLI-other 45% predicted
  - “neutral” 42% predicted

Figure 3. Surgeon Treatment Recommendation Depending on Whether Race Correction Is Used in Pulmonary Function Tests



Use additional information such as 6MWD, CPETs etc

Bonner JAMA Surgery 2023  
Medlock JAMA Surgery 2023

## Summary of changes to PFT interpretation

- Severity graded based on FEV<sub>1</sub> Z score
- Bronchodilator response now more stringent, fewer people will meet this criteria
  - But still consider in clinical context
- Race-neutral equations

# Summary

- Options for implementation of anti-inflammatory reliever therapy
    - SMART with ICS-formoterol
    - ICS/SABA
    - Add ICS with SABA
  - Patients with severe asthma may benefit from biologics
    - Type 2 high and low
  - Updates to PFT *interpretation* may affect patient results without any change in lung function values
    - implications for treatment decisions
- 

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  16. Bonner JAMA Surgery 2023
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