천식관리의 진화

천식 조절(control)에서 관해(remission)까지

2025. 03. 16

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- 천식의 자연경과
- GINA 가이드라인 변화
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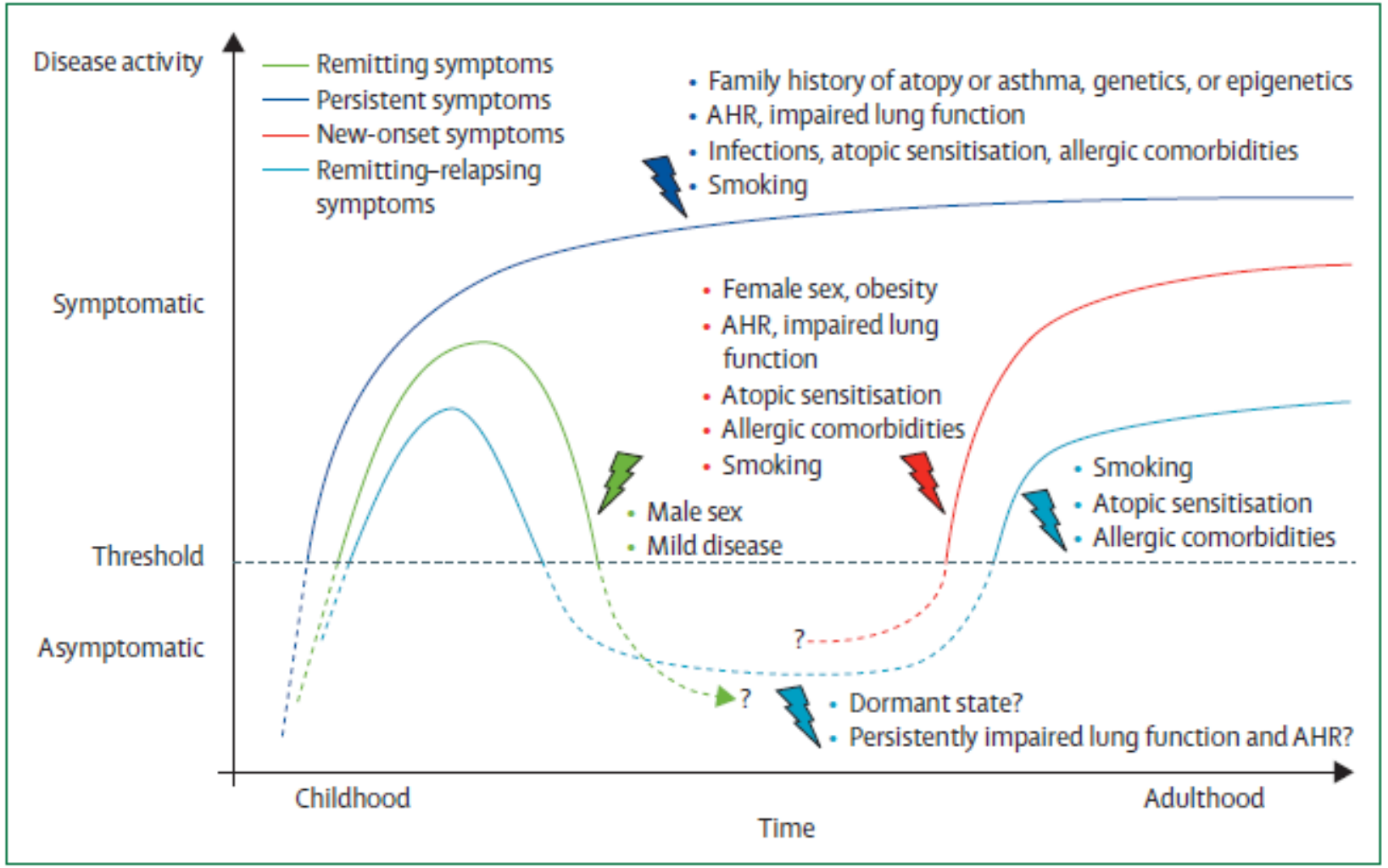
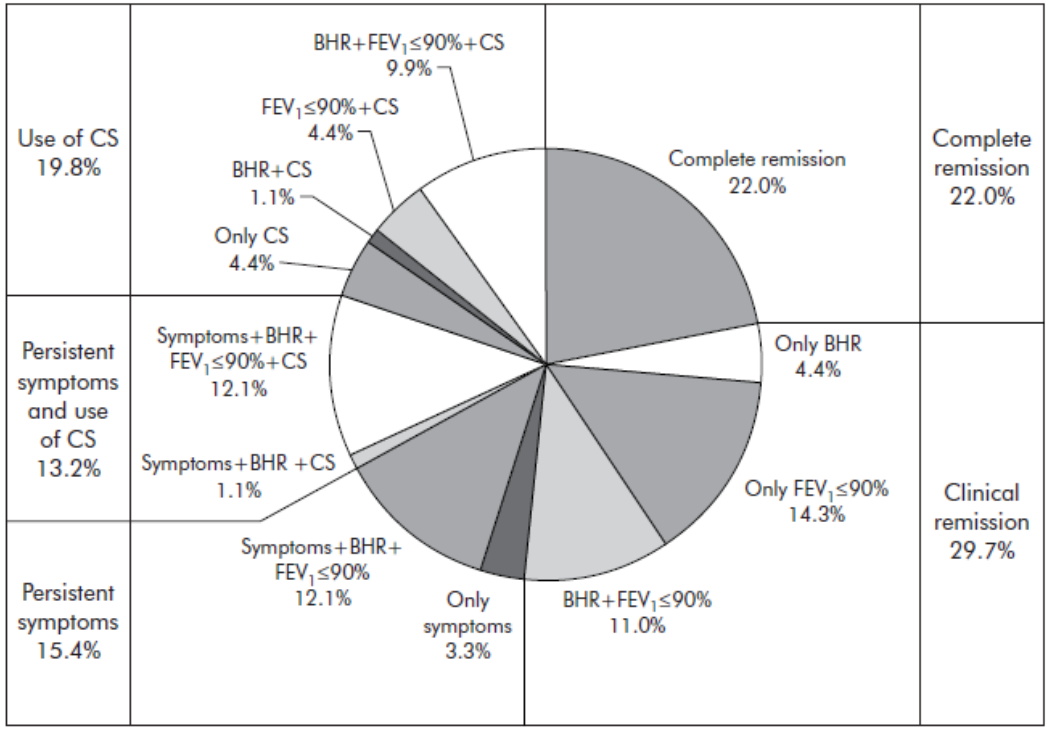
- 천식 조절 *vs.* 치료반응 *vs.* 천식 관해
- 요약/정리

Determinants of disease course across asthma transition and ages

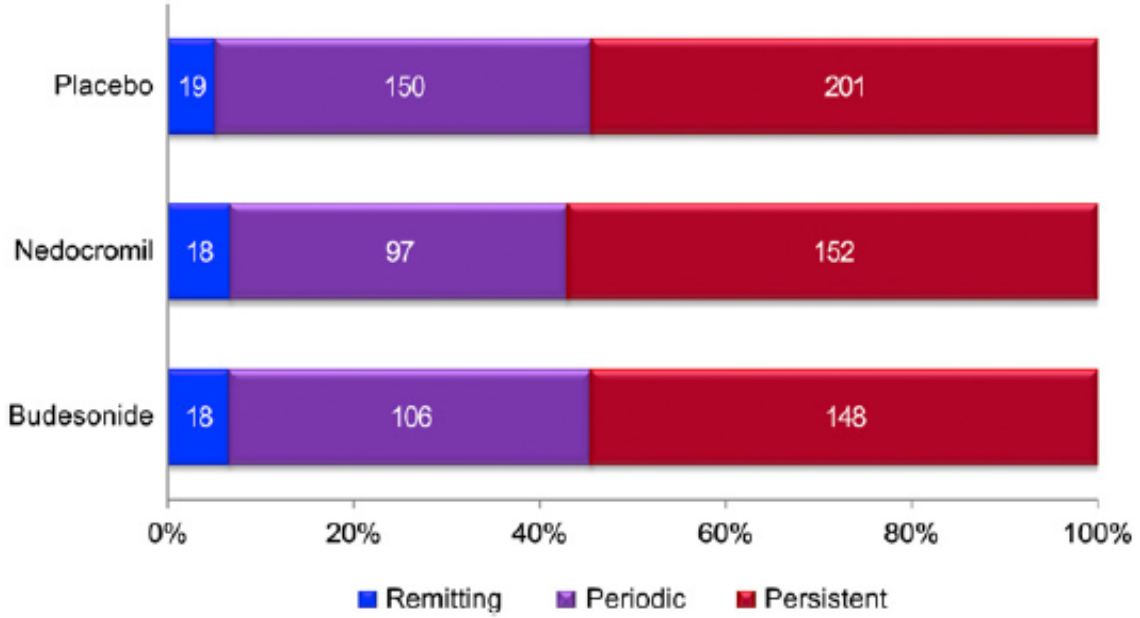


Lancet Respir Med 2017;5: 224–34

Childhood factors associated with asthma remission



The Childhood Asthma Management Program (CAMP)



Thorax 2004;59:925–929.

J Allergy Clin Immunol 2010;125:359-66

GINA 2004

Figure 5-6. Classification of Asthma Severity by Clinical Features Before Treatment

STEP 1: Intermittent

Symptoms less than once a week
Brief exacerbations
Nocturnal symptoms not more than twice a month

- FEV_1 or PEF ≥ 80% predicted
- PEF or FEV_1 variability < 20%

STEP 2: Mild Persistent

Symptoms more than once a week but less than once a day
Exacerbations may affect activity and sleep
Nocturnal symptoms more than twice a month

- FEV_1 or PEF ≥ 80% predicted
- PEF or FEV_1 variability 20-30%

STEP 3: Moderate Persistent

Symptoms daily
Exacerbations may affect activity and sleep
Nocturnal symptoms more than once a week
Daily use of inhaled short-acting β_2-agonist

- FEV_1 or PEF 60-80% predicted
- PEF or FEV_1 variability > 30%

STEP 4: Severe Persistent

Symptoms daily
Frequent exacerbations
Frequent nocturnal asthma symptoms
Limitation of physical activities

- FEV_1 or PEF ≤ 60% predicted
- PEF or FEV_1 variability > 30%

Figure 7-5. Recommended Medications by Level of Severity: Adults and Children Older Than 5 Years of Age

All Levels: In addition to regular daily controller therapy, rapid-acting inhaled β_2-agonist* should be taken as needed to relieve symptoms, but should not be taken more than 3 to 4 times a day. Patient education is essential at every level.

Level of Severity**	Daily Controller Medications	Other Treatment Options***
Step 1 Intermittent Asthma****	• None necessary	
Step 2 Mild Persistent Asthma	• Low-dose inhaled glucocorticosteroid	• Sustained-release theophylline, *or* • Cromone, *or* • Leukotriene modifier
Step 3 Moderate Persistent Asthma	• Low-to-medium inhaled glucocorticosteroid *plus* long-acting inhaled β_2-agonist	• Medium-dose Inhaled glucocorticosteroid *plus* sustained-release theophylline, *or* • Medium-dose Inhaled glucocorticosteroid *plus* long-acting oral β_2-agonist, *or* • High-dose inhaled glucocorticosteroid *or* • Medium-dose Inhaled glucocorticosteroid *plus* leukotriene modifier
Step 4 Severe Persistent Asthma	• High-dose Inhaled glucocorticosteroid *plus* long-acting inhaled β_2-agonist, *plus* one or more of the following, if needed: • Sustained-release theophylline • Leukotriene modifier • Long-acting oral β_2-agonist • Oral glucocorticosteroid • Anti-IgE*****	

All Levels: Once control of asthma is achieved and maintained for at least 3 months, a gradual reduction of the maintenance therapy should be tried in order to identify the minimum therapy required to maintain control.

GINA 2014

LONG-TERM GOALS OF ASTHMA MANAGEMENT

The long-term goals of asthma management are:

- To achieve good control of symptoms and maintain normal activity levels
- To minimize future risk of exacerbations, fixed airflow limitation and side-effects.

A. Asthma symptom control		Level of asthma symptom control		
In the past 4 weeks, has the patient had:		**Well controlled**	**Partly controlled**	**Uncontrolled**
• Daytime asthma symptoms more than twice/week?	Yes☐ No☐	None of these	1–2 of these	3–4 of these
• Any night waking due to asthma?	Yes☐ No☐			
• Reliever needed for symptoms* more than twice/week?	Yes☐ No☐			
• Any activity limitation due to asthma?	Yes☐ No☐			

B. Risk factors for poor asthma outcomes

Assess risk factors at diagnosis and periodically, particularly for patients experiencing exacerbations.

Measure FEV_1 at start of treatment, after 3–6 months of controller treatment to record the patient's personal best lung function, then periodically for ongoing risk assessment.

Potentially modifiable independent risk factors for flare-ups (exacerbations)

- Uncontrolled asthma symptoms[68]
- Excessive SABA use (>1 x 200-dose canister/month)[69]
- Inadequate ICS: not prescribed ICS; poor adherence;[70] incorrect inhaler technique[71]
- Low FEV_1, especially if <60% predicted[72,73]
- Major psychological or socioeconomic problems[74]
- Exposures: smoking;[73] allergen exposure if sensitized[73]
- Comorbidities: obesity;[75] rhinosinusitis;[76] confirmed food allergy[77]
- Sputum or blood eosinophilia[78,79]
- Pregnancy[80]

Other major independent risk factors for flare-ups (exacerbations)

- Ever intubated or in intensive care unit for asthma[81]
- ≥1 severe exacerbation in last 12 months[82]

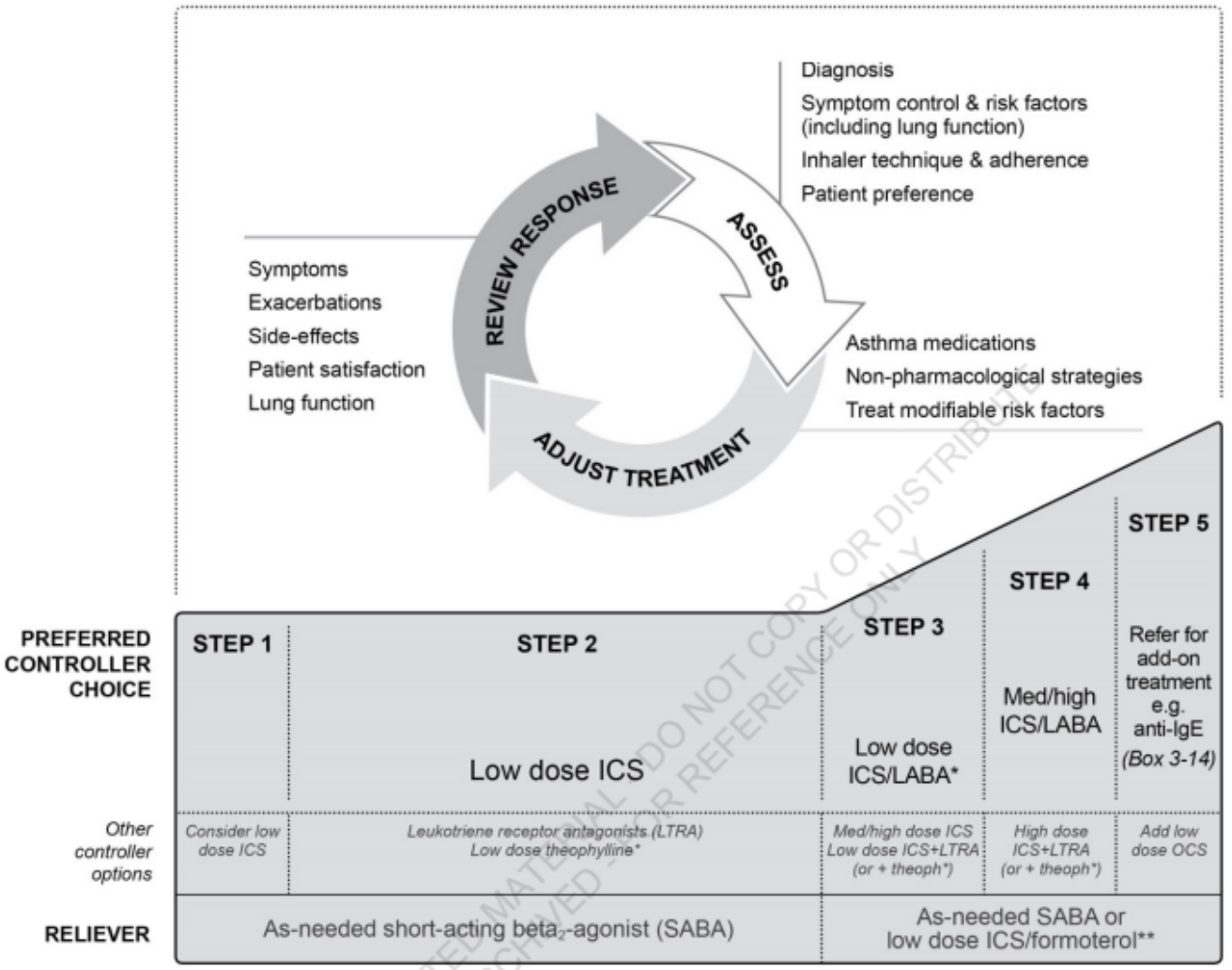
Having one or more of these risk factors increases the risk of exacerbations even if symptoms are well controlled.

Risk factors for developing fixed airflow limitation

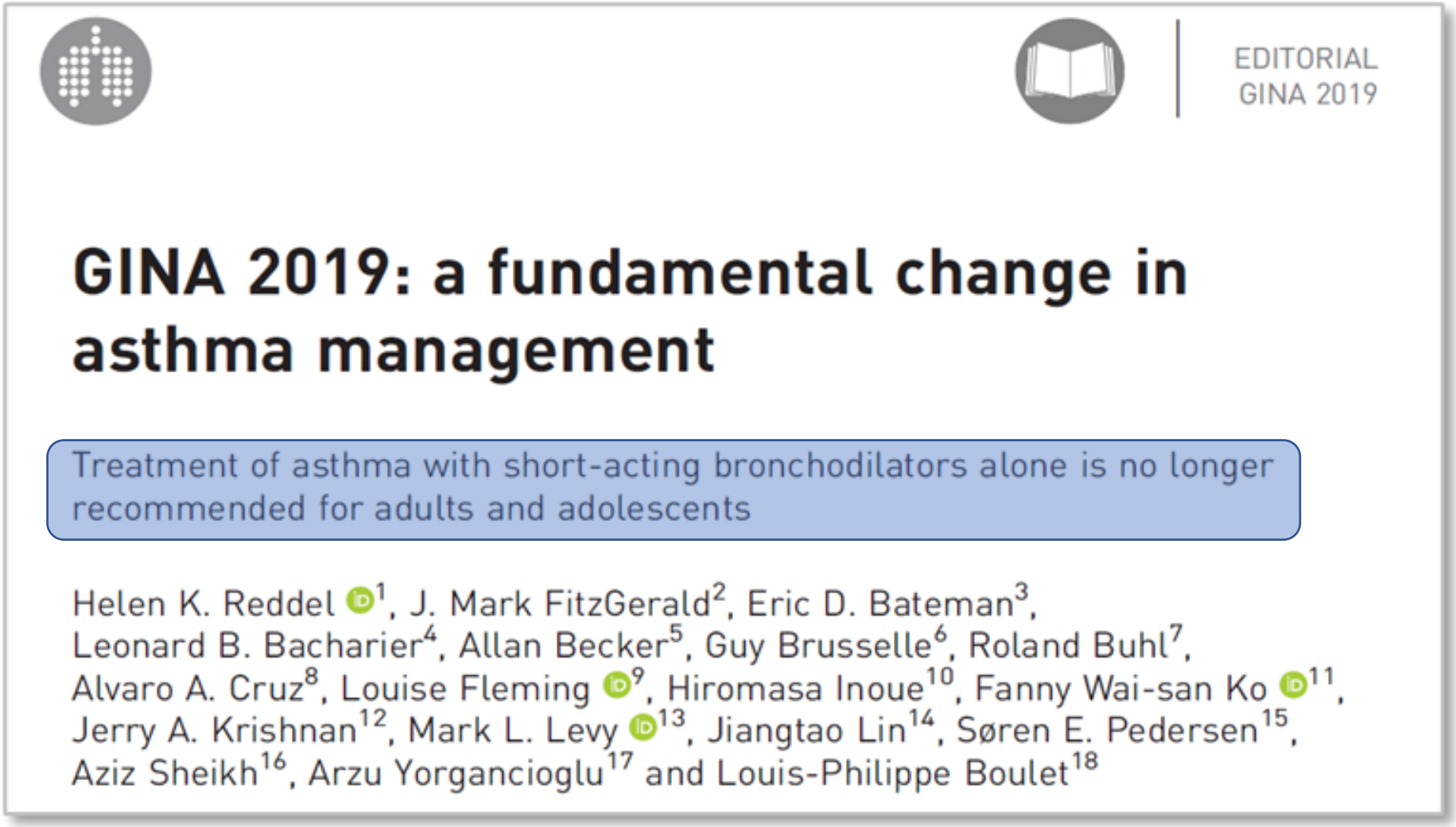
- Lack of ICS treatment[83]
- Exposures: tobacco smoke;[84] noxious chemicals; occupational exposures[28]
- Low initial FEV_1;[85] chronic mucus hypersecretion;[84,85] sputum or blood eosinophilia[85]

Risk factors for medication side-effects

- *Systemic*: frequent OCS; long-term, high dose and/or potent ICS; also taking P450 inhibitors[86]
- *Local*: high-dose or potent ICS;[86,87] poor inhaler technique[88]



A reminder – the key change in GINA 2019



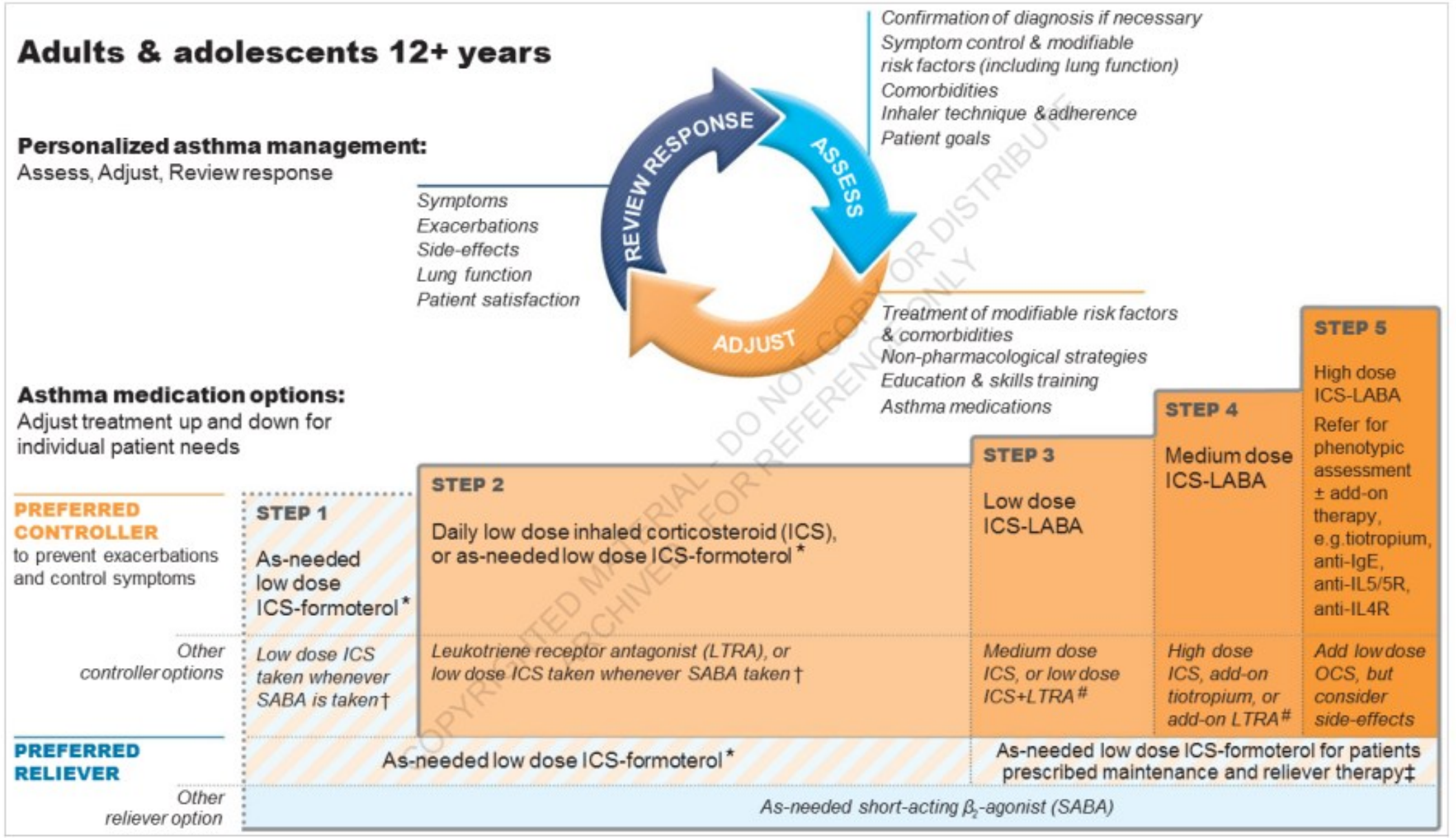
EDITORIAL
GINA 2019

GINA 2019: a fundamental change in asthma management

Treatment of asthma with short-acting bronchodilators alone is no longer recommended for adults and adolescents

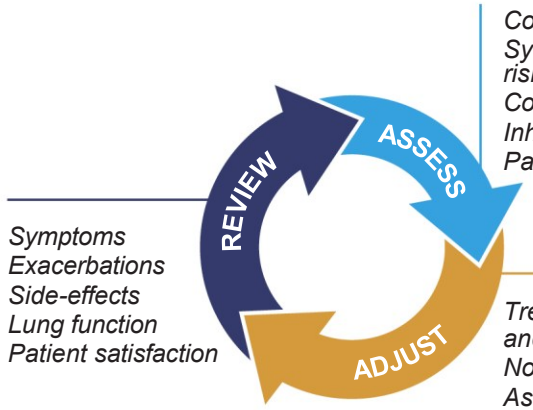
Helen K. Reddel[1], J. Mark FitzGerald[2], Eric D. Bateman[3], Leonard B. Bacharier[4], Allan Becker[5], Guy Brusselle[6], Roland Buhl[7], Alvaro A. Cruz[8], Louise Fleming[9], Hiromasa Inoue[10], Fanny Wai-san Ko[11], Jerry A. Krishnan[12], Mark L. Levy[13], Jiangtao Lin[14], Søren E. Pedersen[15], Aziz Sheikh[16], Arzu Yorgancioglu[17] and Louis-Philippe Boulet[18]

GINA 2019


Adults & adolescents 12+ years
Personalized asthma management:
Assess, Adjust, Review response
Confirmation of diagnosis if necessary
Symptom control & modifiable risk factors (including lung function)
Comorbidities
Inhaler technique & adherence
Patient goals
REVIEW RESPONSE
ASSESS
ADJUST
Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction
Treatment of modifiable risk factors & comorbidities
Non-pharmacological strategies
Education & skills training
Asthma medications
Asthma medication options:
Adjust treatment up and down for individual patient needs
PREFERRED CONTROLLER
to prevent exacerbations and control symptoms
STEP 1
As-needed low dose ICS-formoterol *
STEP 2
Daily low dose inhaled corticosteroid (ICS), or as-needed low dose ICS-formoterol *
STEP 3
Low dose ICS-LABA
STEP 4
Medium dose ICS-LABA
STEP 5
High dose ICS-LABA
Refer for phenotypic assessment ± add-on therapy, e.g. tiotropium, anti-IgE, anti-IL5/5R, anti-IL4R
Other controller options
Low dose ICS taken whenever SABA is taken †
Leukotriene receptor antagonist (LTRA), or low dose ICS taken whenever SABA taken †
Medium dose ICS, or low dose ICS+LTRA #
High dose ICS, add-on tiotropium, or add-on LTRA #
Add low dose OCS, but consider side-effects
PREFERRED RELIEVER
As-needed low dose ICS-formoterol *
As-needed low dose ICS-formoterol for patients prescribed maintenance and reliever therapy ‡
Other reliever option
As-needed short-acting β2-agonist (SABA)

GINA 2022

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



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

Symptoms
Exacerbations
Side-effects
Lung function
Patient satisfaction

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

AIR-only treatment

CONTROLLER and **PREFERRED RELIEVER** (Track 1). Using ICS-formoterol as reliever reduces the risk of exacerbations compared with using a SABA reliever

STEPS 1 – 2	STEP 3	STEP 4	STEP 5
As-needed low dose ICS-formoterol	Low dose maintenance ICS-formoterol	Medium dose maintenance ICS-formoterol	Add-on LAMA Refer for assessment of phenotype. Consider high dose maintenance ICS-formoterol, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP
RELIEVER: As-needed low-dose ICS-formoterol			

See GINA severe asthma guide

CONTROLLER and **ALTERNATIVE RELIEVER** (Track 2). Before considering a regimen with SABA reliever, check if the patient is likely to be adherent with daily controller

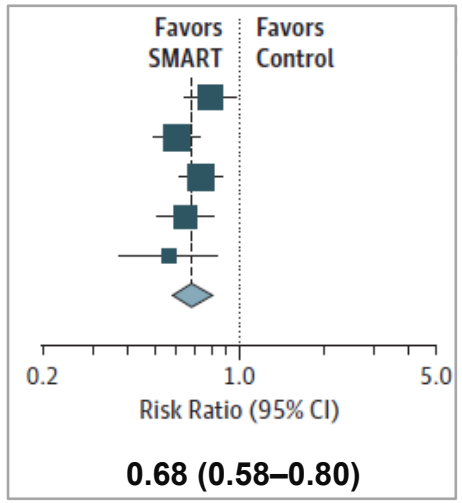
STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Take ICS whenever SABA taken	Low dose maintenance ICS	Low dose maintenance ICS-LABA	Medium/high dose maintenance ICS-LABA	Add-on LAMA Refer for assessment of phenotype. Consider high dose maintenance ICS-LABA, ± anti-IgE, anti-IL5/5R, anti-IL4R, anti-TSLP
RELIEVER: As-needed short-acting beta$_2$-agonist				

Other controller options for either track (limited indications, or less evidence for efficacy or safety)	*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*

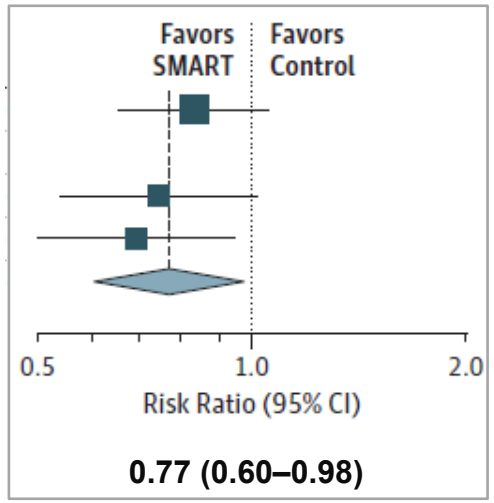
GINA 2022, Box 3-5A

Track 1, Steps 3–5: Maintenance and reliever therapy (MART)

- MART with ICS-formoterol reduces severe exacerbations compared with ICS or ICS-LABA plus SABA reliever, with similar symptom control
  - Confirmed by regulatory studies and pragmatic open-label studies, n~30,000
- Both budesonide and formoterol contribute to the reduction in severe exacerbations

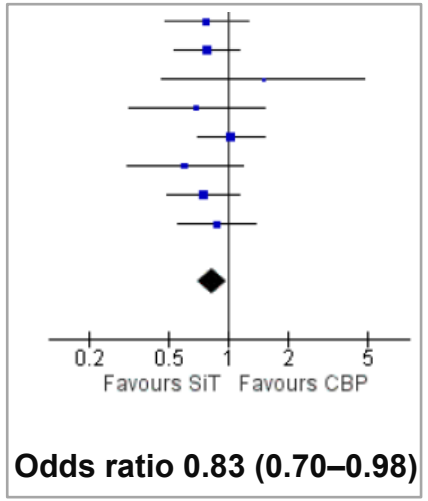


Compared with same dose ICS-LABA +SABA



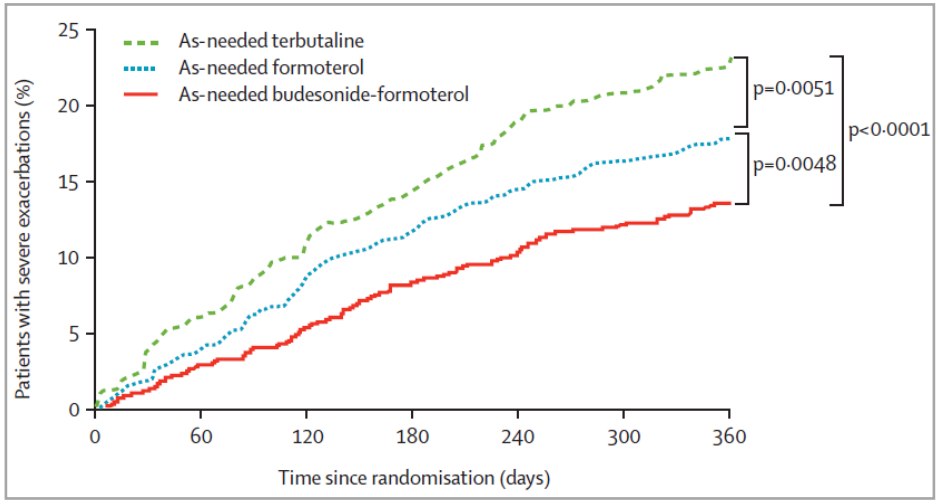
Compared with higher dose ICS-LABA + SABA

Sobieraj et al, JAMA 2018 (n=22,748)



Compared with conventional best practice

Cates et al, Cochrane 2013 (n=4,433)



Compared with formoterol or SABA reliever

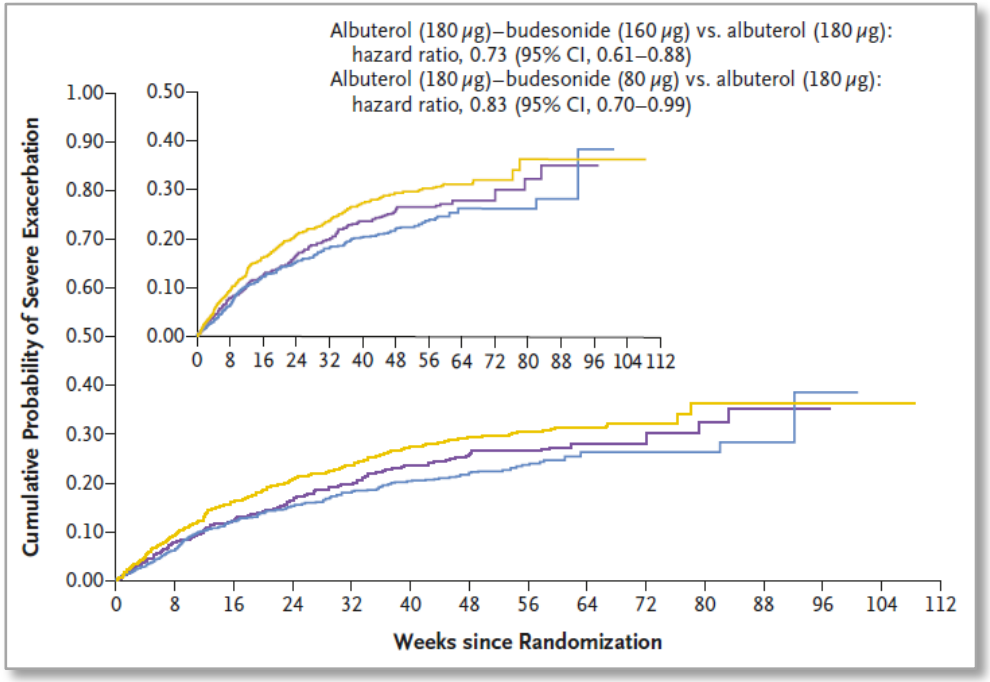
Rabe, Lancet 2006
N=3,395, all taking maintenance budesonide-formoterol

Track 2, Steps 3–5: as-needed ICS-SABA added to maintenance treatment

Papi et al, NEJMed 2022 (n=3,132)

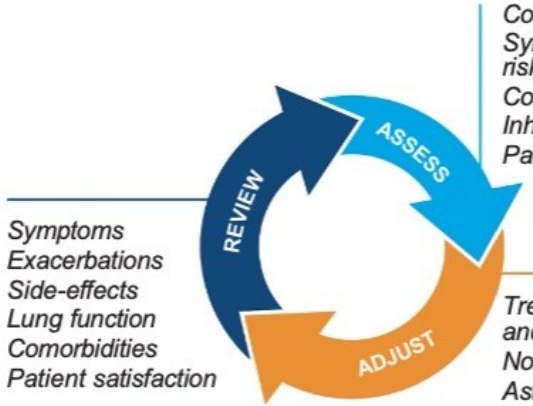
In patients taking Step 3–5 maintenance treatment:

- Hazard ratio for probability of severe exacerbations was 0.73 (95% CI 0.61–0.88) with higher dose of as-needed albuterol-budesonide compared with as-needed albuterol
- Most benefit seen in Step 3



GINA 2024

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 including ICS (as below)
Education & skills training

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	STEP 3	STEP 4	STEP 5
As-needed-only low dose ICS-formoterol	Low dose maintenance ICS-formoterol	Medium dose maintenance ICS-formoterol	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	STEP 2	STEP 3	STEP 4	STEP 5
Take ICS whenever SABA taken*	Low dose maintenance ICS	Low dose maintenance ICS-LABA	Medium/high dose maintenance ICS-LABA	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 add LTRA† or add HDM SLIT, or switch to high dose ICS-only*	*Add azithromycin (adults) or add LTRA†. As last resort consider adding low dose OCS but consider side-effects*

*Anti-inflammatory reliever; †advise about risk of neuropsychiatric adverse effects

GINA 2024 Box 4-6

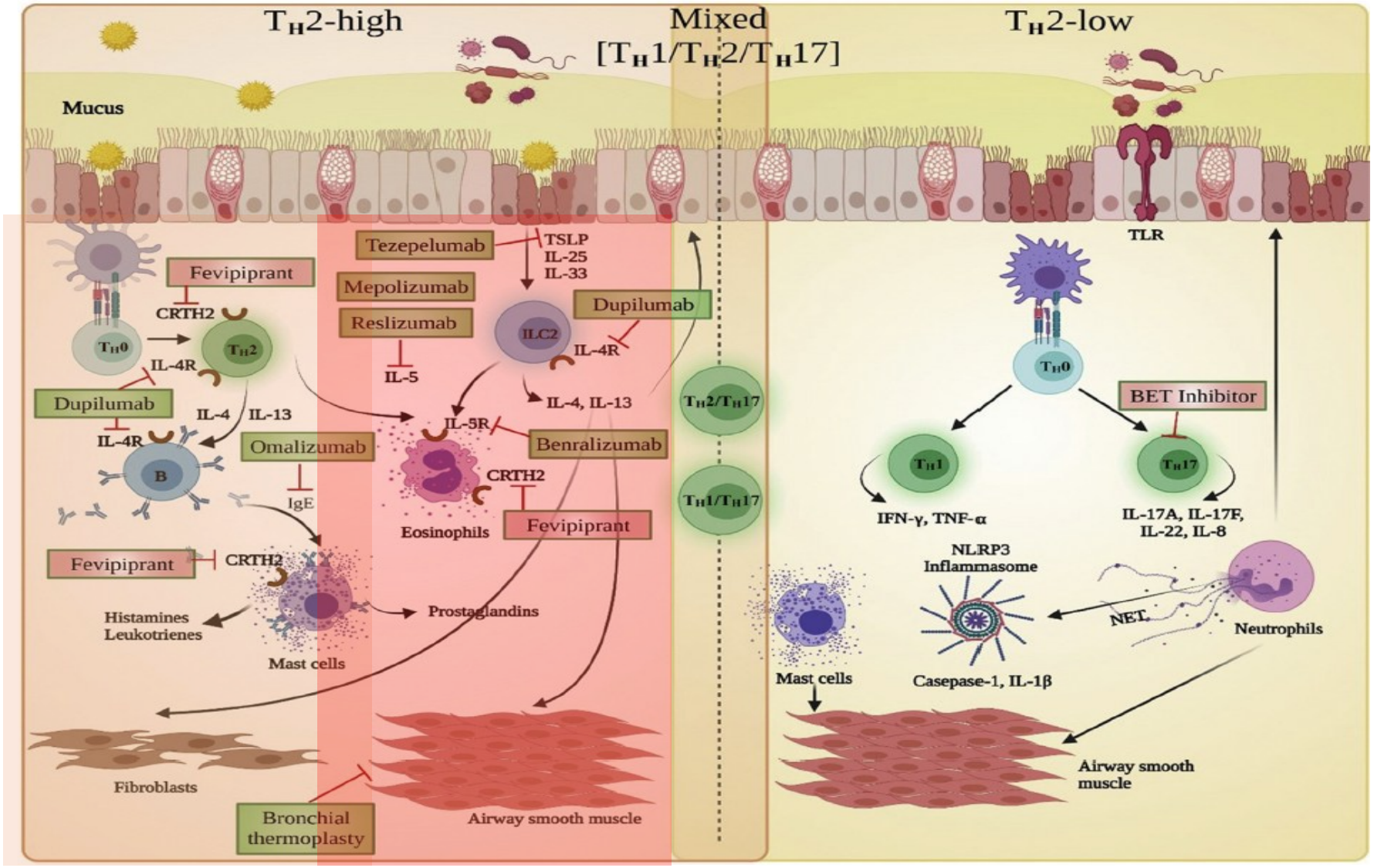
Remission of asthma

- Children vs adults
- Clinical vs complete remission
- “Off treatment” vs “on treatment”
- Multiple definitions, operationalized in many ways
  - Often assessed over only 12 months
  - “No exacerbations” and “no maintenance OCS” assessed from electronic medical record or patient interview
  - “No symptoms over 12 months” often assessed from Asthma Control Questionnaire (i.e. the last 7 days!)
- No validated tools for assessment of symptoms over periods longer than 4 weeks

Remission of asthma

- Remission from childhood wheezing or asthma, off treatment
  - Parents/caregivers often ask if their child will 'grow out of their asthma'
  - Rates vary depending on population and age, e.g. 59% at age 6, 15% at age 26
  - Asthma often recurs: remission is not cure, and patients may develop persistent airflow limitation
  - Say to parent/caregiver 'Their asthma has gone quiet for a while'
- Remission in adults, on treatment
  - Current reports are mostly for patients with severe asthma treated with biologic therapy
  - Remission also seen in non-severe asthma with ICS-containing treatment, and sometimes spontaneously
  - Research needed to identify pathways in patients who have ongoing respiratory symptoms, e.g. multimorbidity, anxiety and/or depression, moderate or severe persistent airflow limitation
- Evidence about goal-setting tells us that treatment goals for patients should be personalized and achievable
- Avoid encouraging automatic step-up of therapy
  - Treat comorbidities and modifiable risk factors first (including poor inhaler technique and poor adherence); use non-pharmacologic strategies; if high-dose ICS or ICS-LABA is used, limit to 3–6 months whenever possible
  - Use GINA Track 1 regimen to reduce exacerbations using *lower* ICS doses

Pathophysiological mechanisms involved in T2-high and T2-low severe ast hma and the molecular targets



allergic eosinophilic nonallergic eosinophilic

J Allergy Clin Immunol 2022;149:455-65

Summary of biologics targeting T2–high phenotype

	Mechanism of Action	Indication	Dosing and Route	Adverse Effects
Omalizumab	Anti-IgE; prevents IgE from binding to its receptor on mast cells and basophils	≥6 yr old with moderate to severe persistent asthma, positive allergy testing, incomplete control with an ICS, and IgE elevation	0.016 mg/kg per IU of IgE administered every 2–4 wk s.c.	Black box warning: 0.1–0.2% risk of anaphylaxis in clinical trials
Mepolizumab	Anti–IL-5; binds to IL-5 ligand; prevents IL-5 from binding to its receptor	≥12 yr old with severe eosinophilic asthma AEC≥150–300 cells/ml	100 mg s.c. every 4 wk	Rarely causes hypersensitivity reactions; can cause activation of zoster
Reslizumab	Anti–IL-5; binds to IL-5 ligand; prevents IL-5 from binding to its receptor	≥18 yr old with severe eosinophilic asthma AEC≥400 cells/ml	Weight-based dosing of 3 mg/kg i.v. every 4 wk	Black box warning: ~0.3% risk of anaphylaxis in clinical trials
Benralizumab	Anti–IL-5; binds to IL-5 receptor a; causes apoptosis of eosinophils and basophils	≥12 yr old with severe eosinophilic asthma AEC≥300 cells/ml	30 mg s.c. every 4 wk for three doses; followed by every 8 wk subsequently	Rarely causes hypersensitivity reactions
Dupilumab	Anti–IL-4R; binds to IL-4 receptor a; blocks signaling of IL-4 and IL-13	≥12 yr old with severe eosinophilic asthma AEC≥150 cells/ml ±FENO level≥25 ppb	200 or 300 mg s.c. every 2 wk	Rarely causes hypersensitivity reactions; higher incidence of injection site reactions (up to 18%) and hypereosinophilia (4–14%)
Tezepelumab	Anti-thymic stromal lymphopoietin (TSLP)	≥12 yr old with severe asthma	210 mg s.c.every 2 wk	Hypersensitivity reactions

Modified, Am J Respir Crit Care Med. 2019 ;199(4):433-445

Efficacy of the T2 biologics for severe asthma

Therapy	Asthma Exacerbation	Lung Function	Corticosteroid Weaning
Omalizumab	Reduces by ~ 25%	Minimal or Equivocal improvement	Decreases use of ICS, but no data that it helps with OCS weaning
Mepolizumab	Reduces by ~ 50%	Inconsistent effect	Decreases total use of OCS and has been shown to facilitate complete weaning from chronic OCS (14%)
Reslizumab	Reduces by ~ 50–60%	Improved	Has not been specifically evaluated for this indication
Benralizumab	Reduces by ~ 25–60%	Improved	Decreases total use of OCS and has been shown to facilitate complete weaning from chronic OCS (50%)
Dupilumab	Reduces by ~50–70%	Improved	Decreases total use of OCS and has been shown to facilitate complete weaning from chronic OCS (50%)
Tezepelumab	Reduces by ~40–60%	Improved	Did not observe the beneficial effect of OCS reduction (only TEC≥150/μL)

Modified, Am J Respir Crit Care Med. 2019 ;199(4):433-445

Clinical efficacy of biologics

Criteria for Remission	Dupilumab		Benralizumab			Tezepelumab	Mepolizumab	Multiple Biologics	
	2021[1] QUEST Phase 3	2022[2] TRAVERSE OLE	2022[3] SIROCCO/ CALIMA Phase 3	2022[4] ANDHI Phase 3b	2023[5] XALOC-1	2022[6,7] NAVIGATOR Phase 3	2022[8] REDES	2022[9] CHRONICLE	2022[10] Danish Registry
Absence of symptoms[a,b] **and**	ACQ-5 < 1.5	ACQ-5 < 1.5	ACQ-6 < 1.5" or ≤ 0.75	ACQ-6 < 1.5" or ≤ 0.75	ACQ-5 < 1.5 or ACT ≥ 16	ACQ-6 ≤ 1.5[a,b]	ACT ≥ 20	Majority ≥ (50%) ACT ≥ 20	ACQ ≤ 1.5
Optimized/ stabilized lung function **and**	Post-BD FEV_1pp ≥ 80%	Post-BD FEV_1 ≥ 80% *OR* pre-BD FEV_1 ≥ 100 mL	Pre-BD FEV_1 increase ≥ 100 mL	Pre-BD FEV_1 increase ≥ 100 mL	Not included	Pre-BD FEV_1pp > 80% *OR* Pre-BD FEV_1 > 20% from baseline; FEV1 > 95% of baseline**	Not included	Not included	Post-BD FEV_1pp ≥ 80%
No exacerbations; no OCS[c]	✓	✓	✓	✓	✓	✓[d]	✓	✓	✓
Prevalence of clinical remission	31.7%	36.4%	26.3%"	28.7%	43%	14%^- 28.5%**	37%	35%	19%

Chest. 2023 Oct;164(4):831-834

Rostrum

An expert consensus framework for asthma remission as a treatment goal

Andrew Menzies-Gow, PhD,[a] Mona Bafadhel, PhD,[b] William W. Busse, MD,[c] Thomas B. Casale, MD,[d] Janwillem W. H. Kocks, MD, PhD,[e,f,g] Ian D. Pavord, MD,[b] Stanley J. Szefler, MD,[h] Prescott G. Woodruff, MD,[i] Alexander de Giorgio-Miller, PhD,[j] Frank Trudo, MD,[k] Malin Fageras, PhD,[l] and Christopher S. Ambrose, MD[m]

London, Oxford, and Cambridge, United Kingdom; Madison, Wis; Tampa, Fla; Groningen, The Netherlands; Singapore; Aurora, Colo; San Francisco, Calif; Wilmington, Del; Gothenburg, Sweden; and Gaithersburg, Md

Understanding the Difference Between Cure and Remission

Cure means that there are no traces of your cancer after treatment and the cancer will never come back.

Remission means that the signs and symptoms of your cancer are reduced. Remission can be partial or complete. In a complete remission, all signs and symptoms of cancer have disappeared.

If you remain in complete remission for 5 years or more, some doctors may say that you are cured. Still, some cancer cells can remain in your body for many years after treatment. These cells may cause the cancer to come back one day. For cancers that return, most do so within the first 5 years after treatment. But, there is a chance that cancer will come back later. For this reason, doctors cannot say for sure that you are cured. The most they can say is that there are no signs of cancer at this time.

from NIH

J Allergy Clin Immunol 2020;145:757-65

Generalized framework for remission in asthma

Clinical Remission on Treatment

For ≥12 months:

- Sustained absence of significant asthma symptoms based on validated instrument, **and**
- Optimization and stabilization of lung function, **and**
- Patient and HCP agreement regarding disease remission, **and**
- No use of systemic corticosteroid therapy for exacerbation treatment or long-term disease control

Clinical Remission off Treatment

Same criteria maintained without asthma treatment for ≥12 months

Complete Remission on Treatment

Clinical remission plus the following:

- Current, objective evidence of the resolution of previously documented asthma-related inflammation (eg, reduced blood or sputum eosinophil counts, FENO, and/or other relevant measures), **and**
- In appropriate research settings: Current negative bronchial hyperresponsiveness

Complete Remission off Treatment

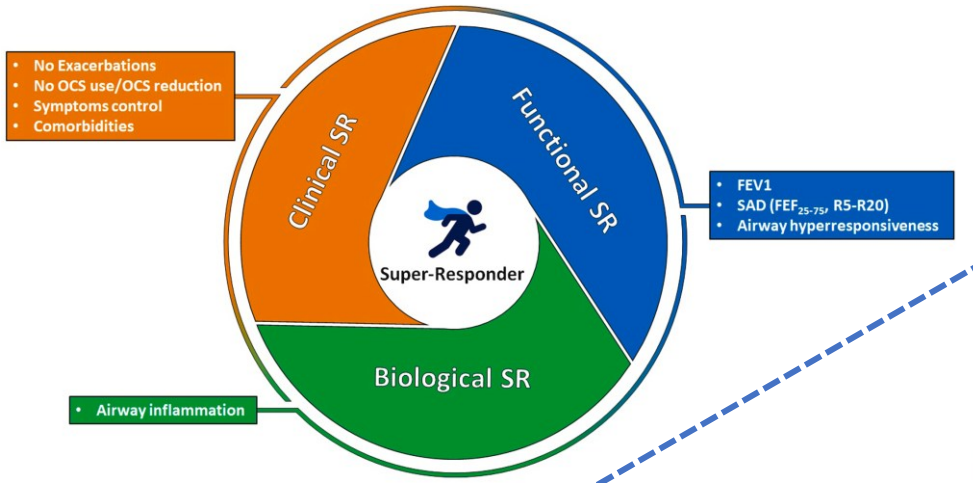
Same criteria maintained without asthma treatment for ≥12 months

J Allergy Clin Immunol 2020;145:757-65

Comparison of definition of clinical remission in asthma

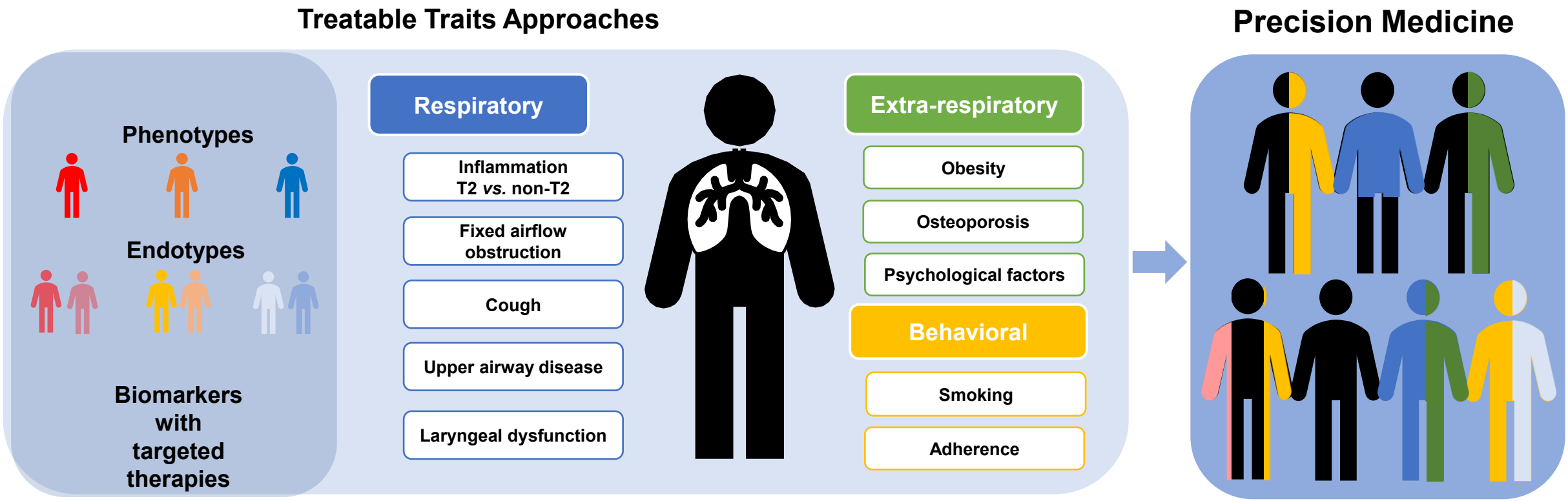
	Menzies-Gow et al	Nagase et al	Pavord et al	Blaiss et al
Patient symptom	Validated instrument	ACQ<1.5 or ACT>19	ACT ≥ 20	No missed work or school
Lung function	Optimization/stabilization	FEV1 ≥ 80(%)	postBD FEV1 ≥ 80(%)	stable and optimized pulmonary function (≥ 2measures in a 12 mon)
No use of OCS	(+)	(+)	(+)	(+)
No Exacerbation	(+)	(+)	(+)	(+)
Duration	≥ 12month		52 weeks	12 months
	Pt/provider agreement	Suppressive T2 infla. (TEC <300 ul and FENO 50 ppb)		Continued use of controller therapies (ICS, ICS/LATA, LTRA) only at low-medium dose of ICS
		Control of comorbidities		Symptom requiring 1 time reliver therapy ≤1/mon

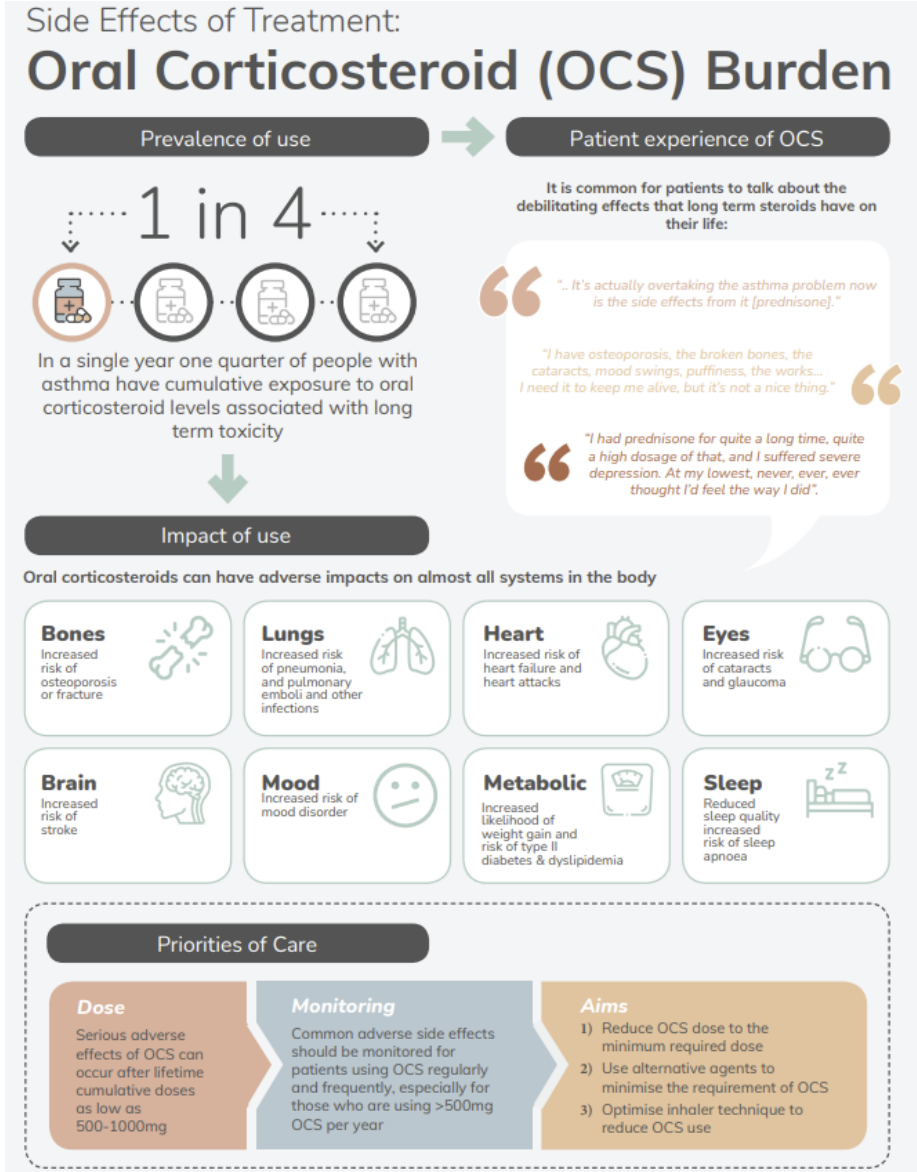
Responder vs. Clinical remission



J Allergy Clin Immunol Pract 2023;11:1417-20

Treatable traits approaches in severe asthma





AARD
Allergy Asthma Respir Dis 13(1):12-21, January 2025 https://doi.org/10.4168/aard.2025.13.1.12
pISSN: 2288-0402
eISSN: 2288-0410
REVIEW

중증 천식 환자 스테로이드 사용과 감량에 대한 전문가 의견서

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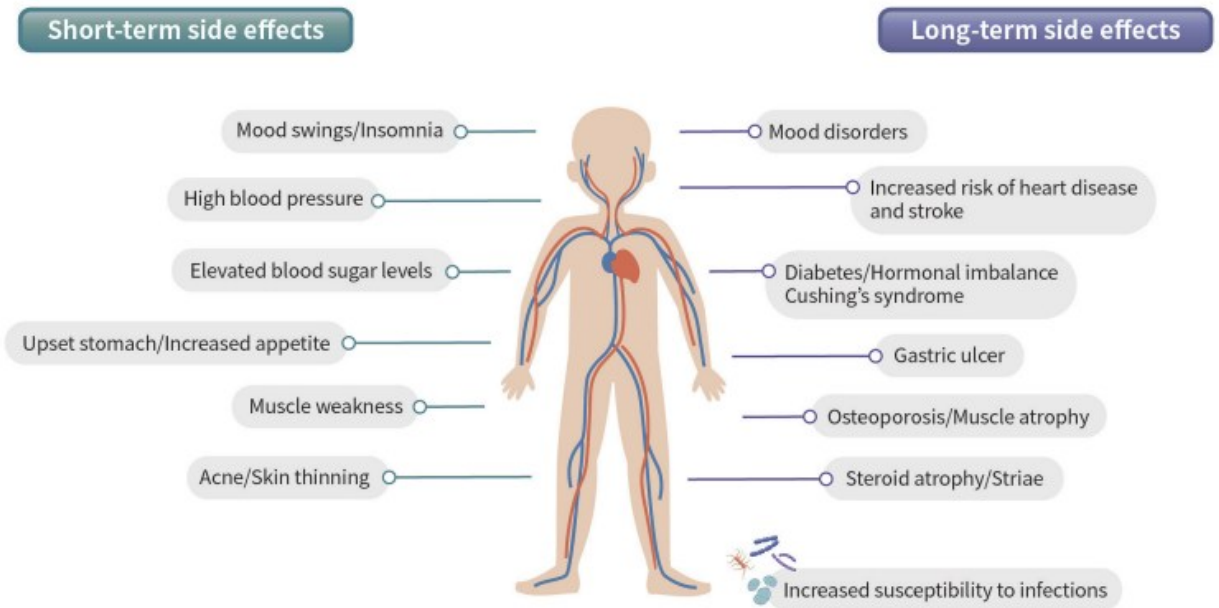
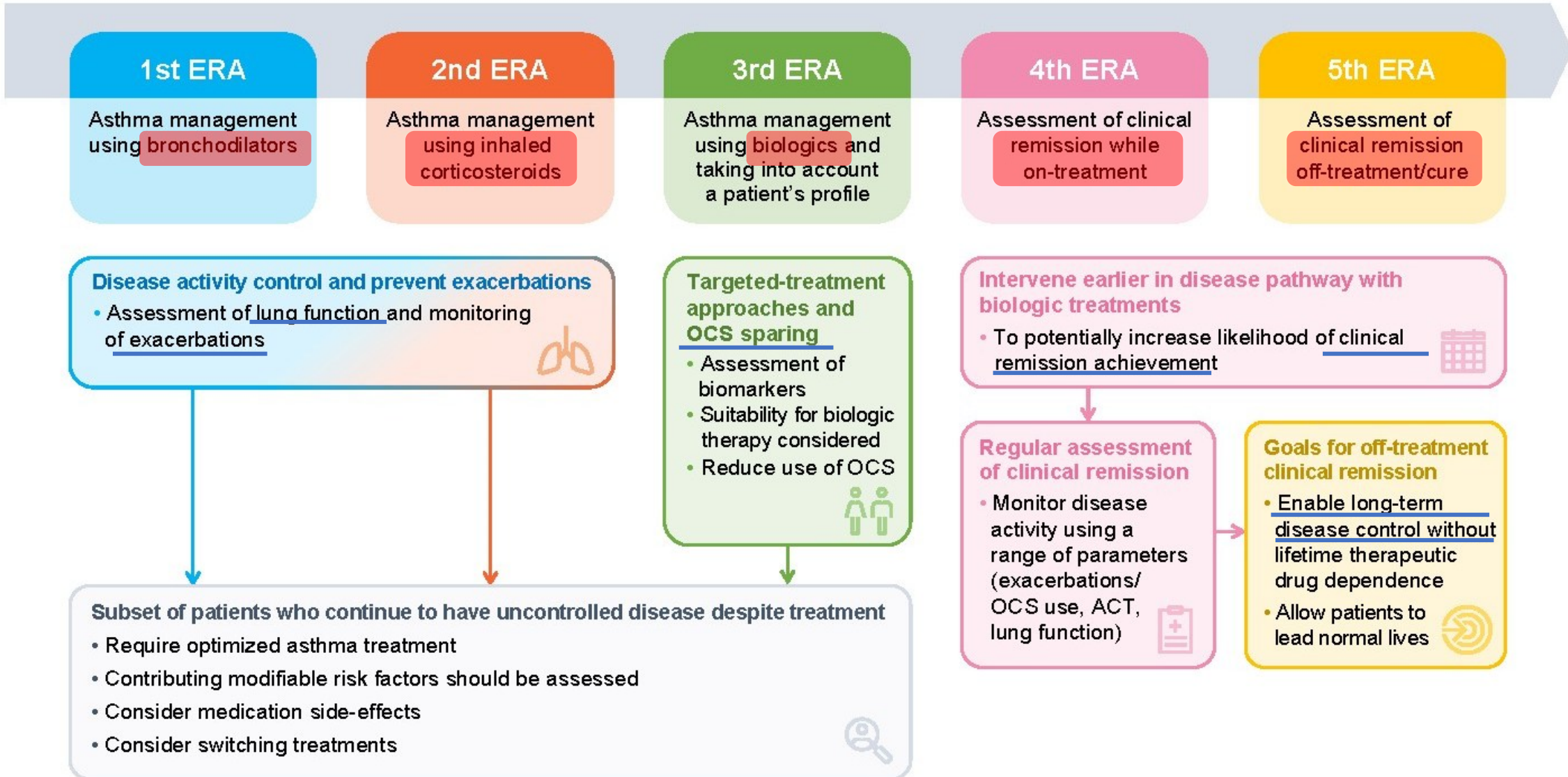


Era of asthma treatment goal



Front Immunol. 2023 :14:1150162.

Summary

- Personalized medicine

- Treatment recommendation
  - Anti-inflammatory reliever (AIR) therapy
  - Discouragement of short-acting beta 2 agonist (SABA)
  - Biologics for severe asthma

- Asthma remission
  - High level of disease control – the absence of signs and symptoms of asthma ≥ 12 months
  - Clinical remission: No symptom, No AE (No OCS), Lung function
  - Complete remission: + normalization of underlying pathology (inflammation, AHR)

- How to induce remission
  - T2 asthma – biologics vs nonT2 asthma ??
  - Treatable traits approach: extrapulmonary or behavior related

Thank you