천식이 괜찮아요, 언제까지 흡입기를 써야 하나요?

가천대 길병원

호흡기 알레르기내과

강성윤

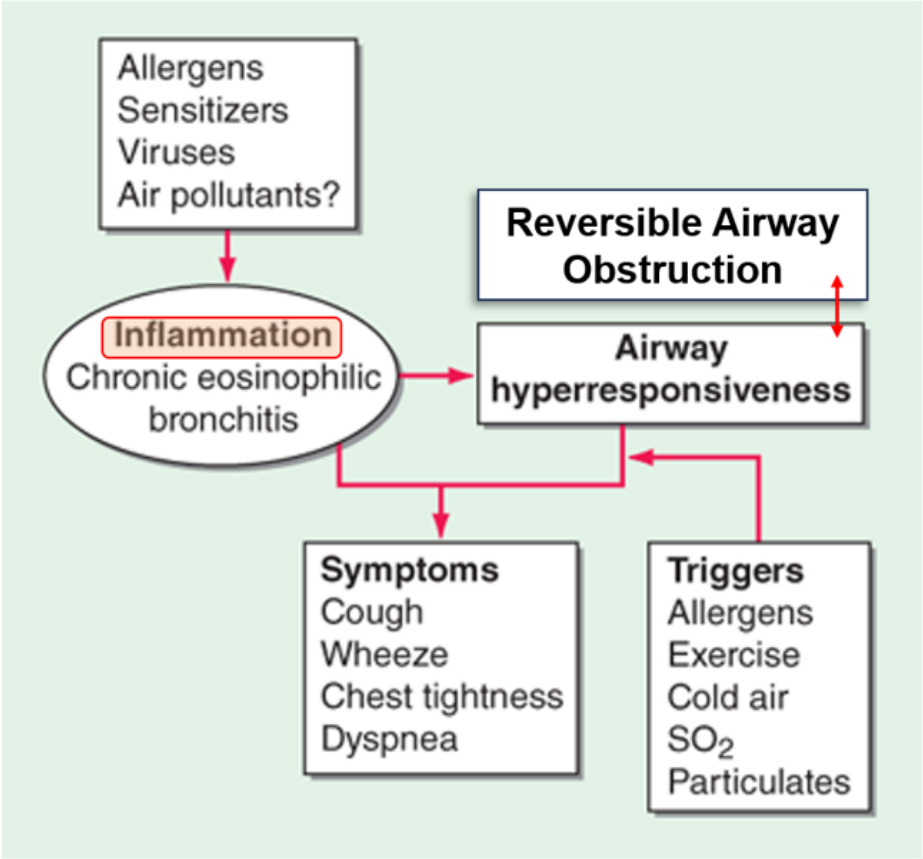
천식 치료, 잘하고 계신가요?

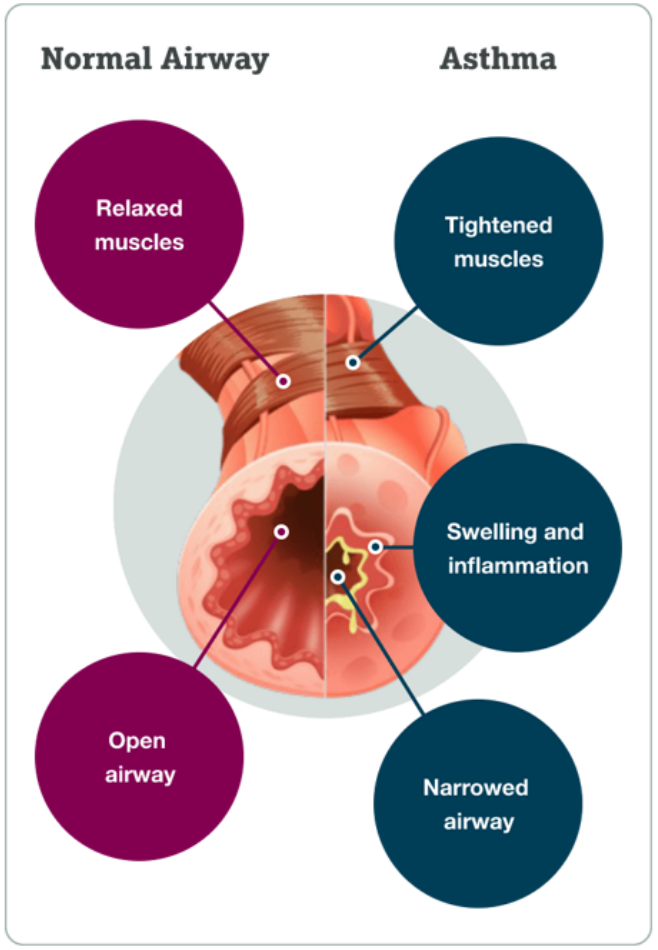
Contents

The Use of Inhaled Corticosteroids in Asthma

What is asthma?

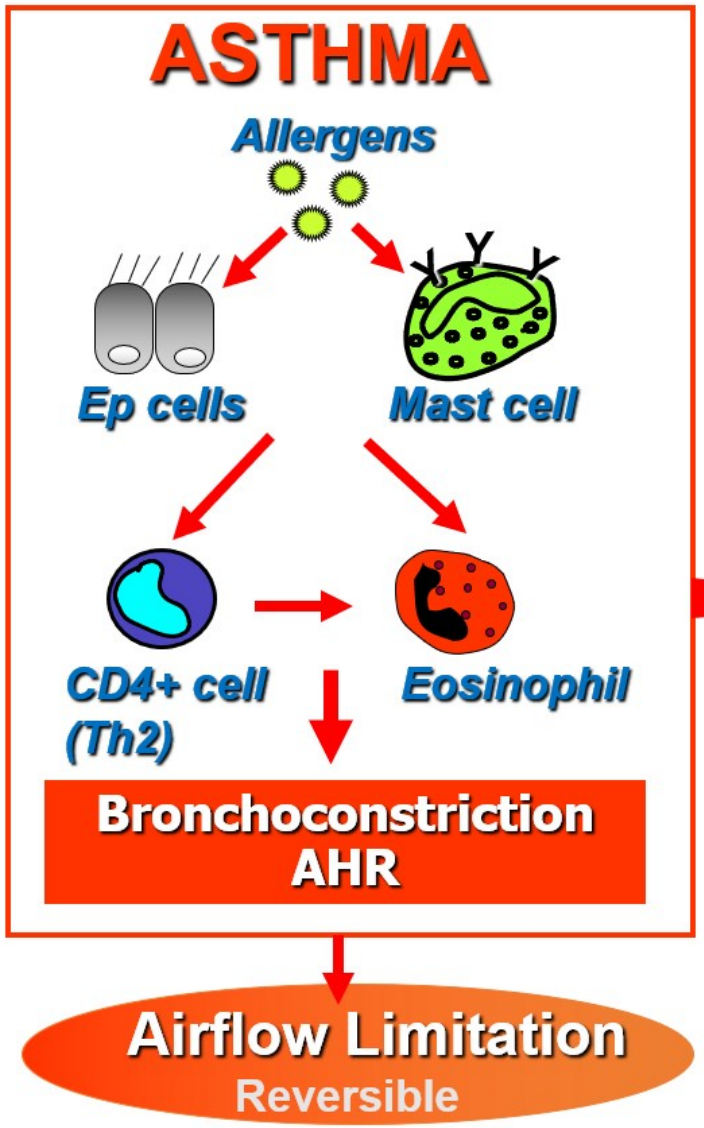
Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It is defined by the history of respiratory symptoms, such as wheeze, shortness of breath, chest tightness and cough, that vary over time and in intensity, together with variable expiratory airflow limitation. One or more symptoms (e.g., cough) may predominate. Airflow limitation may later become persistent.

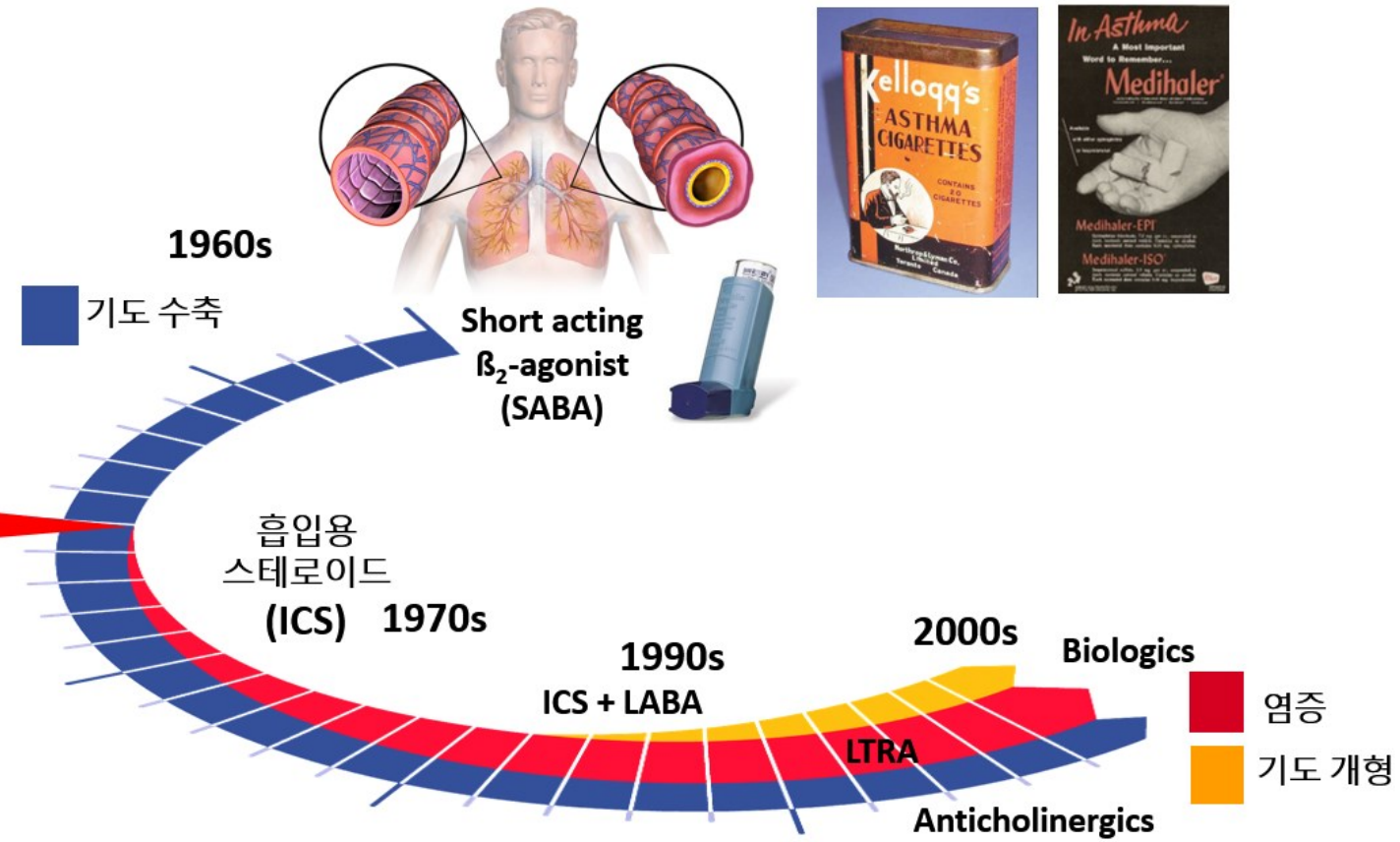




GINA 2025; Harrison's Principles of Internal Medicine, 20e

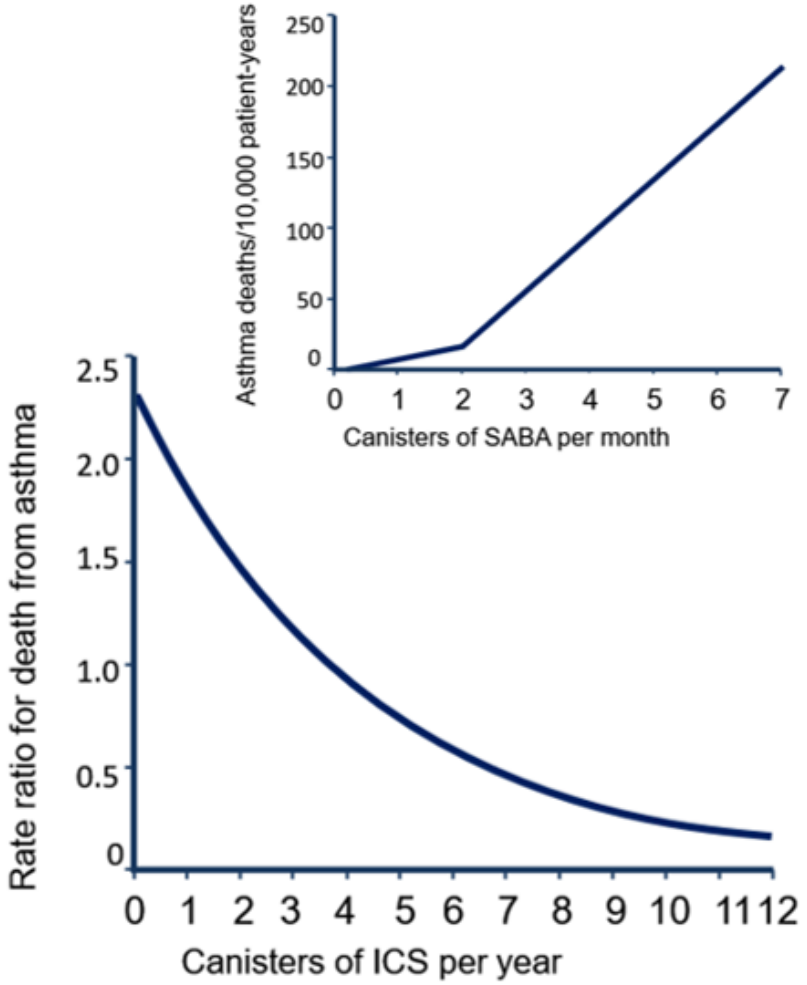
The History of Asthma Therapy

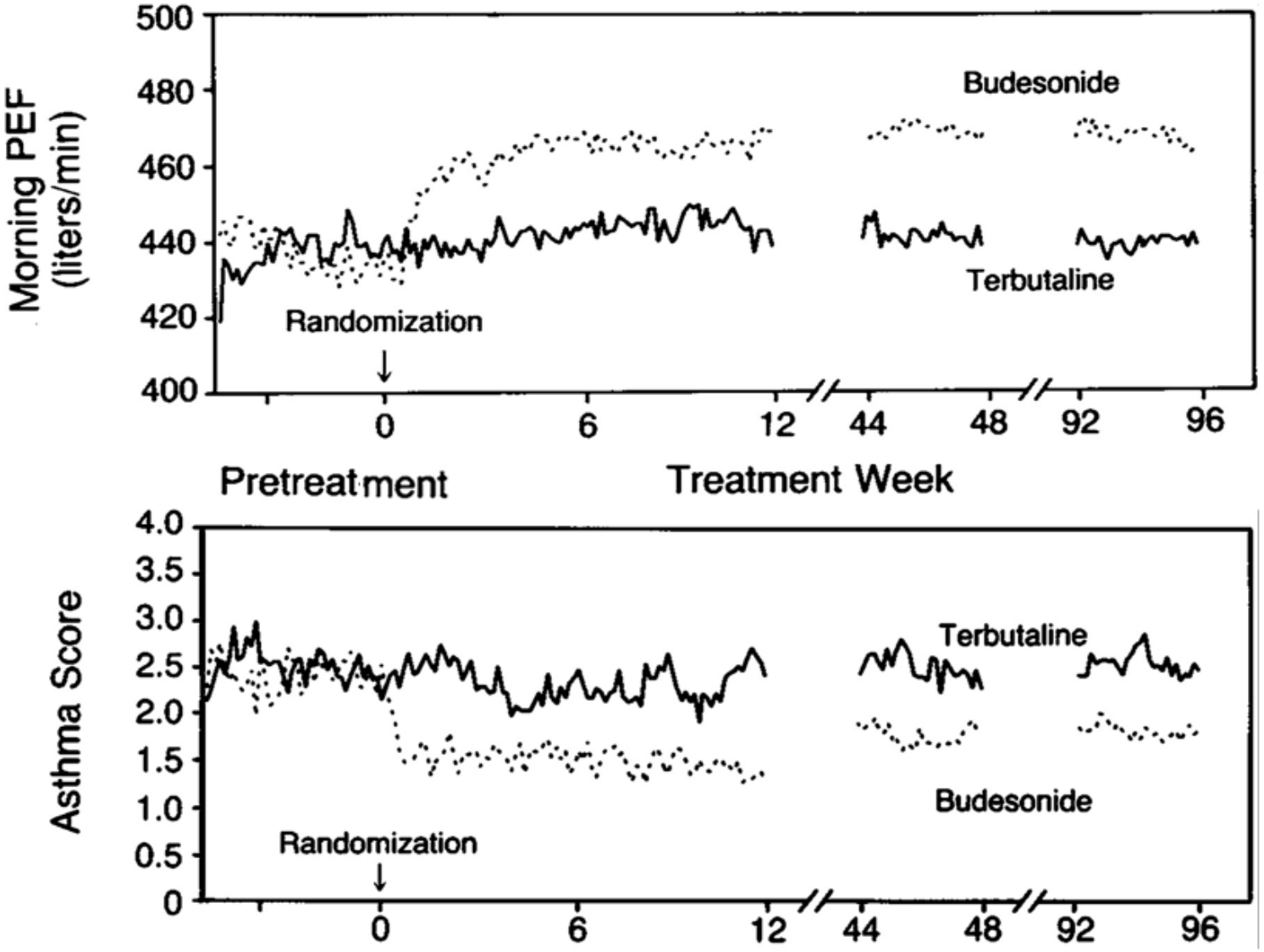




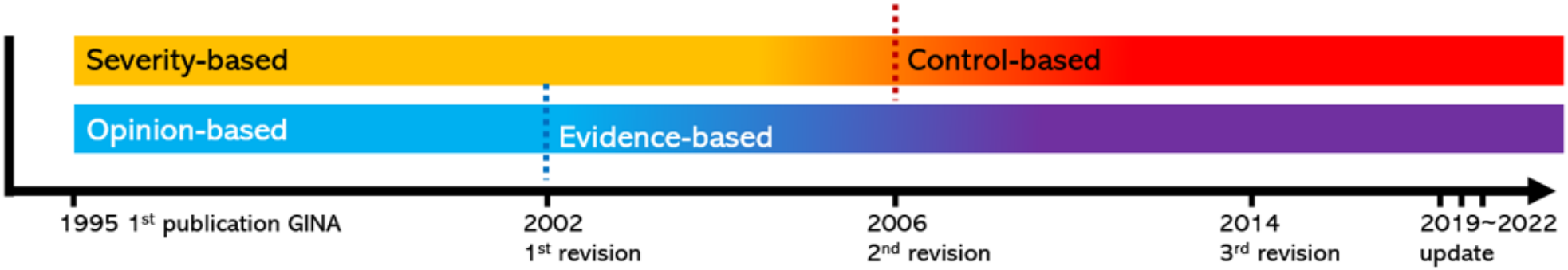
Roche *et al.* J Aerosol Med Pulm Drug Deliv 2016;29(4):311-27; Bjermer. J Allergy Clin Immunol 2007;120(6):1269-75.

Clinical Benefit of Inhaled Corticosteroids (ICS) in Asthma





Suissa *et al.* Am J Respir Crit Care Med 1994;149(3):604-10; Haahtela *et al.* N Engl J Med 1991;325(6):388-92.



2002

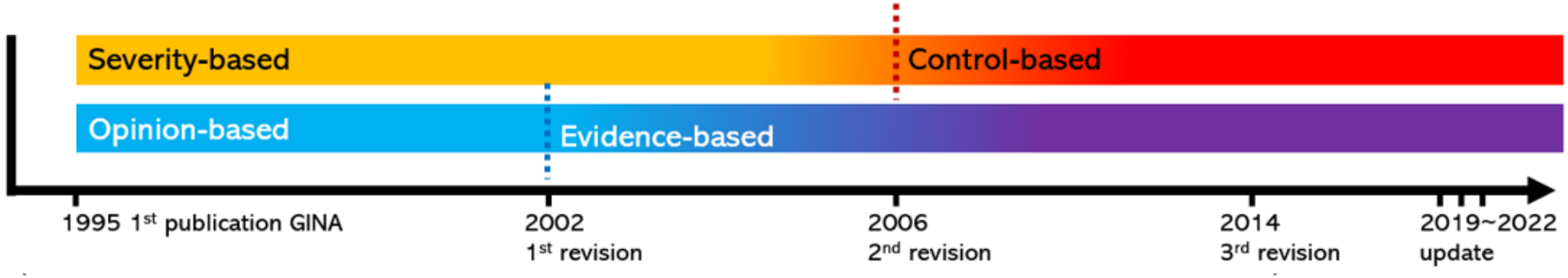
ICS를 기반으로 한 단계적 치료 전략

All Steps: 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.

Level of Severity**	Daily Controller Medications	Other Treatment Options***
Step 1 Intermittent Asthma****	• None necessary	
Step 2 Mild Persistent Asthma	• Inhaled glucocorticosteroid (≤ 500 µg BDP or equivalent)	• Sustained-release theophylline, *or* • Cromone, *or* • Leukotriene modifier
Step 3 Moderate Persistent Asthma	• Inhaled glucocorticosteroid (200-1,000 µg BDP or equivalent) *plus* long-acting inhaled β_2-agonist	• Inhaled glucocorticosteroid (500-1,000 µg BDP or equivalent) *plus* sustained-release theophylline, *or* • Inhaled glucocorticosteroid (500-1,000 µg BDP or equivalent) *plus* long-acting oral β_2-agonist, *or* • Inhaled glucocorticosteroid at higher doses (> 1,000 µg BDP *or* equivalent), *or* • Inhaled glucocorticosteroid (500-1,000 µg BDP or equivalent) *plus* leukotriene modifier
Step 4 Severe Persistent Asthma	• Inhaled glucocorticosteroid (> 1,000 µg BDP or equivalent) *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	

All Steps: 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 1995; GINA 2002; GINA 2006; GINA 2014



Step 1 | Step 2 | Step 3 | Step 4 | Step 5

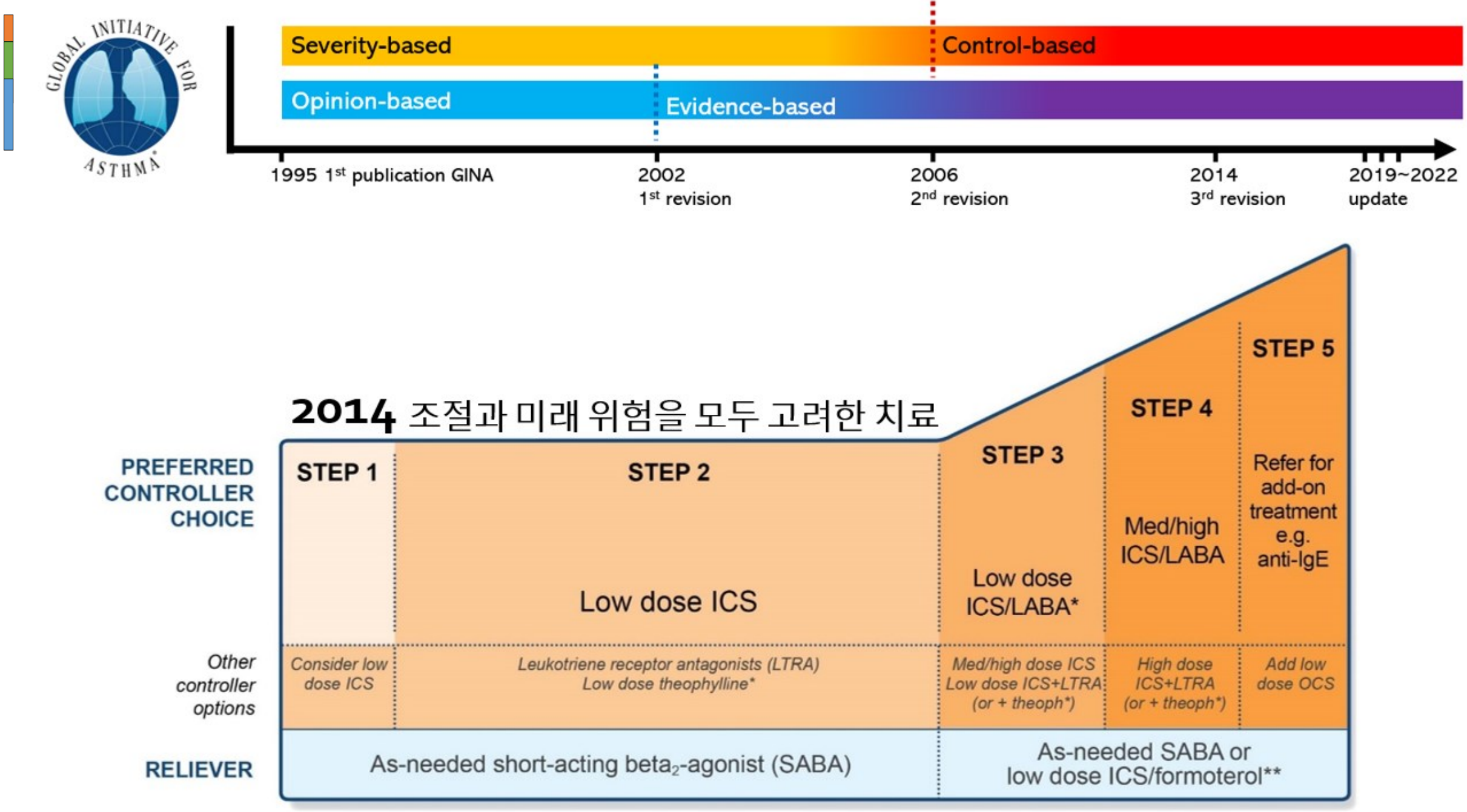
2006

Asthma education
Environmental control

조절중심의 치료전략

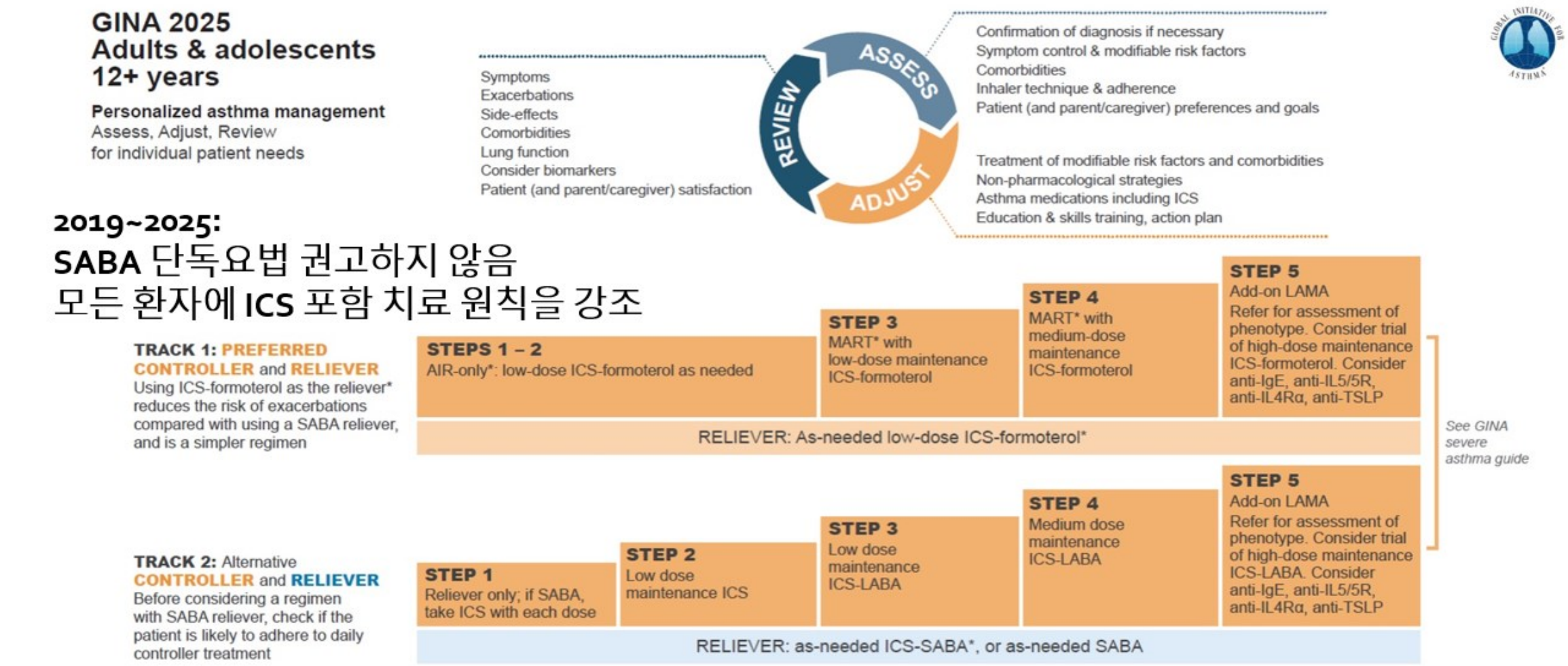
As needed rapid-acting β_2-agonist	As needed rapid-acting β_2-agonist			
Controller options***	Select one	Select one	Add one or more	Add one or both
	Low-dose inhaled ICS*	Low-dose ICS plus long-acting β_2-agonist	Medium-or high-dose ICS plus long-acting β_2-agonist	Oral glucocorticosteroid (lowest dose)
	Leukotriene modifier**	Medium-or high-dose ICS	Leukotriene modifier	Anti-IgE treatment
		Low-dose ICS plus leukotriene modifier	Sustained release theophylline	
		Low-dose ICS plus sustained release theophylline		

GINA 1995; GINA 2002; GINA 2006; GINA 2014



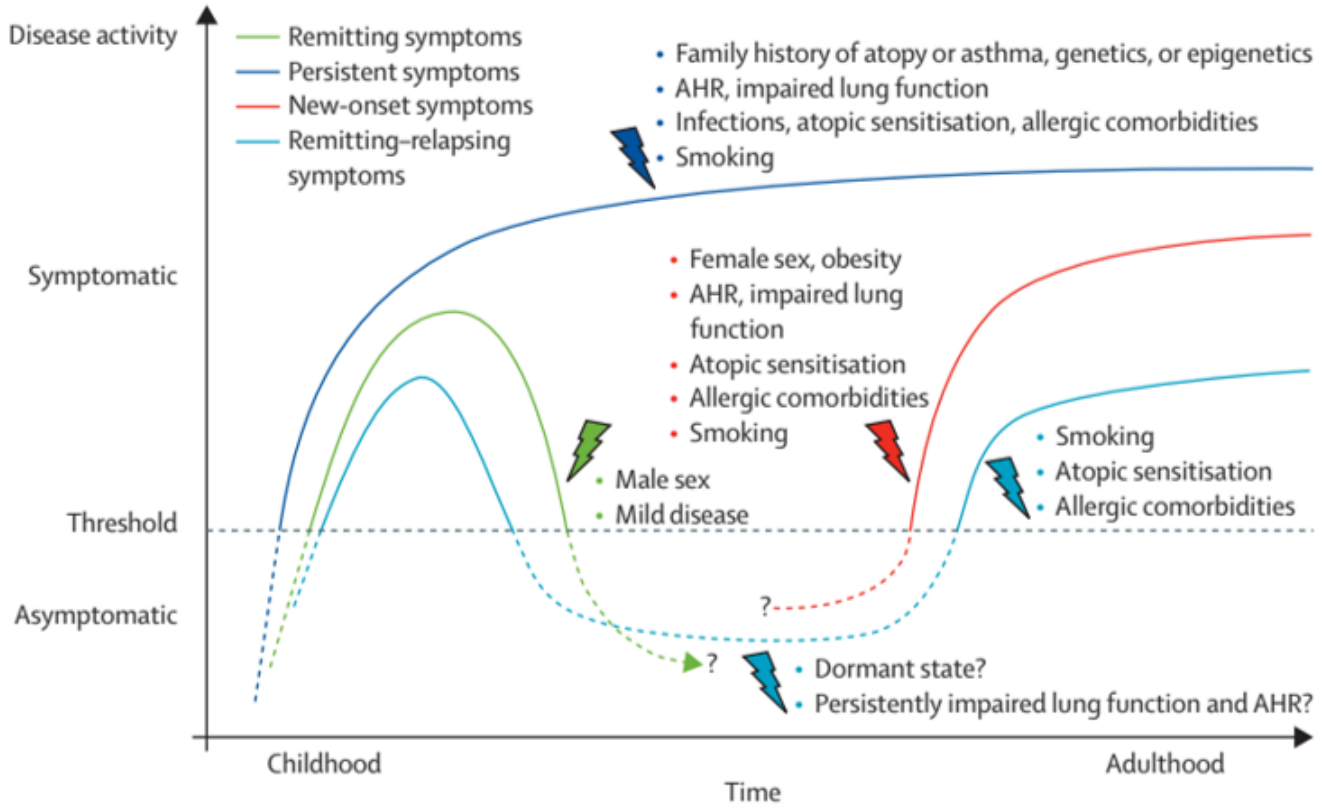
GINA 1995; GINA 2002; GINA 2006; GINA 2014

Asthma should receive inhaled corticosteroid (ICS)-containing medication and should not be treated with SABA alone



Long-Term Outcomes of Asthma

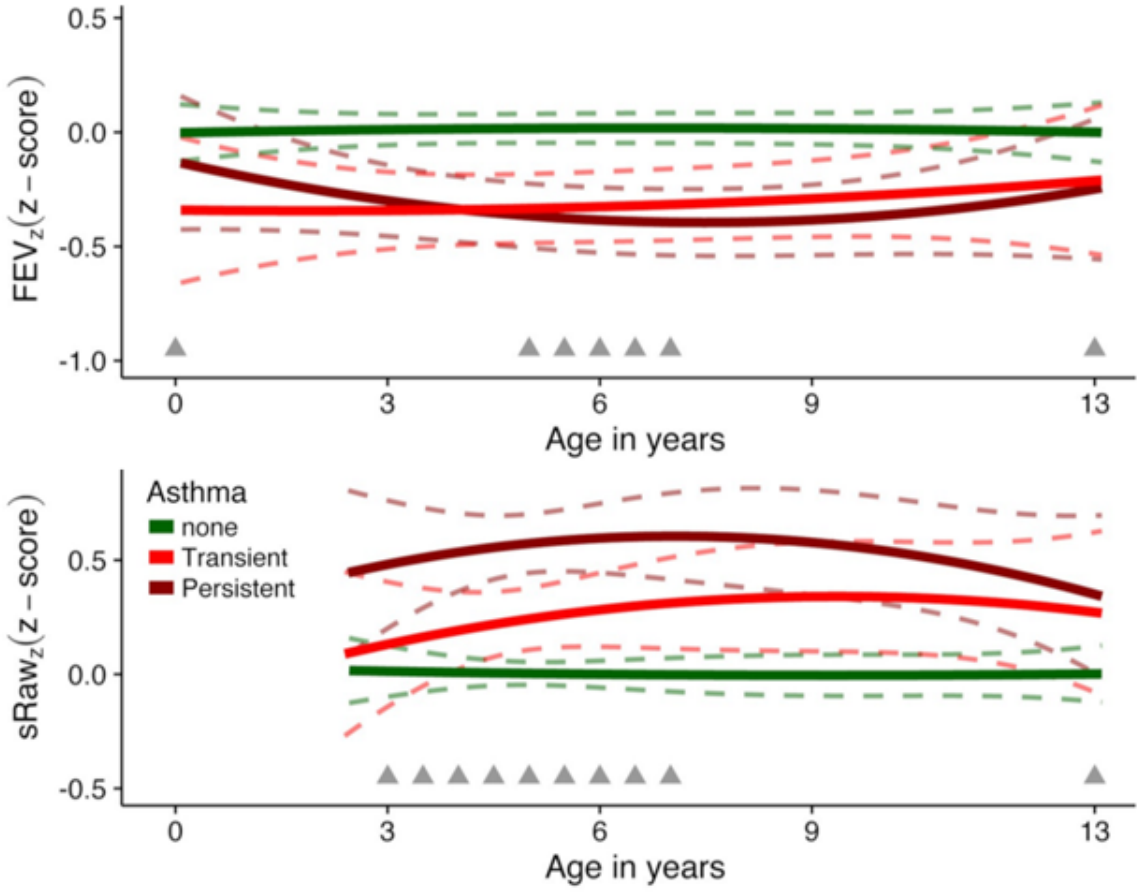
Asthma transition from childhood into adulthood

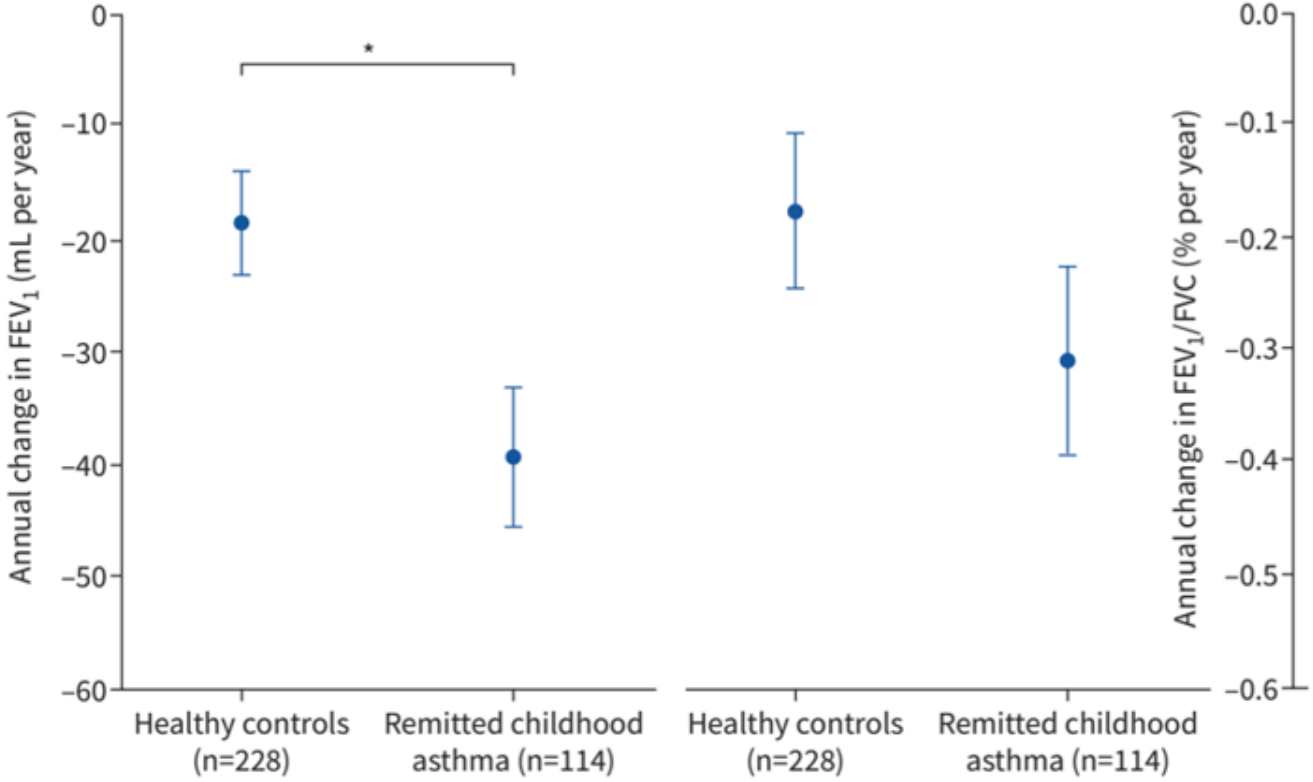


Persistent rate: 30 %

Location, subjects	Follow-up duration, rate
Australia, 346 (7yr)	43 yr, 53%
UK, 1,335 (from birth)	35 yr, 19%
New Zealand,1,037 (9yr)	17 yr , 15%
UK, 63 (from birth)	22 yr, 25%
Finland, 108 (15yr)	9 yr, 22%
UK, 11,486 (from birth)	10 yr, 50%
UK, 1,456 (from birth)	10 yr, 47%
UK, 67 (5yr)	6 yr, 80%

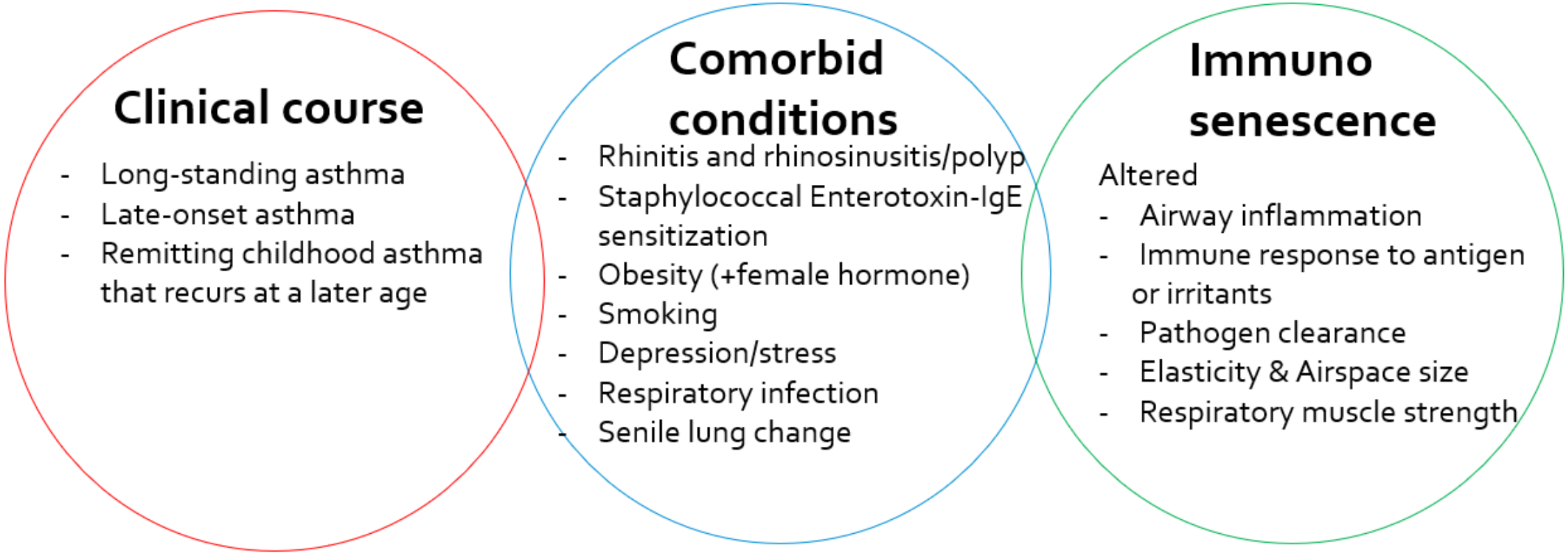
Early Origins and Long-Term Impact of Childhood Asthma





- Lung function and bronchial reactivity, COPSAC (n=367)
- Lung function with a remitted childhood asthma (n=3,584)

Heterogeneity of adult asthma

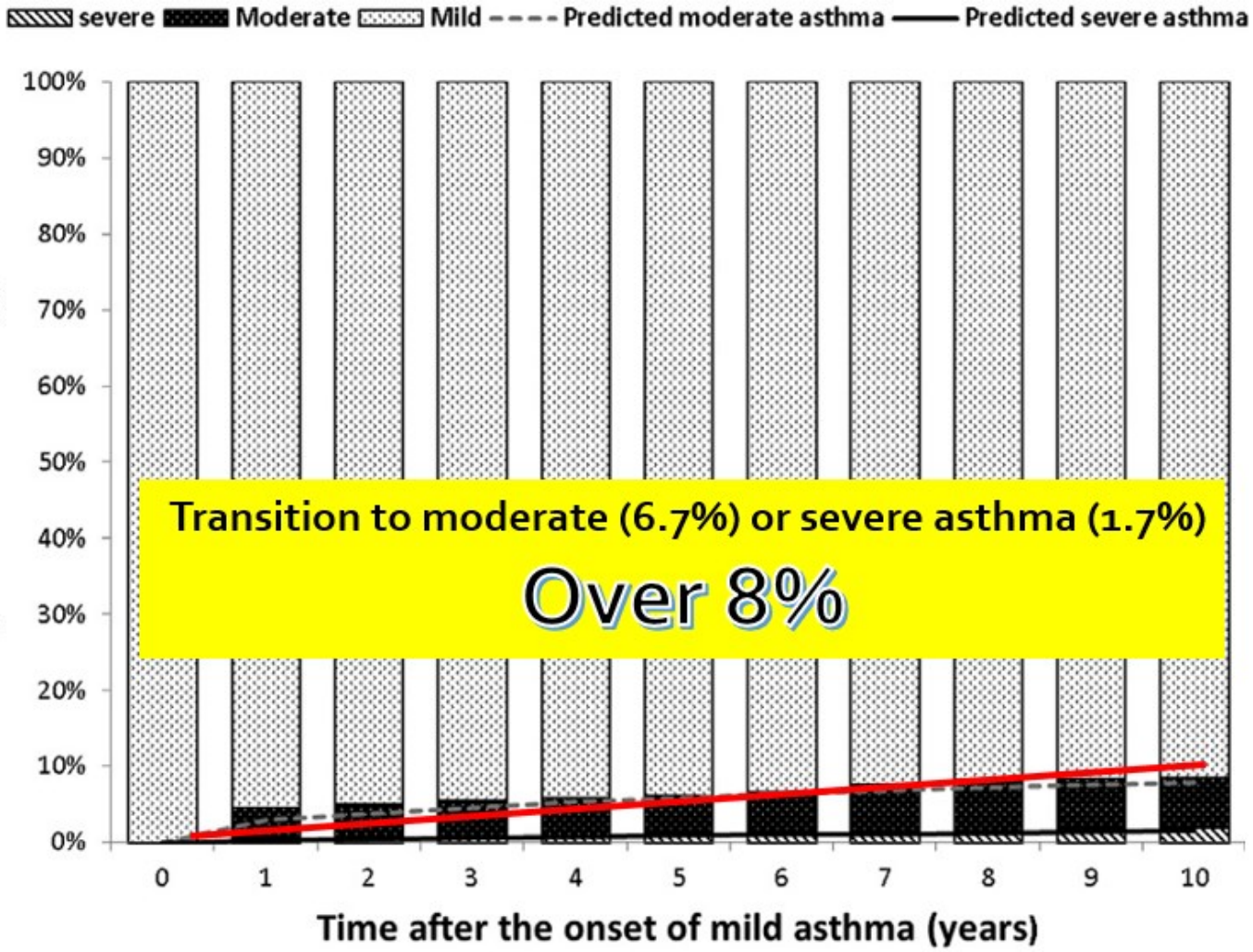


Dunn *et al.* Allergy 2018;73(2):284-294; Song *et al.* Allergy Asthma Immunol Res 2015;7(5):431-439; Busse *et al.* J Allergy Clin Immunol 2010;126:690-9.

Long-Term Trajectories of Adulthood Asthma

Administrative health data in Canada (n=70,829)

14~45 years with newly diagnosed mild asthma



Risk factors in the index year	Transition to moderate/severe/dead (relative to mild) OR (95% CI)	*P* value
Age (per 10- y increase)	1.24 (1.22-1.27)	<.0001
Sex (male vs female)	1.05 (1.01-1.08)	.006
SES		
Low	Reference	
Middle	0.93 (0.89-0.98)	.003
High	0.95 (0.92-0.99)	.011
Comorbidity		
CCI score = 0	Reference	
CCI score = 1	1.07 (1.02-1.13)	.010
CCI score = 2	1.11 (0.97-1.27)	.122
CCI score ≥ 3	1.25 (1.01-1.54)	.039
Allergic rhinitis (yes vs no)	0.95 (0.91-1.00)	.063
Inappropriate SABA use*		
No	Reference	
Yes	1.79 (1.68-1.90)	<.0001
No ICS or SABA use	0.63 (0.59-0.68)	<.0001
ICS therapy		
ICS only	Reference	
ICS-LABA	0.92 (0.87-0.97)	.004
Both	0.96 (0.84-1.10)	.56
None	0.73 (0.69-0.78)	<.0001

Remission Rates for Adult Asthma

Location, subjects	Subjects	Definition	f/u duration	Remission rates
US,1,303 General population (1984)	Adult+Child, 73	Self-reported	6 yr	68%
Australia, 5,729 General population (2011)	A+C, 1811	Self-reported	39yr	65%
US,2,300 General population (1986)	A+C, 136	Self-reported+ -medication -AE asthma ≥ 1/yr -Sx severity ≥ 3/5	9.4 yr	22%
US, 1,601 college students (2000)	A, 84	Physician-diagnosed	23 yr	40%
Netherland, patient cohort (1997)	A, 181	Self-reported+ -BDR or MBPT (+)	25 yr	11%
Denmark,10,952 General population (1994)	A, 82	Self-reported+ -BDR or MBPT (+)	11 yr	20%
Israel, 107,636 Armed forces (1995)	A, 6,496	Self-reported+ -FEV1 change	7 yr	Improved 4.5%

Panhuysen *et al.* Am J Respir Crit Care Med 1997;155(4):1267–72; Ulrik *et al.* Am J Respir Crit Care Med 1994;150(3):629–34.

±Questionnaire or survey studies
+Clinical remission criteria
*Complete remission criteria
n/a; not available (no data)
Patients under treatment

Denmark
Children n/a
Adult 25%+(6), 15%*(6)

Sweden
Children 10%±(1)
Adult 11.2%+(2), 4%*(3)

Canada
Children 34%-53%±(12)
Adult n/a

Netherlands
Children 30%+(7), 22%*(7)
Adult 15.9%+ (8)

Finland
Children n/a
Adult 18.4%+ (4) 2%*(5)

Japan
Children n/a
Adult 56.9%+ (16),
13.4% *(16)

USA
Children 33%±(13),
26%+(14), 15%*(14)
Adult 11.9%±(15)

Italy
Children n/a
Adult 52%±(10), 29.7%+(11),

Turkey
Children n/a
Adult 11.3%+, 2%* (9)

Thailand
Children 48.3%+ (17)
Adult n/a

Australia
Children 75%±(18)
Adult n/a

DEFINITION
Clinical Remission/On-Treatment

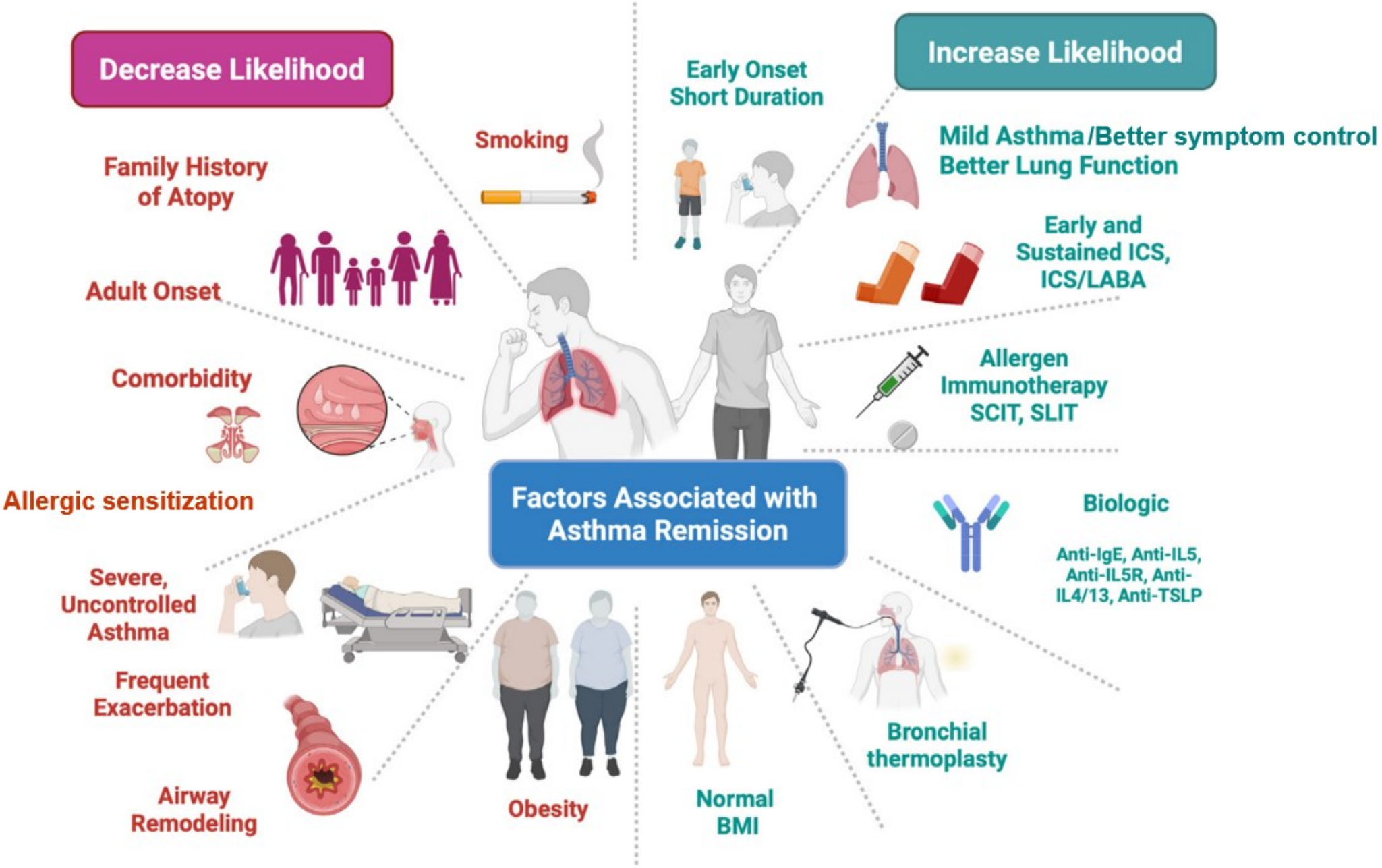
- Absence of symptoms-ACT, ACQ
- No use of systemic steroid
- No exacerbations
- Stabilization of lungs function

DEFINITION
Complete Remission/On-Treatment

Clinical remission plus the following:

- No sign of underlying inflammation
- No airway hyperresponsiveness

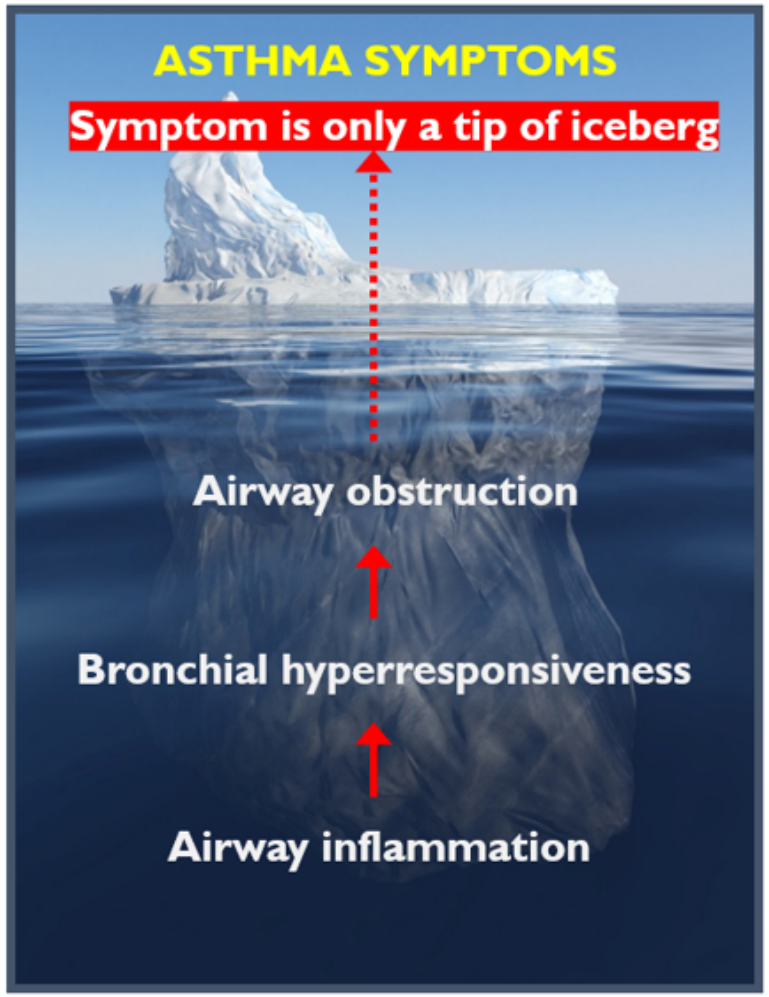
1. Backlund et al. 2006
2. Almqvist L. et al. 2020
3. Ronmark E at al. 2007
4. Honkamaki et al. 2021
5. Tuomisto L. et al. 2016
6. Tupper O. et al. 2021
7. Vonk et al. 2004
8. Westerhof G et al. 2018
9. Sozener ZC et al. 2015
10. Pesce G. et al. 2015
11. Cazzoletti L. et al. 2014
12. Longo et al. 2021
13. Curry et al. 2021
14. Wand et al. 2020
15. De Marco R. et al. 2006
16. Oishi K. et al. 2025
17. Siripattarasopon et al. 2015
18. Jenkins et al. 1994

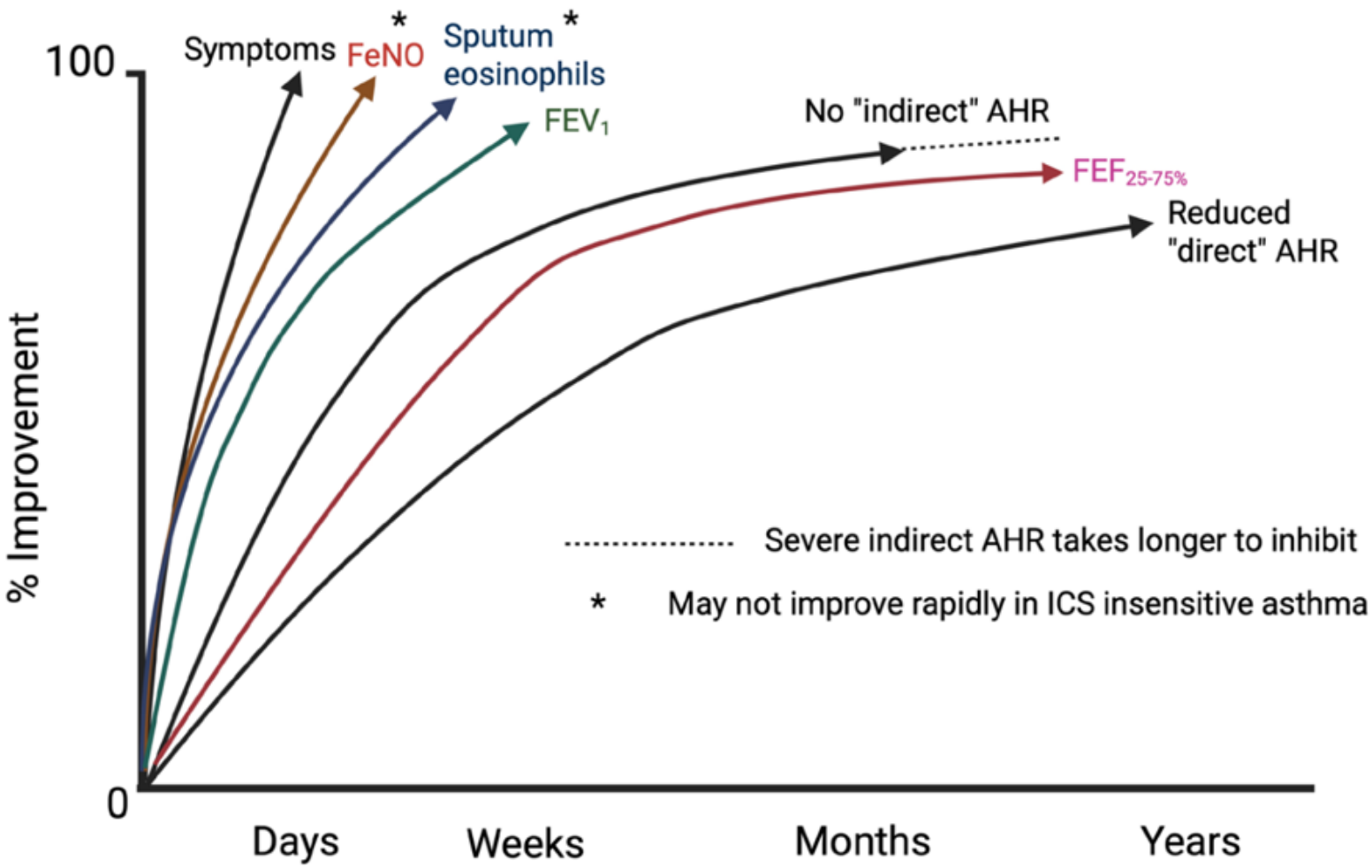


Chiewchalermsri *et al*. Asian Pac J Allergy Immunol 2025;43(2):135-150.

ICS in Asthma Control: The Need for Continuous Use

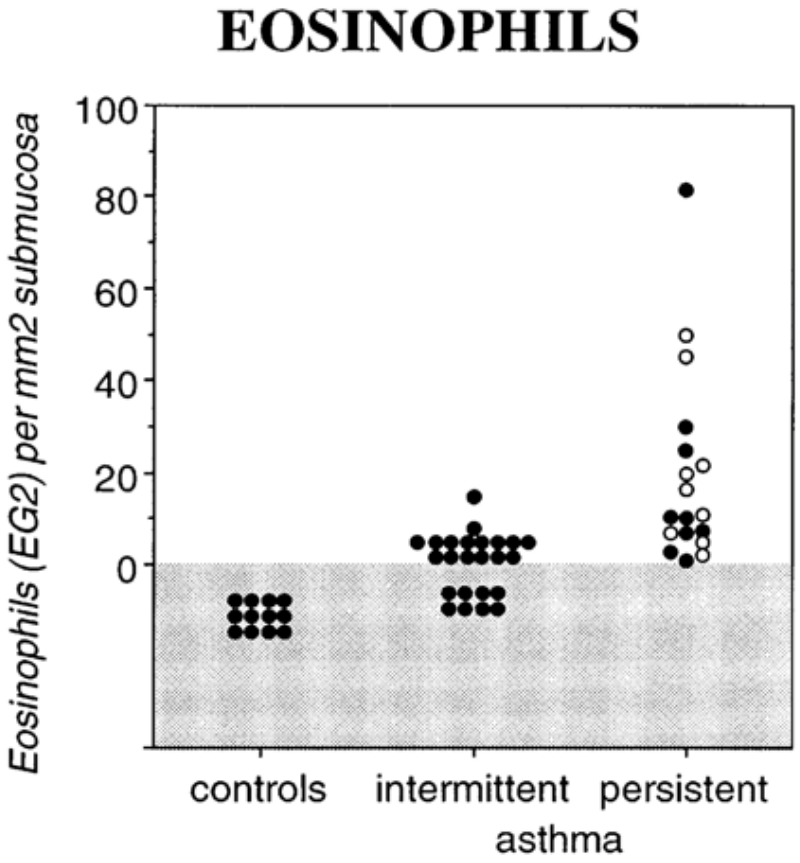
It ain't over till it's over: improvement over time following ICS

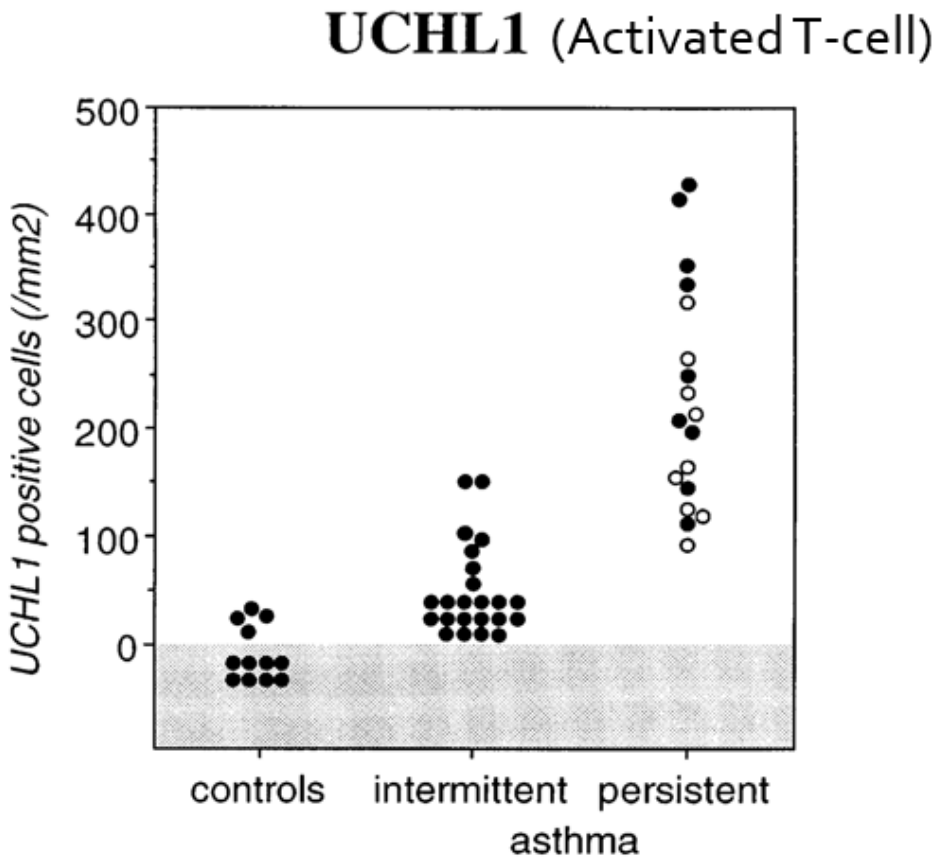




Brannan *et al*. Clin Respir J. 2007;1(1):3-15.

Airway Inflammation persists in Asthma despite Symptom Control



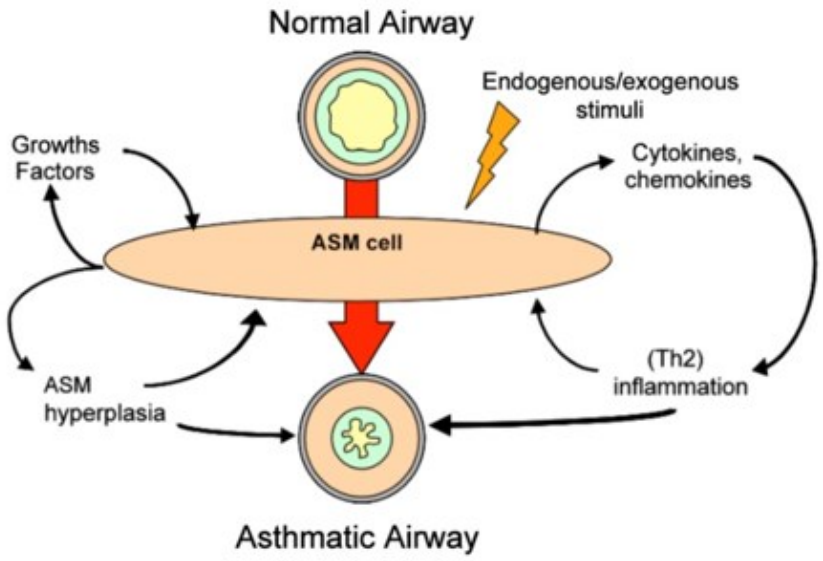


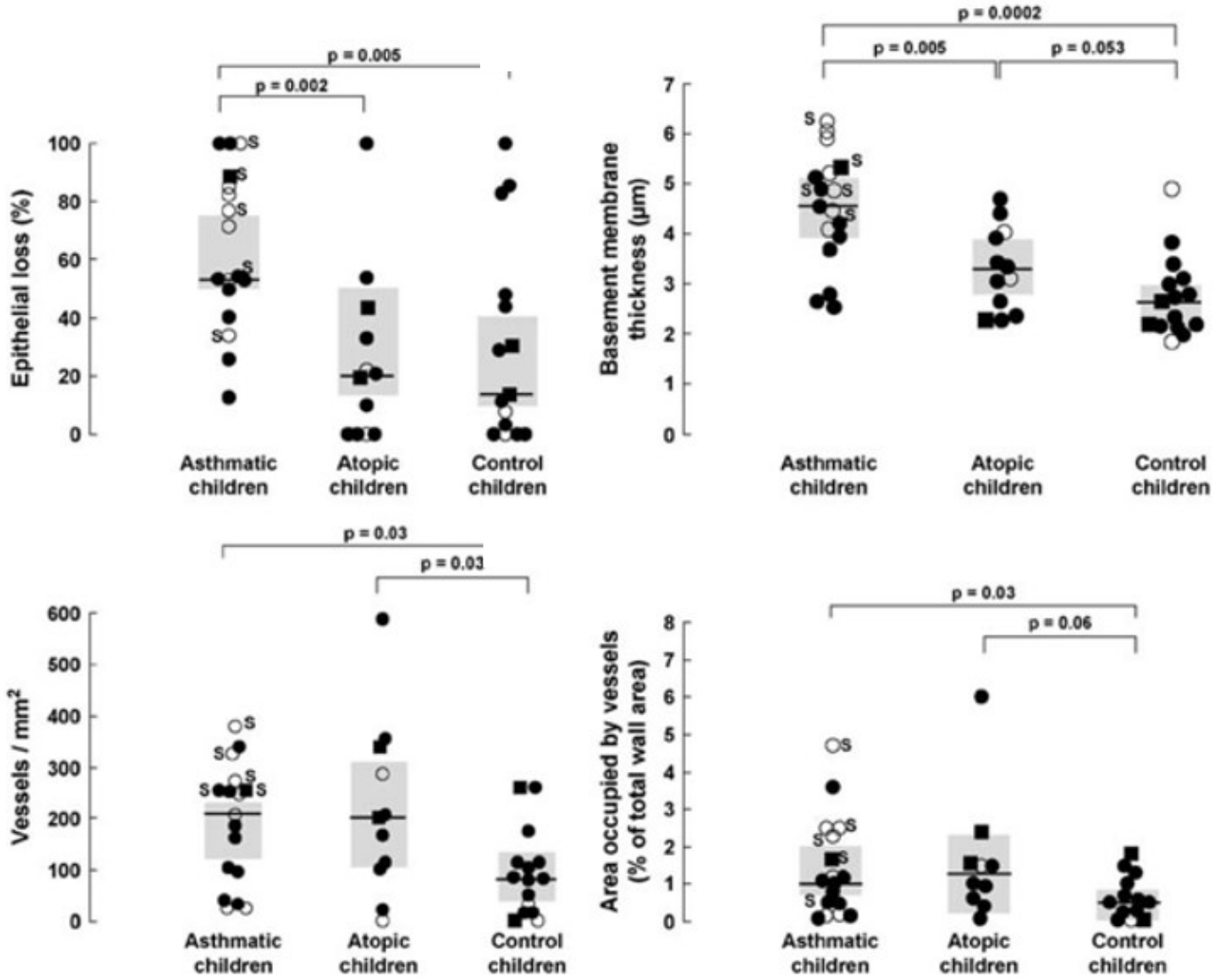
RESULTS OF BRONCHIAL BIOPSIES

	Control Subjects	Intermittent Asthma	Persistent Asthma		p Value		
			Atopic	Nonatopic	C/IA	C/PA*	IA/PA*
Epithelial shedding	10 (5–10)	50 (31–80)	100 (95–100)	100 (95–100)	0.0001	0.0001	0.004
BM size, μm	7 (6–9)	9.5 (7–11)	10.7 (8–12.5)	11.3 (8–15)	NS	0.025	NS

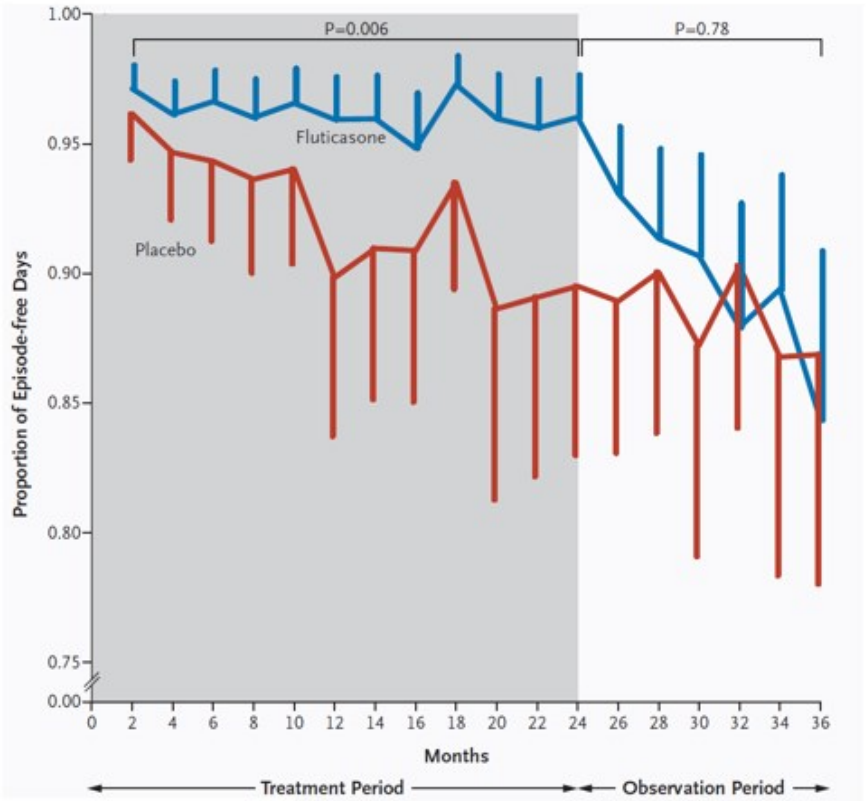
Vignola *et al.* J Respir Crit Care Med 1998;157(2):403-9.

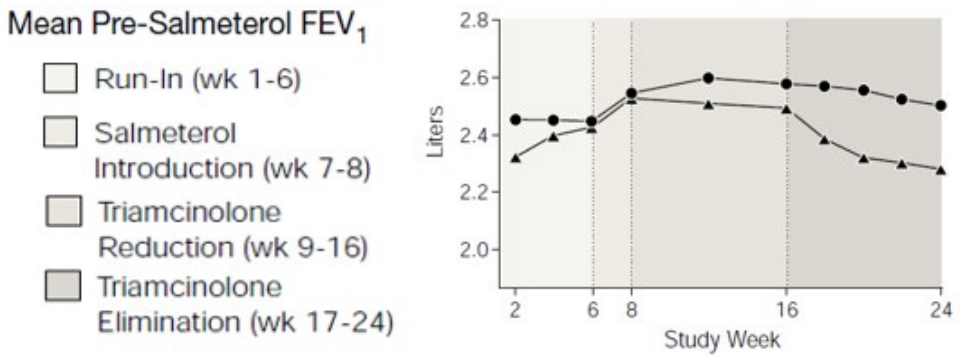
Airway Remodeling Parallels Inflammation in Asthma

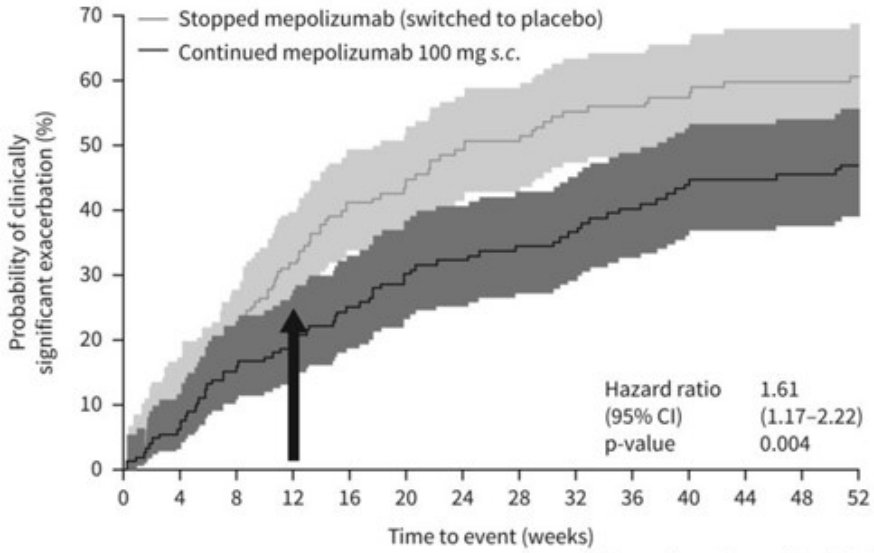


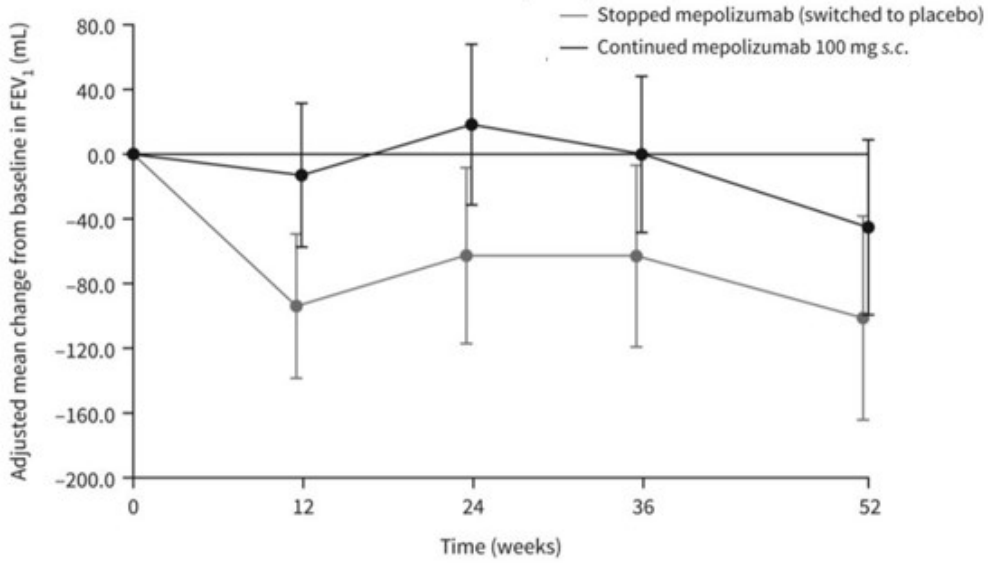


Alteration of the Natural History of Asthma in Adults

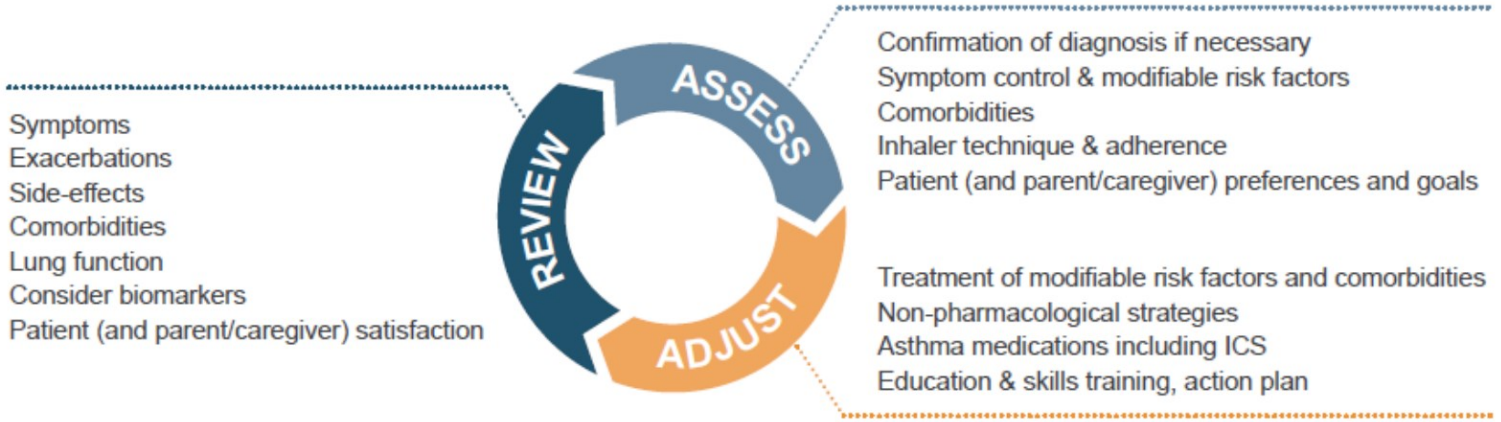








Guilbert *et al.* N Engl J Med 2006;354(19):1985-97; Lemanske *et al.* JAMA 2001;285(20):2594-603; Moore *et al.* Eur Respir J 2022;59(1):2100396.



Stepping down treatment when asthma is well controlled

When good asthma control has been maintained for 2–3 months, consider stepping down treatment. The aims are to find the lowest treatment step that controls both symptoms and exacerbations, and to minimize side-effects.

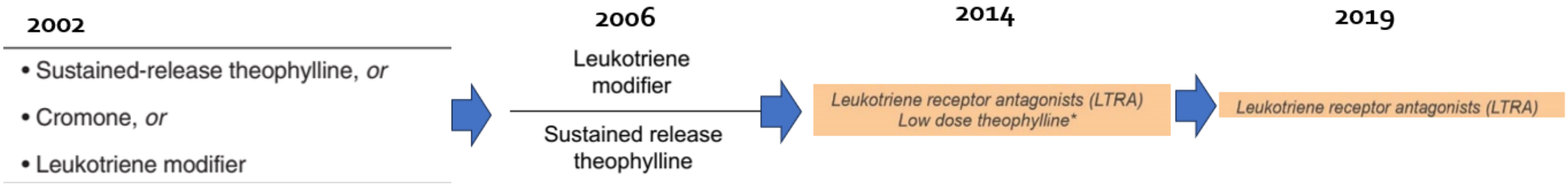
Choose an appropriate time for step-down (no respiratory infection, patient not travelling, not pregnant). Assess risk factors for exacerbation, including history of previous exacerbations or emergency department visits for asthma, and low lung function (see Table 2, page 12).

Record symptom control and lung function before stepping down, provide a written asthma action plan, monitor closely, and plan a follow-up visit.

Reduce the ICS dose by 25–50% by changing to an inhaler with a lower strength of the same ICS or by reducing the frequency of inhalations (see Box 4-13 in the full 2024 GINA Report for information on how to step down from different treatments). Review asthma after each step-down, and wait 2–3 months to confirm asthma is stable before stepping down again. Do not completely stop ICS in adults or adolescents with asthma.

Therapeutic Alternatives When ICS Cannot Be Used

Other controller options than ICS

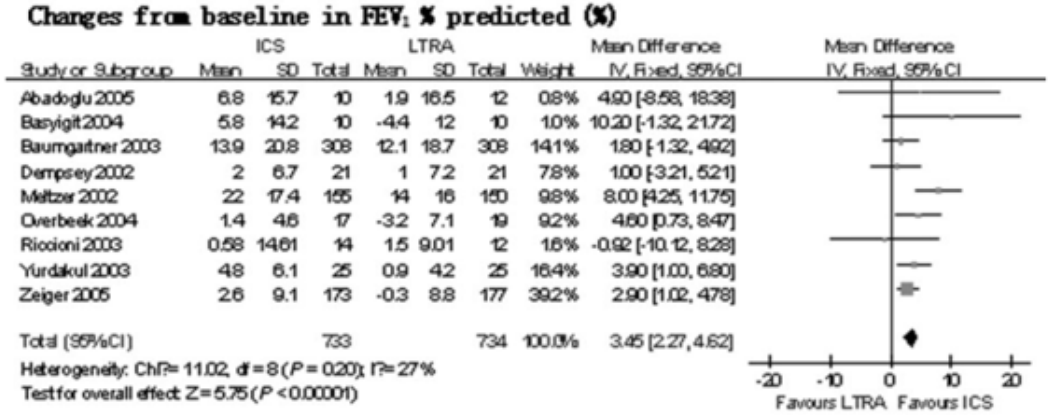


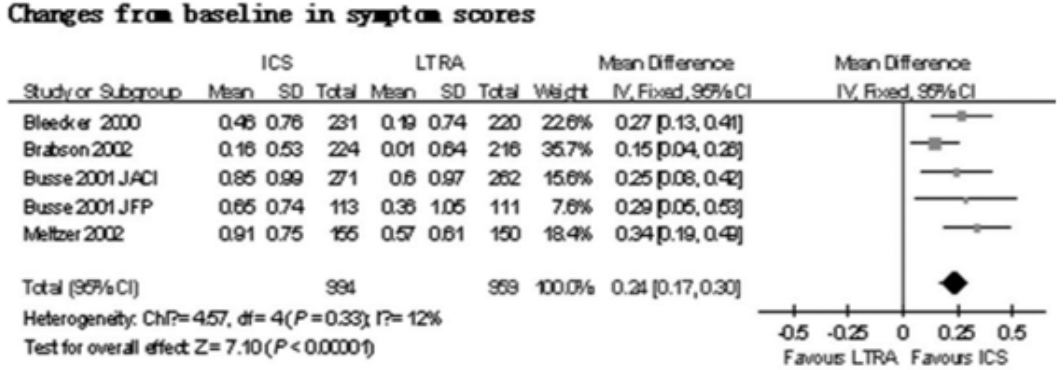
Sustained-release theophylline has only weak efficacy in asthma[192-194] (Evidence B) and side-effects are common, and may be life-threatening at higher doses.[195] Chromones (nedocromil sodium and sodium cromoglycate) have a favorable safety profile but low efficacy[196,197] (Evidence A), and their inhalers require burdensome daily washing to avoid blockage.

In adults, inhaled anticholinergic agents like ipratropium, oral SABA or short-acting theophylline are potential alternatives to SABA for relief of asthma symptoms; however, these agents have a slower onset of action than inhaled SABA (Evidence A), and oral SABA and theophylline have a higher risk of side-effects. No long-term safety studies have been performed to assess the risk of severe exacerbations with these reliever medications in patients not also taking ICS.

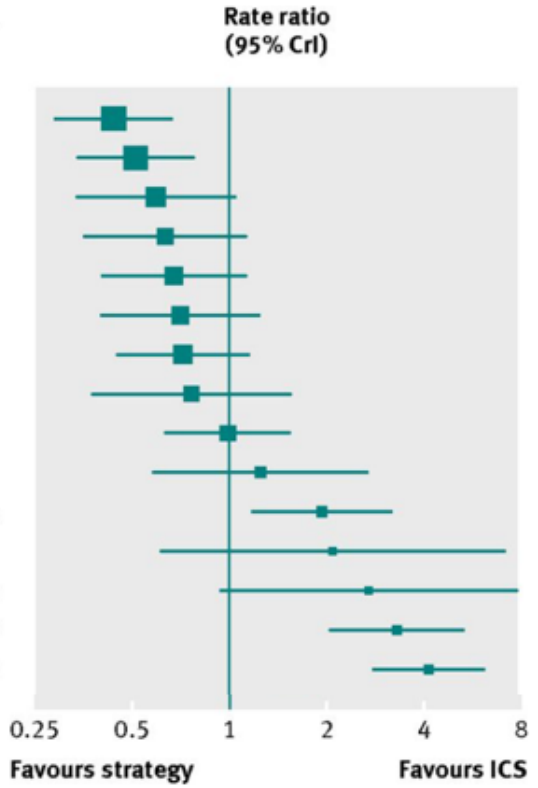
Non-pharmacologic strategies include smoking cessation, physical activity, pulmonary rehabilitation, weight reduction, vaccinations (see text for more)
Allergen immunotherapy, e.g. HDM SLIT: consider for patients with clinically relevant sensitization and not well-controlled (but stable) asthma See text for further information and safety advice
Additional controller options (e.g., add-on LAMA at Step 4, add-on LTRA) have less evidence for efficacy or for safety than Tracks 1 or 2 (see text). Maintenance OCS should only ever be used as last resort.

Leukotriene receptor antagonists (LTRAs): LTRAs, which include montelukast, zafirlukast and zileuton, are less effective than ICS,[361] particularly for exacerbations (Evidence A). Before prescribing montelukast, healthcare providers should consider its benefits and risks, and patients or parents/caregivers should be counselled about the risk of neuropsychiatric events.[309]



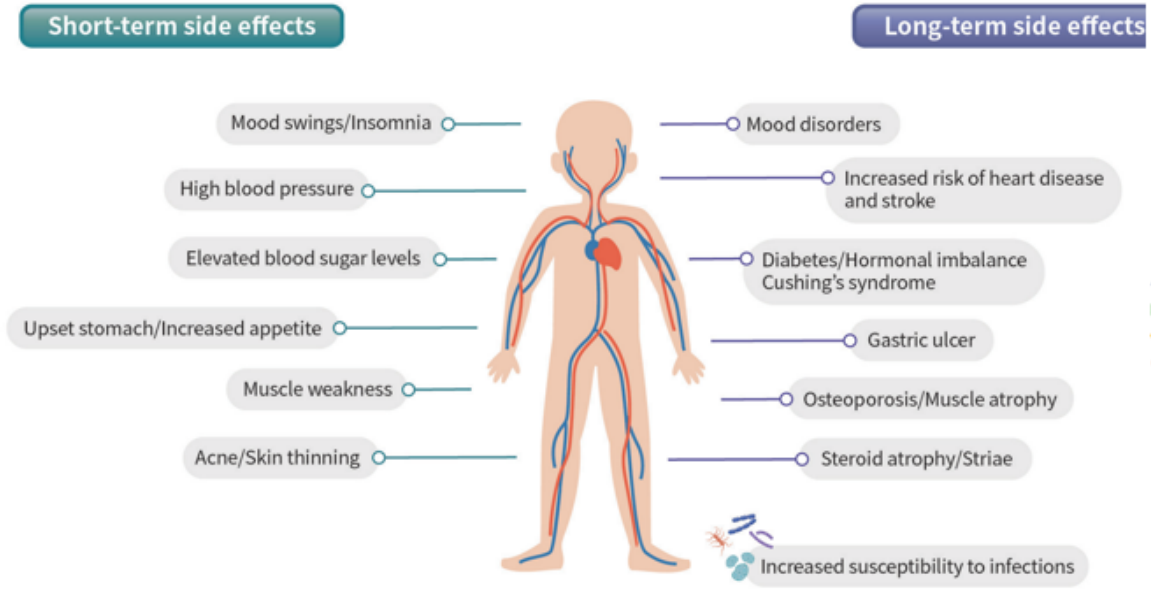


	Rate ratio (95% CrI)	Median rank (95% CrI)
Severe exacerbations		
COMBI MAR	0.44 (0.29 to 0.66)	1 (1 to 3)
COMBI FIX	0.51 (0.35 to 0.77)	2 (1 to 5)
Best Practice	0.60 (0.34 to 1.05)	4 (1 to 9)
COMBI AMD	0.64 (0.36 to 1.12)	5 (1 to 9)
ICS H + LABA	0.67 (0.41 to 1.11)	5 (2 to 9)
ICS + LABA	0.70 (0.40 to 1.22)	6 (1 to 10)
COMBI FIX H	0.72 (0.46 to 1.14)	6 (3 to 9)
ICS + LTRA	0.76 (0.38 to 1.51)	7 (1 to 12)
ICS H	0.99 (0.65 to 1.53)	10 (7 to 12)
ICS H + SABA	1.25 (0.58 to 2.66)	11 (5 to 14)
LTRA	1.95 (1.20 to 3.13)	12 (11 to 15)
ICS + SABA	2.08 (0.63 to 7.21)	13 (4 to 16)
SABA	2.73 (0.98 to 7.83)	14 (10 to 16)
LABA	3.32 (2.09 to 5.32)	15 (13 to 16)
Placebo	4.19 (2.87 to 6.16)	16 (13 to 16)

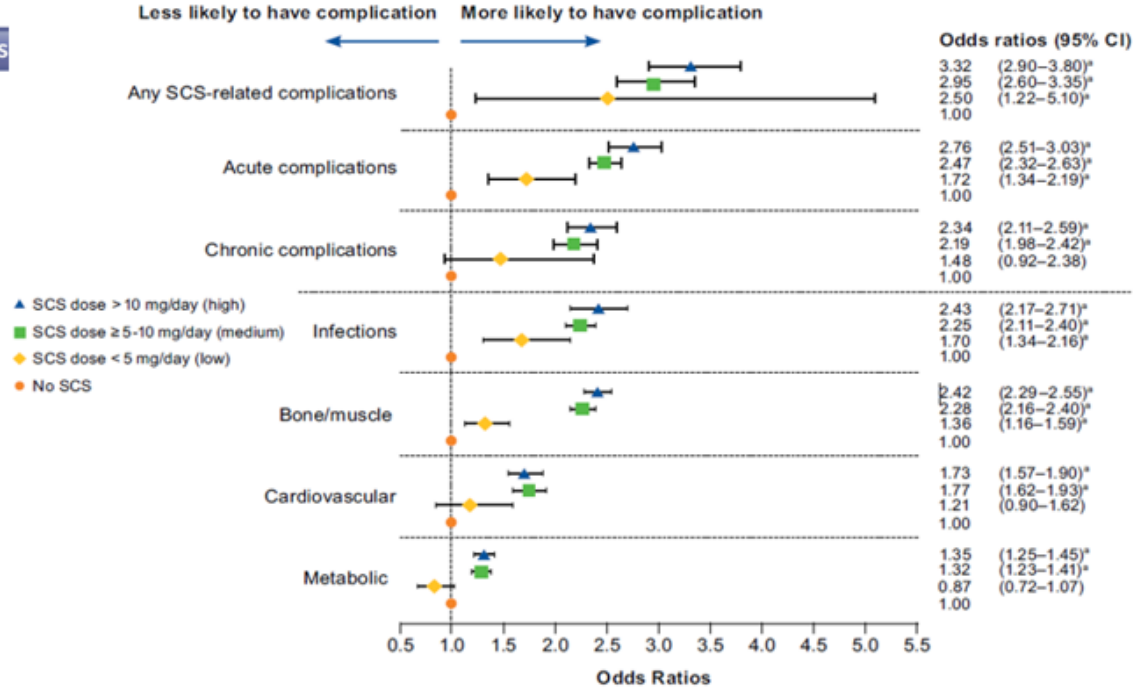


Oral corticosteroids

As a last resort, add-on low-dose OCS (≤7.5 mg/day prednisone equivalent) may be considered for some adults with severe asthma (Evidence D),[183] but maintenance OCS is associated with substantial cumulative side effects (Evidence A).[234,407-409] It should only be considered for adults with poor symptom control and/or frequent exacerbations despite good inhaler technique and adherence on Step 5 treatment, and after exclusion of other contributory factors and trial of other add-on treatments including biologics where available and affordable. Patients should be counseled about potential side-effects.[408,409] They should be assessed and monitored for risk of adrenal suppression and corticosteroid-induced osteoporosis, and those expected to be treated for ≥3 months should be provided with relevant lifestyle counseling and prescription of therapy for prevention of osteoporosis and fragility fractures (where appropriate).[410]



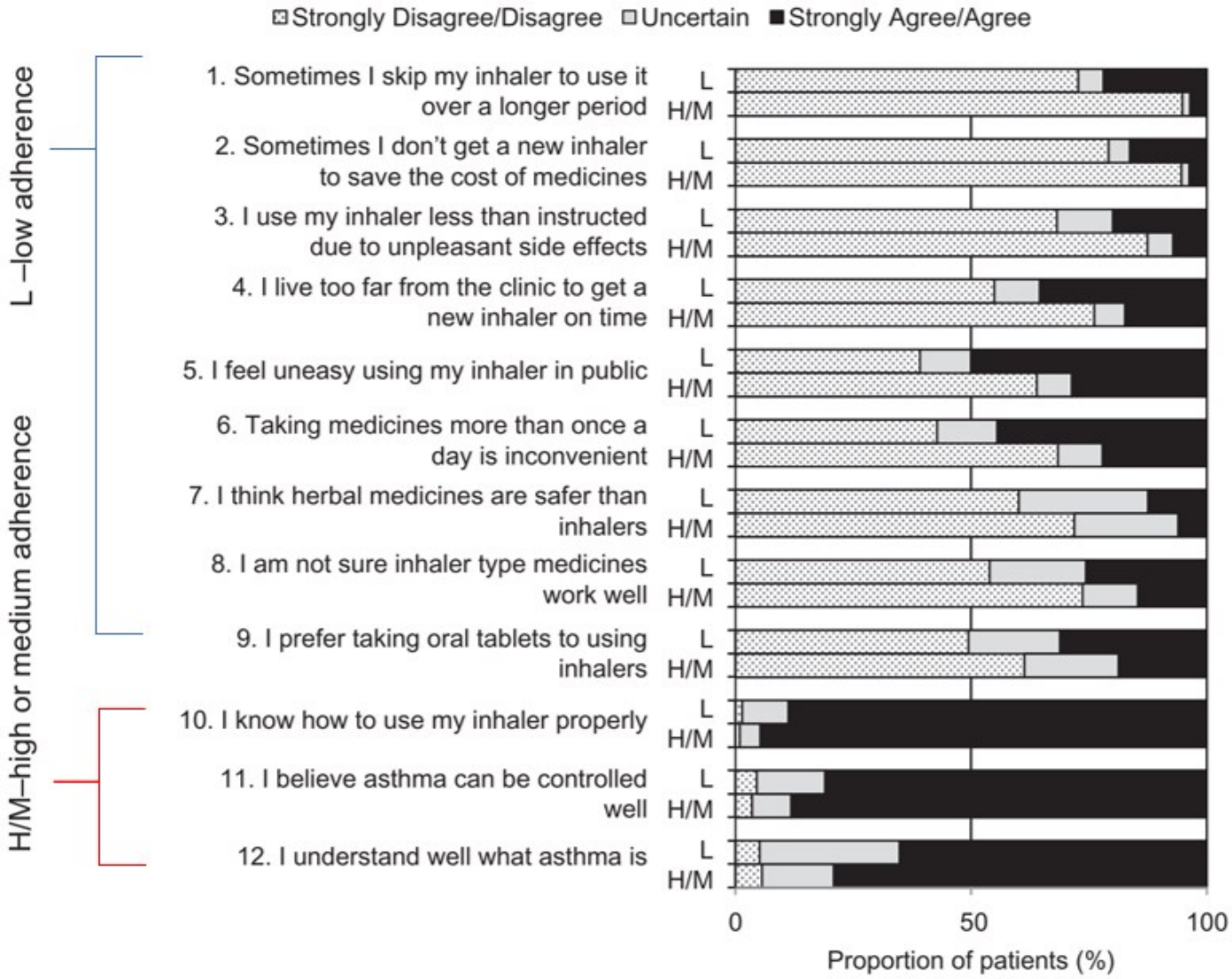
Real-world risk of systemic steroid-related complications



Barriers to ICS Use and Strategies to Overcome Them

Comparison of patients' perceptions among high or medium adherent patients and low adherent patients

Cross-sectional study (n=1,035)



Chiu *et al.* J Asthma 2014;51(6):652-9; Jo *et al.* J Korean Med Sci. 2020;35(12):e72.

Factors contributing to suboptimal adherence in asthma

의견 공유를 통한 결정
(Shared decision makin

	With adjustment[a]		
	OR	95% CI	*p*
BMQ-subscales			
General beliefs			
Overuse	0.42	0.22–0.80	<.01
Harm	0.43	0.21–0.88	.02
Specific beliefs			
Necessity	2.97	1.54–5.73	<.01

BMQ Beliefs about Medicines-Questionnaire, *MARS* Medication Adherence Report-Scale

Medication

처방형태, 사용횟수, 흡입기 사용법,
약물 효과와 부작용, 비용 등
약물과 관련된 이유

환자 선호도 파악

Unintentional

망각, 사용법의 이해 부족,
약물 사용이 어려운 상태

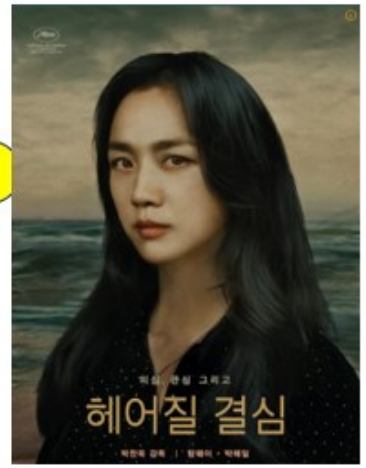
흡입기 사용법 교육
흡입기 사용이 어려운 경우 파악

Intentional

환자가 투약을 거부,
지시 받은 것과는 다른 방식으로 투약

천식은 관리가 필요한 만성질환
ICS는 꾸준히 유지

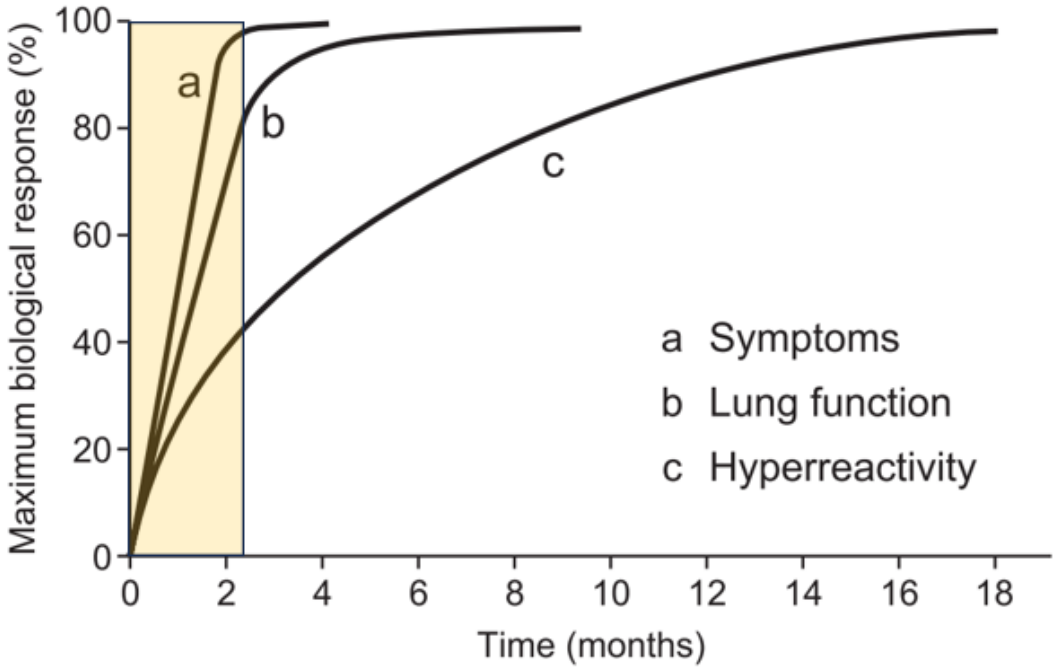
George *et al.* Patient Prefer Adherence 2019;13:1325-1334; Brandstetter *et al.* Clin Transl Allergy 2017;7:39.

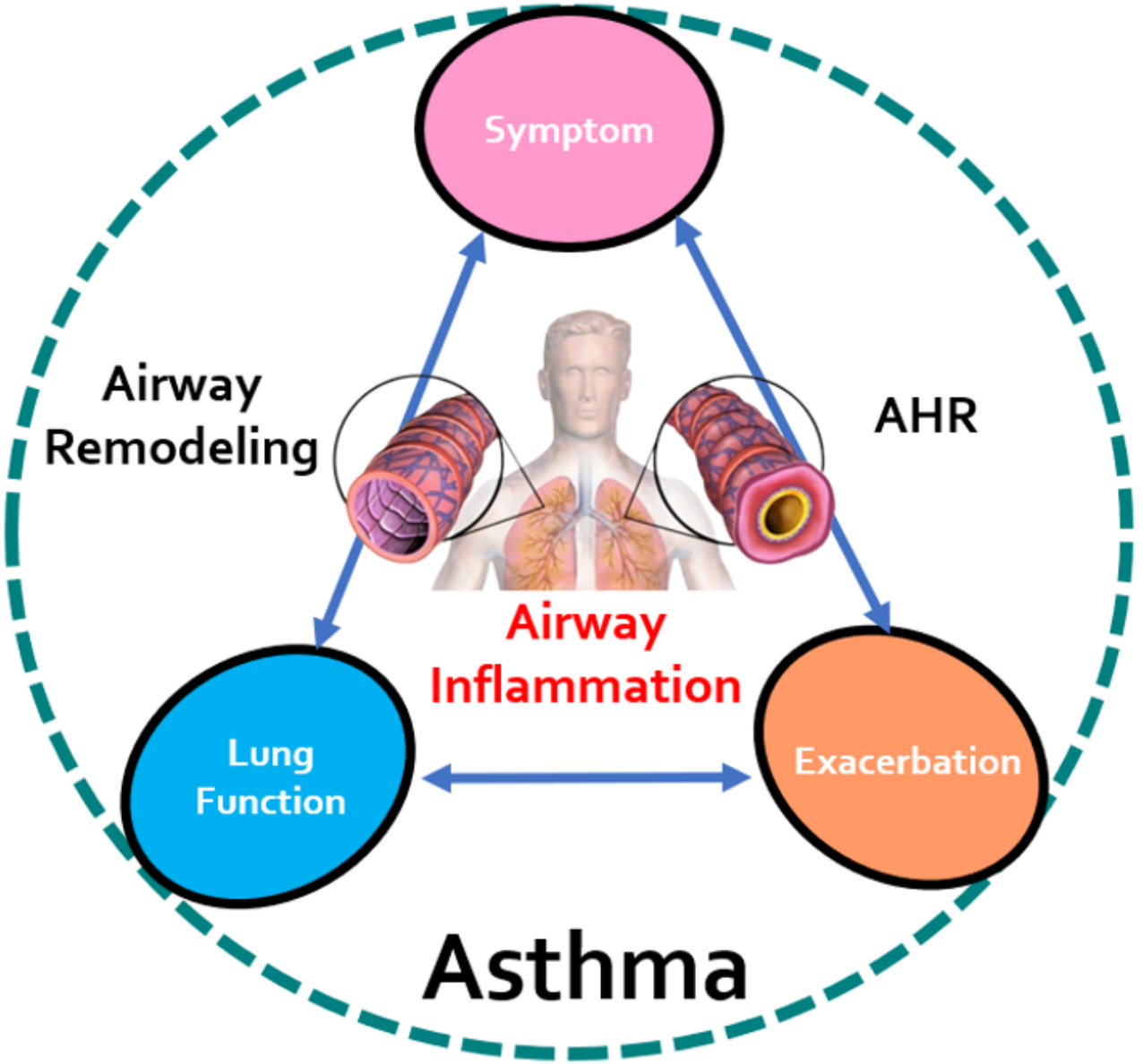


언제까지 흡입기를 써야 하나요?

환자가 천식이라면...
(가능한) 흡입기는 꾸준히 유지하십시오.

Graphic Summary





진단적 특징	천식 진단 기준
가변적인 호흡기 증상의 병력	
호흡곤란, 천명, 기침, 가슴답답함	• 일반적으로 한 가지 이상의 증상 • 시간에 따라 변동성을 보이며 다양한 강도로 나타남 • 밤이나 기상 직후 더 나빠지는 경우가 많음 • 운동, 웃음, 알레르겐, 찬 공기에 의해 나타나기도 함 • 바이러스 감염 시 나타나거나 더 악화 됨

호기 흐름의 가변성(폐기능의 변화) 확인

아래 항목 중 하나 이상 해당되면 진단 가능성이 높음

✅ **기관지 확장제 반응 검사 양성**

- 측정: 기관지 확장제 투여 후 10–15분 후 FEV_1 변화 확인
  - **성인**: FEV_1 증가 ≥12% & ≥200 mL 또는 PEF 증가 ≥20%
  - **소아**: FEV_1 증가 ≥12% (또는 PEF 증가 ≥15%)

✅ **ICS 치료 4주 후 폐기능 향상**

- **성인**: FEV_1 증가 ≥12% 및 ≥200 mL (또는 PEF ≥20%)
- **소아**: FEV_1 증가 ≥12% (또는 PEF ≥15%)

✅ **방문 간 폐기능의 과도한 변동**

- **성인**: FEV_1 변화 ≥12% 및 ≥200 mL (또는 PEF ≥20%)
- **소아**: FEV_1 변화 ≥12% (또는 PEF ≥15%)

✅ **기관지 유발검사 양성**

- 메타콜린, 운동, 고장성 식염수 등 사용
  - **성인**: FEV_1 ≥20% 감소
  - **소아**: FEV_1 ≥12% 감소 (또는 PEF ≥15%)

Type 2 biomarker 활용

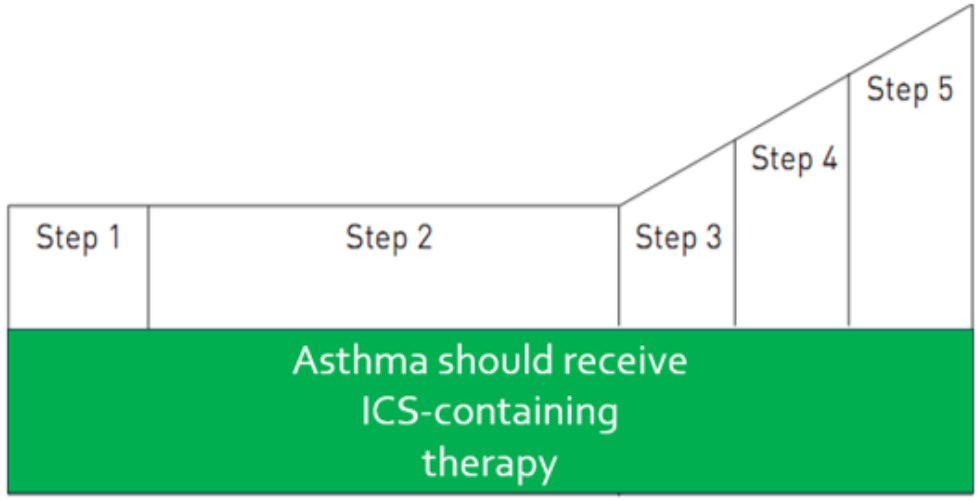
검사 불가능한 경우

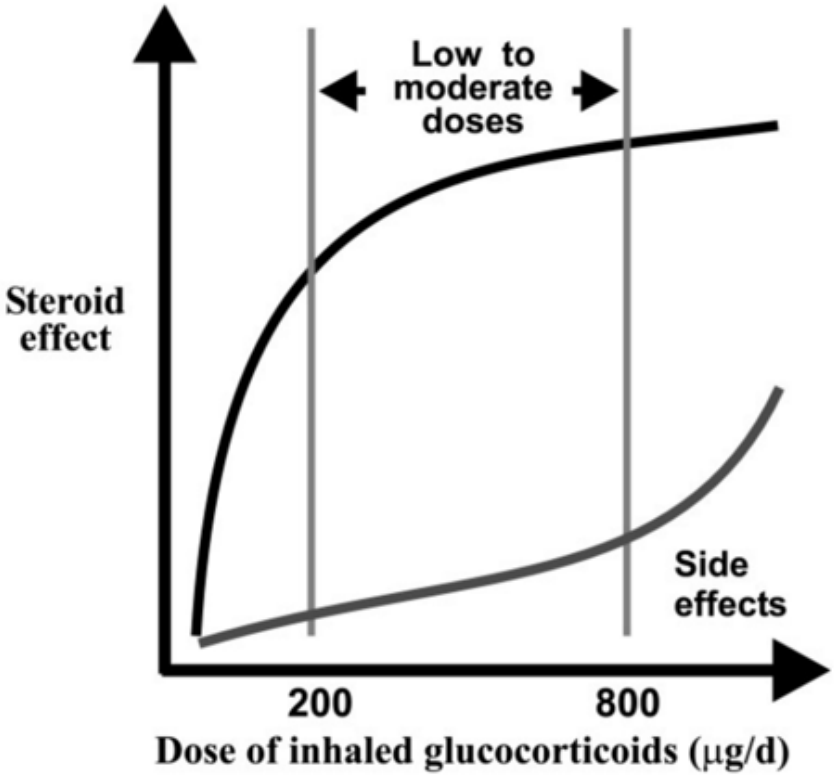
호기산화질소 수치 상승

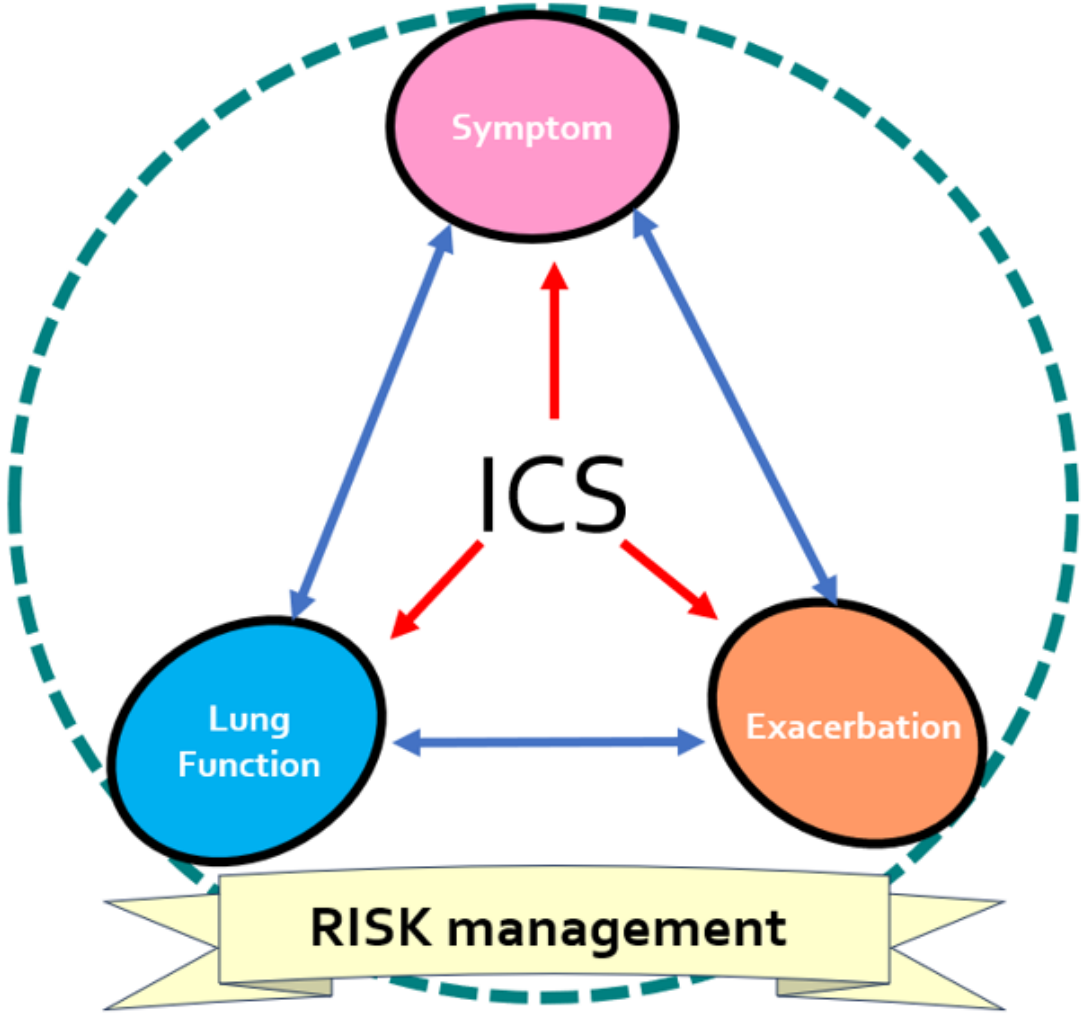
혹은 혈중 호산구 증가가

진단에 도움 (성인)

- **혈중 호산구 ≥ upper limit of normal**
- **호기산화질소**
  - **ICS-naïve: >50 ppb**
  - **Medium-dose ICS: ≥25 ppb**
  - **High-dose ICS: ≥20 ppb**







Shared Decision Making

- Insight & Preference
- Adherence & Monitoring

경청해 주셔서 감사합니다.