COVID-19 in Asthma

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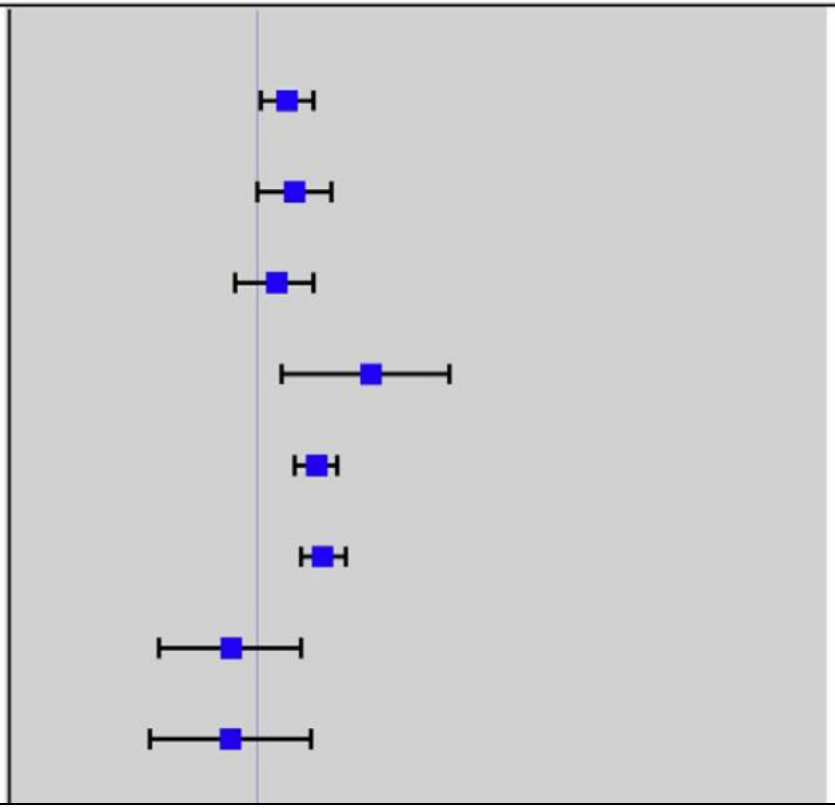
Susceptibility

Higher susceptibility in asthma

- 219,959 paients tested for SARS-CoV-2, Korean nationwide cohort, between Jan 2020 and May 2020, HIRA data

Outcome	Odd ratio (95% CI)	Total number	Odd ratio (95% CI)
Test positive			
Asthma		59,140	**1.08 (1.01 to 1.17)**
Current asthma		51,106	**1.10 (1.00 to 1.23)**
Allergic asthma		56,354	1.06 (0.97 to 1.17)
Non-allergic asthma		32,356	**1.34 (1.07 to 1.71)**
Allergic rhinitis		147,054	**1.18 (1.11 to 1.25)**
Current allergic rhinitis		153,838	**1.20 (1.13 to 1.28)**
Atopic dermatitis		16,872	0.93 (0.76 to 1.13)
Current atopic dermatitis		13,448	0.93 (0.74 to 1.16)



Yang JM, et al. J Allergy Clin Immunol 2020;146(4):790-798.

Lower susceptibility in asthma

- 37,469 subjects tested for COVID-19, from Israel (Positive:2266, 6.05%)

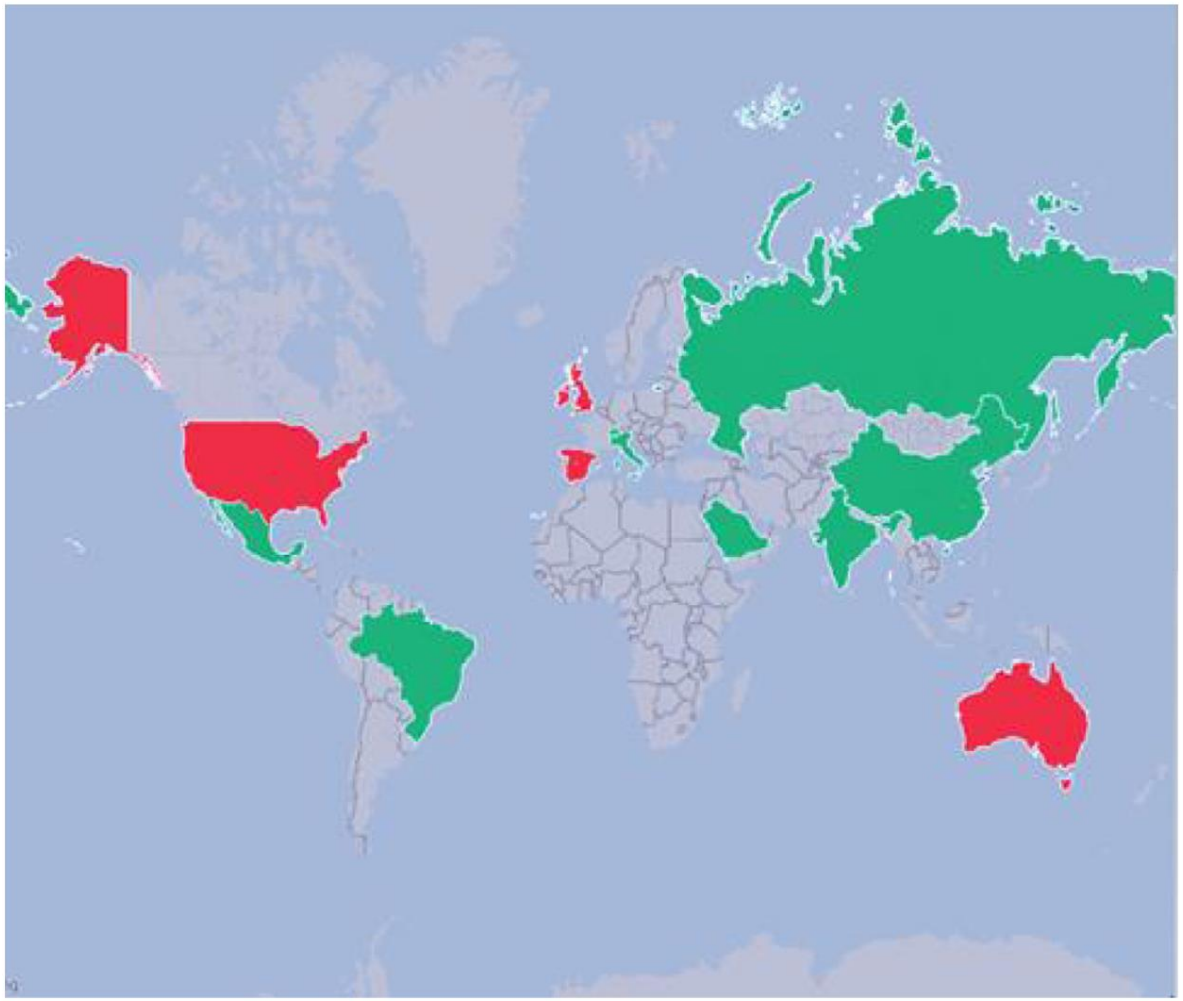
	COVID-19-positive diagnosis	
	aOR* (95% CI)	P-value
Male sex	1.26 (1.13-1.40)	<0.001
Age, years	0.99 (0.98-1.00)	0.042
Asthma	**0.73 (0.61-0.90)**	**0.003**
Current smoking	0.32 (0.23-0.39)	<0.001
Blood eosinophil (cells/$\mu\ell$)	0.94 (0.71-1.14)	0.38
Inhaled corticosteroid	0.85 (0.36-1.98)	0.71
Obesity	1.14 (1.02-1.29)	0.026

*Adjusted for age, sex, socioeconomic status, smoking and comorbidity

Green I, et al. J Allergy Clin Immunol Pract 2021;9:684-92.

Is asthma risk factor for SARS-CoV-2 infection?

- Variable prevalence of asthma from country to country

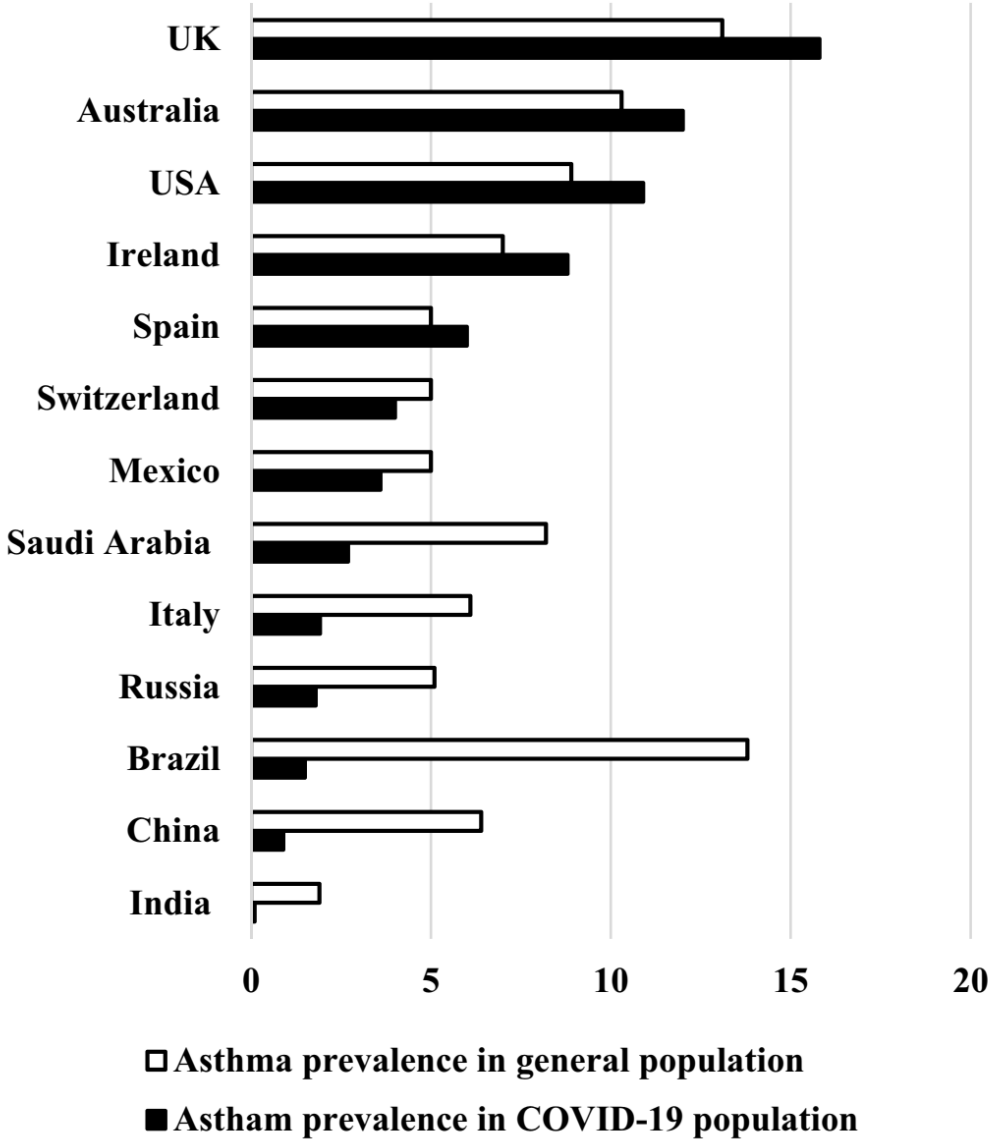


Asthma prevalence among COVID-19 vs. in the general population

- Low asthma-COVID-19 zone
- High asthma-COVID-19 zone

Skevaki C, et al. J Allergy Clin Immunol 2020;146:1295-301.

Is asthma risk factor for SARS-CoV-2 infection?



- Reasons for differences in epidemiology
  - ✓ Method of asthma diagnosis
  - ✓ Vulnerability to SARS-CoV-2 infection in different races or ethnic groups
  - ✓ Asthma prevalence according to countries

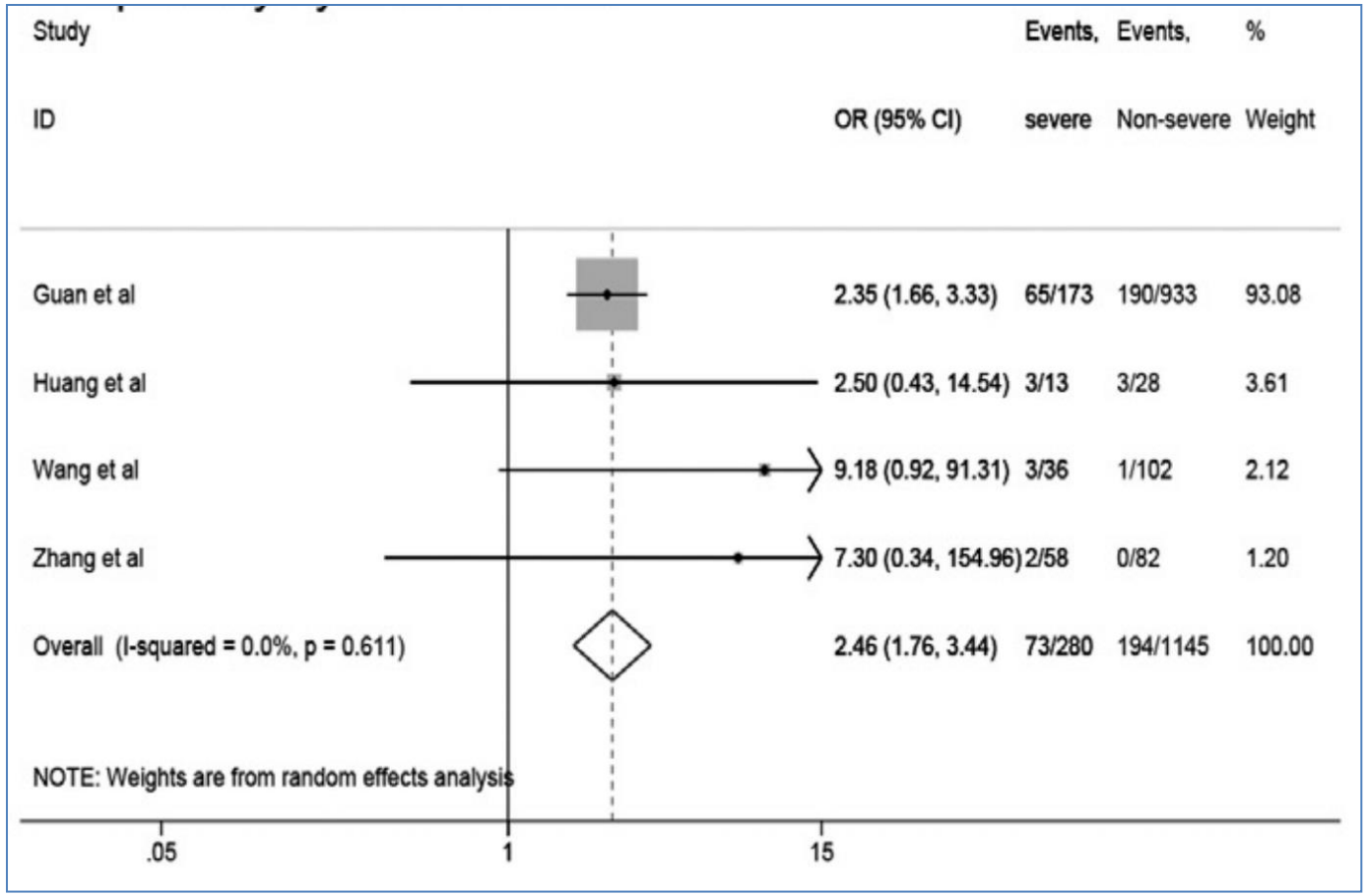
The current evidence supports that asthma does not increase the risk of SARS-CoV-2 infection.

Skevaki C, et al. J Allergy Clin Immunol 2020;146:1295-301.

Severe COVID-19 infection

Respiratory disease and severe COVID-19 infection

- Meta-analysis with 7 studies, 1576 COVID-19 infected patients
- Prevalence of repiratory disease: 1.5%



✓ Risk of severe COVID-19 infection

Respiratory disease
OR 2.36, 95% CI 1.76-3.44

Yang J, et al. Int J infect Dis 2020;94:91-95.

Risk for severe COVID-19 disease

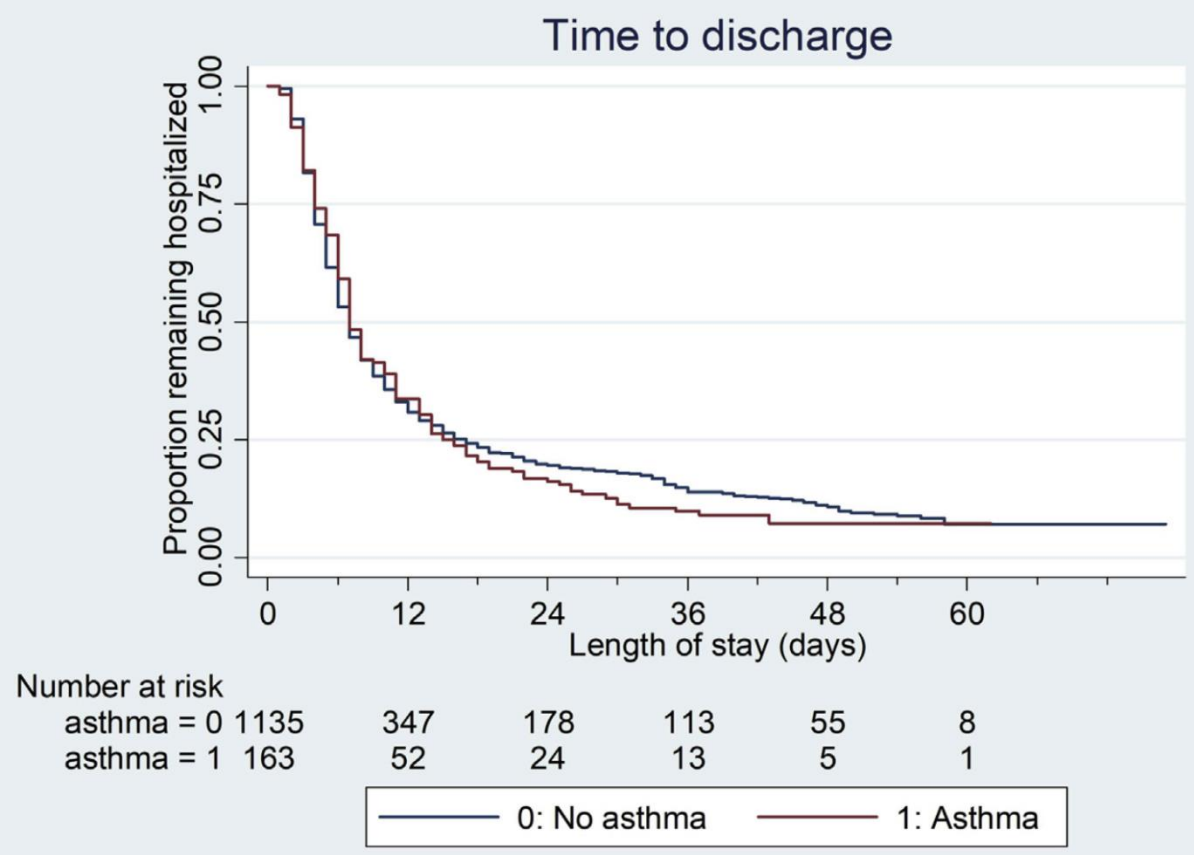
- 1,298 patients hospitalized with COVID-19, age ≤ 65years
- Overall prevalence of asthma: 12.6% (23.5% in age <21yrs)

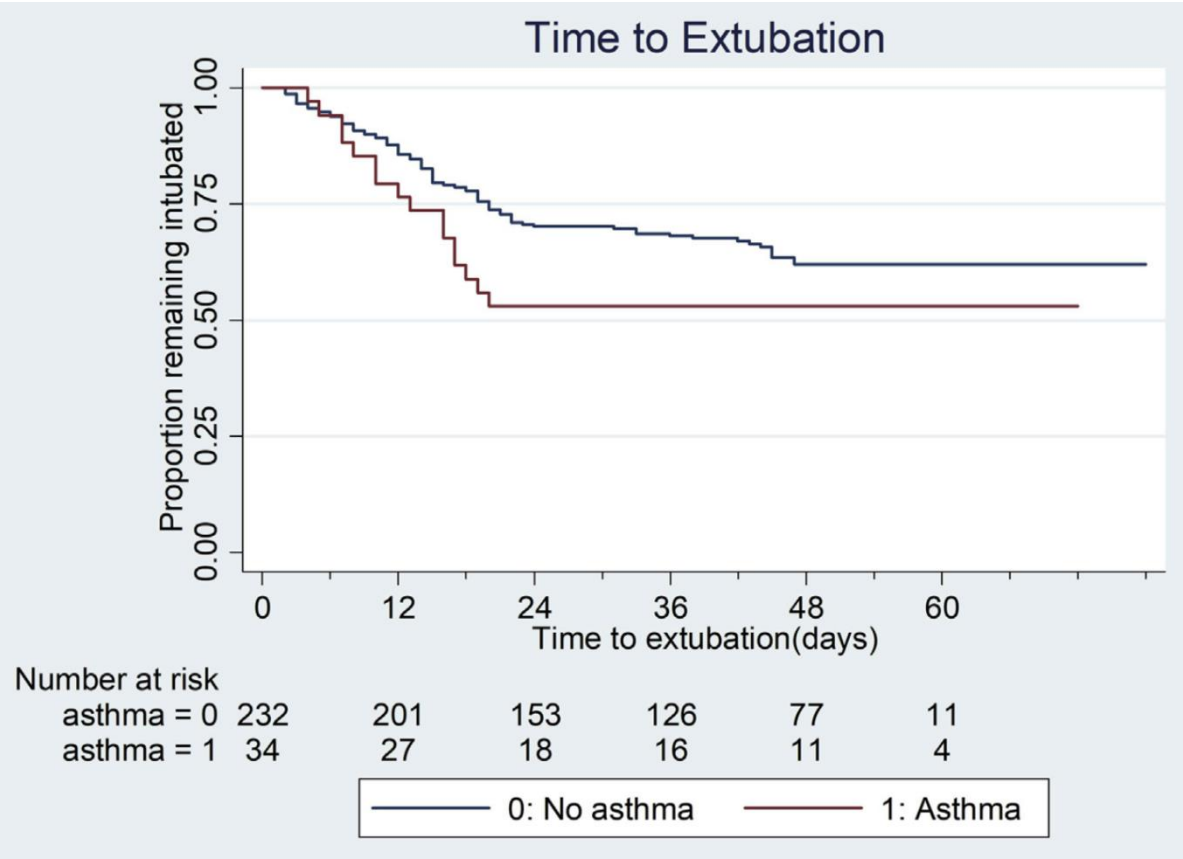
	No asthma (n=1135)	Asthma (n=163)	P-value
Length-of-stay, median (IQR)	5 (7)	6 (9)	0.25
Readmission	55 (5%)	9 (5%)	0.70
Intubation	231 (20%)	34 (21%)	0.92
Tracheostomy	71 (6%)	10 (6%)	1.00
Death	101 (9%)	9 (6%)	0.18

Lovinsky-Desir S, et al. J Allergy Clin Immunol 2020;16(5):1027-1034.

Risk for severe COVID-19 disease

- 1,298 patients hospitalized with COVID-19, age ≤ 65years
- Overall prevalence of asthma: 12.6% (23.5% in age <21yrs)





Lovinsky-Desir S, et al. J Allergy Clin Immunol 2020;16(5):1027-1034.

Asthma and COVID-19 outcome

- 150 studies conducted worldwide to to assess whether asthma increases the risk of morbidity and severity of COVID-19

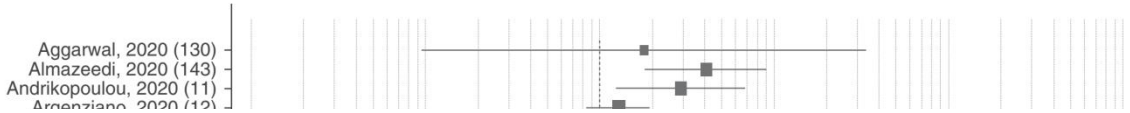
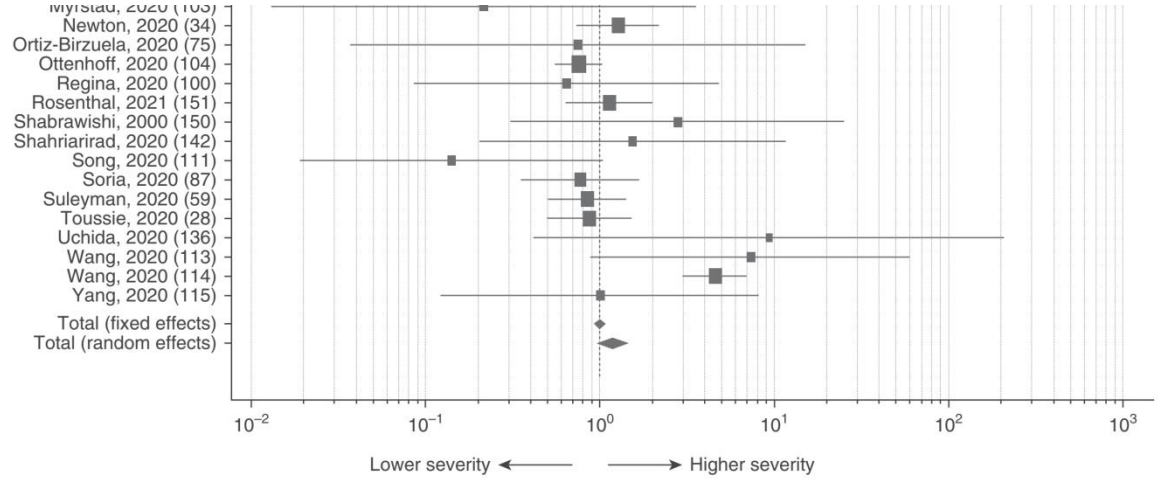


Table 1. Summary of Asthma Prevalence Data by Measures of COVID-19 Severity

	Hospital Admission*		COVID-19 Severity†		COVID-19 Survival‡	
	Hospitalized	Not Hospitalized	Severe	Not Severe	Died	Survived
Asthma prevalence, %	10.0 (8.0–12.2)	9.5 (8.0–11.0)	9.9 (7.8–12.3)	8.2 (7.0–10.0)	7.1 (5.6–8.8)	8.6 (7.0–10.3)
Pooled prevalence ratio	1.06 (0.94–1.19); $P = 0.37$		1.18 (0.98–1.42); $P = 0.07$		0.89 (0.77–1.02); $P = 0.09$	



Terry PD, et al. Am J Respir Crit Med 2021;203(7):893-905.

Asthma and COVID-19 outcome

- 410,382 patients with COVID-19 in 159 studies, meta-analysis
- Prevalence of astham in different countries or regions: 1.1%~16.9%

Prevalence of comorbid asthma in patients with COVID-19	Risk ratio (95% CI)
Hospitalization	1.15 (0.92-1.43)
Severe COVID-19 disease	1.21 (0.92-1.57)
ICU admission	1.19 (0.92-1.54)
Intubation/ MV support	0.91 (0.71-1.17)
Death	0.90 (0.73-1.17)

Liu S, et al. J Allergy Clin Immunol Pract 2021;9:693-701.

COVID-19 severity according to control status

- School-aged children (5-17 yrs), Scotland, EAVE II study

	Children aged 5-17 yrs with COVID-19 hospital admission	aHR (95% CI) for children aged 5-17 yrs	aHR (95% CI) for children aged 5-17 yrs	aHR (95% CI) for children aged 12-17 yrs
Using **previous hospital admission for asthma** as marker of uncontrolled asthma				
No asthma	382	1 (ref)	1 (ref)	1 (ref)
Asthma without previous hospital admission	58	1.36 (1.02-1.80)	2.05 (1.35-3.12)	1.06 (0.73-1.54)
Asthma with previous hospital admission	9	6.40 (3.27-12.53)	3.78 (1.20-11.93)	10.04 (4.39-22.97)
Using **previous prescribed oral corticosteroids** as marker of uncontrolled asthma				
No asthma	366	1 (ref)	1 (ref)	1 (ref)
Asthma with 0 course of OCS	47	1.34 (0.98-1.82)	2.18 (1.36-3.50)	1·03 (0.68-1.55)
Asthma with 1 course of OCS	15	1.52 (0.90-2.57)	1.30 (0.61-2.79)	1·79 (0.88-3.67)
Asthma with 2 courses of OCS	10	3.53 (1·87-6.67)	3.21 (1.31-7.87)	3·96 (1.61-9.73)
Asthma with ≥3 courses of OCS	11	3.38 (1.84-6.21)	4.81 (2.33-9.92)	1·92 (0.60-6.10)

Shi T, et al. Lancet Respir Med 2022;10:191-98.

Severe asthma and COVID-19 outcome

- 7590 COVID-19 patients (218, 2.9% asthma), HIRA data

Significant factors affecting the admission duration (days)

	aOR (95% CI)	P-value
Among all COVID-19 patients		
Asthma	0.656 (0.295-1.460)	0.685
Among asthma patients		
Severity of asthma (reference step 1)		
Step 2	4.565 (-1.127-10.258)	0.115
Step 3	2.739 (-3.998-9.475)	0.424
Step 4	0.976 (-3.802-5.753)	0.688
Step 5	18.414 (4.031-32.796)	0.012

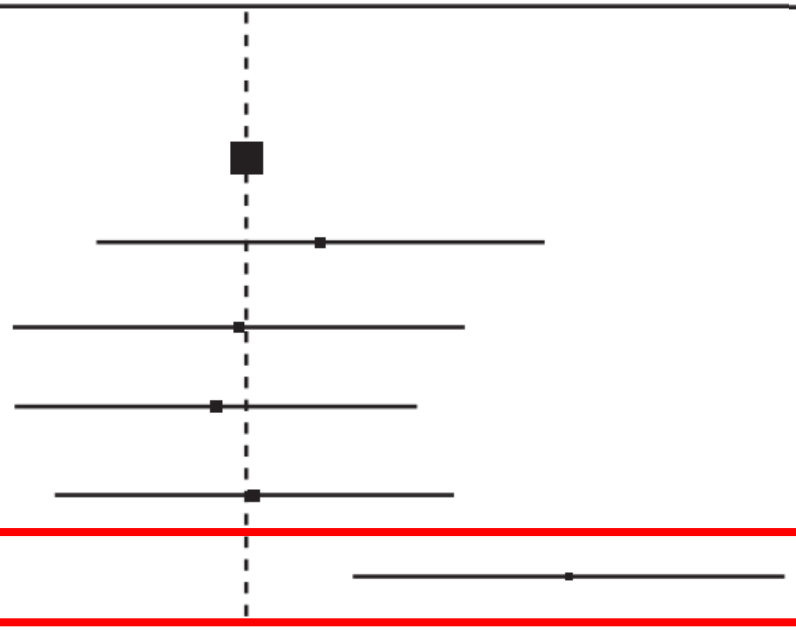
Choi YJ, et al. Eur Repir J 2021;57:200226.

Severe asthma and COVID-19 outcome

- 75,463 patients hospitalized with COVID-19, from ISARIC WHO Clinilcal Characterisation Protocol UK study

Asthma and death from COVID-19 (age 16-49 yrs)

	Hazard ratio (95% CI)	p value
Asthma and therapy		
No asthma	Ref	..
No asthma therapy	1·17 (0·73–1·86)	0·511
SABA	0·99 (0·61–1·58)	0·950
ICS only	0·94 (0·62–1·43)	0·768
LABA plus ICS	1·02 (0·67–1·54)	0·934
Most severe asthma	1·96 (1·25–3·08)	0·0037

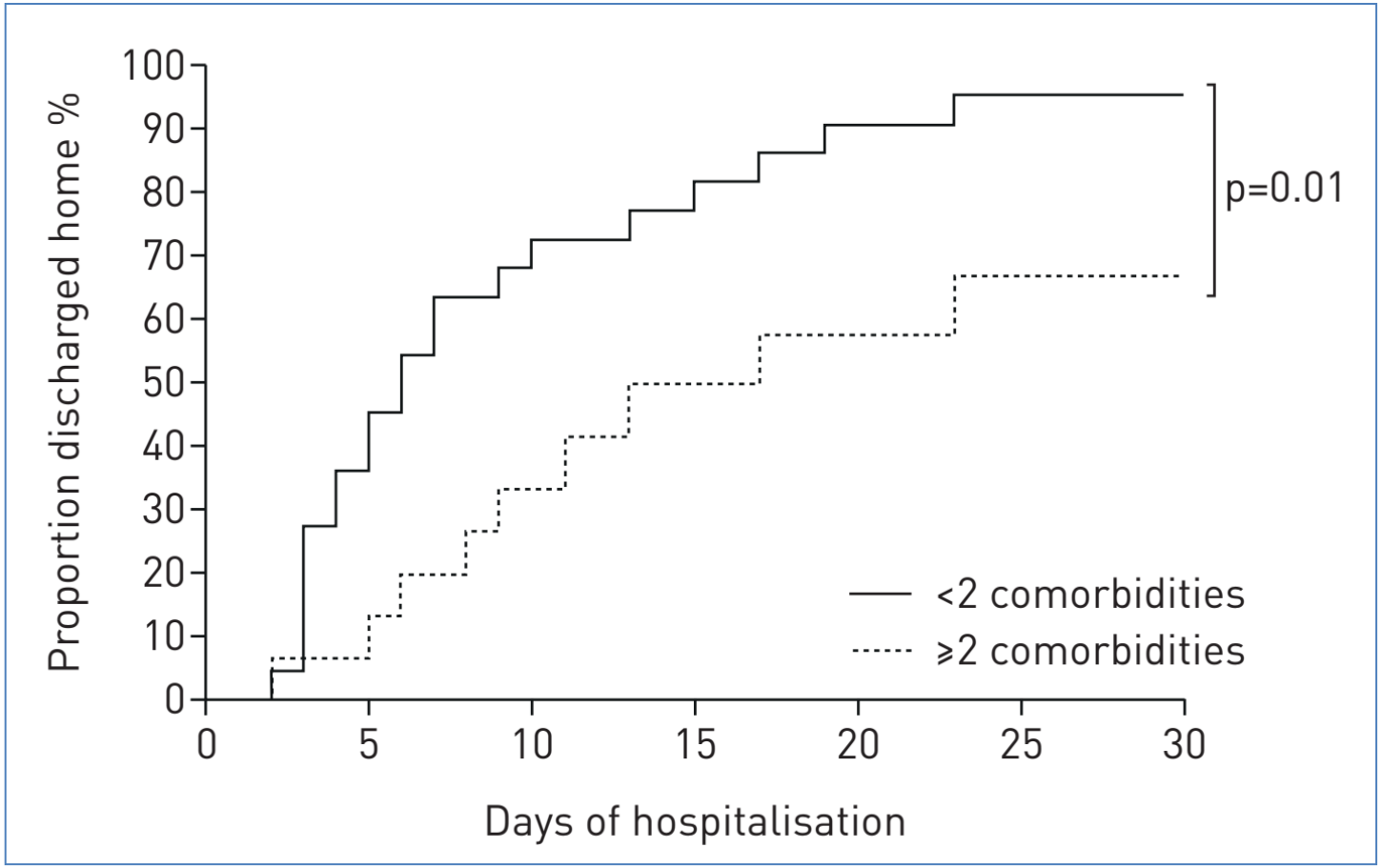


Bloom CI, et al. Lancet Respir Med 2021;9:699-711.

Comorbidity and COVID-19 outcome

- 768 hospitalized COVID-19 patients, 4.8 % of asthma prevalence, France

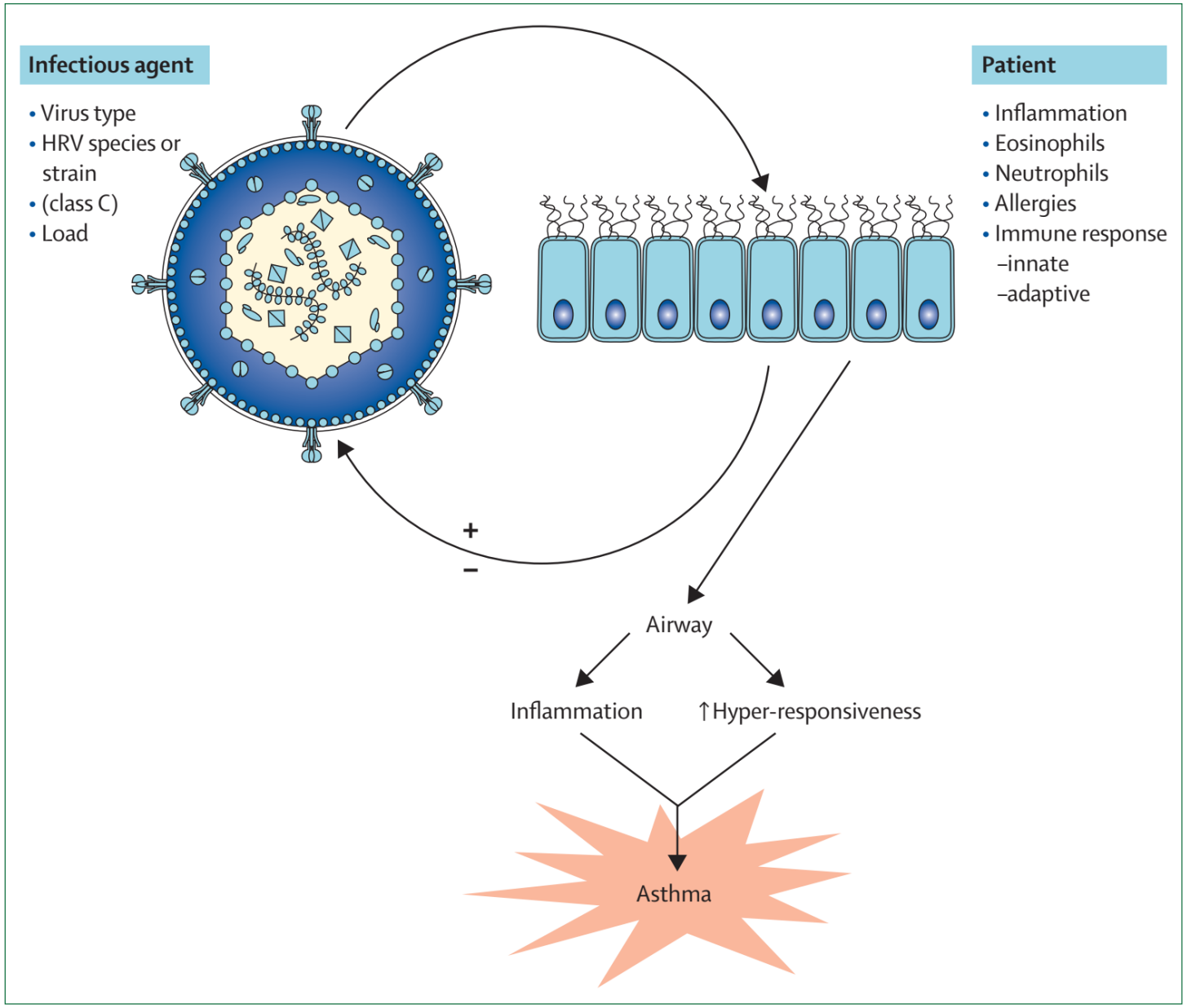
Proportion of asthma patients discharged home over the first 30 days of hospitalization according to the number of comorbidities



Beurnier A, et al. Eur Respir J 2020;56(5):2001875.

Asthma exacerbation

Role of viral infecitons in asthma exacerbation



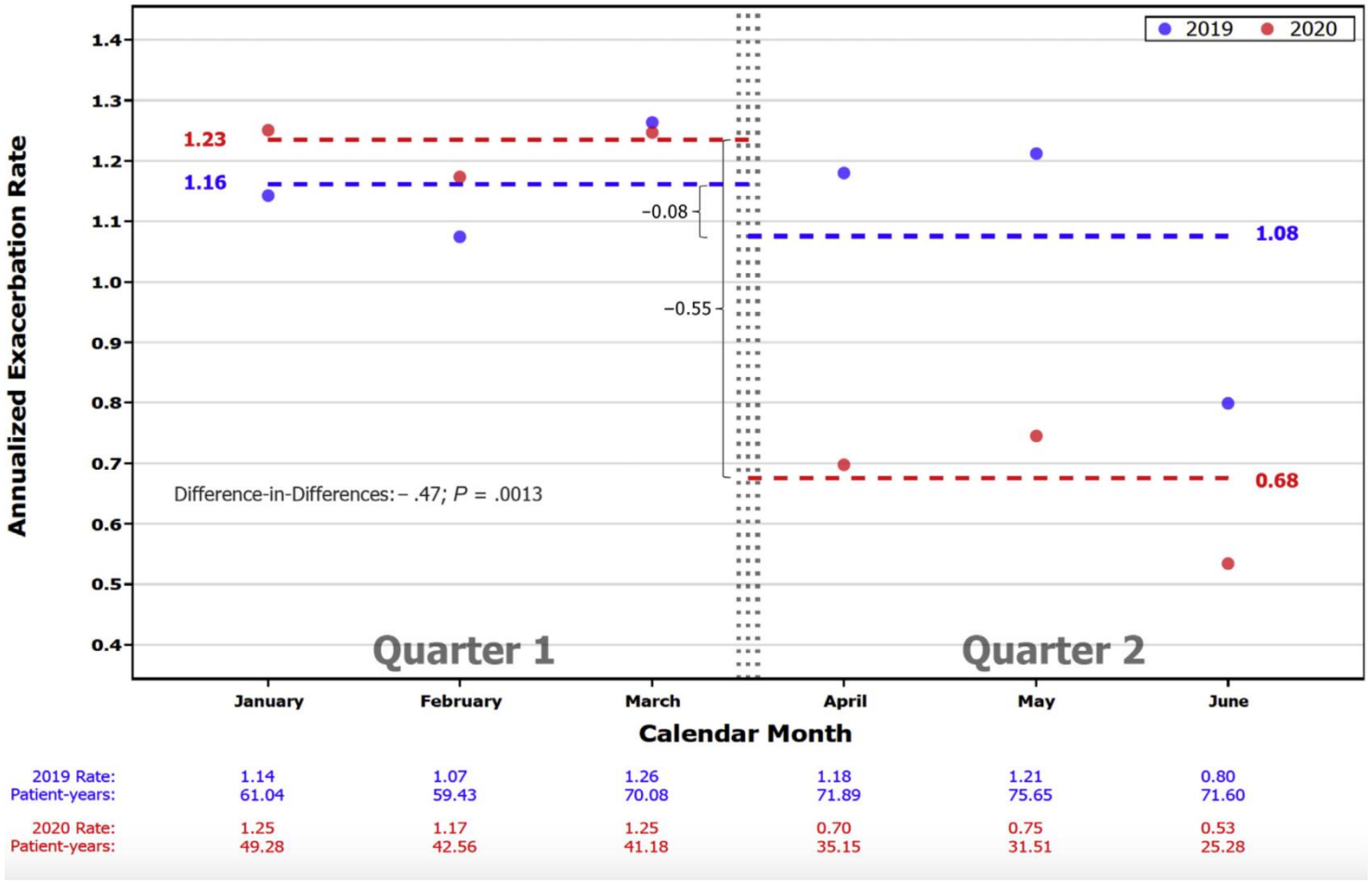
- The interaction between the infectious agent and patient

→ determinants of the outcome of infection

Busse WW, et al. Lanet 2010;376:826-34.

Exacerbation before and during COVID-19 era

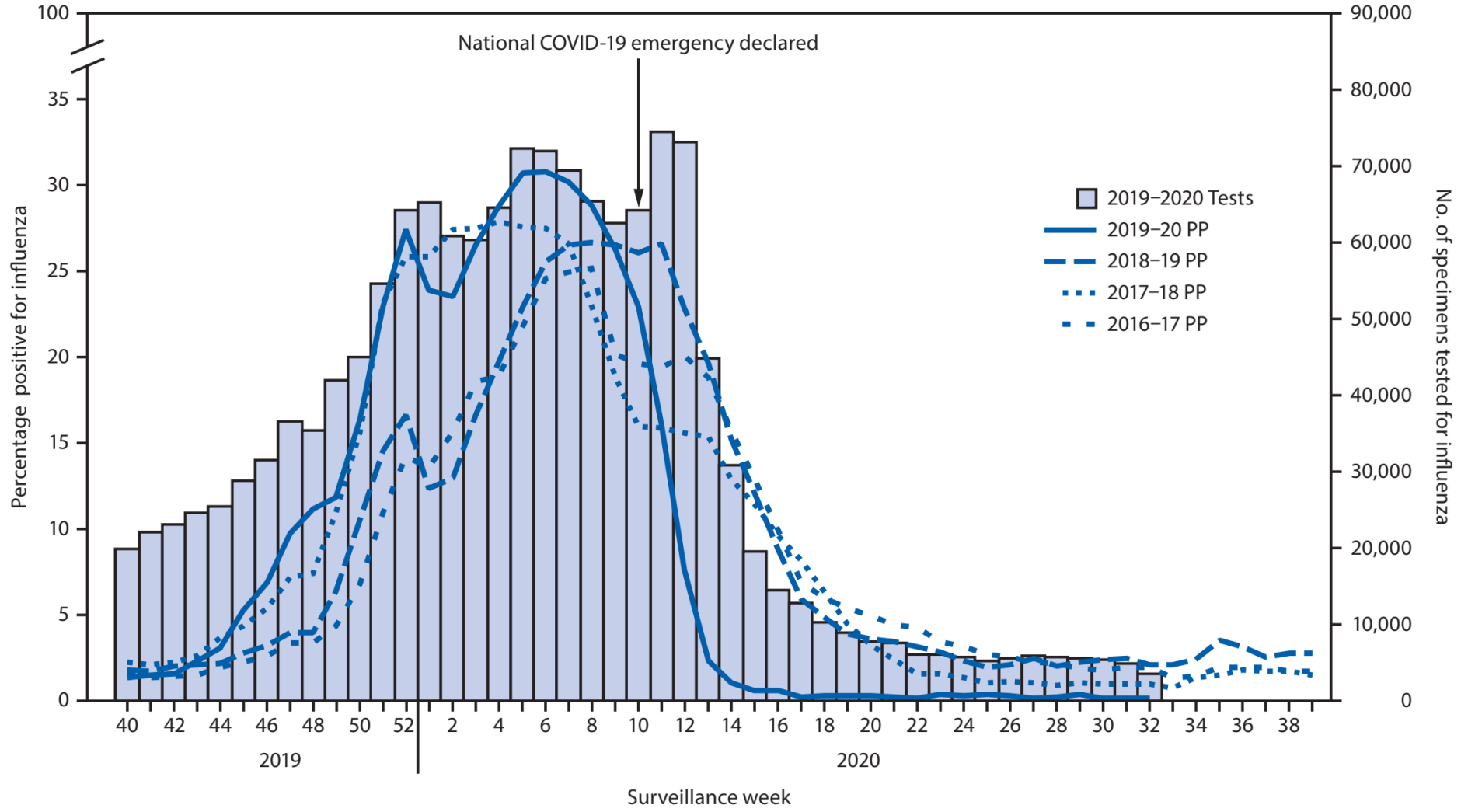
- 1,178 African American/black and Hispanic/Latinx adults with moderate-to-severe asthma



Salciccioli JD, et al. J Allergy Clin Immunol Pract 2021;9(7): 2896-2899.

Influenza activity during COVID-19 pandemic

FIGURE 1. Number of respiratory specimens tested and percentage testing positive for influenza, by year — United States, 2016–17 through 2019–20 seasons



Olsen SJ, et al. MMWR Morb Mortal Wkly Rep. 2020;69(37):1305-1309.

Phenotype issue

COVID-19 severity according to asthma phenotype

- 219,959 paients tested for SARS-CoV-2, Korean nationwide cohort, between Jan 2020 and May 2020, HIRA data

Exposure	Event	Event number/total number (%)	Fully adjusted OR* (95% CI)
Patients who tested positive for SARS-CoV-2			
None	Severe clinical outcomes of COVID-19	24/537 (4.5)	Reference
Allergic asthma		30/493 (6.1)	1.40 (0.83 to 2.41)
Nonallergic asthma		7/44 (15.9)	**4.09 (1.69 to 10.52)**

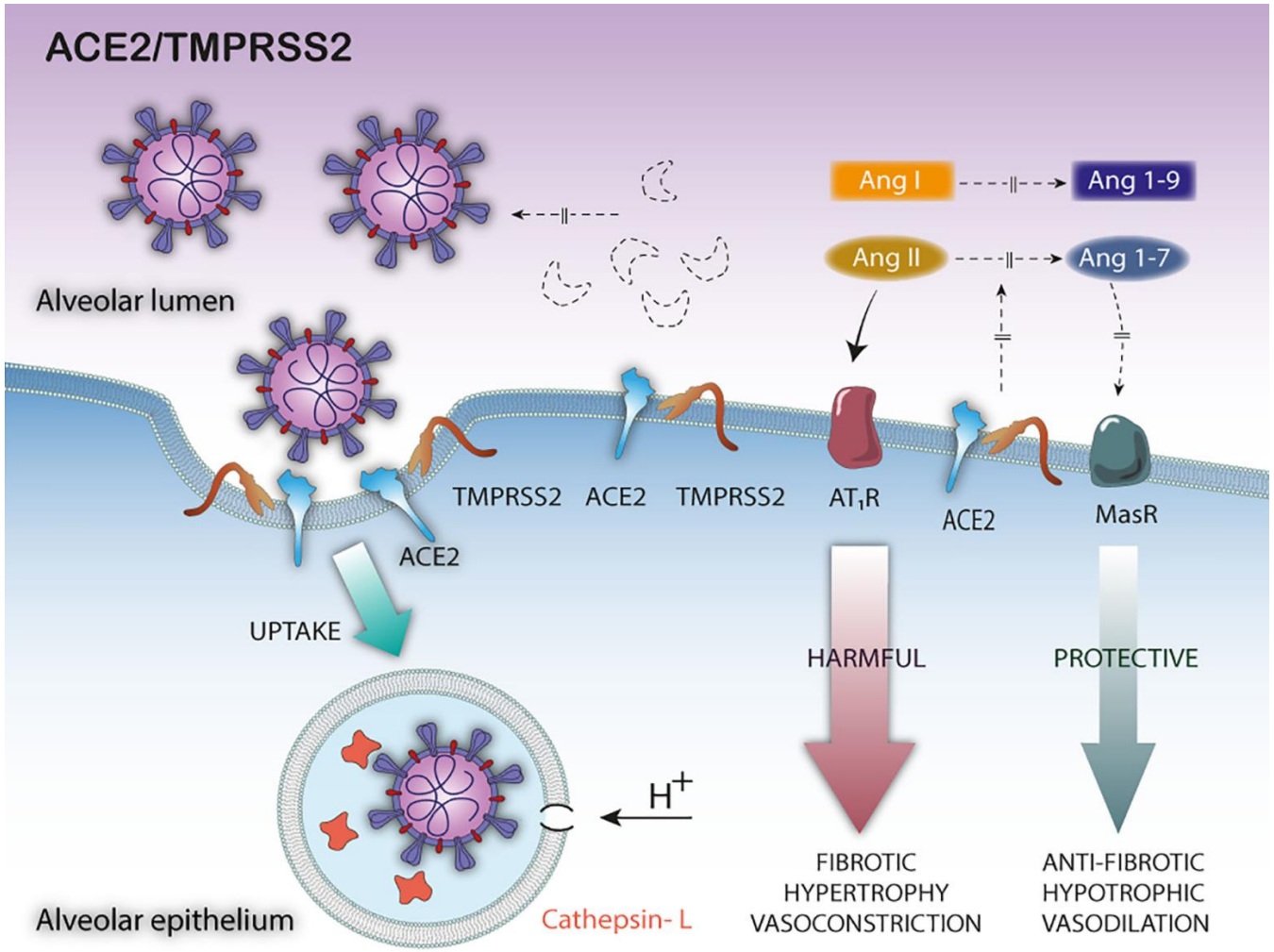
Exposure	Event	Duration (d), crude mean ± SD	Adjusted mean difference* (95% CI)
Patients who tested positive for SARS-CoV-2			
None	Length of stay for patients in hospital	22.1 ± 14.1	Reference
Allergic asthma		24.1 ± 16.5	0.60 (−1.79 to 0.58)
Nonallergic asthma		29.3 ± 21.4	**3.91 (0.40 to 7.42)**

Numbers in boldface indicate significant differences ($P < .05$).

*Fully adjusted: adjustment for age, sex, region of residence, history of diabetes mellitus, cardiovascular disease, cerebrovascular disease, COPD, hypertension, chronic kidney disease, Charlson comorbidity index, use of immunosuppressants, use of systemic glucocorticoids, allergic rhinitis, and atopic dermatitis.

Yang JM, et al. J Allergy Clin Immunol 2020;146(4):790-798.

Role of ACE2/TMPRSS2 in SARS-CoV-2 infection



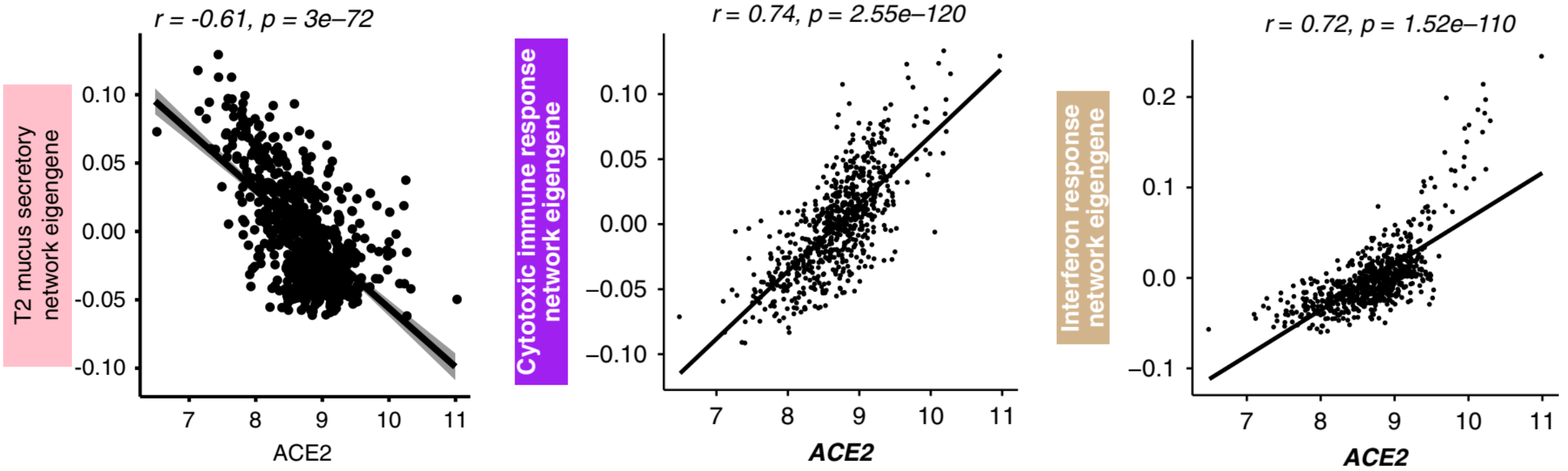
- Entry of SARS-CoV-2 is mediated by fusion of the viral spike protein and cellular membranes through interaction with cell surface angiotensin-converting enzyme 2 (ACE2)

- Transmembrane protease serine subtype 2 (TMPRSS2)-mediated ACE2 cleavage promotes viral uptake through the cathepsin L-dependent pathway

Zipeto D, et al. Front Immunol 2020;11:576745.

Inflammation type and ACE2 expression

- Analysis of nasal airway transcriptome data from 695 children
- Type 2 and interferon inflammation regulate SARS-CoV-2 entry factor expression in the airway epithelium

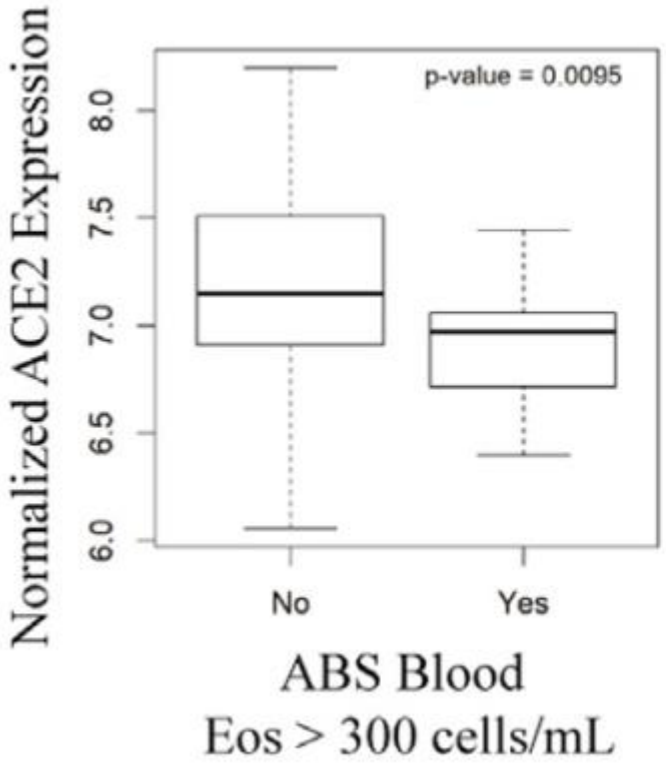


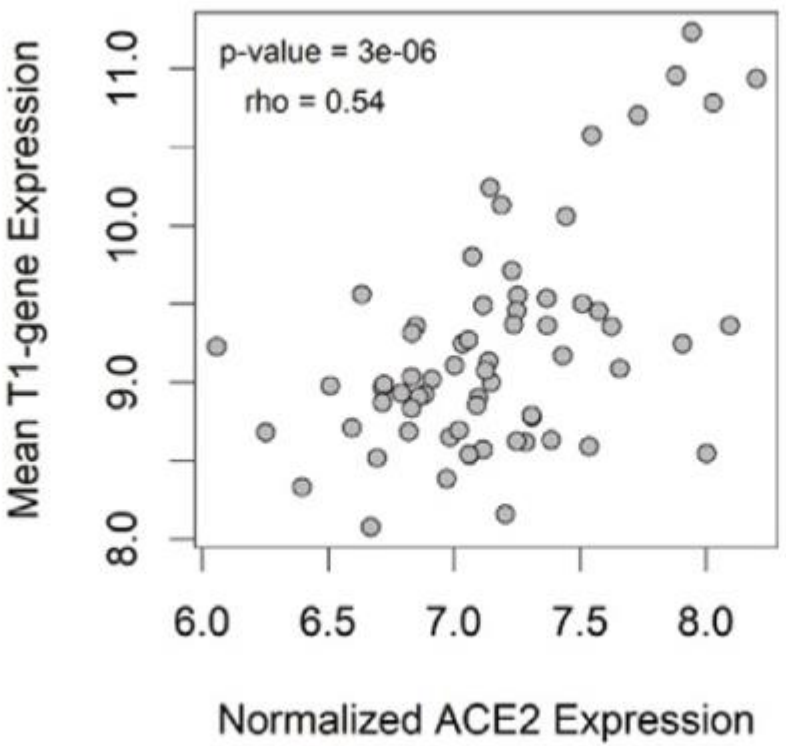
Sajuthi SP, et al. Nat Commun 2020;11(1):5139

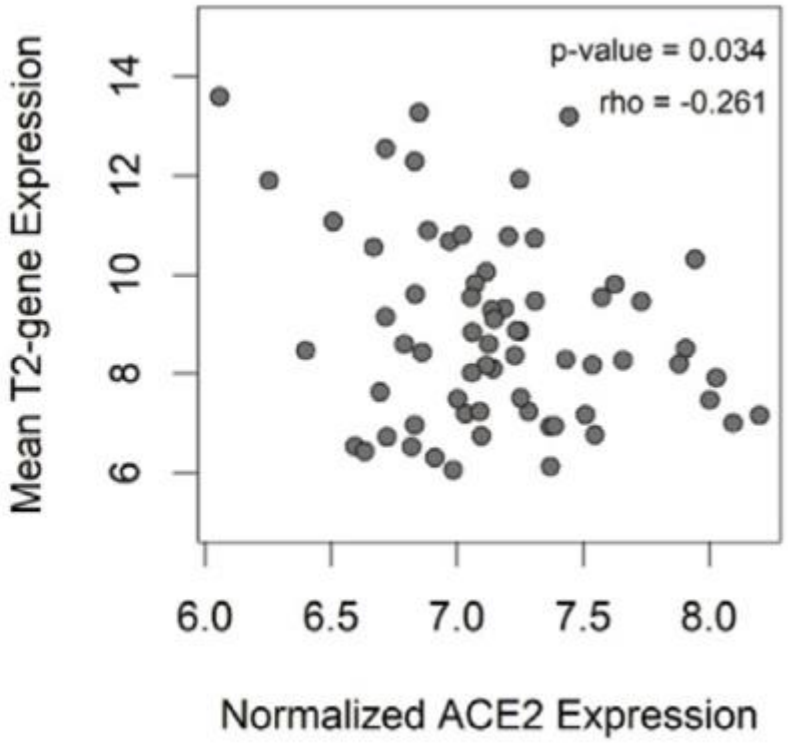
ACE2 expression according to phenotype

- Patients from 2 large asthma cohort, blood/BAL samples

ACE2 expression within blood sample





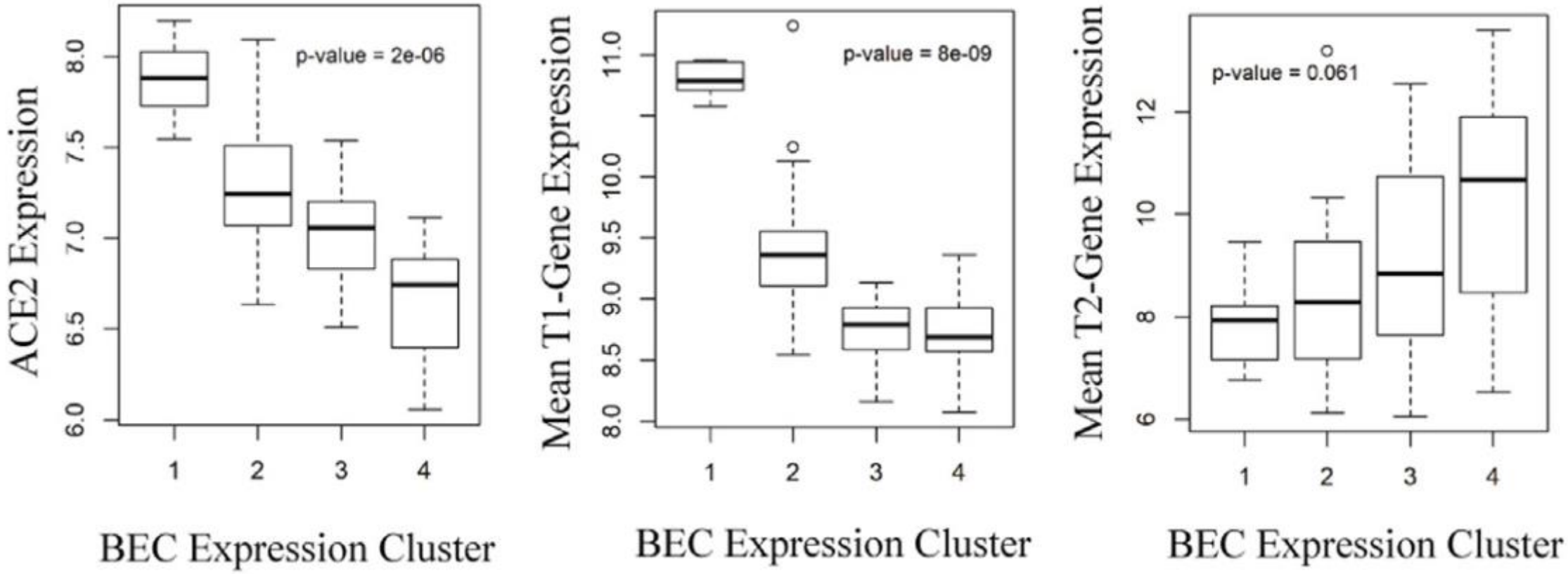


Camiolo M, et al. J Allergy Clin Immunol 2020;146:315-324.

ACE2 expression according to phenotype

- Patients from 2 large asthma cohort, blood/BAL samples

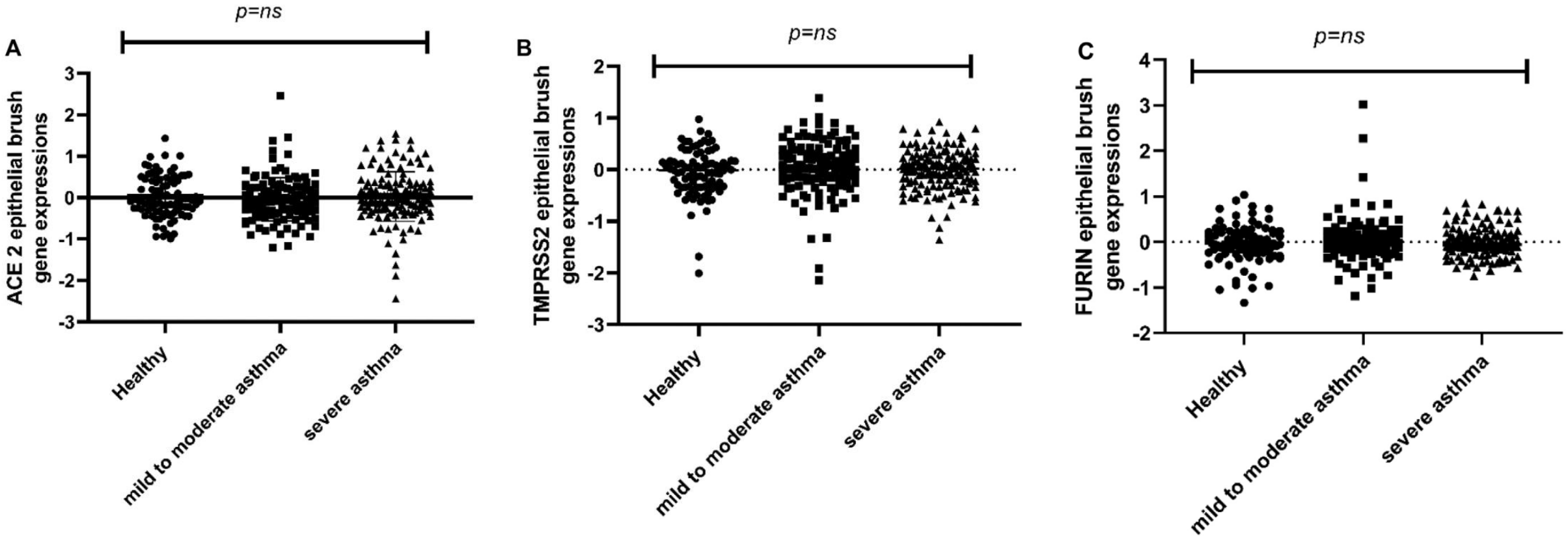
ACE2 expression within bronchial epithelium



Camiolo M, et al. J Allergy Clin Immunol 2020;146:315-324.

ACE2 expression in asthma vs. healthy control

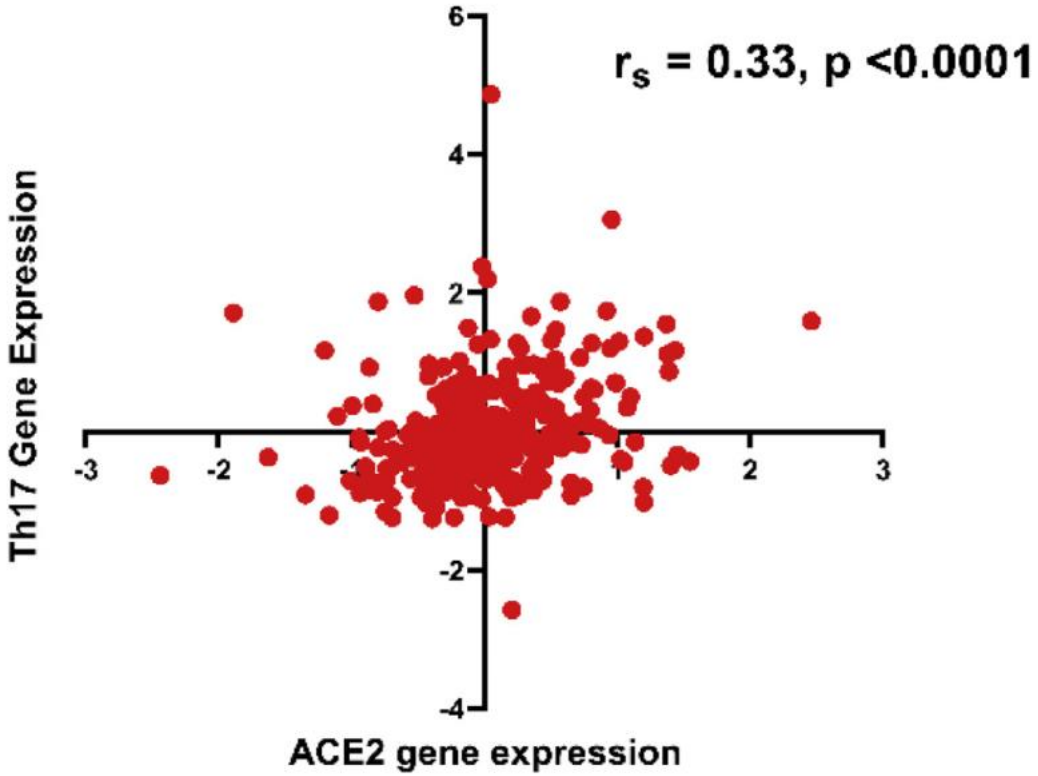
- RNA expression of ACE2 , TMPRSS2, and furin in bronchial brushes and biopsies in mild-to-moderate asthma patientsand heathy voluteers

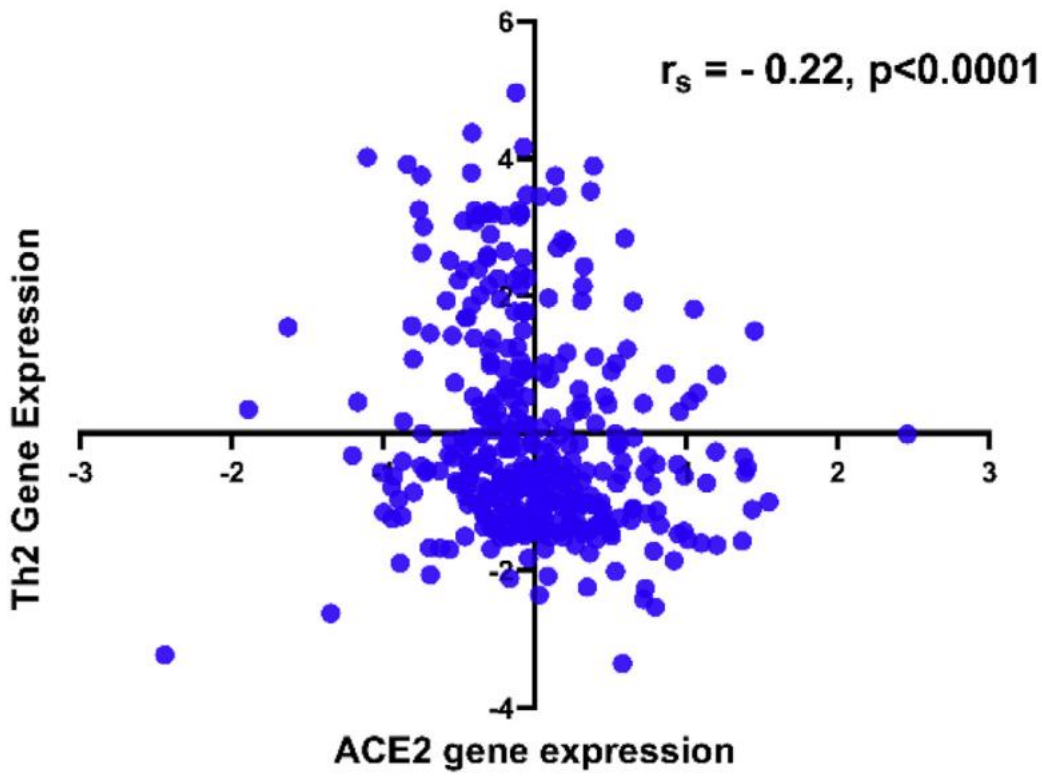


Bradding P, et al. J Allergy Clin Immunol 2020;146:208-211.

ACE2 expression in asthma vs. healthy control

- Weak positive correlation between ACE2 and T_H17-dependent gene expression
- Weak inverse correlation between ACE2 and T_H2-dependent gene expression

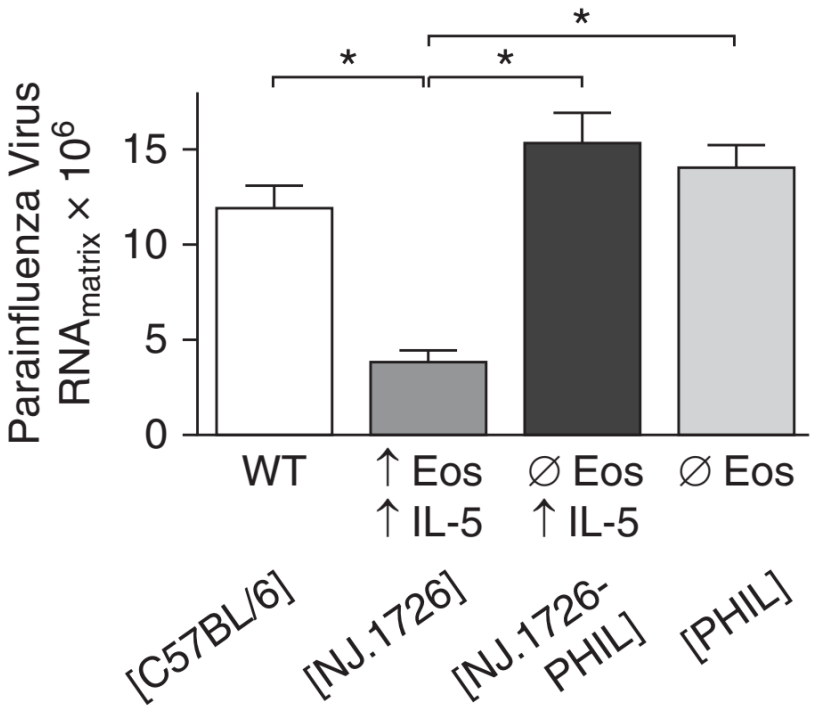


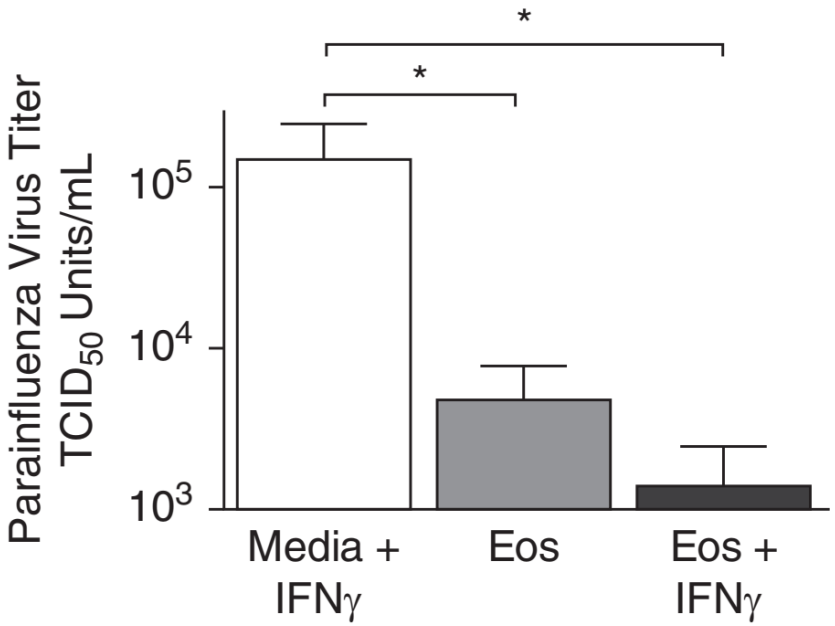


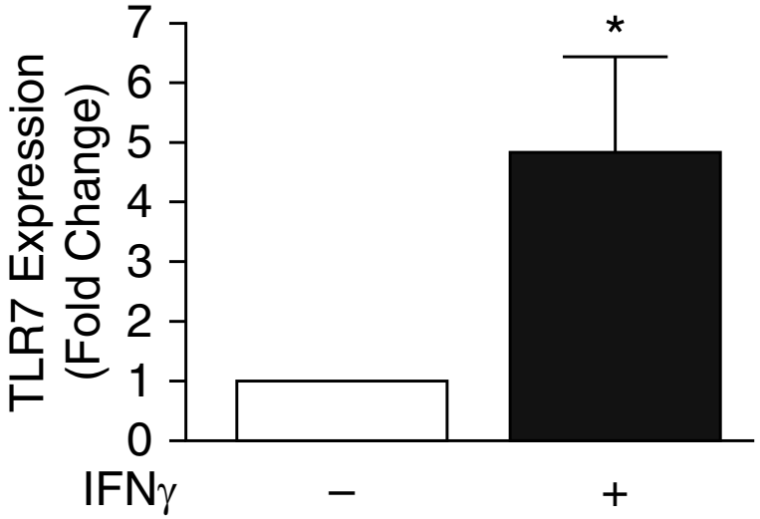
Bradding P, et al. J Allergy Clin Immunol 2020;146:208-211.

Anti-viral activity of eosinophil

- Eosinophils promote parainfluenza virus clearance in the lung in vivo
- Eosinophil-derived nitric oxide reduces parainfluenza virus infectivity
- IFN-γ increases eosinophil TLR7 expression and nitric oxide production







Drake MG, et al. Am J Respir Cell Mol Biol 2016;55(3):387-94.

Blood eosinophilia: Protective role for severe disease

- Retrospective analysis with 951 adult asthma COVID-19 patients, New York

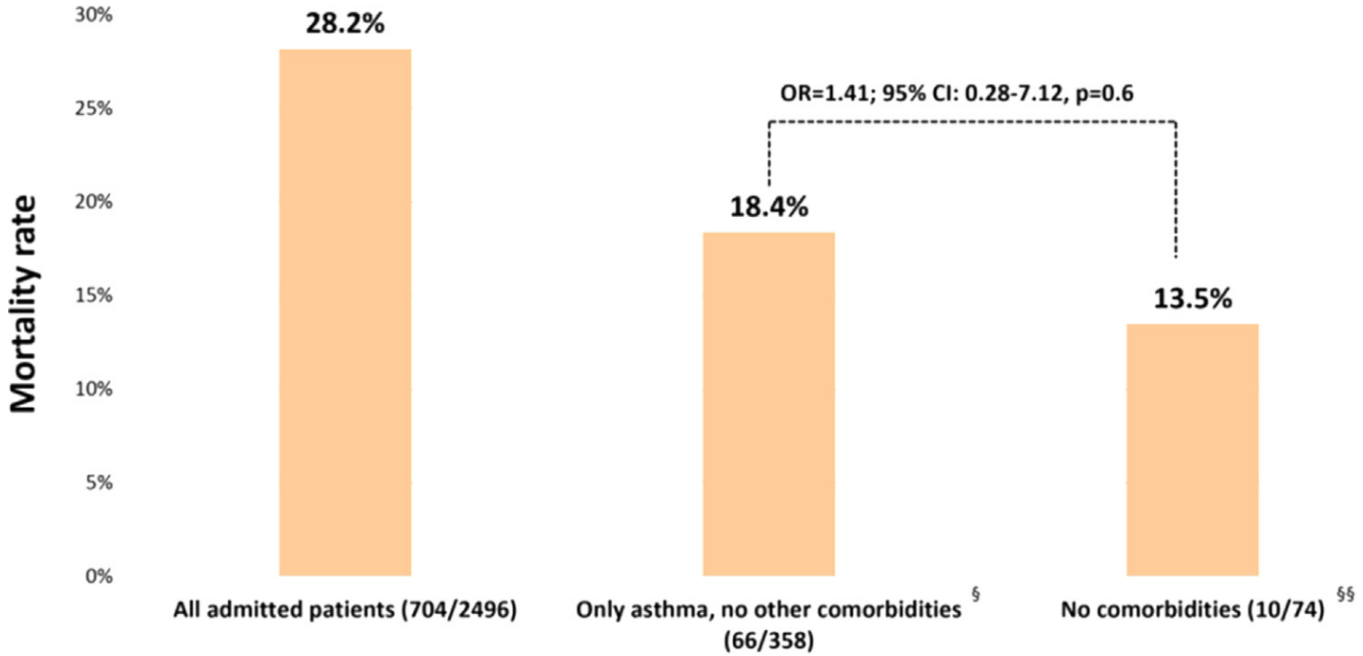
	Admission for COVID-19 infection	
	OR (95% CI)	P-value
Age at diagnosis	1.04 (1.02-1.05)	<0.001
Prior absolute eosinophil count (cells/μℓ), mean	**0.23 (0.08-0.7)**	**0.009**
Prior absolute eosinophil count ≥ 150 cells/μℓ	**0.46 (0.21-0.98)**	**0.04**
Other comorbidities		
CHF	1.61 (1.01-2.56)	0.04
CKD	1.61 (1.04-2.51)	0.03
COPD	2.06 (1.14-3.74)	0.017

* Asthma severity, ICS strength, ICS type, OCS/montelukast within prior year, biologics within prior 3 years: not significant

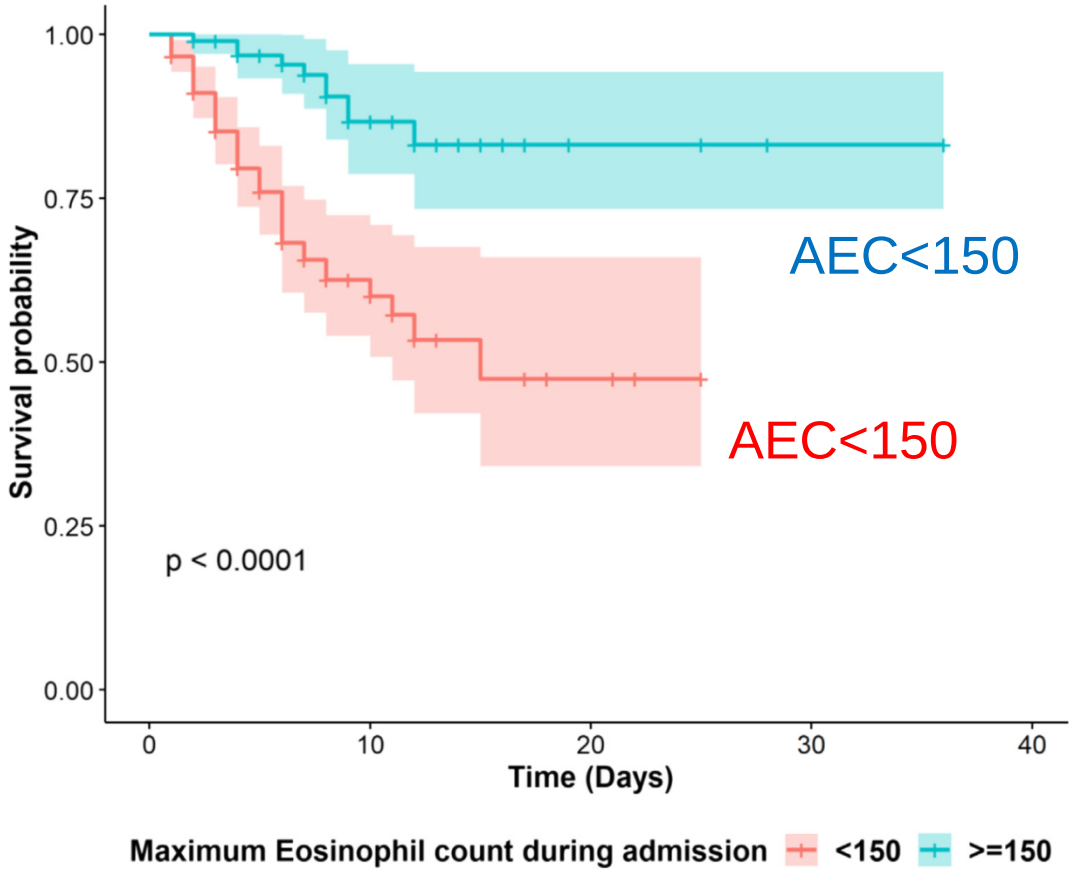
Ferastraoaru D, et al. J Allergy Clin Immunol Pract 2021;9:1152-62.

Blood eosinophilia: Protective role for severe disease

- Increase in absolute eosinophil count > 150 cells/$\mu\ell$ during admission
  - ✓ vs. remained <150 cells/$\mu\ell$
  - ✓ Mortality rate 9.6% vs. 25.8%, OR=0.006, 95% CI 0.0001-0.64P=0.03

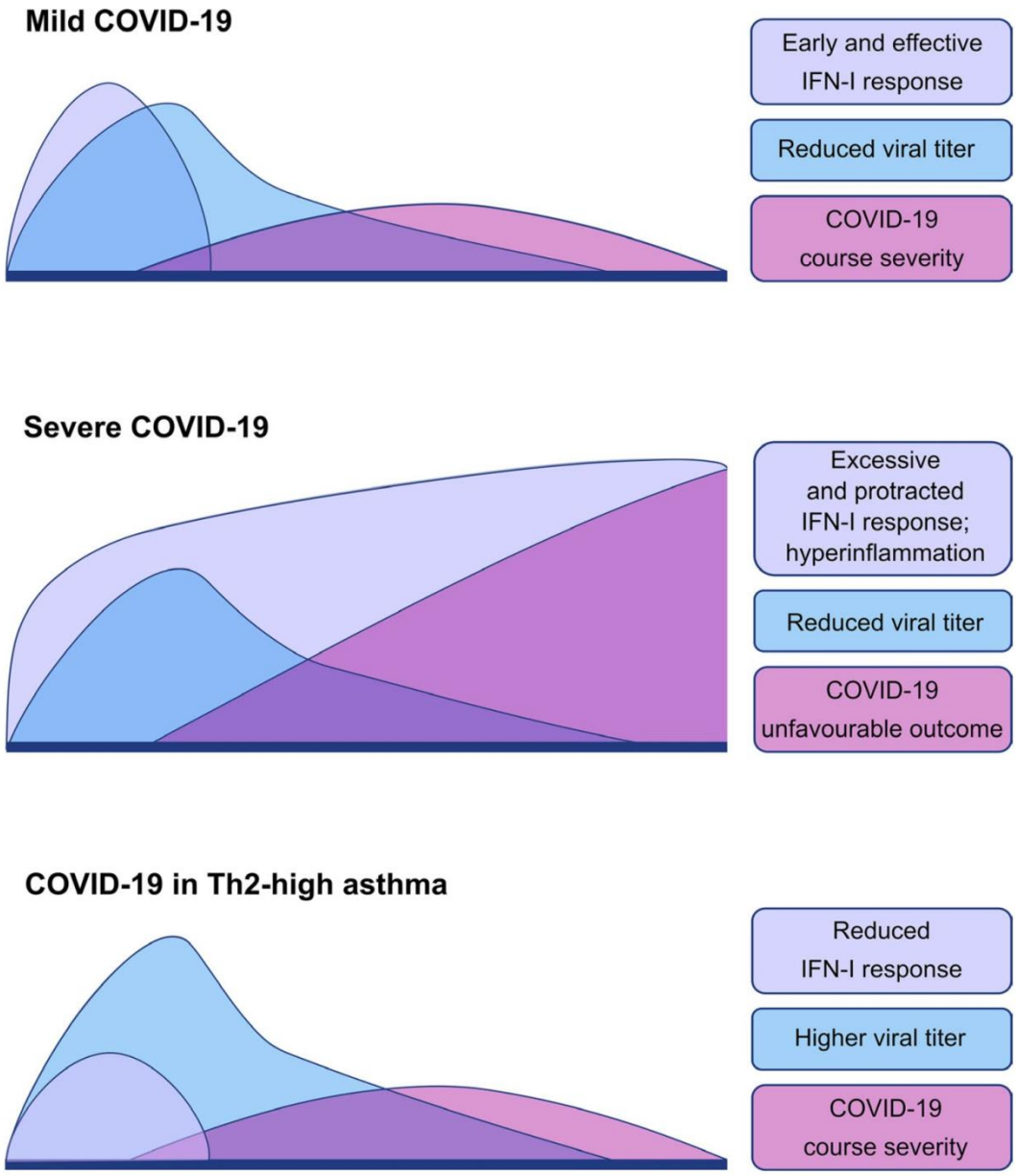


= no CHF/CKD /COPD/DM/HTN



Ferastraoaru D, et al. J Allergy Clin Immunol Pract 2021;9:1152-62.

Progression of COVID-19 in type 2 asthma



- After establishment of COVID-19 infection, higher risk for disease progression in patietns with allergic asthma

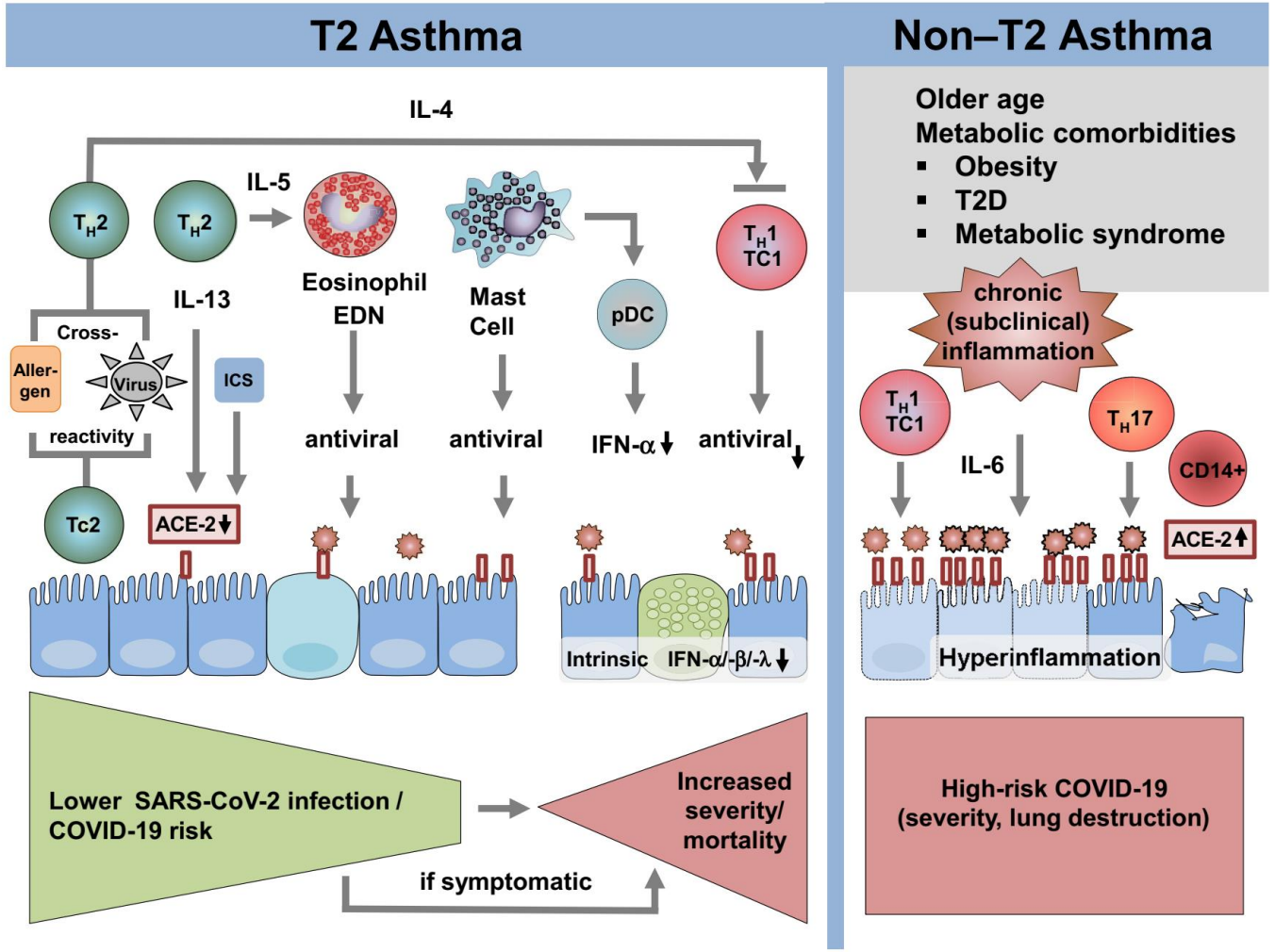
  - ✓ T_H2 inflammation counteracts T_H1 immunity and limits the production of proinflammatory cytokines

  - ✓ Impaired production of type I and type III IFNs (IFN-α, IFN-β, IFN-λ) by airway epithelial cells in patients with asthma

Carli G, et al. Allergy 2021;76(3):866-868.

Impact of asthma endotype

- Impact of asthma endotypes on infection of airway epithelium with SARS-CoV-2, development and progression of COVID-19



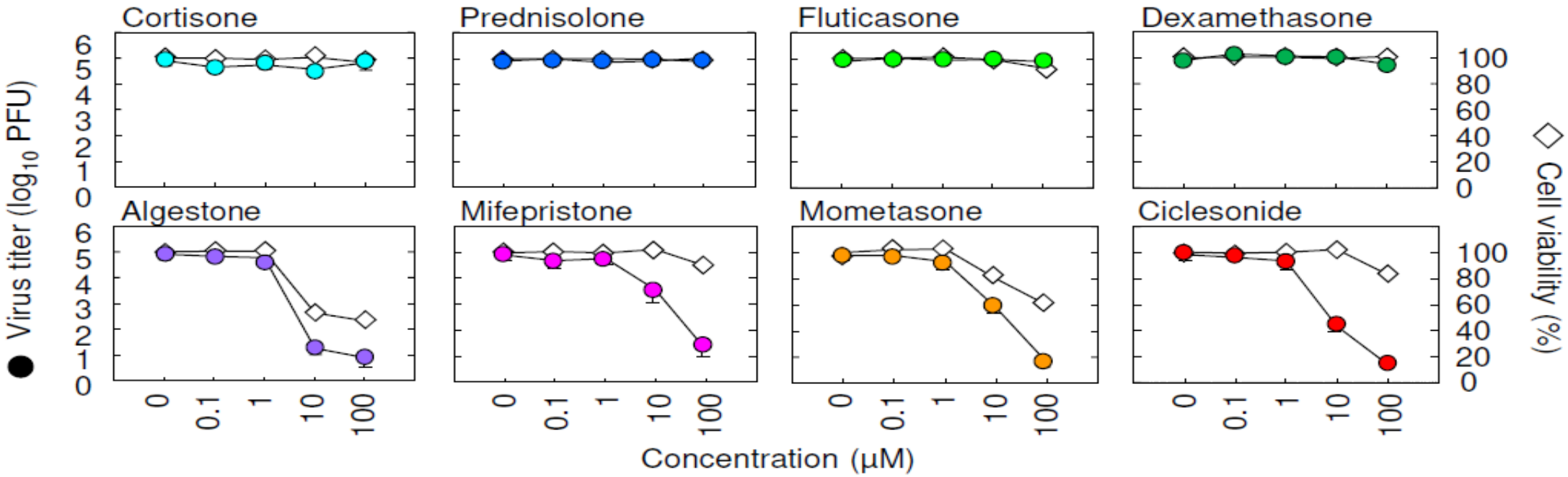
Skevaki C, et al. J Allergy Clin Immunol 2020;146:1295-301.

Inhaled corticosteroids

Risk of ICS

- No evidence that ICS increase the risk of acquiring COVID-19 or increase the severity of infection

- Data on specific suppressive effect from ICS on SARS-COV-2 replication in airway epithelial cells

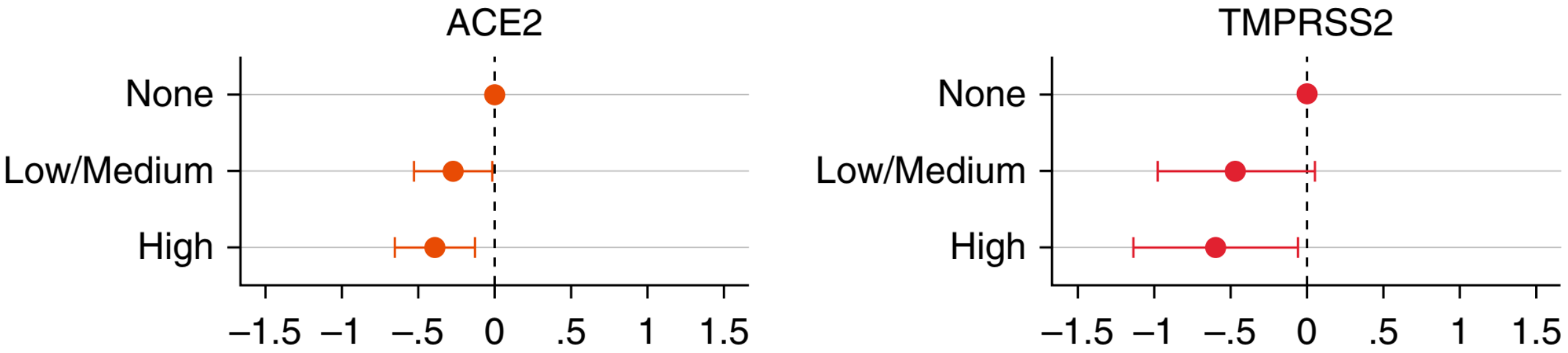


Matsuyama S, et al. J Virol. 2020 Oct 14;JVI.01648-20.

ICS effect of ACE2/TMPRSS2 expression

- 330 paticipant from longitudial cohort study (SARP-3) and 32 healthy control
- Sputum ACE2 and TMPRSS2 gene expression

Effect of ICS on sputum gene expression



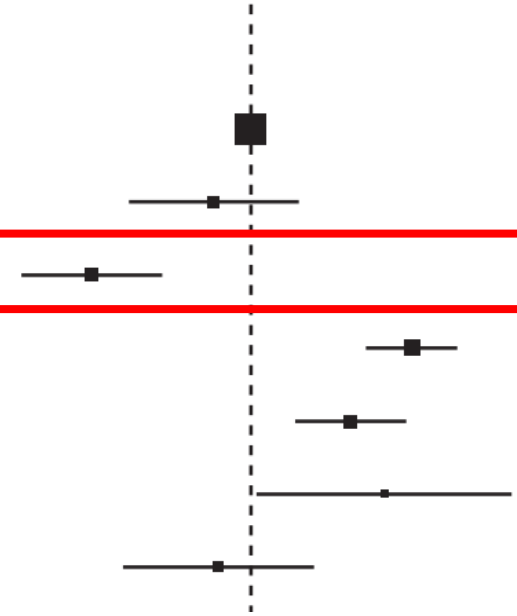
Peters MC, et al. Am J Respir Crit Care Med 2020;201(1):83-90.

ICS and COVID-19 outcome

- 75,463 patients hospitalized with COVID-19, from ISARIC WHO Clinilcal Characterisation Protocol UK study

ICS use with respiratory conditions and in-hospital mortality (age ≥ 50 yrs)

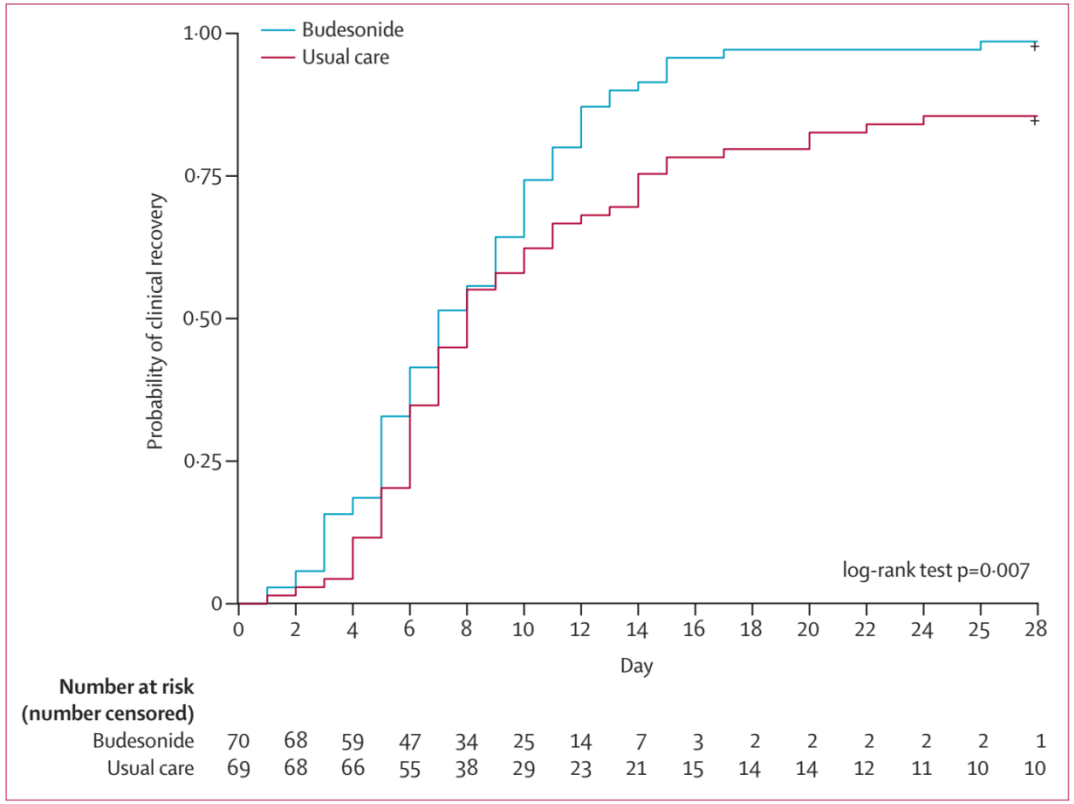
	Hazard ratio (95% CI)	p value
Respiratory disease		
No respiratory disease; no inhaled steroids	Ref	..
Asthma only; no inhaled ICS	0·97 (0·89–1·05)	0·391
Asthma only; on inhaled ICS	0·86 (0·80–0·92)	<0·0001
Chronic pulmonary disease only; no inhaled ICS	1·16 (1·12–1·22)	<0·0001
Chronic pulmonary disease on inhaled ICS	1·10 (1·04–1·16)	<0·0001
Asthma and chronic pulmonary disease; no inhaled ICS	1·13 (1·01–1·28)	0·041
Asthma and chronic pulmonary disease on inhaled ICS	0·97 (0·89–1·06)	0·506



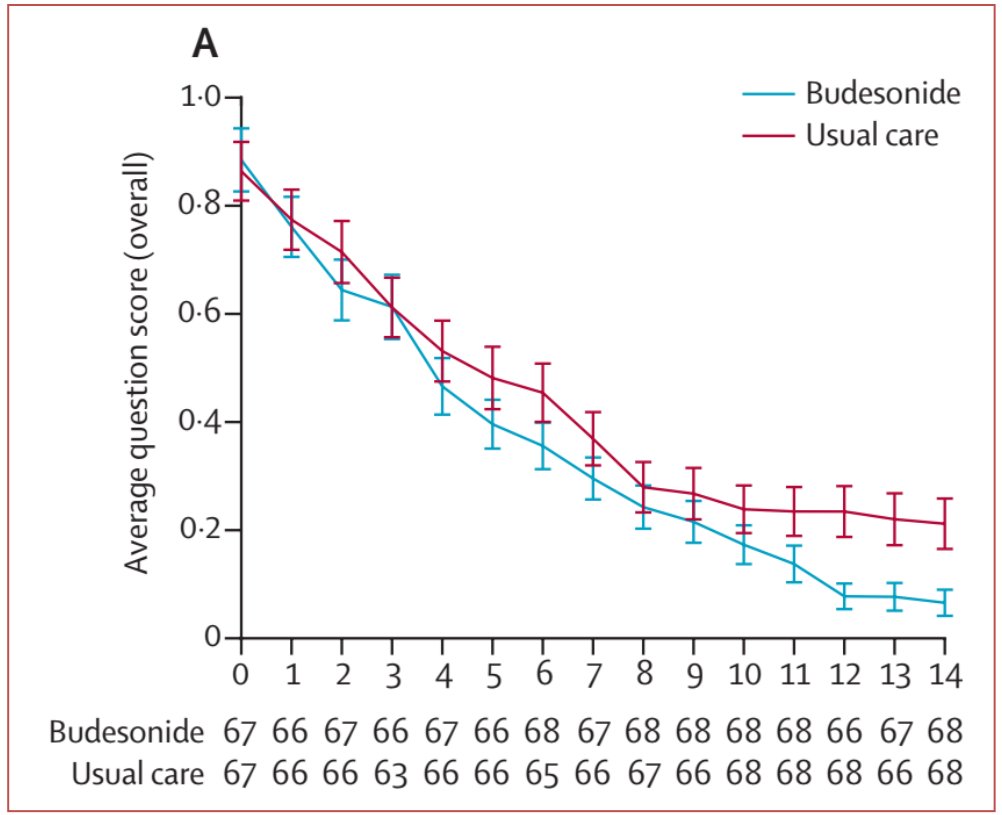
Bloom CI, et al. Lancet Respir Med 2021;9:699-711.

ICS for treament of COVID-19

- Adults within 7 days of the onset of mild COVID-19 symptoms, phase 2 RCT
- Inhaled budesonide (turbohaler, 400μg) vs. usual care



Time to self-reported clinical recovery



Daily total symptom

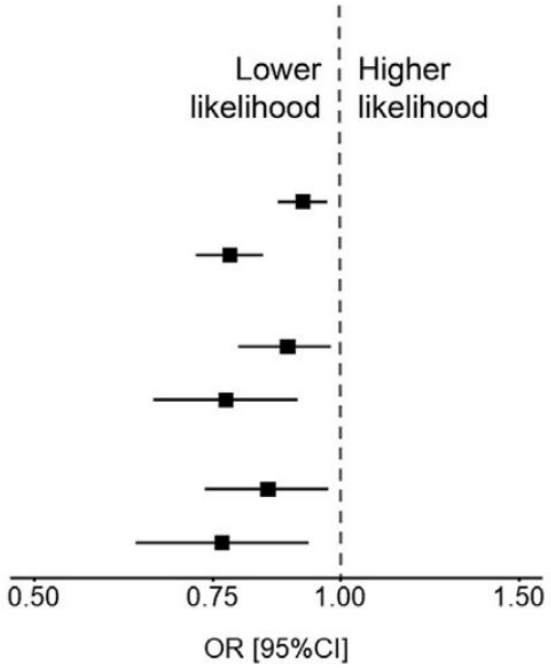
Ramakrishnan S, et al. Lancet Respir Med 2021;9:763-72.

Intranasal steroid for COVID-19

- Patients who had a prescription for intranasal corticosteroids before the diagnosis of COVID-19, from Cleveland Clinic COVID-19 Research Registry

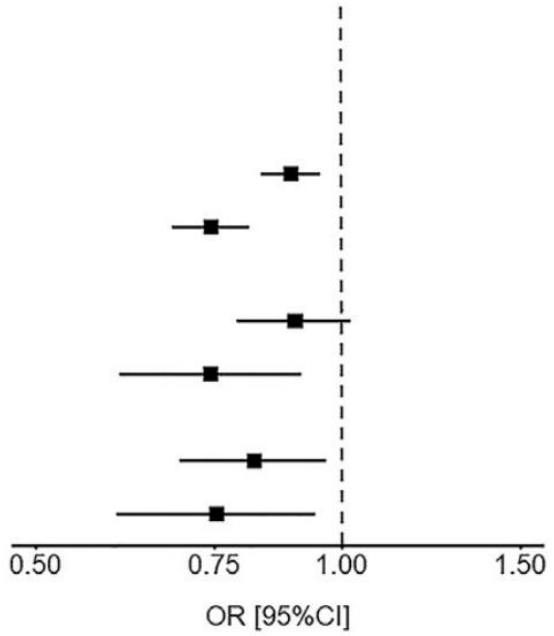
All Patients (n = 72,147)

Outcome	OR [95%CI]
Hospital Admission	
Unadjusted	0.92 [0.87; 0.97]
Adjusted	0.78 [0.72; 0.85]
ICU Admission	
Unadjusted	0.89 [0.80; 0.99]
Adjusted	0.77 [0.65; 0.92]
Hospital Mortality	
Unadjusted	0.85 [0.74; 0.97]
Adjusted	0.76 [0.61; 0.94]



Excluding Allergic Rhinitis (n = 65,767)

Outcome	OR [95%CI]
Hospital Admission	
Unadjusted	0.89 [0.83; 0.95]
Adjusted	0.74 [0.67; 0.83]
ICU Admission	
Unadjusted	0.90 [0.79; 1.02]
Adjusted	0.74 [0.61; 0.90]
Hospital Mortality	
Unadjusted	0.82 [0.69; 0.96]
Adjusted	0.75 [0.60; 0.94]

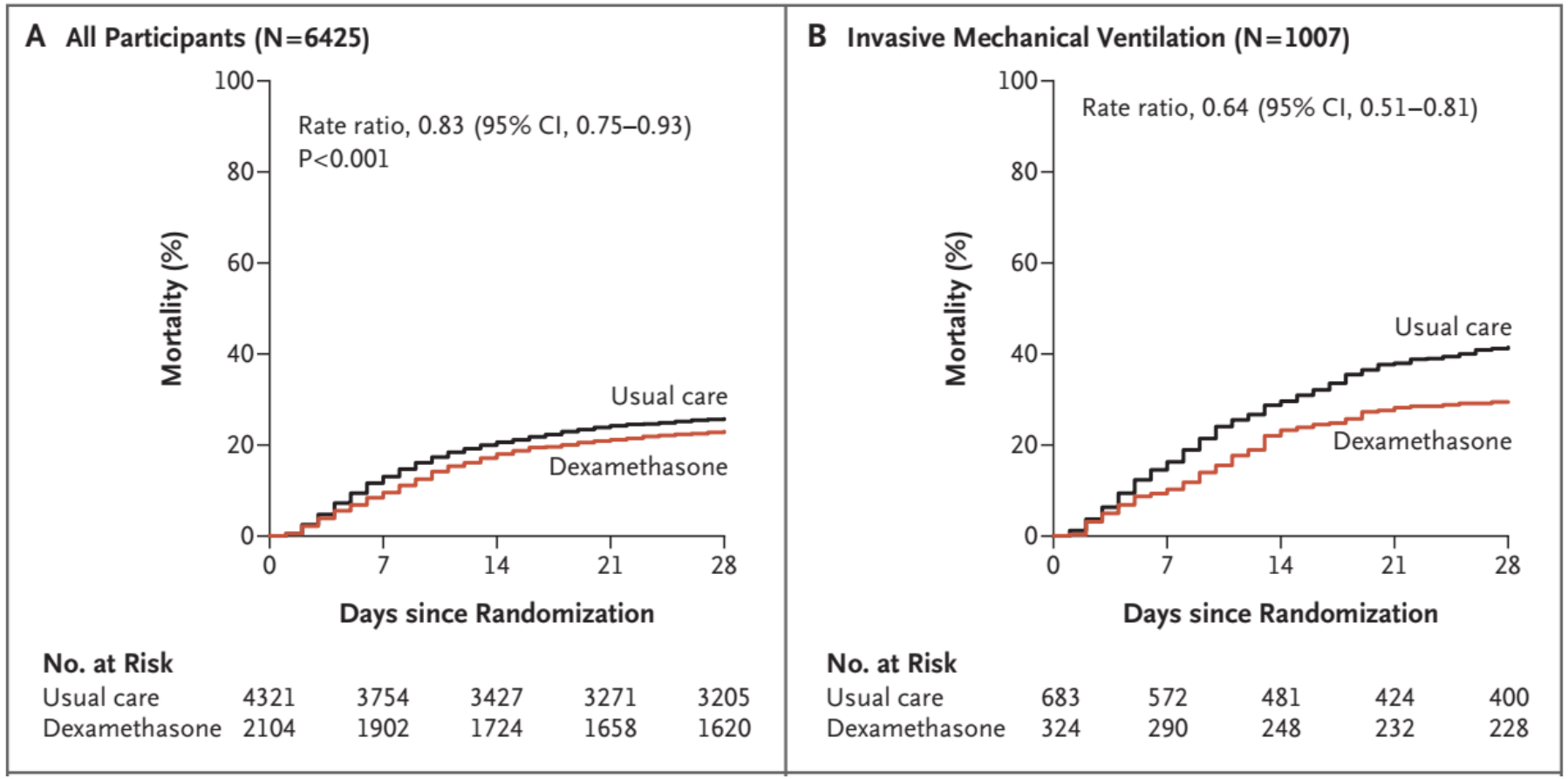


Strauss R, et al. J Allergy Clin Immunol Pract 2021;9(11):3934-3940.e9.

Systemic corticosteroids/biologics

Dexamethasone as COVID-19 treatment

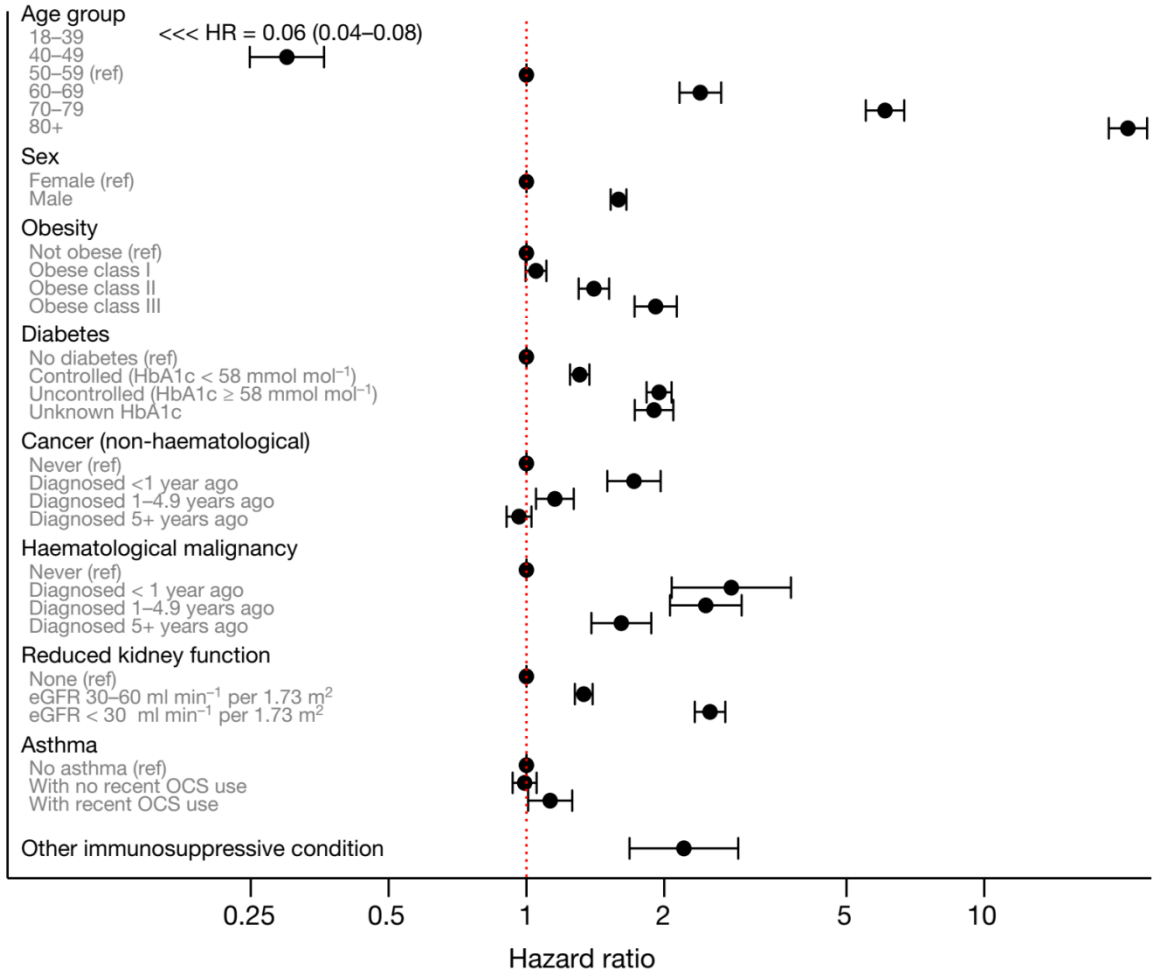
- 2,104 patients hospitalized with COVID-19, RCT
- Dexamethasone 6mg once daily, 6-10days vs. usual care



RECOVERY Collaborative Group, et al. N Engl J Med 2021;384:693-704.

COVID-19 outcome with previous OCS use

- 17,238,392 COVID-19 adults (10,926 COVID-19-related deaths)
- OpenSAFELY analytics platform, England



	COVID-19 death aHR (95%CI)
Asthma	
No asthma	1 (ref)
With no recent OCS use	0.99 (0.93-1.05)
With recent OCS use	1.13 (1.01-1.26)

Williamson EJ, et al. Nature 2020;584(7821):430-436.

COVID-19 outcome with previous systemic therapy

- 80,602 asthma patients tested with PCR for SARS-CoV-2

  (514 on biologics)

Composite of moderate-to-severe COVID-19 or all-cause mortality within 90 d in confirmed COVID-19 patients (n = 8,242)

Variable	Adjusted* HR (95% CI)	*P* value
Age (for each year increase)	1.057 (1.050-1.063)	<.001
Sex		
Males	1.23 (1.03-1.48)	.023
Females	Reference	
Ethnicity		
Jews	Reference	
Arabs	1.56 (1.30-1.88)	<.001
Diabetes	1.36 (1.13-1.63)	.001
Hypertension	1.35 (1.07-1.70)	.010
Obesity	1.36 (1.13-1.63)	.001
IHD	1.37 (1.13-1.67)	.001
Smoking (ever)	1.05 (0.87-1.26)	.590
Steroids use in the previous year (no. of filled prescriptions)		
None	Reference	
1 prescription	1.01 (0.78-1.30)	.955
2 prescriptions	1.39 (1.00-1.93)	.049
≥3 prescriptions	1.92 (1.52-2.41)	<.001
Biologics use (at least 1 prescription filled in the previous 120 d)		
None	Reference	
Yes	1.42 (0.70-2.88)	.332

Adir Y, et al. J Allergy Clin Immunol 2021;148;361-7.

COVID-19 outcome with previous systemic therapy

- 80,602 asthma patients tested with PCR for SARS-CoV-2 (514 on biologics)

Composite of moderate-to-severe COVID-19 or all-cause mortality within 90 d in confirmed COVID-19 patients (n = 8,242)

- The use of systemic corticosteroid, whether for chronic, recent or for recurrent exacerbations, is a clear risk factor for increased COVID-19 severity and mortality.

Variable	Adjusted* HR (95% CI)	*P* value
Steroids use in the previous year		
None	Reference	
Yes	1.38 (1.16-1.64)	<.001
Steroids use in the previous year		
None	Reference	
Recent (≤120 d)	1.76 (1.43-2.17)	<.001
Former (120-365 d)	1.04 (0.82-1.33)	.734
Chronic steroids treatment (≥6 prescriptions in the previous year)		
None	Reference	
Yes	2.07 (1.55-2.76)	<.001
Steroids use in the previous year (no. of filled prescriptions)		
None	Reference	
1 prescription	1.01 (0.78-1.30)	.955
2 prescriptions	1.39 (1.001-1.93)	.049
≥3 prescriptions	1.92 (1.52-2.41)	<.001

Adir Y, et al. J Allergy Clin Immunol 2021;148;361-7.

Biological treatment during COVID-19

- 545 adults patients with severe asthma under biological treatment, Spain
- 35 (6.4%): diagnosed with COVID-19

TABLE II. Clinical and epidemiologic characteristics of patients with severe asthma diagnosed with COVID-19

	Drug				
Characteristic	**Omalizumab**	**Mepolizumab**	**Reslizumab**	**Benralizumab**	***P* Value**
N (%)	14 (5.32)	11 (7.14)	3 (11.54)	7 (7.14)	
Sex: female, N (%)	10 (71.43)	5 (45.50)	1 (33.00)	5 (71.40)	NS
BMI, mean ± SD	26.71 ± 6.30	26.04 ± 4.26	25.73 ± 2.40	27.00 ± 4.70	NS
Age (y), mean ± SD	46.36 ± 12.21	56.45 ± 5.30	49 ± 12.12	60.29 ± 11.30	NS
FEV_1%, mean ± SD	84.52 ± 22.65	83.35 ± 21.02	76.00 ± 2.83	85.97 ± 7.38	NS
Arterial hypertension, N (%)	3 (21.43)	4 (36.40)	0 (0.0)	2 (28.60)	NS
Diabetes, N (%)	0 (0.0)	1 (9.09)	0 (0.0)	0 (0.0)	NS
CRSwNP, N (%)	8 (57.14)	8 (72,73)	3 (100)	3 (42.86)	NS
Hospital admission	1 (11.1)	3 (33.33)	2 (66)	2 (28.60)	NS
ICU admission, N (%)	1 (7.14)	0 (0.0)	0 (0.0)	0 (0.0)	NS
Exitus, N (%)	0 (0.0)	1 (9.09)	0 (0.0)	0 (0.0)	NS
OR	0.70	1.18	1.99	1.15	
P value	.38	.67	.23	.82	
95% CI	0.35-1.38	0.55-2.41	0.60-6.36	0.46-2.74	
β error	0.83	0.92	0.73	0.93	

BMI, Body mass index; *CRSwNP*, chronic rhinosinusitis with nasal polyps; *ICU*, intensive care unit; *OR*, odds ratio; *NS*, not statistically significant.
The possibility that COVID-19 occurs in one treatment group vs the risk that occurs in another treatment group has been expressed as OR. The OR for each group compares that group to all other groups combined.

Rial MJ, et al. J Allergy Clin Immunol Pract 2021;9(1):487-489.e1.

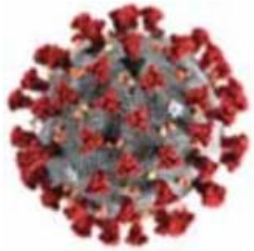
Biological treatment during COVID-19

- 545 adults patients with severe ashtma under biological treatment, Spain
- 35 (6.4%): diagnosed with COVID-19

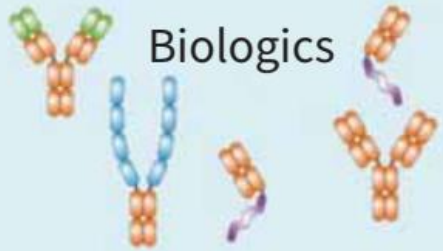
Clinical features	Patients with asthma treated with biologics (n = 8)	Patients with asthma without biologic treatment (n = 11)
Age (y), mean ± SD	62.8 ± 13.6	57.7 ± 14.6
Body mass index	27 ± 3.7	29.9 ± 4.6
Pneumonia	7 (87%)	9 (81%)
ICU admission	1 (12%)	2 (18%)
Intubation	1 (12%)	1 (9%)
Death	1 (12%)	2 (18%)

Rial MJ, et al. J Allergy Clin Immunol Pract 2021;9(1):487-489.e1.

Asthma medications and risk of COVID-19

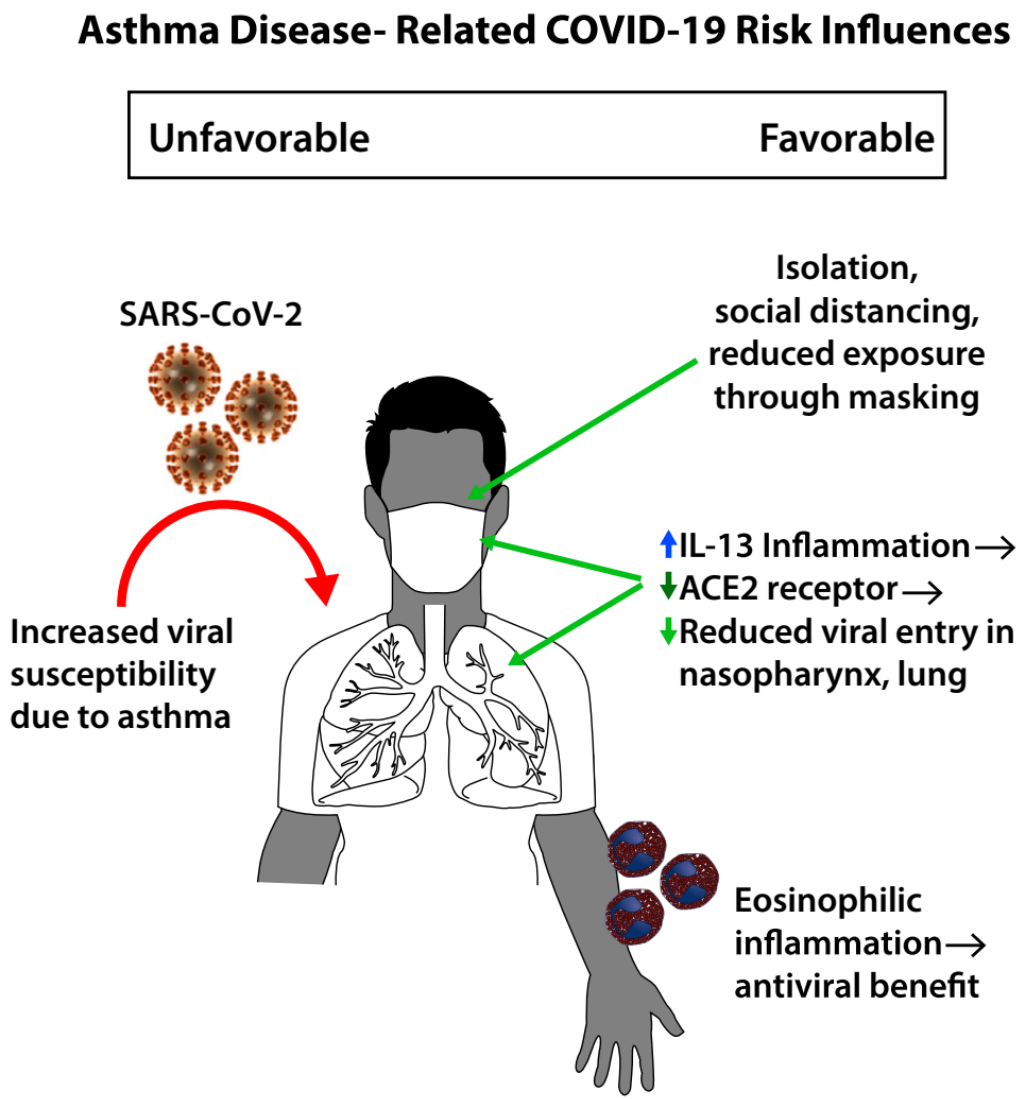


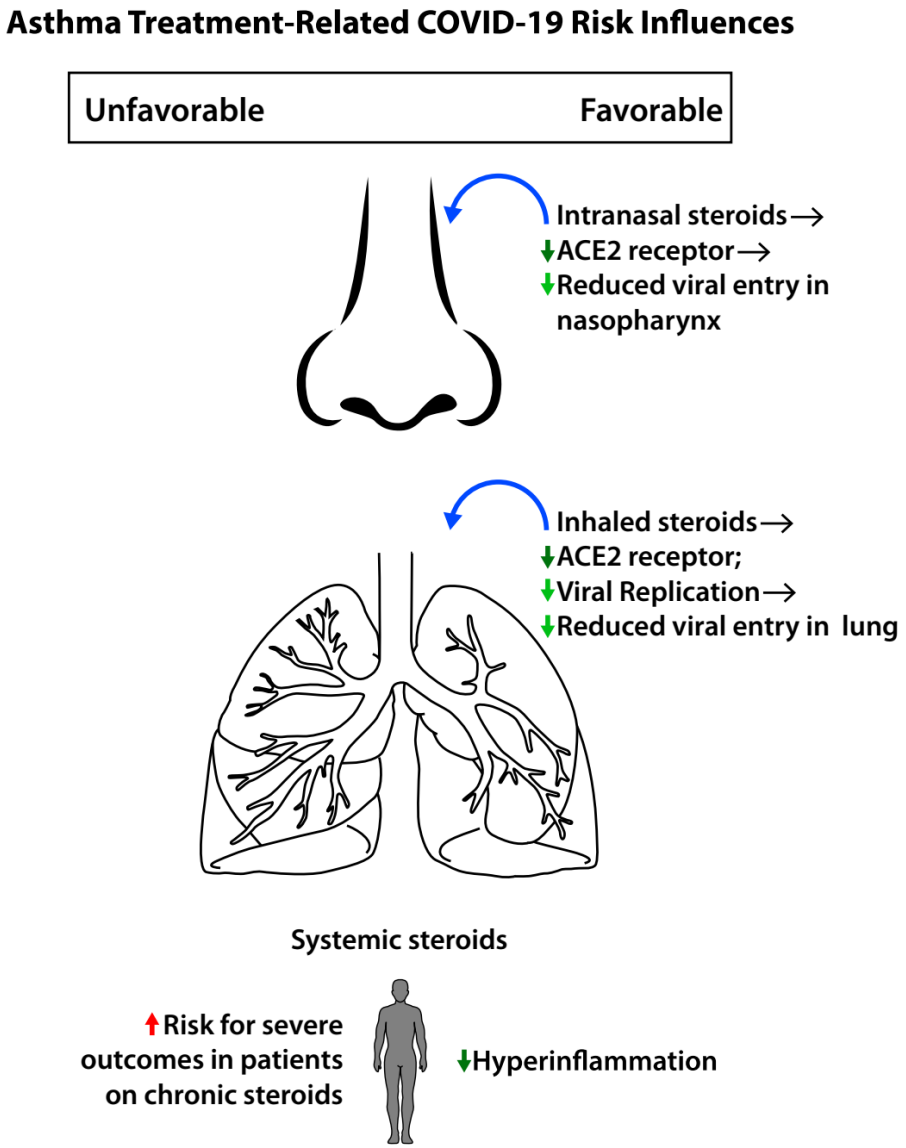
Asthmatic patients with positive PCR for SARS-CoV-2

	Previous treatment with SCS 	ICS 	Biologics 
Infection with SARS-CoV-2	No increased risk	No increased risk	No increased risk
COVID-19 severity	Increased risk	No increased risk	No increased risk
COVID-19 mortality	Increased risk	No increased risk	No increased risk

Adir Y, et al. Eur Respir Rev 2021;30:210152.

Asthma and COVID-19





Carr TF, et al. J Allergy Clin Immunol 2022;149(2):562-564.

Summary

- Asthma is not an independent risk factor for both SARS-CoV-2 infection and disease severity.
- Asthma severity, comorbidities and phenotypes are important factors in evaluating the risk for SARS-CoV-2 infection and disease severity.
- ICS use is safe in asthma patients with SARS-CoV-2 infection.
  - ✓ Some evidence for protective effect against SARS-CoV-2 infection
- Chronic or recurrent use of systemic corticosteroids before SARS-CoV-2 infection is a major risk factor for poor outcomes and worst survival.
- Biologics do not increase infectivity or disease severity.

Thank You for Your Attention