

Severe asthma and the role of thymic stromal lymphopoietin (TSLP)

SEVERE ASTHMA IS ASSOCIATED WITH:



Recurrent exacerbations and hospitalisations^{1,2}



Poor asthma-related quality of life³



Life-changing side effects due to OCS use⁴



Increased risk of mortality⁵



Higher healthcare costs compared with controlled disease⁶

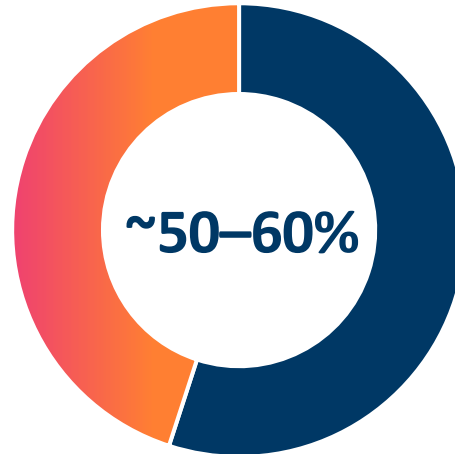
OCS = Oral Corticosteroids

1. Global Initiative for Asthma (GINA);2022(cited 2023 Jan 11; <https://ginasthma.org/gina-reports/> 2. Wang E, Wechsler ME, Tran TN et al. *Chest*. Characterization of Severe Asthma Worldwide: Data From the International Severe Asthma Registry 2020;157:790–804; 3. Chung KF, Wenzel SE, Brozek JL et al. International ERS/ATS guidelines on definition, evaluation and treatment of severe asthma *Eur Respir J*. 2014;43:343–373; 4. Price DB, Trudo F, Voorham J et al. Adverse outcomes from initiation of systemic corticosteroids for asthma: long-term observational study *J Asthma Allergy*. 2018;11:193–204; 5. Fernandes AG, Souza-Machado C, Coelho RCP et al. Risk factors for death in patients with severe asthma *J Bras Pneumol*. 2014;40:364–372; 6. Chen S, Golam S, Myers J et al. Systematic literature review of the clinical, humanistic, and economic burden associated with asthma uncontrolled by GINA Steps 4 or 5 treatment *Curr Med Res Opin*. 2018;34:2075–2088

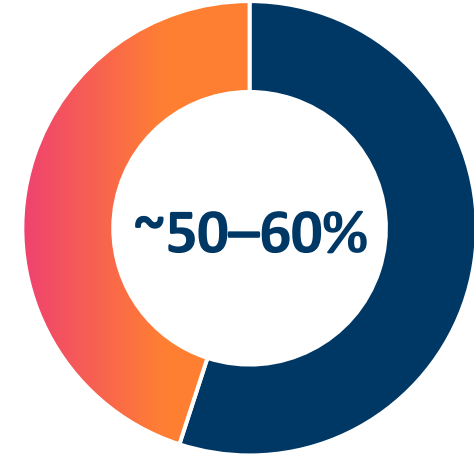
SEVERE ASTHMA IS A COMPLEX AND HETEROGENEOUS DISEASE



Of asthma patients **have severe asthma**¹



Have **multiple drivers of inflammation**²

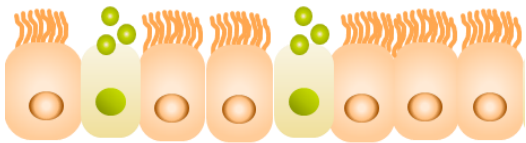


Have **Eos ≤ 300 cells/ μ L**³

THE AIRWAY EPITHELIUM IS THE FIRST POINT OF CONTACT WITH ENVIRONMENTAL TRIGGERS¹

Epithelium¹⁻³

- Key role in tissue homeostasis
- Mediator between environment and immune system
- Rapid production of epithelial cell-derived cytokines in response to triggers



Environmental Triggers^{1,4}

Allergens



Viruses



Pollutants/
smoke



Bacteria



Physical
injury

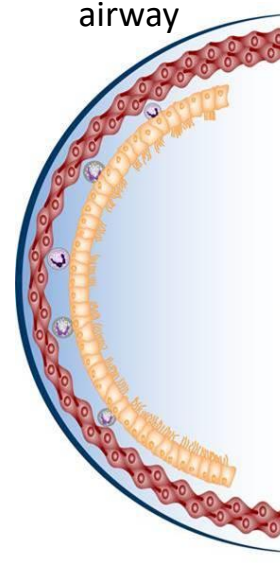


Other external
stimuli

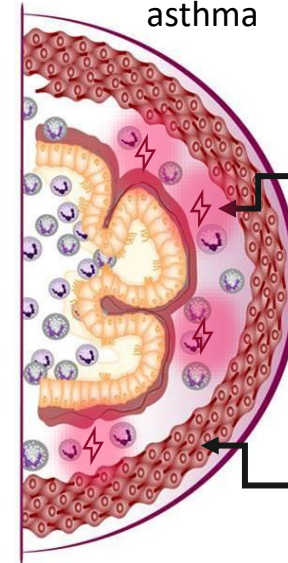


Variable Bronchoconstriction^{3,4a}

Healthy
airway



Severe
asthma



Two hallmarks of asthma

Airway
inflammation⁵

Airway
hyperresponsiveness⁵

Adapted from ref a

^aFigure adapted from the Centre of Excellence in Severe Asthma as part of the Centre of Research Excellence in Severe Asthma (<https://toolkit.severeasthma.org.au>)

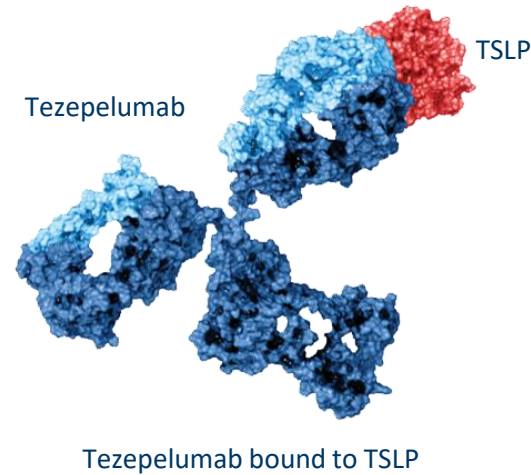
4. 1. Bartemes KR, Kita H; Dynamic role of epithelium-derived cytokines in asthma; *Clin Immunol.* 2012;143:222–235; 2. Watson B, Gauvreau GM. *Expert Opin Ther Targets.* 2014;18:771–785; 3. Loxham M, Davies DE, Blume C; Epithelial function and dysfunction in asthma *Clin Exp Allergy.* 2014;44:1299–1313; 4. Pellaia G, Vatrella A, Maselli R; The potential of biologics for the treatment of asthma; *Nat Rev Drug Discov.* 2012;11:958–972; 5. Global Initiative for Asthma (GINA);2022(cited 2023 Jan 11); <https://ginasthma.org/gina-reports>

TSLP IS A KEY EPITHELIAL CYTOKINE IN ASTHMA^{1,2}

TSLP is expressed and released in response to a **broad range of stimuli** (e.g., allergens, viruses, pollutants)⁴

Epithelial cells are the primary source of TSLP.⁵

TSLP initiates multiple **downstream immune responses** involved in **asthma inflammation and pathology**⁴



Variants at **TSLP gene loci** have been associated with **increased risk of developing asthma**⁶

Tezepelumab is a human monoclonal antibody that binds to TSLP, specifically blocking it from interacting with its receptor⁷

TEZSPIRE bound to TSLP figure adapted from Verstraete K et al. *Nat Commun* 2017;8:14937

TSLP = Thymic Stromal Lymphopoietin

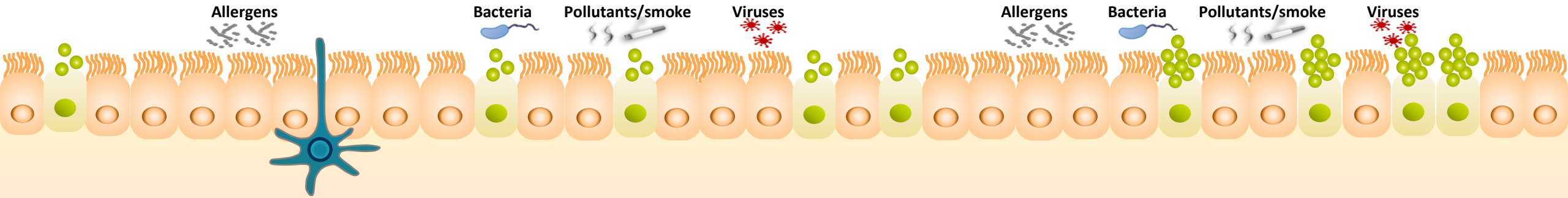
1. Van Rompaey D, Verstraete K, Peelman F et al; Virtual screening for inhibitors of the human TSLP:TSLPR interaction *Sci Rep*. 2017;7:17211; 2. Corren J, Ziegler SF. TSLP: from allergy to cancer *Nat Immunol*. 2019;20:1603–1609; 4. Gauvreau GM, Sehmi R, Ambrose CS et al. Thymic stromal lymphopoietin: its role and potential as a therapeutic target in asthma; *Expert Opin Ther Targets*. 2020;24:777–792; 5. Bartemes

5 KR, Kita H; Dynamic role of epithelium-derived cytokines in asthma; *Clin Immunol*. 2012;143:222–235; 6. Torgerson DG, Ampleford EJ, Chiu GY et al. Meta-analysis of Genome-wide Association Studies of Asthma In

Ethnically Diverse North American Populations; Article and supplementary information. *Nat Genet*. 2011;43:887–892; 7. Menzies-Gow A, Wechsler ME, Brightling CE; Unmet need in severe, uncontrolled asthma: can anti-

TSLP therapy with tezepelumab provide a valuable new treatment option?; *Respir Res*. 2020;21:268

TSLP IS AN EPITHELIAL CYTOKINE THAT PLAYS AN IMPORTANT ROLE IN DRIVING ASTHMA¹⁻³



TSLP is released after epithelial damage or immune cell activation^{1,2}

Leading to airway inflammation^{1,2}

Leading to airway hyperresponsiveness via smooth muscle dysfunction¹⁻³

6 TSLP = Thymic Stromal Lymphopoietin

1. Bartemes KR, Kita H; Dynamic role of epithelium-derived cytokines in asthma; *Clin Immunol.* 2012;143:222–235; 2. Roan F, Obata-Ninomiya K, Ziegler SF; Epithelial cell–derived cytokines: more than just signaling the alarm; *J Clin Invest.* 2019;129:1441–1451; 3. Redhu NS, Gounni AS; Function and mechanisms of TSLP/TSLPR complex in asthma and COPD *Clin Exp Allergy.* 2012;42:994–1005

TSLP DRIVES AIRWAY INFLAMMATION AND AIRWAY HYPERRESPONSIVENESS FROM THE TOP OF THE CASCADE¹⁻³

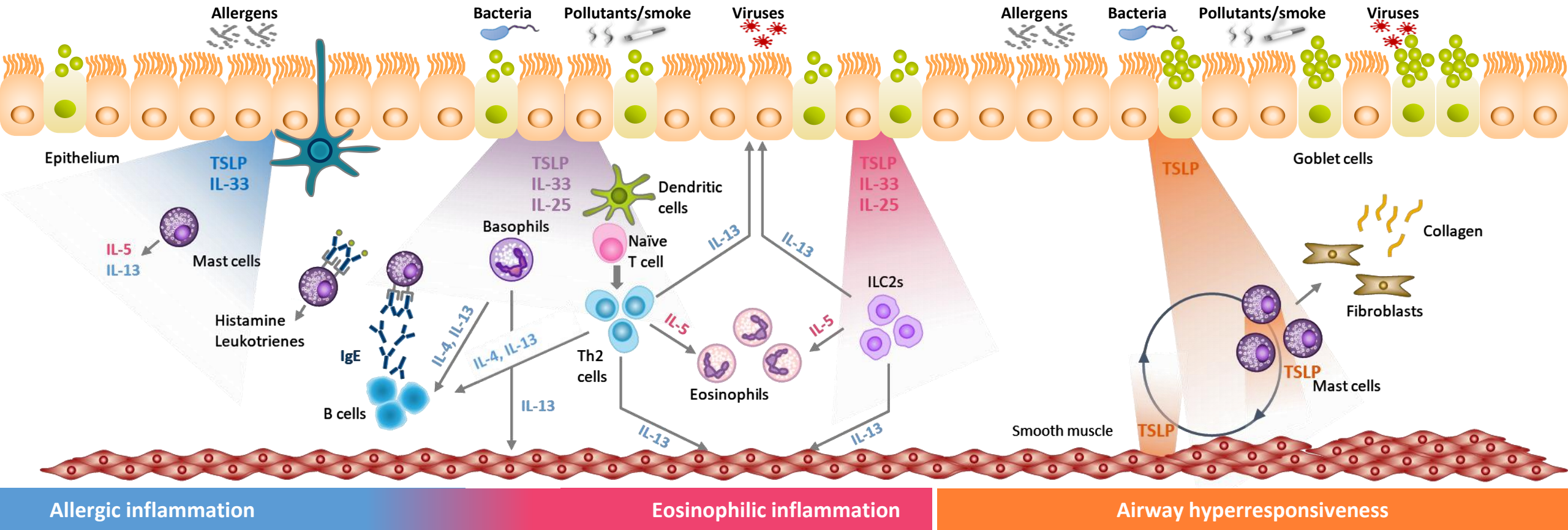
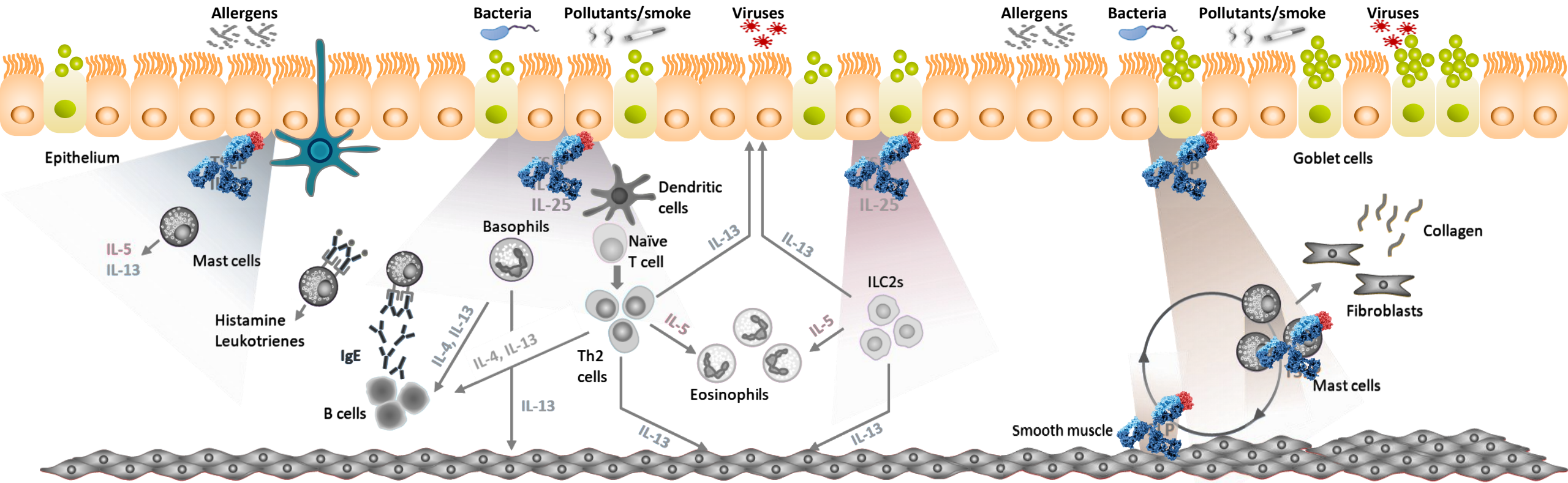


Figure adapted from ref. 1

IgE = Immunoglobulin E; IL = Interleukin; ILC2 = Type 2 Innate Lymphoid Cell; Th = T Helper; TSLP = Thymic Stromal Lymphopoietin

1. Gauvreau GM, Sehmi R, Ambrose CS et al. Thymic stromal lymphopoietin: its role and potential as a therapeutic target in asthma; Expert Opin Ther Targets. 2020;24:777–792; 2. Roan F, Obata-Ninomiya K, Ziegler SF; Epithelial cell–derived cytokines: more than just signaling the alarm; J Clin Invest. 2019;129:1441–1451; 3. Menzies-Gow A, Wechsler ME, Brightling CE; Unmet need in severe, uncontrolled asthma: can anti-TSLP therapy with tezepelumab provide a valuable new treatment option?; Respir Res. 2020;21:268

TEZPELUMAB TARGET TSLP AT THE TOP OF THE INFLAMMATORY CASCADE¹⁻⁷



Allergic inflammation

Eosinophilic inflammation

Airway hyperresponsiveness

IgE = Immunoglobulin E; IL = Interleukin; ILC2 = Type 2 Innate Lymphoid Cell; Th = T Helper; TSLP = Thymic Stromal Lymphopoietin

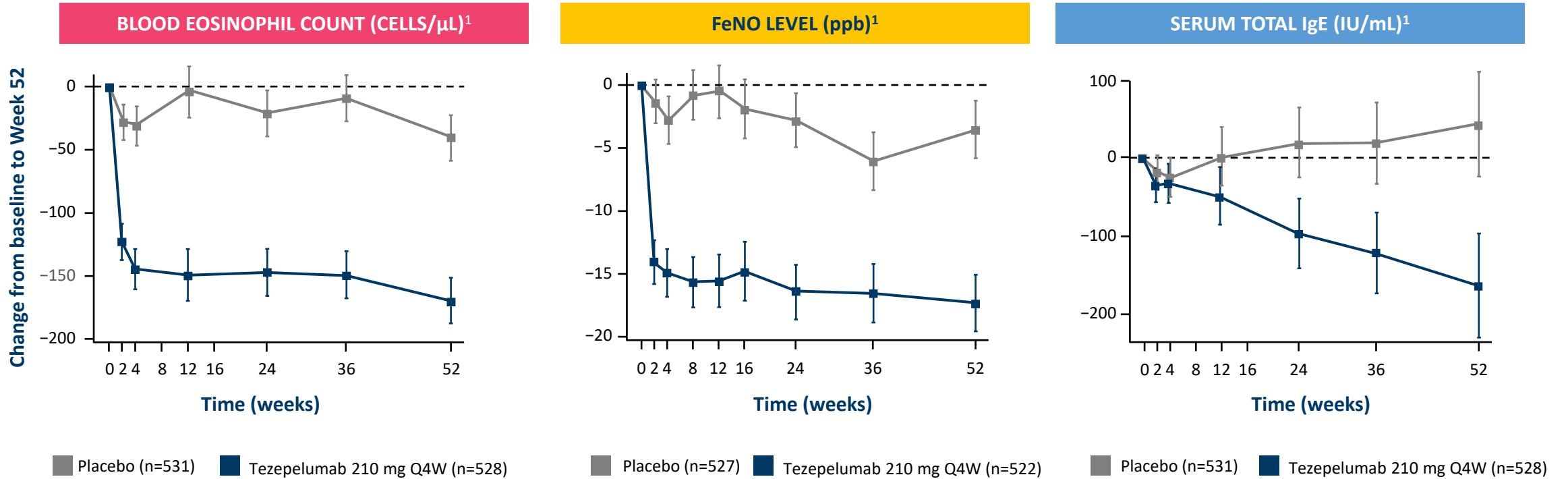
Figure based on ref. 2

1. Menzies-Gow A, Wechsler ME, Brightling CE; Unmet need in severe, uncontrolled asthma: can anti-TSLP therapy with tezepelumab provide a valuable new treatment option?; *Respir Res.* 2020;21:268; 2. Gauvreau GM, O'Byrne PM, Boulet LP et al. Effects of an anti-TSLP antibody on allergen-induced asthmatic responses *N Engl J Med.* 2014;370:2102–2110; 3. Diver S, Khalfaoui L, Emson C et al. Effect of tezepelumab on airway inflammatory cells, remodelling, and hyperresponsiveness in patients with moderate-to-severe uncontrolled asthma (CASCADE): a double-blind, randomised, placebo-controlled, phase 2 trial *Lancet Respir Med.* 2021;9:1299–1312; 4. Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma Supplementary information. *N Engl J Med.* 2021;384:1800–1809; 5. Corren J, Parnes JR, Wang L et al. Tezepelumab in Adults with Uncontrolled Asthma *N Engl J Med.* 2017;377:936–946; 6. Gauvreau GM, Sehmi R, Ambrose CS et al. Thymic stromal lymphopoietin: its role and potential as a therapeutic target in asthma; *Expert Opin Ther Targets.* 2020;24:777–792; 7. Tezpire SmPC last update 2023.01.12



TEZPELUMAB REDUCES AIRWAY INFLAMMATION ACROSS ALL KEY BIOMARKERS¹

NAVIGATOR¹



Data are LS means and 95% CIs over time;

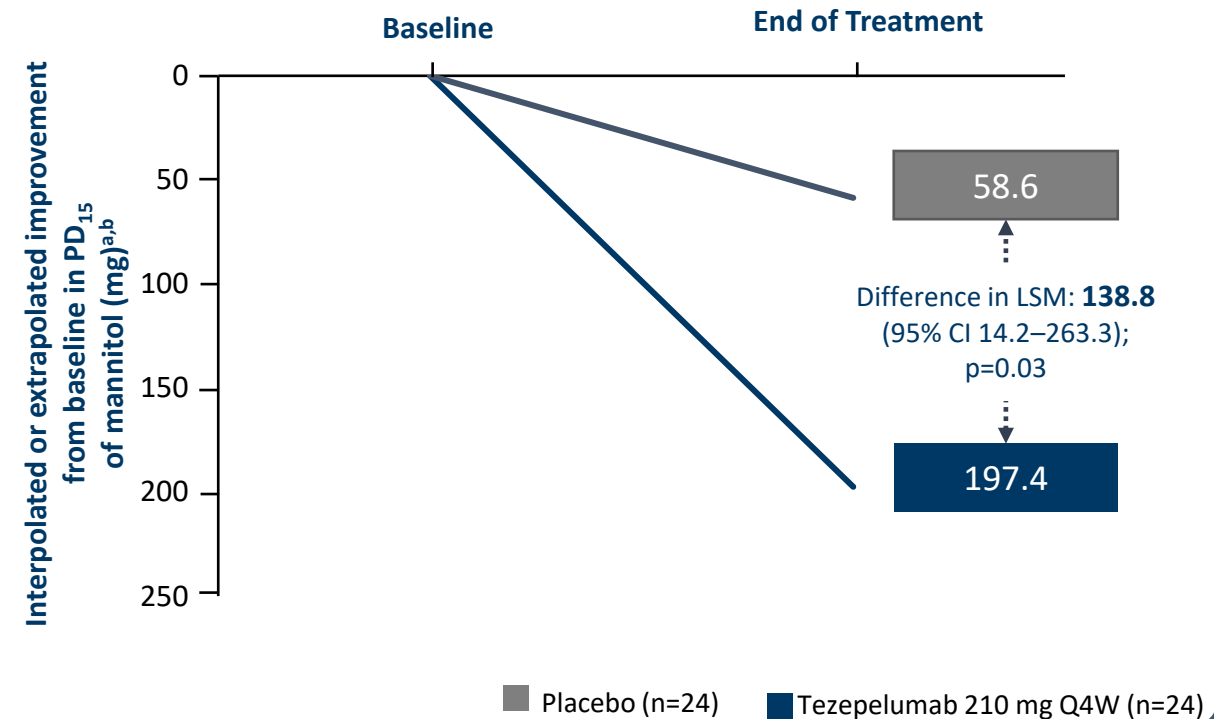
Figures adapted from ref.1 fig S6 a,b,c

TEZPELUMAB REDUCE TISSUE EOSINOPHILS AND AIRWAY HYPERRESPONSIVENESS ¹

Primary Endpoint

- **Airway submucosal eos** were **reduced** from baseline to EOT with tezepelumab versus placebo, by **6.7-fold** (nominal $p < 0.001$)¹
 - Tezepelumab: **89% reduction**
 - Placebo: **25% reduction**
- **No significant differences between treatment groups** in change in other submucosal inflammatory cells were observed from baseline to EOT in neutrophils, CD3+ T cells, CD4+ T cells, tryptase+ mast cells, and chymase+ mast cells¹

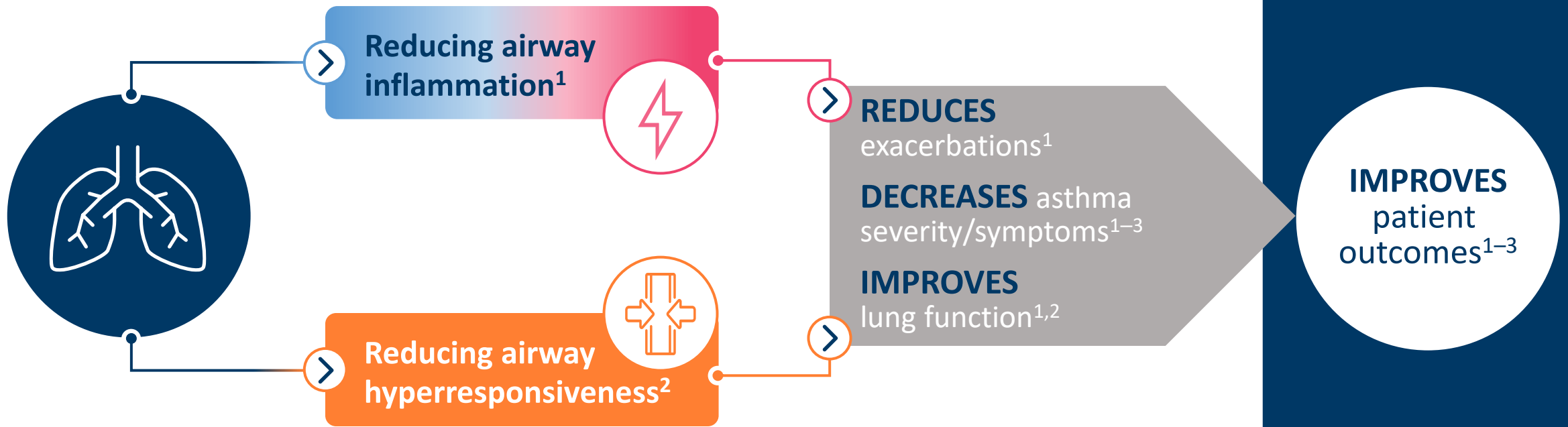
Select exploratory endpoint: Reduction from baseline to EOT in AHR




^aInterpolated/extrapolated absolute change in PD₁₅ to mannitol. PD₁₅ is defined as the cumulative provoking dose of mannitol required to induce $\geq 15\%$ reduction in FEV₁ from baseline zero mannitol dose, or otherwise $\geq 10\%$ reduction in FEV₁ between successive non-zero mannitol doses. PD₁₅ mannitol dose is considered the positive response dose at the first occurrence of the provoking dose; ^bData are mean with differences from baseline to end of treatment and between treatment groups shown as difference in LS means (95% CI);¹

CI = Confidence Interval; Eos = Eosinophils; FeNO = Fractional Exhaled Nitric Oxide; FEV₁ = Forced Expiratory Volume in 1 Second; IgE = Immunoglobulin E; IL = Interleukin; LS = Least Squares; PD₁₅ = Provoking Dose Causing a 15% Decline in FEV₁; Q4W = Every 4 Weeks; TSLP = Thymic Stromal Lymphopoietin

ADDRESSING TWO HALLMARKS OF ASTHMA MAY HELP TO IMPROVE OUTCOMES^{1,2}



THE CLINICAL PROGRAM WITH TEZPELUMAB¹⁻³




PATHWAY¹

Phase IIb

Efficacy and safety of Tezepelumab
in **adults with SUA**

N=550^a
Age range = 18–75 years

**No biomarker
restrictions**




NAVIGATOR²

Phase III

Efficacy and safety of Tezepelumab
in **adults and adolescents with
SUA**

N=1061^a
Age range = 12–80 years

**No biomarker
restrictions**



CASCADE³

Phase II

Effect of Tezepelumab on **airway
inflammatory cells**, remodelling
and **hyperresponsiveness** in
patients with uncontrolled asthma

N=116^a
Age range = 18–75 years

**No biomarker
restrictions**

^aIntention-to-treat population; SUA = Severe Uncontrolled Asthma

1. Corren J, Parnes JR, Wang L et al. Tezepelumab in Adults with Uncontrolled Asthma article inkl. Supplement; N Engl J Med. 2017;377:936–946; 2. Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma article and Supplement; N Engl J Med. 2021;384:1800–1809; 3. Diver S, Khalfaoui L, Emson C et al. Effect of tezepelumab on airway inflammatory cells, remodelling, and hyperresponsiveness in patients with moderate-to-severe uncontrolled asthma (CASCADE): a double-blind, randomised, placebo-controlled, phase 2 trial Lancet Respir Med. 2021;9:1299–1312

REDUCTION OF EXACERBATIONS^{1,2}

PATHWAY¹

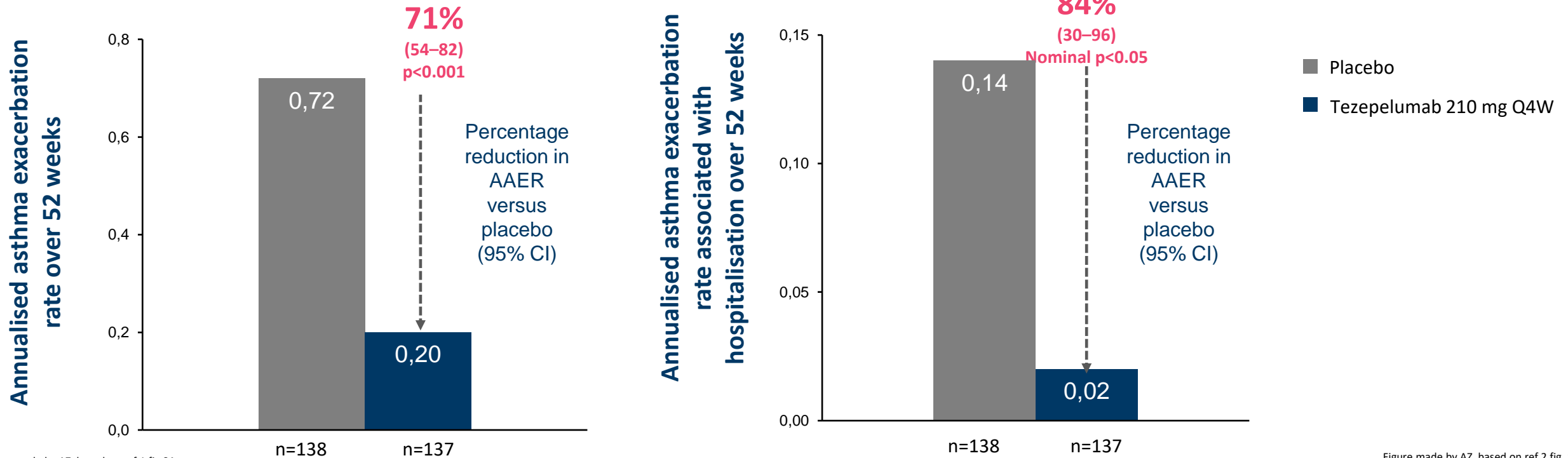


Figure made by AZ based on ref 1 fig S4 a

Figure made by AZ based on ref 2 fig. 1 a

13 PATHWAY included 3 tezepelumab doses; only data from the 210 mg dose are presented; Rate ratios are given with their 95% CIs

CI = Confidence Interval; Q4W = Every 4 Weeks; SUA = Severe Uncontrolled Asthma

1. Corren J, Parnes JR, Wang L et al. Tezepelumab in Adults with Uncontrolled Asthma article and Supplement; N Engl J Med. 2017;377:936–946; 2. Corren J, Chen S, Callan L et al. The effect of tezepelumab on hospitalizations and emergency department visits in patients with severe asthma *Ann Allergy Asthma Immunol.* 2020;125:211–214

REDUCTION OF EXACERBATIONS¹

NAVIGATOR¹

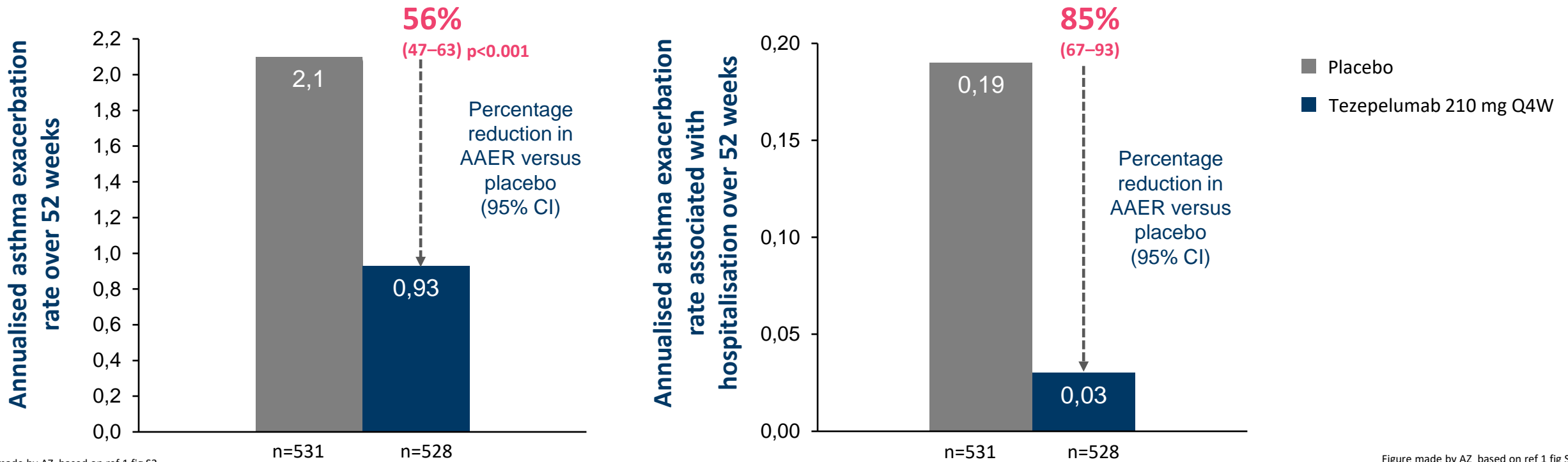


Figure made by AZ based on ref 1 fig S2

Figure made by AZ based on ref 1 fig S4 b

REDUCTION OF EXACERBATIONS, ACROSS PHENOTYPES AND IRRESPECTIVE OF BIOMARKER LEVELS^{1,a}

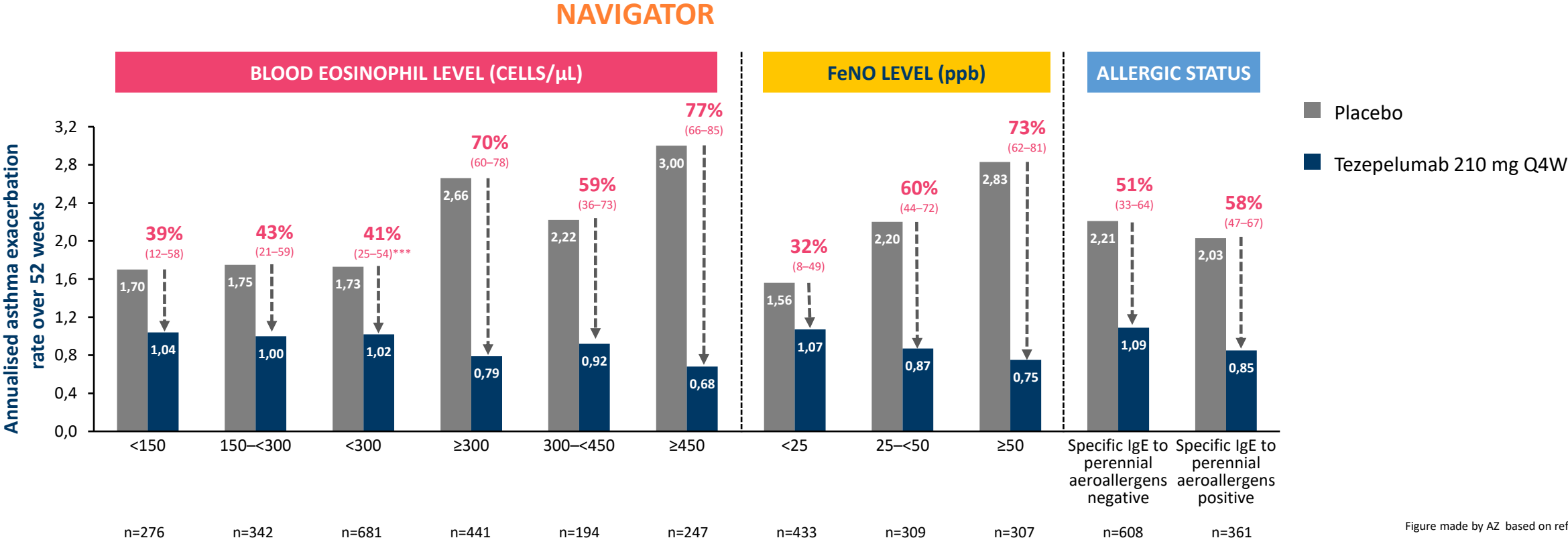


Figure made by AZ based on ref 1 fig 1

^aEosinophilic and non-eosinophilic, allergic and non-allergic; ***p<0.001 compared with placebo

CI = Confidence Interval; FeNO = Fractional Exhaled Nitric Oxide; IgE = Immunoglobulin E; Ppb = Parts per Billion; Q4W = Every 4 Weeks

1. Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma article and Supplement; N Engl J Med. 2021;384:1800-1809



IMPROVEMENTS IN LUNG FUNCTION¹

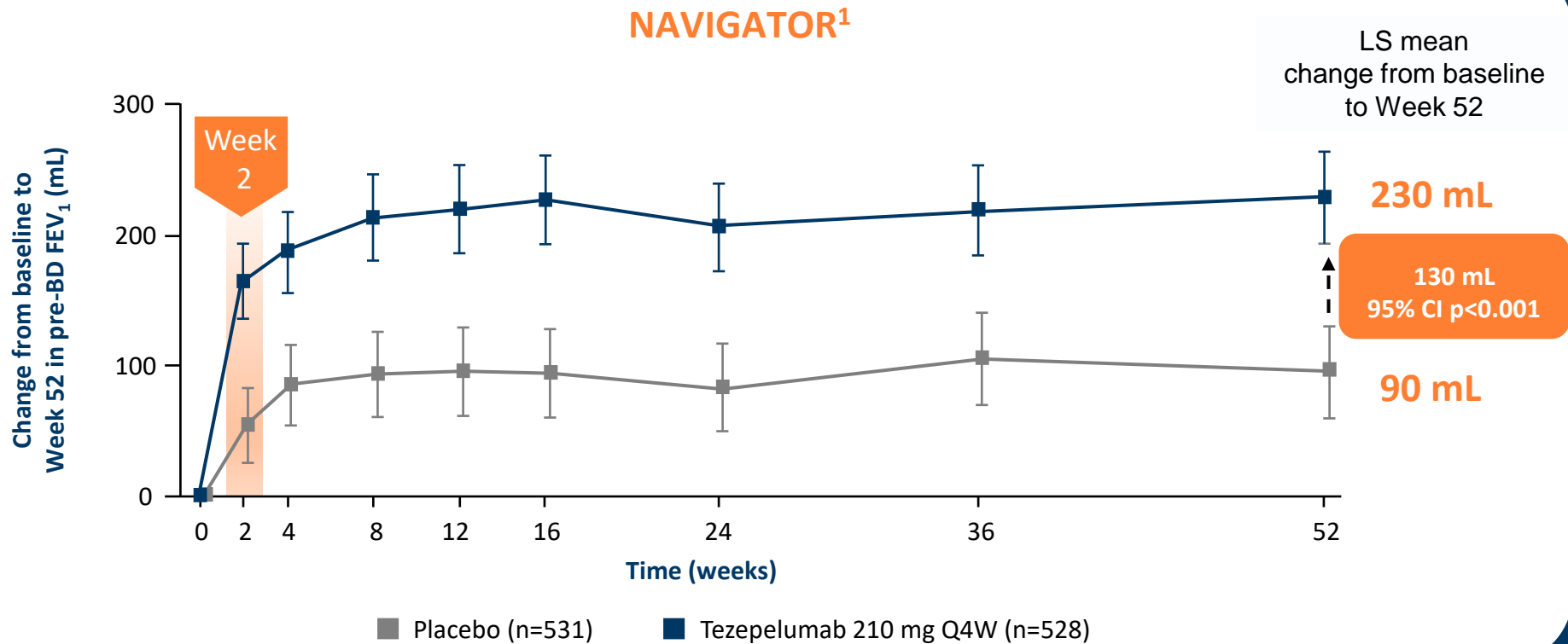
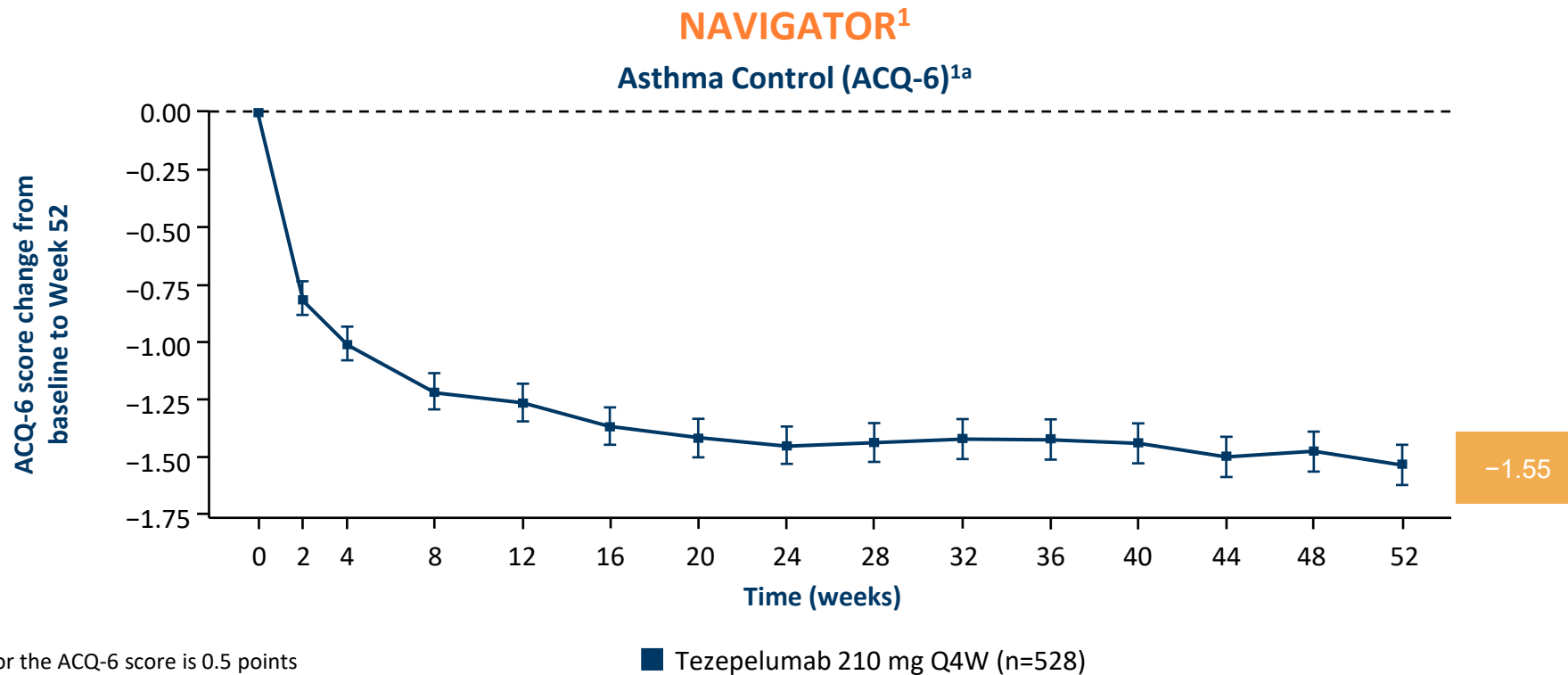


Figure made by AZ based on ref 1 fig 1

CLINICALLY MEANINGFUL IMPROVEMENTS IN ASTHMA CONTROL FROM BASELINE¹



MCID for the ACQ-6 score is 0.5 points

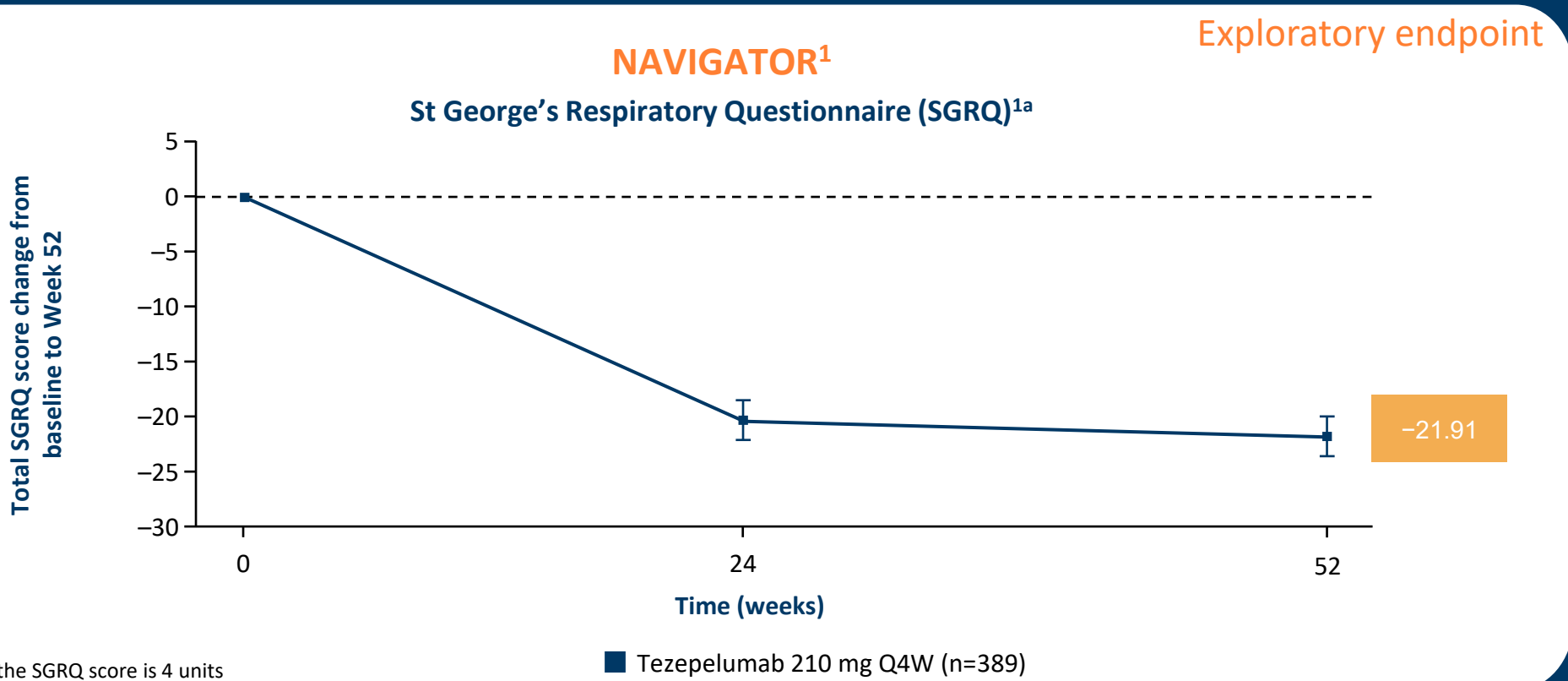
Figure made by AZ based on ref 1 fig S3 a

¹⁷ ^aLS mean change in the placebo group, -1.22 (n=531)

ACQ-6 = Asthma Control Questionnaire-6; LS = Least Squares; MCID = Minimal Clinically Important Difference; Q4W = Every 4 Weeks

¹Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma article and Supplement; N Engl J Med. 2021;384:1800–1809

CLINICALLY MEANINGFUL IMPROVEMENTS IN QUALITY OF LIFE FROM BASELINE¹



MCID for the SGRQ score is 4 units

Figure made by AZ based on ref 1 table S3

Data in figure are adjusted means and 95% CIs

^aScores were expressed as percentage of overall impairment where 100 represents worst possible health status and 0 indicated best possible health status; hence, decrease from baseline indicates improvement in health status;

CI = Confidence Interval; MCID = Minimal Clinically Important Difference; Q4W = Every 4 Weeks; SGRQ = St George's Respiratory Questionnaire

1. Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma article and Supplement; N Engl J Med. 2021;384:1800–1809

ADVERSE EVENTS¹

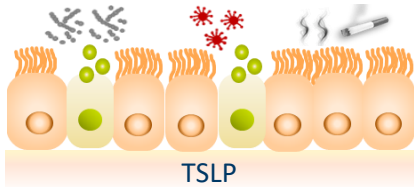
NAVIGATOR¹

Most Common AEs occurring in ≥3% of patients who received Tezepelumab, n (%)	Tezepelumab 210 mg Q4W n=528	Placebo n=531
Nasopharyngitis	113 (21.4)	114 (21.5)
Upper respiratory tract infection	59 (11.2)	87 (16.4)
Headache	43 (8.1)	45 (8.5)
Asthma	27 (5.1)	59 (11.1)
Bronchitis	25 (4.7)	33 (6.2)
Bronchitis bacterial	24 (4.5)	17 (3.2)
Hypertension	23 (4.4)	22 (4.1)
Urinary tract infection	22 (4.2)	22 (4.1)
Back pain	21 (4.0)	15 (2.8)
Arthralgia	20 (3.8)	13 (2.4)
Influenza-like illness	19 (3.6)	22 (4.1)
Sinusitis	19 (3.6)	40 (7.5)
Pharyngitis	17 (3.2)	15 (2.8)
Gastroenteritis	17 (3.2)	16 (3.0)
Viral upper respiratory tract infection	17 (3.2)	14 (2.6)
Rhinitis allergic	16 (3.0)	17 (3.2)
Rhinitis	14 (2.7)	17 (3.2)

SUMMARY

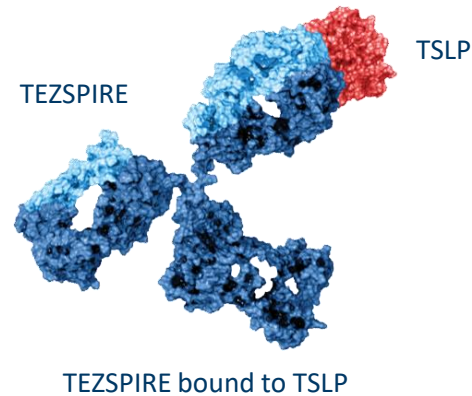
Severe Asthma and the Role of TSLP

- Severe asthma is a complex and heterogeneous disease¹
- TSLP is an epithelial cytokine, released in response to a variety of triggers, that drives airway inflammation and airway hyperresponsiveness²



First-in-Class Mechanism of Action

- Tezepelumab target TSLP, at the top of the cascade, reducing multiple drivers of airway inflammation and airway hyperresponsiveness²⁻⁷



Efficacy and Safety Profile

- Tezepelumab treats across phenotypes and irrespective of biomarker levels^{5,6}
 - Significant reduction in exacerbations and exacerbation related hospitalisations^{5,6}
 - Early improvement in lung function, asthma control and quality of life^{5,6}
 - No clinically meaningful differences in adverse events versus placebo^{5,6}

¹Global Initiative for Asthma (GINA);2022(cited 2023 Jan 11; <https://ginasthma.org/gina-reports>; ²Menzies-Gow A, Wechsler ME, Brightling CE; Unmet need in severe, uncontrolled asthma: can anti-TSLP therapy with tezepelumab provide a valuable new treatment option?; *Respir Res.* 2020;21:268; ³ Gauvreau GM, O'Byrne PM, Boulet LP et al. Effects of an anti-TSLP antibody on allergen-induced asthmatic responses *N Engl J Med.* 2014;370:2102–2110; ⁴ Diver S, Khalfaoui L, Emson C et al. Effect of tezepelumab on airway inflammatory cells, remodelling, and hyperresponsiveness in patients with moderate-to-severe uncontrolled asthma (CASCADE): a double-blind, randomised, placebo-controlled, phase 2 trial *Lancet Respir Med.* 2021;9:1299–1312; ⁵ Menzies-Gow A, Corren J, Bourdin A et al.; Tezepelumab in Adults and Adolescents with Severe, Uncontrolled Asthma article and Supplement; *N Engl J Med.* 2021;384:1800–1809; ⁶ Corren J, Parnes JR, Wang L et al. Tezepelumab in Adults with Uncontrolled Asthma article inkl. Supplement; *N Engl J Med.* 2017;377:936–946 ⁷ Gauvreau GM, Sehmi R, Ambrose CS et al. Thymic stromal lymphopoietin: its role and potential as a therapeutic target in asthma; *Expert Opin Ther Targets.* 2020;24:777–792

▼ TEZSPIRE (tezepelumab) - viktig informasjon (utvalg)

Indikasjon: Tezpire er indisert som tillegg til vedlikeholdsbehandling hos voksne og ungdom i alderen 12 år og eldre med alvorlig astma som er utilstrekkelig kontrollert til tross for høye doser inhalasjonskortikosteroider i tillegg til et annet legemiddel for vedlikeholdsbehandling.

Dosering: Anbefalt dose: 210 mg s.c. hver 4. uke. Tezpire er til langtidsbehandling. Minst 1 gang årlig bør det vurderes om behandlingen skal fortsette, basert på nivået av astmakontroll. Ved glemt dose, skal denne administreres så fort som mulig. Deretter kan doseringen gjenopptas på neste planlagte administrasjonsdag. Dersom det allerede er tid for neste dose, skal den administreres som planlagt. Dobbel dose skal ikke administreres. Behandling skal initieres av lege med erfaring med diagnostisering og behandling av alvorlig astma.

Vanlige bivirkninger: Faryngitt, utslett, artralgi, reaksjon på injeksjonsstedet.

Forsiktighetsregler: Skal ikke brukes til å behandle akutte astmaeksasjoner. Astmarelaterede symptomer eller eksasjoner kan oppstå. Pasienten bør instrueres om å oppsøke lege hvis astmaen forblir ukontrollert eller forverres. Brå seponering av kortikosteroider etter behandlingsoppstart anbefales ikke. Eventuell dosereduksjon av kortikosteroid bør skje gradvis under legeoppsyn. Overfølsomhetsreaksjon/anafylaksi kan oppstå innen noen timer, men også noen dager, etter administrering. Anamnese med anafylaksi (ikke relatert til Tezpire) kan være en risikofaktor. Pasienter skal overvåkes i passende tid etter administrering. Alvorlige infeksjoner bør behandles før oppstart av behandling. Ved utvikling av alvorlig infeksjon under behandling, bør behandlingen seponeres inntil denne er over. Pasienten skal informeres om å oppsøke øyeblikkelig legehjelp ved tegn/symptomer på kardiovaskulær hendelse. Ved utvikling av alvorlig kardiovaskulær hendelse bør behandlingen seponeres inntil den akutte hendelsen er stabilisert. Helmintinfeksjon bør behandles før behandlingsoppstart. Hvis pasienten smittes under behandling og ikke responderer på antihelmintika, skal Tezpire seponeres til infeksjonen går over. Levende, svekkede vaksiner skal unngås. Graviditet og amming: Bruk under graviditet bør unngås med mindre forventet nytte for den gravide oppveier mulig risiko for fosteret. Risiko for nyfødte som ammes de første dagene etter fødsel kan ikke utelukkes. Basert på fordel av amming for barnet/fordel av behandling for mor må det tas en beslutning om Tezpire skal avsluttes/avstås fra i denne perioden.

Pakninger og priser: Injeksjonsvæske, oppløsning i ferdigfylt penn (210 mg): 1 stk. kr. : 15 053,40
Injeksjonsvæske, oppløsning i ferdigfylt sprøyte (210 mg): 1 stk. kr. : 15 053,40

Reseptgruppe: C. Refusjon: H-resept.

Refusjonsberettiget bruk: Der det er utarbeidet nasjonale handlingsprogrammet/nasjonal faglig retningslinje og/eller anbefalinger fra RHF/LIS spesialistgruppe skal rekvirering gjøres i tråd med disse. Vilkår: 216 Refusjon ytes kun etter resept fra sykehuslege eller avtalespesialist. Anbud alvorlig astma. Behandlingen kan tas i bruk fra oppstart av neste avtaleperiode, tentativt 01.09.2024..

Beslutning i Beslutningsforum for nye metoder (18.03.2024)

Tezepelumab (Tezpire) innføres som tillegg til vedlikeholdsbehandling ved alvorlig astma med eosinofili hos voksne og ungdom i alderen 12 år og eldre som er utilstrekkelig kontrollert til tross for høye doser inhalasjonskortikosteroider i tillegg til et annet legemiddel for vedlikeholdsbehandling.

For fullstendig informasjon, les TEZSPIRE SPC på www.felleskatalogen.no

NO-12027-03-2024-TEZ

EKSTRA

Tezepelumab Reduced Exacerbations across a broad range of inflammatory profiles¹

NAVIGATOR¹

Annualised Asthma Exacerbation Rate (over 52 Weeks) According to Baseline Biomarkers

