ORIGINAL REPORT

Efficacy and Safety of Nemolizumab at Week 48: Results from the Maintenance Phase of Two Global Phase 3 Pivotal Studies (ARCADIA 1&2) in Patients with Moderate-to-Severe Atopic Dermatitis

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Nemolizumab with background topical therapy (corticosteroids±calcineurin inhibitors) significantly improved skin lesions, itch and sleep in two global phase 3 trials (ARCADIA 1&2) in adolescents and adults with moderate-to-severe atopic dermatitis through week (W)16. Efficacy and safety of nemolizumab, combined with background topical therapy, were evaluated for an additional 32 weeks (W16–W48) with a focus on maintained skin responses in clinical responders (patients achieving Investigator's Global Assessment [IGA] score of 0/1 [clear/almost clear] or ≥75% improvement in Eczema Area and Severity Index [EASI-75] at W16). At W16, clinical responders (*N*=507) to nemolizumab every 4 weeks (Q4W) were re-randomized (1:1:1) to receive nemolizumab 30 mg-Q4W/-Q8W/placebo (nemolizumab-withdrawal) subcutaneously with background topical therapy. At W48, 61.5% (strata-adjusted difference versus nemolizumab-withdrawal group [Δ], 11.8% [95% CI 1.3–22.3]) and 76.3% (Δ, 12.4% [95% CI 2.7–22.0]) of patients in nemolizumab-Q4W; 60.4% (Δ, 10.7% [95% CI 0.3–21.0]) and 75.7% (Δ, 11.8% [95% CI 2.1–21.5]) in nemolizumab-Q8W; and 49.7% and 63.9% in nemolizumab-withdrawal group maintained response rate for IGA success and EASI-75, respectively. The percentage of patients who experienced ≥1 adverse events were similar across the groups (range: 53.5%–58.3%). Up to W48, skin responses were maintained without notable differences in the safety profile of both nemolizumab dosing regimens.

Key words: atopic dermatitis; Investigator's Global Assessment; Eczema Area and Severity Index; itch; quality of life; sleep disturbance.

SIGNIFICANCE

The 16-week treatment results from ARCADIA 1&2 demonstrated that nemolizumab with topical therapy significantly improved signs and symptoms of moderate-to-severe atopic dermatitis, with notable benefits in itch response and sleep disturbance reduction. Our pooled 32 week maintenance data (weeks 16–48) further showed that clinical responders to nemolizumab 30 mg every 4 weeks (Q4W) at week 16 who were re-randomized to nemolizumab-Q4W or -Q8W with topical background therapy maintained these improvements through W48. Importantly, both dosing regimens had comparable safety profiles, reinforcing nemolizumab's sustained efficacy and tolerability.

Submitted Oct 8, 2025. Accepted after revision Apr 20, 2026

Published Jun 10, 2026.
DOI: 10.2340/actadv.v106.adv-2025-0085

Acta Derm Venereol 2026; 106: adv-2025-0085.

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Atopic dermatitis (AD) is a common and chronic inflammatory neuroimmune-mediated skin disease with multifactorial aetiology, affecting up to 10% adults and 20% children across different regions (1, 2). In multiple studies, individuals with AD ranked itch as their most burdensome symptom (3, 4). Pruritus, a characteristic symptom of AD, reduces quality of life (QoL); induces sleep disturbances; and negatively affects psychosocial well-being, daytime activities and work-related performance (5–7). Recently

approved targeted therapies for moderate-to-severe AD include biologics (dupilumab, tralokinumab and lebrikizumab) and oral Janus kinase inhibitors (abrocitinib, upadacitinib and baricitinib) (8–11). Long-term, efficacious and safe treatments are required to control the symptoms of AD and to improve the QoL. Heterogeneity of AD responses and concerns of adverse events (AEs) with current treatments emphasized the need for more long-term treatment options (12). Interleukin (IL)-31 is an important neuroimmune cytokine contributing to the primary pathogenesis of AD, promoting itch and perpetuating the itch–scratch cycle (13, 14). Nemolizumab, a novel humanized monoclonal antibody agent, specifically targets the IL-31 pathway of itch and inflammation in AD via IL-31 receptor alpha (15–17). Nemolizumab has been approved in the USA and Europe for the treatment of prurigo nodularis in adults and for moderate-to-severe AD in both adults and adolescents (aged ≥12 years) (18, 19). Subcutaneous nemolizumab 30 mg every 4 weeks (Q4W) with background topical therapy significantly improved skin lesions, itch and sleep in adolescents and adults with moderate-to-severe AD at week (W) 16 in phase 3 studies (ARCADIA 1&2) (20). Herein, we report an analysis of the pooled data from the 32-week treatment maintenance period of the ARCADIA 1&2 trials including maintenance of skin response.

MATERIALS AND METHODS

ARCADIA 1&2 were phase 3, 48-week randomized, double-blinded, placebo-controlled studies in ≥12-year-old patients with moderate-to-severe AD, associated pruritus and inadequate response to topical medications (topical corticosteroid [TCS] with/without topical calcineurin inhibitors [TCI]). For the initial 16-week treatment period, patients were randomized (2:1) to receive 30 mg nemolizumab (60 mg baseline loading dose) or matching placebo Q4W with background TCS–TCI. Details of the eligibility criteria have been reported previously (20).

This report presents a pooled analysis of the efficacy and safety data from the maintenance period (period from W16 [maintenance baseline, i.e. end of the initial treatment period/beginning of the maintenance period] to W48) of ARCADIA 1&2 in clinical responders to nemolizumab-Q4W (patients achieving either Investigator's Global Assessment [IGA] score of 0/1 [clear/almost clear] or ≥75% improvement in the Eczema Area and Severity Index (EASI-75) at W16). Clinical responders were re-randomized (1:1:1) to receive nemolizumab 30 mg-Q4W to Q4W + TCS–TCI (nemolizumab-Q4W group), nemolizumab 30 mg-Q4W to Q8W + TCS–TCI (with placebo at W20, W28, W36 and W44 to maintain the blind; nemolizumab-Q8W group), or placebo + TCS–TCI (nemolizumab-withdrawal group) subcutaneously for additional 32 weeks (last injection at W44) (Fig. S1). The nemolizumab-Q8W regimen aimed to evaluate whether clinical response could be maintained with less frequent dosing. Placebo responders at W16 continued placebo-Q4W and were not re-randomized or included in the pooled analysis. Patients who were non-responders at W16, or discontinued the study drug before W32 (but continued study visits until W32) or completed the W48 visit were eligible to be enrolled in a long-term extension study (NCT03989206).

ARCADIA 1&2 studies were carried out at 182 study centres in Europe, the USA and the Asia-Pacific region (Appendix S1). The maintenance period study was performed from February 12, 2020 to August 11, 2022 (ARCADIA 1) and from April 08, 2020 to September 26, 2022 (ARCADIA 2).

Procedure

Patients were advised to apply a moisturizer (current or investigator recommended) at least once daily throughout the study. Patients continued using background topical therapy (same as during the initial treatment period) for AD (including a medium-potency TCS for the body and a low-potency TCS/TCI for sensitive areas [face, neck and intertriginous areas]), adjusted according to disease activity and tolerability based on the investigator's clinical judgement. If deemed medically necessary by the investigator, rescue therapies (topical and systemic treatments, such as higher potency of TCS, oral corticosteroids, biologics [including their biosimilars], systemic nonsteroidal immunosuppressants/immunomodulators and phototherapy) could be recommended to patients during the study to control intolerable signs and/or symptoms of AD.

Efficacy endpoints were evaluated in the intent-to-treat (ITT) population, comprising all the re-randomized patients. Skin responses were assessed every 4 weeks using IGA and EASI, conducted by the investigator or a trained designee.

Diary data, e.g. Peak Pruritus Numerical Rating Scale (PP NRS) and Sleep Disturbance NRS, were assessed by an average using a minimum of 4 daily scores within 7 days' data before the visit for W24, W32, W40 and W48. The Dermatology Life Quality Index (DLQI) score was collected at W32 and W48. AEs were coded using MedDRA, v25.0. Treatment-emergent adverse events (TEAE) included any untoward medical occurrence after the first administration of the study drug. Adverse events of special interest (AESI) included injection-related reactions (IRR), newly diagnosed asthma or worsening of asthma, infections (severe, or requiring parenteral antibiotics, or oral anti-infectious agents for

>14 days and COVID-19), peripheral (bilateral)/facial oedema and elevated alanine aminotransferase/aspartate aminotransferase (>3 × upper limit of normal [ULN]) in combination with elevated bilirubin (>2 × ULN) for assessing potential drug-induced liver injury [DILI].

Endpoints

Maintenance endpoints included proportion of patients maintaining response rate for IGA success (score: 0/1 [clear/almost clear] and a ≥2-point reduction on the IGA scale from the initial baseline) and EASI-50, EASI-75 and EASI-90 (defined as ≥50%, ≥75% and ≥90% improvement from the initial baseline in the EASI score, respectively) up to W48. Improvements in pruritus included the weekly average change in PP NRS score in the ITT population. Patients with relapse (defined as clinically significant worsening of signs and/or symptoms of AD requiring rescue therapy, if judged to be medically necessary by the investigator) and time to relapse were also assessed. The change in mean DLQI was recorded to assess the QoL. Additional details on efficacy assessments are given in Appendix S1. Safety was assessed based on the incidence and severity of AEs, including AESI, TEAE and serious adverse events (SAE).

Statistical analysis

All efficacy endpoints were analysed for the ITT population. Analyses of efficacy endpoints were not multiplicity-adjusted. Confidence intervals (CIs) were presented as two-sided 95% CIs. Binary endpoints were analysed using a Cochran-Mantel-Haenszel test, adjusted for stratification variables (i.e. study variable). Missing data were managed using non-responder imputation for which patients with missing response were considered non-responders. Continuous endpoints and QoL were analysed using an analysis of covariance (ANCOVA) (including treatment group as factors and appropriate maintenance baseline values as covariates, if applicable). For the endpoint change in PP NRS, missing values were imputed using multiple imputation under missing at random assumption, while DLQI was analysed on observed cases (OC). The number of days free of topical therapy throughout the study was summarized as a continuous variable by visit using OC. When analysis was not performed on OC, if a patient received a rescue therapy, data on or after the receipt of rescue therapy were replaced by the worst possible value before any imputation method of missing data (i.e. non-response for binary endpoint and multiple imputation for continuous endpoint). For safety data, only those patients in the ITT population who received ≥1 dose of the study drug during the maintenance period were included in the analyses.

To check the robustness of findings, additional post hoc analyses were performed for maintenance of IGA success and EASI-75; maintenance of IGA success and EASI-75 in the subset of patients with such response at W16; ≥4 points improvement in PP NRS; and ≥4 point, ≥75% and ≥90% improvements in both SCORAD VAS-pruritus and SCORAD VAS-sleep (Appendix S1). All analyses were performed using SAS version 9.4 or higher.

RESULTS

In this pooled analysis, 507 clinical responders were re-randomized equally (*N*=169) to receive nemolizumab-Q4W, nemolizumab-Q8W or placebo with topical background therapy. Of the re-randomized patients, 422 (83.2%) completed the study after the maintenance period (142 [84.0%] nemolizumab-Q4W group, 147 [87.0%] nemolizumab-Q8W group and 133 [78.7%] nemolizumab-withdrawal group). Overall, 85 (16.8%) patients discontinued during the maintenance period (27 [16.0%] in nemolizumab-Q4W group, 22 [13.0%] in nemolizumab-Q8W group and 36 [21.3%] in nemolizumab-withdrawal group) (Fig. S2). The maintenance baseline and demographic characteristics were similar across the groups at W16 (**Table I**). In each group, most patients were female (57.4%–63.3%) and White (84.6%–87.0%), and the mean age ranged from 31.5 to 35.2 years. The percentage of adolescent patients (18.3%–20.1%) and disease characteristics at the maintenance baseline were similar across the treatment arms (Table I).

At W48, response rate for IGA success was maintained in 61.5% (strata-adjusted difference (Δ), 11.8% [95% CI 1.3–22.3]) and 60.4% (Δ, 10.7% [95% CI 0.3–21.0]) of patients in the nemolizumab-Q4W and nemolizumab-Q8W groups and was higher than that (49.7%) in the nemolizumab-withdrawal group (**Fig. 1**). The nemolizumab-Q4W and nemolizumab-Q8W groups maintained a higher response rate for EASI-75 than the nemolizumab-withdrawal group at W20 and at each visit up to W48 (nemolizumab-Q4W: 76.3%; Δ, 12.4%; 95% CI 2.7–22.0 and nemolizumab-Q8W: 75.7%; Δ, 11.8%; 95% CI 2.1–21.5 vs nemolizumab-withdrawal: 63.9%) (Fig. 1). At W48, EASI-50 and EASI-90 response rates were higher in patients in the nemolizumab-Q4W (EASI-50:82.2% [Δ, 10.6%; 95% CI 1.7–19.5]; EASI-90:58.6% [Δ, 11.8%; 95% CI 1.3–22.3]) and nemolizumab-Q8W groups (EASI-50:87.6% [Δ, 16.0%; 95% CI 7.6–24.4]; EASI-90:56.2% [Δ, 9.5%; 95% CI -1.1 to 20.0]) than those in the nemolizumab-withdrawal group

Table I. Maintenance baseline demographics and disease characteristics at W16

Variables	Nemolizumab-Q4W (*n* =169)	Nemolizumab-Q8W (*n*=169)	Nemolizumab-withdrawal (*n*=169)
Age, years, mean (SD)	31.5(16.1)	33.1(16.3)	35.2(19.3)
Age group, *n* (%)			
12–17years	34(20.1)	33(19.5)	31(18.3)
18–65years	128(75.7)	129(76.3)	119(70.4)
>65years	7(4.1)	7(4.1)	19(11.2)
Sex, *n* (%)			
Male	69(40.8)	72(42.6)	62(36.7)
Female	100(59.2)	97(57.4)	107(63.3)
Ethnicity, *n* (%)			
Hispanic or Latino	13(7.7)	26(15.4)	23(13.6)
Not Hispanic or Latino	156(92.3)	140(82.8)	144(85.2)
Not reported	0	3(1.8)	2(1.2)
Race, *n* (%)			
White	145(85.8)	143(84.6)	147(87.0)
Black/African American	8(4.7)	6(3.6)	8(4.7)
Asian	15(8.9)	19(11.2)	11(6.5)
Other[a]	1(0.6)	1(0.6)	3(1.8)
Body mass index (kg/m^2), mean (SD)	25.2(5.1)	25.7(5.4)	26.0(6.0)
EASI score, mean(SD)	2.9(3.2)	2.4(2.7)	3.0(3.1)
Investigator's Global Assessment score, *n* (%)			
0 - Clear	24(14.2)	24(14.2)	16(9.5)
1 - Almost clear	118(69.8)	118(69.8)	115(68.0)
2 - Mild	24(14.2)	27(16.0)	36(21.3)
3 - Moderate	3(1.8)	0	2(1.2)
Body surface area (%) of AD involvement, mean (SD)	9.2(10.7)	7.5(9.8)	10.1(11.6)
SCORAD, mean(SD)	18.5(10.9)	17.3(9.5)	19.9(10.9)
DLQI, mean (SD)	3.1(3.7)	3.0(3.3)	3.7(4.3)
cDLQI, mean (SD)	2.1(2.8)	3.7(3.3)	3.3(4.1)
Weekly average PP NRS, *n* mean (SD)	143, 2.1 (2.0)	155, 2.2 (2.1)	152, 2.7 (2.3)
Weekly average PP NRS group, *n* (%)			
PP NRS<4	115(68.0)	124(73.4)	107(63.3)
PP NRS≥4	28(16.6)	31(18.3)	45(26.6)
Not reported	26(15.4)	14(8.3)	17(10.1)
Weekly average AP NRS, *n* mean (SD)	143, 1.7 (1.8)	155, 1.9 (2.0)	152, 2.4 (2.3)
Weekly average SleepDisturbanceNRS, *n* mean (SD)	143, 1.3 (1.6)	154, 1.6 (2.0)	152, 2.0 (2.1)

Percentages (%) are based on number of patients in each treatment group (*N*). If W16 measurements were missing, the last valid non-missing measurements prior to W16 were taken as the maintenance baseline measurement.
[a]Multiple: Black or African American, Native Hawaiian or Other Pacific Islander; Multiple: White, Black or African American; and Multiple: White, Other.
AD: atopic dermatitis; AP NRS: Average Pruritus Numerical Rating Scale; cDLQI: Children's Dermatology Life Quality Index; DLQI: Dermatology Life Quality Index; EASI: Eczema Area and Severity Index; PP NRS: Peak Pruritus Numerical Rating Scale; Q4/Q8W: every 4/8 weeks; SCORAD: SCORing Atopic Dermatitis; SD: standard deviation; TCI: topical calcineurin inhibitors; TCS: topical corticosteroids.

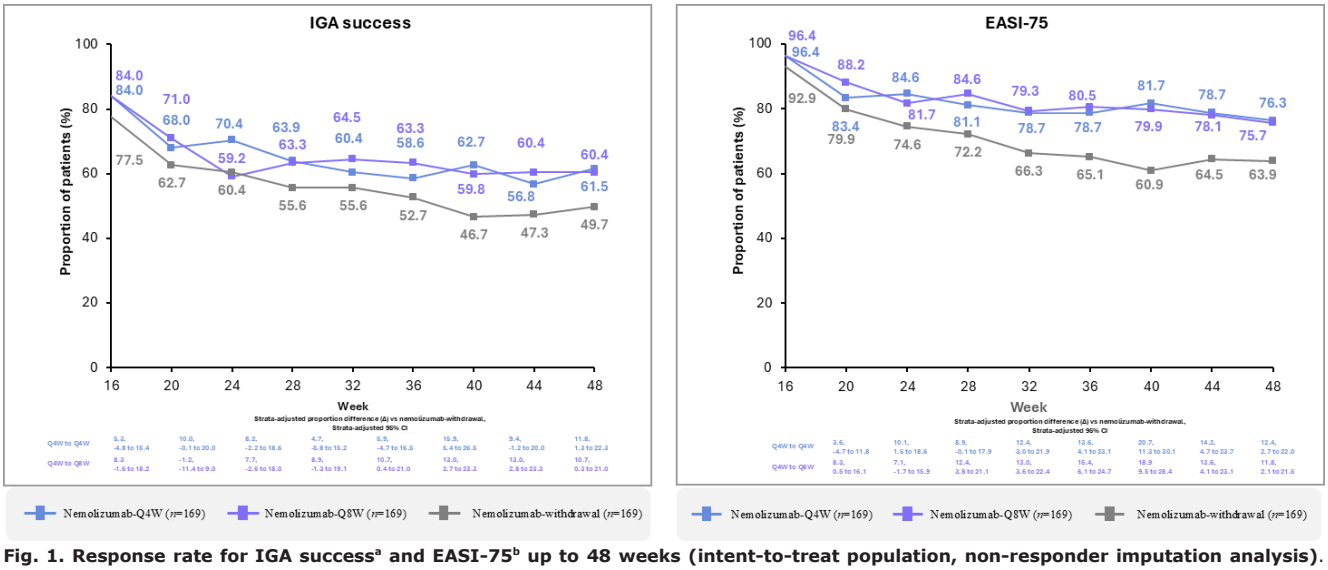

Fig. 1. Response rate for IGA success[a] and EASI-75[b] up to 48 weeks (intent-to-treat population, non-responder imputation analysis). The initial baseline value was the last valid value prior to the first injection of study treatment of the initial period. The initial period was from day 1/baseline to W16. For non-responder imputation, patients with data collected after use of rescue therapy or with missing data at a visit were considered non-responders. [a]Investigator's Global Assessment success was defined as 0/1 [clear/almost clear] and a ≥2-point reduction on the IGA scale from the initial baseline. [b]EASI-75 was defined as ≥75% improvement in EASI from the initial baseline. CI: confidence interval; EASI: Eczema Area and Severity Index; IGA: Investigator's Global Assessment; Q4/8W: every 4/8 weeks.

(EASI-50:71.6%; EASI-90:46.7%) (**Fig. 2**). At W48, the nemolizumab-treated groups showed a greater reduction in the weekly average PP NRS score from the maintenance baseline (W16) (least squares mean [LSM] change: nemolizumab-Q4W, -0.5; Δ, -1.8 [95% CI -2.4 to -1.2] and nemolizumab-Q8W, 0.1; Δ, −1.3 [95% CI −1.8 to −0.7]) than the nemolizumab-withdrawal group (LSM change: 1.4) (**Fig. 3**). LSM change from the maintenance baseline in the DLQI was greater in the nemolizumab-Q4W (−0.4; Δ, −1.1 [95% CI −2.1 to −0.2]) and nemolizumab-Q8W (0.1; Δ, −0.6 [95% CI −1.5 to 0.4%]) groups than in the nemolizumab-withdrawal group (0.7) at W48. This indicated an improvement in QoL in the nemolizumab arms compared with the nemolizumab-withdrawal arm (**Table II**).

Post hoc analysis of a ≥4-point improvement in weekly average PP NRS score revealed that at W16, the response rate was achieved by 68.8% (Δ, 14.5% [95% CI 3.6–25.4]), 60.5% (Δ, 6.2% [95% CI –4.8 to 17.2]) and 54.3% of patients in nemolizumab-Q4W, nemolizumab-Q8W and nemolizumab-withdrawal groups, respectively. By W48, the response rate further increased in the nemolizumab-Q4W (76.2%; Δ, 35.2% [95% CI 23.5–47.0]) group, was well maintained in the nemolizumab-Q8W (59.7%; Δ, 18.7% [95% CI 6.7–30.7]) group and was higher in both treatment groups than the nemolizumab-withdrawal group (41.0%) (Fig. S3). At W16, itch-free or nearly itch-free state (weekly average PP NRS score <2) was achieved by 50.5% (nemolizumab-Q4W: Δ, 9.1%; 95% CI –2.1 to 20.3]), 50.8% (nemolizumab-Q8W: Δ, 9.4%; 95% CI –1.7 to 20.4]) and 41.5% (nemolizumab-withdrawal) of patients. At W48, 64.0% of patients in the nemolizumab-Q4W group (Δ, 32.8% [95% CI 20.6–45.0]) and 52.9% in the nemolizumab-Q8W group (Δ, 21.7% [95% CI 9.4–33.9]) achieved itch-free or nearly itch-free state compared with 31.3% in the nemolizumab-withdrawal group (Fig. S3). At W48, more patients in the nemolizumab-Q4W (57.7%; Δ, 18.7% [95% CI 6.3–31.0]) and nemolizumab-Q8W (50.1%; Δ, 11.1% [95% CI –1.1 to 23.3]) groups than in the nemolizumab-withdrawal group (39.0%) maintained response rate for a ≥4-point improvement in weekly average Sleep Disturbance NRS (Fig. S4). The mean number of days free of topical AD therapy at W48 was higher in the nemolizumab-Q4W (45.7) and nemolizumab-Q8W (54.3) groups than in the nemolizumab-withdrawal group (38.9) (Table SI). During the maintenance period, topical and systemic rescue therapies were used by 1.2% and 0% (nemolizumab-Q4W), 2.4% and 0.6% (nemolizumab-Q8W) and 5.3% and 2.4% (nemolizumab-withdrawal) of patients, respectively (Table SII). Outcomes for other efficacy endpoints are presented in Appendix S1.

In the pooled maintenance data, 53.5%, 53.9% and 58.3% of patients in the nemolizumab-Q4W, nemolizumab-Q8W and nemolizumab-withdrawal groups, respectively, experienced any TEAE (**Table III**). Treatment-emergent SAE were experienced by 5.9%, 1.8% and 2.4% of patients in the nemolizumab-Q4W, nemolizumab-Q8W and nemolizumab-withdrawal groups, respectively. The study drug-related SAE were experienced by 0.6% (nemolizumab-Q4W), 0% (nemolizumab-Q8W group) and 0.6% (nemolizumab-withdrawal) of patients. TEAE leading to study discontinuation were experienced by 1.8% of patients in the nemolizumab-Q4W, 3.0%

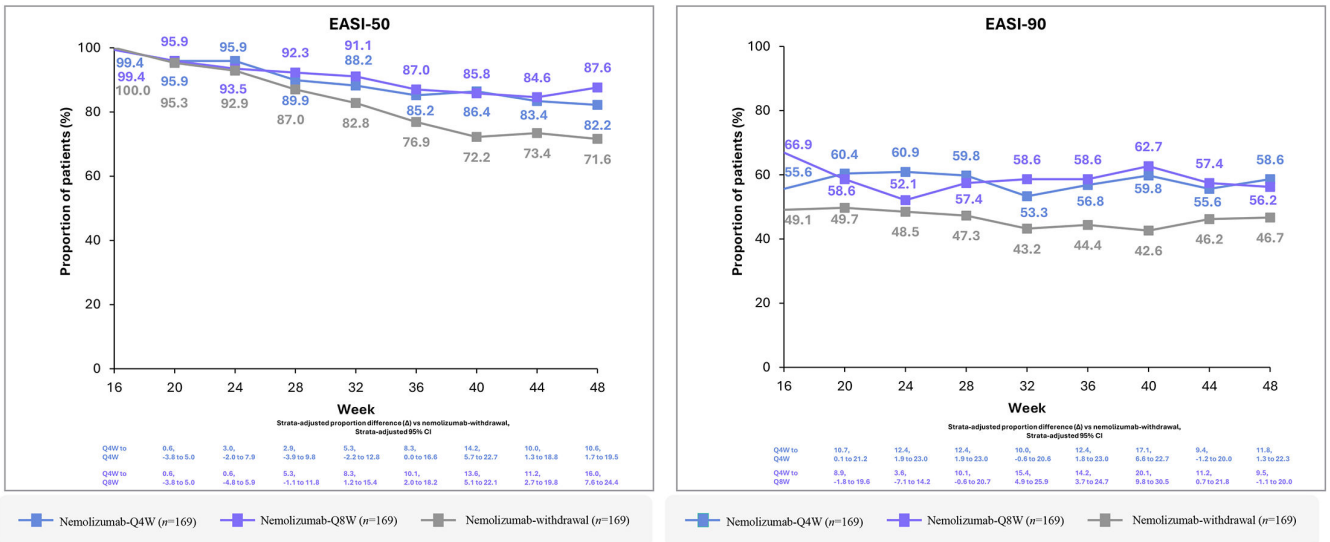

Fig. 2. Response rate for EASI-50[a] and EASI-90[a] up to 48 weeks (intent-to-treat population, non-responder imputation analysis). The initial baseline value was the last valid value prior to the first injection of study treatment of the initial period. The initial period was from day 1/baseline to W16. For NRI, patients with data collected after use of rescue therapy or with missing data at a visit were considered non-responders. [a]EASI-50/90 was defined as ≥50%/≥90% improvement in EASI from the initial baseline. CI: confidence interval; EASI: Eczema Area and Severity Index; Q4/8W: every 4/8 weeks.

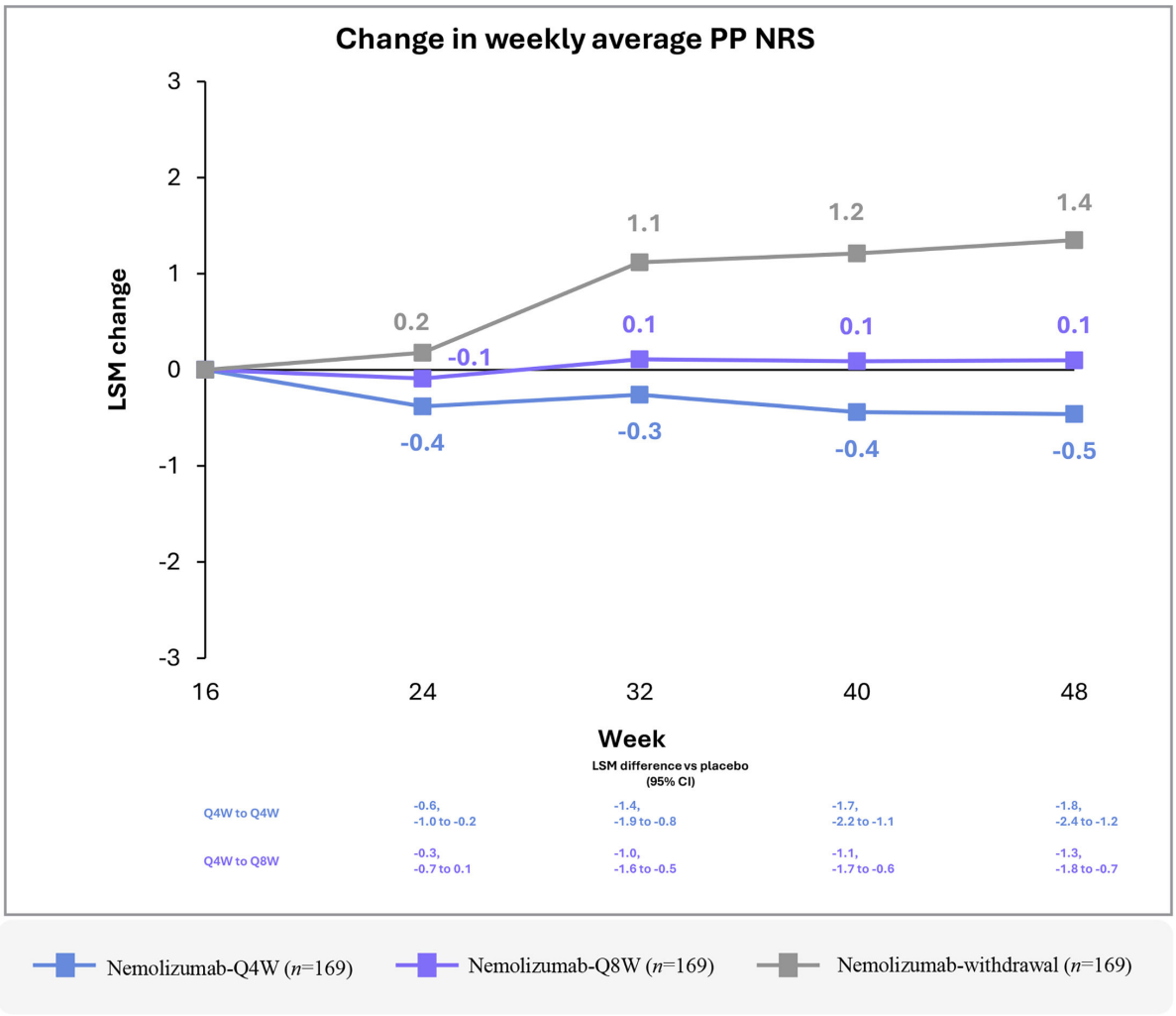

Fig. 3. Change from maintenance baseline in weekly average PP NRS (intent-to-treat population, multiple imputation-missing at random analysis). W16 measurement served as maintenance baseline measurements. If W16 measurements were missing, the last valid nonmissing measurements prior to W16 were taken as the maintenance baseline measurement. The analysis of variance model was used for the change from the maintenance baseline as the dependent variable, including treatment group and study as factors, and the maintenance baseline PP NRS as a covariate. If a patient received any rescue therapy, the data after receipt of rescue therapy were imputed to the worst possible value.CI: confidence interval; LSM: least squares mean; PP NRS: Peak Pruritus Numerical Rating Scale; Q4W: every 4 weeks; Q8W: every 8 weeks.

Table II. Change in DLQI total score from Week 16 (maintenance baseline) at W32 and W48 (ITT population)

Analysis visit	Statistics	Nemolizumab-Q4W (*n* =169)	Nemolizumab-Q8W(***n***=169)	Nemolizumab-withdrawal (*n*=169)
W32	*n*	128	140	132
	LSM (SE)	−0.1(0.4)	0.6(0.4)	1.7(0.4)
	95%CI	−0.9, 0.6	−0.1, 1.3	1.0, 2.4
	LSM difference (95% CI)	−1.8 (−2.8,−0.8)	−1.1 (−2.1,−0.1)	
W48	*n*	119	130	110
	LSM (SE)	−0.4(0.3)	0.1(0.3)	0.70(0.4)
	95%CI	−1.1, 0.2	−0.5, 0.8	0.0, 1.4
	LSM difference (95% CI)	−1.1 (−2.1,−0.2)	−0.6 (−1.5, 0.4)	

W16 measurement served as maintenance baseline measurement. If W16 measurement was missing, the last valid non-missing measurement prior to W16 was taken as the maintenance baseline measurement for the maintenance period.
DLQI score was calculated by summing up question scores, with a range of 0 to 30. A higher score means a greater impairment of quality of life.
The analysis of covariance model was used for the change from maintenance baseline as the dependent variable, including treatment group and study as factors, and the maintenance baseline DLQI as a covariate.
In observed cases analysis, all observed data even after use of rescue therapy were included; no imputation for missing data.
CI: confidence interval; DLQI: Dermatology Life Quality Index; ITT: intent-to-treat; LSM: least squares mean; *N*: number of patients in the treatment group; *n*: number of patients with available data; Q4W: every 4 weeks; Q8W: every 8 weeks; SE: standard error; TCI: topical calcineurin inhibitors; TCS: topical corticosteroids.

Table III. Overall summary of treatment-emergent adverse events over the maintenance period (from W16 to W48)

CategorySystem organ classMedDRA PT	Nemolizumab-Q4W (*n* = 170)	Nemolizumab-Q8W *n* = 167)	Nemolizumab withdrawal (*n*=168)
Any TEAE, *n* (%)	91(53.5)	90(53.9)	98(58.3)
Any serious TEAE	10(5.9)	3(1.8)	4(2.4)
Any serious TEAE related to study drug	1(0.6)	0	1(0.6)
Any TEAE leading to study discontinuation, *n* (%)	3(1.8)	5(3.0)	4(2.4)
Any TEAE leading to death, *n* (%)	0	0	0
Any severe TEAE, *n* (%)	5(2.9)	6(3.6)	5(3.0)
AESI, *n* (%)	24(14.1)	25(15.0)	31(18.5)
Infections[a]	16(9.4)	17(10.2)	25(14.9)
COVID-19	13(7.6)	13(7.8)	19(11.3)
Asymptomatic COVID-19	2(1.2)	3(1.8)	4(2.4)
Cellulitis	0	3(1.8)	1(0.6)
New onset asthma events (Post adjudication by IAC)	2(1.2)	0	0
Worsening of asthma events (Post adjudication by IAC)	7(4.1)	6(3.6)	6(3.6)
Peripheral oedema: limbs, bilateral; facial oedema	1(0.6)	2(1.2)	3(1.8)
Peripheral oedema	1(0.6)	0	0
Facial oedema	0	1(0.6)	2(1.2)
Other oedema		1(0.6)[b]	1 (0.6)[c]
Elevated ALT or AST (>3 × ULN) in combination with elevated bilirubin (>2 × ULN)	0	0	0
Injection-related reactions	0	0	0
TEAEs ≥2%(MedDRA Preferred Term)			
Nasopharyngitis	14(8.2)	8(4.8)	12(7.1)
COVID-19	13(7.6)	13(7.8)	19(11.3)
Dermatitis atopic	13(7.6)	11(6.6)	18(10.7)
Headache	6(3.5)	7(4.2)	3(1.8)
Asthma	6(3.5)	6(3.6)	6(3.6)
Abdominal pain upper	4(2.4)	1(0.6)	0
Diarrhoea	4(2.4)	3(1.8)	6(3.6)
Upper respiratory tract infection	4(2.4)	5(3.0)	10(6.0)
Dyspnoea	4(2.4)	1(0.6)	3(1.8)
Asymptomatic COVID-19	2(1.2)	3(1.8)	4(2.4)
Cough	2(1.2)	1(0.6)	4(2.4)
Acne	1(0.6)	6(3.6)	1(0.6)
Sinusitis	0	3(1.8)	4(2.4)

[a]Infections (severe or requiring parenteral antibiotics or oral anti-infectious agents for >14 days and COVID-19). [b]Event of joint swelling. [c]Event of angioedema (verbatim: angioedema of the hands).
AESI: adverse events AEs of special interest; ALT: alanine aminotransferase; AST: aspartate aminotransferase; COVID-19: coronavirus disease-2019; IAC: independent adjudication committee; MedDRA: Medical Dictionary for Regulatory Activities; *N*: number of patients in the treatment group; *n*: number of patients with available data; PT: Preferred Term; Q4W: every 4 weeks; Q8W: every 8 weeks; TCI: topical calcineurin inhibitors; TCS: topical corticosteroids; TEAE: treatment-emergent adverse event; ULN: upper limit of normal.

in nemolizumab-Q8W and 2.4% in nemolizumab-withdrawal group. No deaths were reported during the study. AESIs were experienced by 14.1% of patients in the nemolizumab-Q4W, 15.0% in nemolizumab-Q8W and 18.5% in nemolizumab-withdrawal group.

No patients experienced IRR or possible DILI during the study. Infections (per AESI definition) were reported in 9.4% (nemolizumab-Q4W group), 10.2% (nemolizumab-Q8W group) and 14.9% (nemolizumab-withdrawal) of patients. Infections experienced by >1% of patients were COVID-19 (13 [7.6%; nemolizumab-Q4W], 13 [7.8%; nemolizumab-Q8W] and 19 [11.3%; nemolizumab-withdrawal]), asymptomatic COVID-19 (2 [1.2%; nemolizumab-Q4W], 3 [1.8%; nemolizumab-Q8W] and 4 [2.4%; nemolizumab-withdrawal]) and cellulitis 0 [0%; nemolizumab-Q4W], 3 [1.8%; nemolizumab-Q8W] and 1 (0.6%; nemolizumab-withdrawal). After adjudication, 2 (1.2%) patients (nemolizumab-Q4W) were confirmed with new onset asthma, and 7 (4.1%; nemolizumab-Q4W), 6 (3.6%; nemolizumab-Q8W) and 6 (3.6%; nemolizumab-withdrawal) with worsening of (pre-existing) asthma. Peripheral/facial oedema was reported in 1 (0.6%; nemolizumab-Q4W), 2 (1.2%; nemolizumab-Q8W) and 3 (1.8%; nemolizumab-withdrawal) patients. Most of the TEAE were non-serious and mild or moderate in intensity. The most common TEAEs (occurring in ≥2% of the patients) were nasopharyngitis, COVID-19 and dermatitis atopic that occurred with a higher frequency in the nemolizumab-withdrawal group. No notable differences between the safety profiles of nemolizumab-Q4W and nemolizumab-Q8W regimens were observed although some differences were noted for some events without evidence of safety concern.

DISCUSSION

Our study highlights that clinical responders to nemolizumab at W16 maintained their response through W48, whether they continued with nemolizumab-Q4W or transitioned to a less frequent dosing regimen nemolizumab-Q8W. Importantly, the use of background TCS–TCI with nemolizumab aligned with standard clinical practice, reflecting real-world management strategies for AD (20, 21).

The skin responses between the nemolizumab-Q8W and nemolizumab-Q4W groups were similar with a higher proportion of patients in these groups maintaining IGA success and EASI-75 response rate than (>60% and >75% of patients, respectively) than in the nemolizumab-withdrawal group, which is consistent with lebrikizumab-Q2W and lebrikizumab-Q4W (without background therapy) (22). At W32, the proportion of patients achieving EASI-75 with nemolizumab-Q4W and nemolizumab-Q8W (≥78.7%) was similar to that (70.2%) in a study of tralokinumab-Q4W+TCS in adults with moderate-to-severe AD (23). Our findings suggest that a clinical response achieved after 16-week induction with nemolizumab-Q4W can be maintained even with the less frequent maintenance dosing of nemolizumab-Q8W. A greater maintenance of a ≥4-point improvement in weekly average of PP NRS in the nemolizumab- than placebo-treated patients was noted throughout the maintenance period. A high response rate in itch-free state/nearly itch-free state was achieved with the Q4W-dosing regimen. This was further supported by an analysis of the VAS pruritus component of SCORAD (Fig. S5), showing a higher maintenance of itch response in the two active arms of nemolizumab than nemolizumab-withdrawal up to W48. Similar improvements in sleep disturbances were observed, supported by SCORAD VAS Sleep Loss component data (Fig. S5). Increased itch intensity is associated with reduced QoL. A durable and maintained response in QoL was noted when patients were continued on nemolizumab-Q4W or spaced out to nemolizumab-Q8W. Maintenance of improvements in itch responses might have influenced this outcome, similar to previous studies in which itch was considered to affect QoL (24, 25). In our study, itch response was maintained with Q8W; moreover, additional benefits were observed with Q4W, along with improvement in sleep and QoL. The clinical significance of the Q8W-dosing regimen lies in optimizing patient convenience by minimizing dosing frequency, thereby enhancing adherence to the treatment. The high rate of efficacy maintenance in the nemolizumab-withdrawal group supports the idea of a long-lasting effect of nemolizumab and suggests that the dosing interval could be extended up to Q8W.

Overall, the safety profile during the maintenance treatment period, as well as the proportion of patients confirmed with new onset asthma or worsening of pre-existing asthma, was consistent with those from the initial 16-week treatment period with nemolizumab (20). This suggests no increased risk with longer exposure to nemolizumab and supports the conclusion that the observed incidences are consistent with the background risk of asthma (newly diagnosed and worsening) in the studied atopic population. Only one patient in the nemolizumab-Q8W group had a study drug-related peripheral oedema (reported as joint swelling), which was not resolved at the end of study. Our findings showed that a longer duration of treatment with nemolizumab did not result in higher incidences of TEAE than those reported over a 16-week treatment period, and no new safety findings were observed during the maintenance period (20).

Limitations

Limitations of our study are the inclusion of topical background therapy, which is consistent with standard clinical practice and might have influenced the observed nemolizumab-withdrawal response. Furthermore, we did not record the weight of TCS–TCI tubes, which limited the ability to accurately assess its usage throughout the study period.

Conclusion

This pooled study showed that responses with the nemolizumab-Q8W and nemolizumab-Q4W regimens with topical background therapy were similar in terms of maintenance of efficacy in skin lesions and itch, as well as impact on sleep and QoL. These results suggest that the nemolizumab-Q8W dose can be used as a maintenance regimen for patients responding to the nemolizumab-Q4W dose. No notable differences in the safety profile between both treatment arms were observed. Overall, the safety profile of nemolizumab over 32 additional weeks was consistent with that of the 16-week initial treatment period. Nemolizumab offered a therapeutic value in adults and adolescents with moderate-to-severe AD up to W48 and further data are required to evaluate long-term safety and efficacy of nemolizumab.

ACKNOWLEDGEMENTS

We thank the clinical trial participants and caregivers, the investigators and the nemolizumab team at Galderma for their contributions to the trial, analyses, manuscript, or all three. Medical writing and editorial support was provided by Dr. Deepika and Anjana (employees of Galderma) in accordance with the Good Publication Practice (GPP) 2022 guidelines.

Funding sources: Galderma.

Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics committee: This study adhered to the Declaration of Helsinki, International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use and Good Clinical Practice guidelines. All patients/guardians (in case of <18-year-old patients) provided written informed consent and were fully informed about the purpose, methods, benefits and risks of the investigational medicinal product. In addition, an independent data monitoring committee reviewed and

monitored patient safety. An independent adjudication committee assessed asthma-related events (pre-defined by the Standardised Medical Dictionary for Regulatory Activities [MedDRA] Query [asthma/bronchospasm]). Both trials were registered with ClinicalTrials.gov (ARCADIA 1, NCT03985943 and ARCADIA 2, NCT03989349).

Disclosure: AW has served as an advisor or paid speaker for, or participated in clinical trials (with honoraria paid to the institution) sponsored by AbbVie, Aileens, Almirall, Amgen, Apogee, Beiersdorf, Bioderma, Bioproject, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Chugai, DKSH, Eli Lilly, Galapagos, Galderma, Glenmark, GSK, Hans Karrer, Hexal, Incyte, Janssen-Cilag, Kyowa Kirin, LEO Pharma, L'Oréal, Maruho, MedImmune, MSD, Mylan, Nektar, Novartis, Pfizer, Pierre Fabre, Regeneron, Sandoz, Santen, Sanofi-Aventis and UCB. JIS has received honoraria as a consultant and/or advisory board member from AbbVie, Afyx, Aobiome, Arena, Asana, Aslan, BioMX, Bluefin, Bodewell, Boehringer-Ingelheim, Celgene, Connect Biopharma, Dermavant, Dermira, Eli Lilly, Galderma, GlaxoSmithKline, Incyte, Kiniksa, LEO Pharma, Luna, Menlo, Novartis, Pfizer, RAPT, Regeneron and Sanofi-Genzyme and as a speaker from AbbVie, Eli Lilly, LEO Pharma, Pfizer, Regeneron and Sanofi-Genzyme; his institution has received grants from Galderma and Pfizer. FJL served as an investigator for Galderma and has received consulting fees or honoraria from AbbVie, Almirall, Amgen, Celgene, Eli Lilly, Galderma, LEO Pharma, Menlo Therapeutics, Novartis, Pelpharma, Pfizer, Sanofi Aventis, Trevi Therapeutics and Vifor Pharma. MT has served as an advisor and/or paid speaker for and/or participated in clinical trials sponsored by AbbVie, Almirall, Boehringer Ingelheim, Galderma, Janssen-Cilag, LEO Pharma, Eli Lilly, MEDAC, Novartis, Pfizer and Sanofi. VTL has served as investigator for AbbVie, Acelyrin, Acrotech, Amgen, Argenx, Arcutis, Aslan, Biofrontera, Bristol Meyers Squibb, Cara, Dermavant, Eli Lilly, Galderma, Horizon Therapeutics, Incyte, Janssen, LEO Pharma, Novartis, Padagis, Pfizer, Q32, Rapt, Sun, UCB and Ventyx. AWA has served as an investigator for Galderma and has received research grants and personal fees from Bristol Myers Squibb, Eli Lilly, Janssen, LEO Pharma and Novartis, has received personal fees from Boehringer Ingelheim/Parexel, Celgene, Dermavant, Genentech, GlaxoSmithKline, Menlo Therapeutics, Merck, Modernizing Medicine, Ortho Dermatologics, Pfizer, Regeneron, Sanofi Genzyme, Science 37, Sun Pharma and Valeant and has received grants from Dermira, Kyowa Hakko Kirin, and UCB, outside the submitted work. AEP has received grants or contracts from Amgen, Medac Pharma and Pfizer and acted as an investigator, speaker and advisor for or received educational support or research funding from Sanofi, Eli Lilly, Pfizer, LEO Pharma, AbbVie, Galderma, Novartis, Janssen, Boehringer Ingelheim, Bristol Myers Squibb, UCB, Amgen, Almirall, Artax Biopharma and Medac Pharma. LN reported grants from Galderma and additional grants and fees from AbbVie, Almirall, BMS, Galderma, LEO Pharma, Eli Lilly, Janssen, Novartis, Pfizer and Sanofi, outside the submitted work. GP has received consulting fees or honoraria and personal fees for travel/accommodation/meeting expenses from Chugai Pharmaceutical. JZ reports serving as an investigator for Almirall, Amgen, BMS, Galderma, Incyte, Innovaderm, Pfizer, Regeneron Pharmaceuticals Inc. and Syneos Health. AT has received consulting fees from Galderma, outside the study. JD has no financial disclosures to report. IS is an investigator of Galderma. JB serves as a consultant for AbbVie, Amgen, Arcutis, Bristol Myers Squibb, Celgene, Eli Lilly, Janssen, LEO Pharma, Novartis, Pfizer, Sun Pharma and UCB, is a speaker for AbbVie, Amgen, Arcutis, Bristol Myers Squibb, Celgene, Eli Lilly, Janssen, LEO Pharma, Novartis, Sun Pharma and UCB, and received research grants from AbbVie, Amgen, Concert, Evelo, Incyte, Janssen, LEO Pharma, Pfizer and Novartis. GB has received fees as a consultant, speaker or for conducting clinical trials from AbbVie, Almirall, Amgen, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Eli Lilly, Galderma, Infectopharm, Janssen-Cilag, LEO Pharma, Novartis, MoonLake, Pfizer, Sanofi and UCB Pharma. SP has served as an investigator for Galderma. LU, AR, JM and CP are employees of Galderma.

The authors have no conflicts of interest to declare.

REFERENCES

1. Wollenberg A, Barbarot S, Bieber T, Christen-Zaech S, Deleuran M, Fink-Wagner A, et al. Consensus-based European guidelines for treatment of atopic eczema (atopic dermatitis) in adults and children: part I. J Eur Acad Dermatol Venereol 2018; 32: 657–682. https://doi.org/10.1111/jdv.14891
2. Wollenberg A, Christen-Zäch S, Taieb A, Paul C, Thyssen JP, de Bruin-Weller M, et al. ETFAD/EADV Eczema task force 2020 position paper on diagnosis and treatment of atopic dermatitis in adults and children. Acad Dermatol Venereol 2020; 34: 2717–2744. https://doi.org/10.1111/jdv.16892
3. Silverberg JI, Gelfand JM, Margolis DJ, Boguniewicz M, Fonacier L, Grayson MH, et al. Patient burden and quality of life in atopic dermatitis in US adults: a population-based cross-sectional study. Ann Allergy Asthma Immunol 2018; 121: 340–347. https://doi.org/10.1016/j.anai.2018.07.006
4. Silverberg JI, Mohawk JA, Cirulli J, Nograles K, Punzalan JC, Kelly KM, et al. Burden of disease and unmet needs in atopic dermatitis: results from a patient survey. Dermatitis® 2023; 34: 135–144. https://doi.org/10.1089/derm.2022.29015.jsi
5. Silverberg JI, Pinter A, Alavi A, Lynde C, Bouaziz JD, Wollenberg A, et al. Nemolizumab is associated with a rapid improvement in atopic dermatitis signs and symptoms: subpopulation (EASI ≥ 16) analysis of randomized phase 2B study. J Eur Acad Dermatol Venereol 2021; 35: 1562–1568. https://doi.org/10.1111/jdv.17218
6. Yu SH, Attarian H, Zee P, Silverberg JI. Burden of sleep and fatigue in US adults with atopic dermatitis. Dermatitis 2016; 27: 50–58. https://doi.org/10.1097/DER.0000000000000161
7. Ruzicka T, Hanifin JM, Furue M, Pulka G, Mlynarczyk I, Wollenberg A, et al. Anti–interleukin-31 receptor A antibody for atopic dermatitis. N Engl J Med 2017; 376: 826–835. https://doi.org/10.1056/NEJMoa1606490
8. Schneider S, Li L, Zink A. The new era of biologics in atopic dermatitis: a review. Dermatol Pract Concept 2021; 11: e2021144. https://doi.org/10.5826/dpc.1104a144
9. Tampa M, Mitran CI, Mitran MI, Georgescu SR. A new horizon for atopic dermatitis treatments: JAK inhibitors. J Pers Med 2023; 13: 384. https://doi.org/10.3390/jpm13030384
10. Radi G, Simonetti O, Rizzetto G, Diotallevi F, Molinelli E, Offidani A. Baricitinib: the first JAK inhibitor approved in europe for the treatment of moderate to severe atopic dermatitis in adult patients. Health Care (Don Mills) 2021; 9: 1575. https://doi.org/10.3390/healthcare9111575
11. Müller S, Maintz L, Bieber T. Treatment of atopic dermatitis: recently approved drugs and advanced clinical development programs. Allergy 2024; 79: 1501–1515. https://doi.org/10.1111/all.16009
12. Wollenberg A, Barbarot S, Bieber T, Christen-Zaech S, Deleuran M, Fink-Wagner A, et al. Consensus-based European guidelines for treatment of atopic eczema (atopic dermatitis) in adults and children: part II. J Eur Acad Dermatol Venereol 2018; 32: 850–878. https://doi.org/10.1111/jdv.14888
13. Datsi A, Steinhoff M, Ahmad F, Alam M, Buddenkotte J. Interleukin-31: the "itchy" cytokine in inflammation and therapy. Allergy 2021; 76: 2982–2997. https://doi.org/10.1111/all.14791
14. Kato A, Fujii E, Watanabe T, Takashima Y, Matsushita H, Furuhashi T, et al. Distribution of IL-31 and its receptor expressing cells in skin of atopic dermatitis. J Dermatol Sci 2014; 74: 229–235. https://doi.org/10.1016/j.jdermsci.2014.02.009

15. Orfali RL, Aoki V. Blockage of the IL-31 pathway as a potential target therapy for atopic dermatitis. Pharmaceutics 2023; 15: 577. https://doi.org/10.3390/pharmaceutics15020577
16. Kabashima K, Matsumura T, Komazaki H, Kawashima M, Nemolizumab JP01 andJP02 Study Group. Nemolizumab plus topical agents in patients with atopic dermatitis (AD) and moderate-to-severe pruritus provide improvement in pruritus and signs of AD for up to 68 weeks: results from two phase III, long-term studies. Br J Dermatol 2022; 186: 642–651. https://doi.org/10.1111/bjd.20873
17. Kwatra SG, Yosipovitch G, Legat FJ, Reich A, Paul C, Simon D, et al. Phase 3 trial of nemolizumab in patients with prurigo nodularis. N Engl J Med 2023; 389: 1579–1589. https://doi.org/10.1056/NEJMoa2301333
18. NEMLUVIO (nemolizumab-ilto) for subcutaneous injection [prescribing information online]. In: IUSA, editor. 2024.
19. Nemluvio: EPAR – Product information. In: European Medicines Agency, editor. Nemluvio, INN-nemolizumab; 2025.
20. Silverberg JI, Wollenberg A, Reich A, Thaçi D, Legat FJ, Papp KA, et al. Nemolizumab with concomitant topical therapy in adolescents and adults with moderate-to-severe atopic dermatitis (ARCADIA 1 and ARCADIA 2): results from two replicate, double-blind, randomised controlled phase 3 trials. Lancet 2024; 404: 445–460. https://doi.org/10.1016/S0140-6736(24)01203-0
21. Davis DMR, Drucker AM, Alikhan A, Bercovitch L, Cohen DE, Darr JM, et al. Guidelines of care for the management of atopic dermatitis in adults with phototherapy and systemic therapies. J Am Acad Dermatol 2024; 90: e43–e56. https://doi.org/10.1016/j.jaad.2023.08.102
22. Blauvelt A, Thyssen JP, Guttman-Yassky E, Bieber T, Serra-Baldrich E, Simpson E, et al. Efficacy and safety of lebrikizumab in moderate-to-severe atopic dermatitis: 52-week results of two randomized double-blinded placebo-controlled phase III trials. Br J Dermatol 2023; 188: 740–748. https://doi.org/10.1093/bjd/ljad022
23. Silverberg JI, Adam DN, Zirwas M, Kalia S, Gutermuth J, Pinter A, et al. Tralokinumab plus topical corticosteroids as needed provides progressive and sustained efficacy in adults with moderate-to-severe atopic dermatitis over a 32-week period: an ECZTRA 3 post hoc analysis. Am J Clin Dermatol 2022; 23: 547–559. https://doi.org/10.1007/s40257-022-00702-2
24. Cork MJ, Eckert L, Simpson EL, Armstrong A, Barbarot S, Puig L, et al. Dupilumab improves patient-reported symptoms of atopic dermatitis, symptoms of anxiety and depression, and health-related quality of life in moderate-to-severe atopic dermatitis: analysis of pooled data from the randomized trials SOLO 1 and SOLO 2. J Dermatolog Treat 2020; 31: 606–614. https://doi.org/10.1080/09546634.2019.1612836
25. Bender BG, Ballard R, Canono B, Murphy JR, Leung DYM. Disease severity, scratching, and sleep quality in patients with atopic dermatitis. J Am Acad Dermatol 2008; 58: 415–420. https://doi.org/10.1016/j.jaad.2007.10.010