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CONSENSUS STATEMENT

International consensus on dose reduction of biologics for patients with psoriasis: The DR. Delphi study

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Abstract

Background: Dose reduction (DR) of biologics for psoriasis is already applied in clinical practice but without clear guidelines, while dermatologists addressed the need for guidance. An international consensus may contribute to optimal implementation of biologic DR in clinical psoriasis practices.

Objectives: This consensus study aims for international consensus on DR of biologics in adult patients with psoriasis among dermatologists worldwide.

Methods: An international, modified eDelphi consensus study was performed among dermatologists worldwide. A total of 11 statements on biologic DR were generated by the international steering committee, based on a previous literature review. Invitations were distributed via international dermatological societies. Participants rated their level of agreement per statement on a 9-point Likert scale. A maximum of three consensus rounds and one (digital) consensus meeting were expected. Statements reached consensus if ≥70% agreed and <15% disagreed; otherwise, statements were revised for a next consensus round.

Results: In total, 62 dermatologists from Europe, South America, Asia, North America, Africa and Australia completed the eDelphi. After one round, 9 out of 11 statements reached consensus. The remaining 2 statements were adapted and reached consensus in the second round. Participants agreed on criteria when to consider and initiate/(dis)continue DR and on a two-step DR algorithm for adalimumab, etanercept and ustekinumab. Participants agreed that this two-step DR strategy can also be considered for IL-17 and IL-23 inhibitors while awaiting more scientific evidence on DR of these newer biologics.

Conclusions: Dermatologists worldwide reached consensus on when and how to initiate and (dis)continue DR of biologics, and on a two-step DR algorithm for adalimumab, etanercept and ustekinumab in adult patients with psoriasis. DR of IL-17 and IL-23 inhibitors was deemed feasible; however, underlying evidence is still limited. This first international consensus provides essential information for uptake and implementation of biologic DR for psoriasis on a global scale.

KEYWORDS
biologics, consensus, dose reduction, implementation, international, psoriasis

The eDelphi consortium collaborators are given in Acknowledgements.

INTRODUCTION

Biologic treatment of patients with psoriasis has become a mainstay over the past years as biologics are highly effective and improve quality of life in patients with psoriasis. On the other hand, biologics are expensive drugs often prescribed in a fixed, registered dose and patients with a good response might be overtreated. Dose reduction (DR) of biologics might reduce avoidable overtreatment, reduce costs and possibly avoid adverse events. Previous studies tested DR strategies of mainly TNFα inhibitors (i) (adalimumab, etanercept) and the IL-12/23i (ustekinumab) in adult patients with psoriasis and showed that this is (cost-) effective and safe.[1–15] In addition, when the DR strategy failed, retreatment with the standard dose or previous effective dose resulted in regaining an adequate treatment response.[8,9,16] Studies on DR of IL-17i and IL-23i remain scarce, especially randomized controlled trials.[15] In previous international (questionnaire) studies, dermatologists expressed the need for consensus or a guideline regarding biologic DR as it is currently applied in clinical practice without clear guidelines.[17–19] Therefore, this international eDelphi consensus study aims for consensus on biologic DR by interval prolongation in adult patients with psoriasis among dermatologists worldwide, contributing to optimal implementation of an effective and safe biologic DR strategy in clinical practice.

Why was the study undertaken?

Biologics are highly effective and improve quality of life in patients with psoriasis. However, as these drugs are prescribed in a fixed, registered dose, patients with controlled disease might be overtreated. Dose reduction (DR) of biologics might reduce avoidable overtreatment, reduce costs and possibly avoid adverse events. DR is already applied in daily practice but without clear (inter)national guidelines, while dermatologists have addressed the need for more guidance in previous studies.

What does this study add?

This international, modified eDelphi consensus study aims for international consensus on biologic DR in adult patients with psoriasis among dermatologists worldwide. This study provides the first international consensus on criteria when to consider, initiate, continue or discontinue DR, and a clear DR algorithm for adalimumab, etanercept and ustekinumab. Participants agreed that the DR strategy can already be considered for IL-17 and IL-23 inhibitors while awaiting more scientific evidence.

What are the implications of this study for disease understanding and/or clinical care?

This international consensus contributes to a clearer and safer uptake and implementation of biologic DR in clinical practice on a global scale, which can be incorporated in future guidelines. Future research on the efficacy and safety of DR of IL-17 and IL-23 inhibitors is needed to reach consensus on a more specified DR strategy of these biologics in the near future.

MATERIALS AND METHODS

To achieve international consensus regarding criteria for biologic dose reduction (DR), an online modified Delphi procedure (eDelphi) was conducted from September to November 2024. The ACCORD (ACcurate Consensus Reporting Document) guideline was used to report on this eDelphi[20]; for extended methods see Appendix S1.

The eDelphi consisted of multiple rounds of statements on biologic DR, which were rated anonymously by an expert panel. The statements were developed by an expert Steering Committee (SC) including the main investigators (EdJ, JvdR, CvR and LvdS), board members of the Skin Inflammation and Psoriasis International Network (SPIN) (WHB, JL, PS), and a patient member of the International Federation of Psoriasis Associations (IFPA) and the Dutch Patient Federation ('Psoriasispatiënten Nederland') (IvE). Statements were based on a literature search (end date July 2023) on DR of biologics in psoriasis,[15,21,22] and on expert opinion.

In total, 11 statements were generated and each statement was accompanied with a summary of available evidence. Additional to the statements, multiple choice questions (MCQs) on criteria of initiating and discontinuing DR were added as they could provide additional information for future research for refining DR algorithms. Appendix S2 shows the used questionnaires.

Before the questionnaires went live, they were piloted by the SC and one independent researcher.

Recruitment of the expert panel

Dermatologists or dermatology residents worldwide, experienced with biologic treatment of adult patients with psoriasis, were asked to participate in the eDelphi expert panel; recruitment took place between September and November 2024. An information leaflet was sent by e-mail to all members of SPIN, the International Psoriasis Council (IPC) and the European Academy of Dermatology and Venerology (EADV) Task Force Psoriasis, consisting of several hundred experts from around the globe with a special interest in inflammatory diseases, including current leading psoriasis

experts. Invitations were also shared via social media channels of SC members, SPIN and IPC. Informed consent was obtained from all participants.

Data collection

After registration, each participant was pseudonymized prior to voting. A subject identification log was only accessible for the main investigators for study purposes only. Each round, participants received the link to the questionnaires from the online system Castor EDC.[23] The statements and the summary of available evidence were in English, but the menu and navigational buttons could be translated to the participant's preferred language. In case of incomplete questionnaires, automatic reminders were sent weekly, up to a maximum of 4 weeks. If a questionnaire remained incomplete, the participant was encouraged to complete the questionnaire via a personal email.

Per round, each statement was rated on a 9-point Likert scale, with 1 to 3 labelled 'not important/disagree', 4–6 'important but not critical/neither agree nor disagree' and 7–9 'critical/agree', and each was provided with a blank text box for additional comments. In case any rating level of agreement of 1–3 (not important/disagree) was selected, participants were asked to explain/justify their response. The additional MCQs asked participants' preferred physician- and/or patient-reported outcome(s) to guide DR, and which scores of these outcomes they preferred as thresholds to initiate and (dis-) continue DR. The first round also included questions on participants' demographics. See S2 for the complete questionnaire of round 1 including the MCQs.

The SC aimed for a maximum of 3 rounds of voting and 1 (digital) consensus meeting in case not all statements reached consensus after 3 rounds. After each round, results were analysed to determine whether consensus on statements was reached. To reach consensus, ≥70% of all participants required a rating level of agreement of 7–9 (critical/agree) and <15% required 1–3 (not important/disagree). As there are no universal standards on which level of agreement indicates consensus in eDelphi studies, the consensus definition from previous dermatology studies was used.[24–26] Results of each round were summarized and discussed within the SC. Per statement, individual suggestions and additional comments were grouped to either (i) 'leave something out of the criteria/lower threshold than stated', (ii) 'add something to the criteria/higher threshold than stated' and (iii) 'other'. Statements which already reached strong consensus, either agreement or disagreement, would not be included in the subsequent round. The SC reconsidered and/or redefined statements in which no consensus was reached for a subsequent consensus round based on input provided by the participants.

Data analysis and ethics

Data were analysed with IBM SPSS Statistics 29. Descriptive statistics were used to analyse demographic participant data, percentages of voters per level of agreement on consensus statements and the results of the MCQs. As a sensitivity analysis, all analyses were repeated in which the voting members of the SC were now also included.

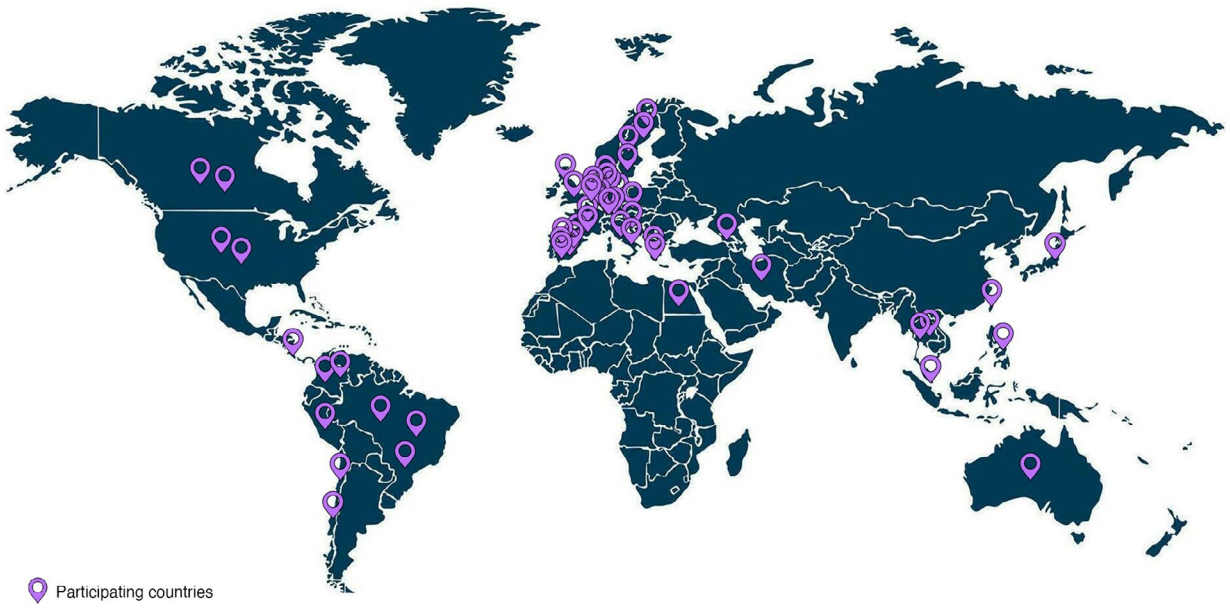


FIGURE 1 Overview of participating countries.

This study was conducted according to the ICH GCP guidelines and the principles of the Declaration of Helsinki. Data collection was performed in accordance with the Dutch Act on Implementation of the General Data Protection Regulation; in Dutch: 'Uitvoeringswet AVG'. This study was exempted for the Medical Research Involving Human Subjects Act (WMO) by the Medical Ethical Committee Arnhem-Nijmegen.

RESULTS

The first round of the eDelphi started September 24, 2024, and ended November 17, 2024. A total of 70 experts registered for participation, of whom 63 completed the first round. Consensus was reached on 9 statements; the 2 statements without consensus were redefined by the SC (Appendix S2). Consensus on both redefined statements was reached in the second round between January 7, 2025 and February 20, 2025 by 62 participants. One participant dropped out during the second round due to time constraints.

Demographic characteristics

Demographic participant data showed that psoriasis experts from Europe, South America, Asia, Africa, North America and Australia participated in the eDelphi (Figure 1).

Table 1 shows demographic characteristics of the participants in both rounds. Mean age of the participants was 47.7 years and a small majority was male. The majority (71%) worked as a dermatologist in an academic setting. Participants were experienced with biologic treatment for almost 15 years on average and almost all participants were experienced with biologic DR. For around 84% of all participants, dose adjustments were allowed in their country of practice with the majority being allowed to both increase and reduce the dose.

TABLE 1 Demographic characteristics of the participants per round.

Demographic characteristics of participants		
	Round 1 (*N* = 63)	**Round 2 (*N* = 62)**
Age (years)	47.7 (±10.9)	47.7 (±10.9)
Male	34 (54.0%)	33 (53.2%)
Setting		
Academic hospital/ University medical center	45 (71.4%)	44 (71.0%)
Private hospital/clinic/ practice	13 (20.6%)	13 (21.0%)
General hospital	8 (12.7%)	8 (12.9%)
Function		
Dermatologist	58 (92.1%)	57 (92%)
Dermatologist in training	4 (6.3%)	4 (6.5%)
Physician assistant	1 (1.6%)	1 (1.6%)
Number of years experienced with biologic treatment	14.6 (±5.6)	14.5 (±5.6)
Number of participants experienced with biologic DR		
Yes	57 (90.5%)	56 (90.3%)
No	6 (9.5%)	6 (9.7%)
Dose adjustment allowed in country of practice		
Yes	53 (84.1%)	52 (83.9%)
Dose increase	2 (3.8%)	2 (3.9%)
Dose reduction	5 (9.4%)	5 (9.6%)
Dose increase and reduction	46 (86.8%)	45 (86.5%)
No	7 (11.1%)	7 (11.3%)
Not known	3 (4.8%)	3 (4.8%)

Note: Results are presented as mean with standard deviation (±) or frequency (%).
Abbreviation: DR: dose reduction.

Consensus of statements

In the first round, consensus was reached regarding criteria when to consider/initiate, (dis)continue and how to apply DR by interval prolongation (Table 2). Statement 8 and 11 did not reach consensus. Based on participants' comments on these two statements, the revised statement 8 was made less imperative and allowed for personal preferences by adding: 'In addition, the time between first and potential second step of DR can also be individualized based on physicians' and patients' preferences' (Table 3). The time schedule included in the original statement, of at least 3 and 6 months between the first and potential second step of DR for, respectively, a short and longer injection interval, was not further extended as it was already a minimum. Comments on statement 11 were mainly about individualization/tailoring of DR of IL-17i and IL-23i to the patients' disease activity/preference. Therefore, the phrase '…, but the DR steps can be individualized based on physicians' and patients' preferences …' was added. The scheme of the two-step interval prolongation for IL-17i and IL-23i (first to 67% of the standard dose, subsequently to 50%) was maintained but was made less imperative while awaiting more scientific evidence (Table 3).

As a sensitivity analysis, votes of the SC ($N = 7$) were added to the analysis. As a result, statement 8 in its original form would have reached consensus in round 1 already ($N = 49$ agreed (70.0%) compared to $N = 44$ (69.8%) without the SC). Although the number of participants that agreed with statement 11 increased to $N = 47$ (67.1%) when adding the SC responses, consensus was not reached in the first round. In round 2, the revised statements 8 and 11 also reached consensus when the votes of the SC were included (78.3% agreement and 85.1% agreement, respectively). Based on the statements that reached consensus, an internationally agreed algorithm for biologic DR was developed (Figure 2).

TABLE 2 Overview of the 11 statements of round 1 ($N=63$) with the results per statement shown as frequencies (%).

		Agree (rating level of agreement 7-9)	Disagree (rating level of agreement 1-3)	Neutral (rating level of agreement 4-6)	Consensus (agree ≥70% and disagree <15%)
1.	**Disease control should have been achieved for at least 6 months with the same biologic before dose reduction.**	45 (71.4%)	8 (12.7%)	10 (15.9%)	Yes
2.	**The decision to initiate dose reduction should be based on all three considerations: 1) shared decision-making, 2) disease activity, and 3) the impact of psoriasis on a patient's quality of life.**	58 (92.1%)	0	5 (7.9%)	Yes
3.	**In the case of concomitant psoriatic arthritis, for which a rheumatologist also treats the patient, the rheumatologist should be consulted before the dermatologist initiates dose reduction.**	53 (84.1%)	5 (7.9%)	5 (7.9%)	Yes
4.	**After dose reduction is initiated, disease control should be monitored by combining at least one physician-reported outcome on disease activity and at least one patient-reported outcome on disease-related quality of life.**	48 (76.2%)	2 (3.2%)	13 (20.6%)	Yes
5.	**In line with previous literature, the standard dose of a biologic (adalimumab, etanercept, ustekinumab) is preferably reduced by injection interval prolongation in two steps:** • Step 1: 67% of the standard dose (see scheme in S2) • Step 2: 50% of the standard dose (see scheme in S2)	46 (73.0%)	6 (9.5%)	11 (17.5%)	Yes
6.	**If a physician or a patient wants to reduce the dose by smaller steps of injection interval prolongation, this can be applied (e.g., for ustekinumab the first step can be to prolong the interval to 15 weeks instead of 18 weeks).**	52 (82.5%)	2 (3.2%)	9 (14.3%)	Yes
7.	**If a physician or a patient wants to reduce the dose by injection interval prolongation beyond the second step of 50%, this can be applied with an individualized schedule.**	47 (74.6%)	3 (4.8%)	13 (20.6%)	Yes
8.	**The time between the first and second step of dose reduction is preferably:** • At least 3 months for biologics with a short injection interval according to the standard dose (standard interval <8 weeks, e.g. adalimumab and etanercept). • At least 6 months for biologics with a longer injection interval according to the standard dose (standard interval ≥8 weeks, e.g. ustekinumab).	44 (69.8%)	3 (4.8%)	16 (25.4%)	No
9.	**After dose reduction, if there is loss of disease control and/or at a patient's request, it should be considered to return to the previous effective dose or the standard dose.**	60 (95.2%)	0	3 (4.8%)	Yes
10.	**Dose reduction of the newer biologics (IL-17 and IL-23 inhibitors) can be considered in individual patients while awaiting more scientific evidence.**	51 (81.0%)	6 (9.5%)	6 (9.5%)	Yes
11.	**Dose reduction of the newer biologics (IL-17 and IL-23 inhibitors) is preferably also performed by two-step injection interval prolongation (67% and consequently 50% of the standard dose) while awaiting more scientific evidence.**	42 (66.7%)	8 (12.7%)	13 (20.6%)	No

Multiple choice questions

In addition to consensus statements, we explored experts' thoughts and beliefs on which physician- and/or patient-reported outcome they would prefer to guide DR by adding MCQs in round 1. It was shown that the majority preferred the absolute Psoriasis Area and Severity Index (PASI) as physician-reported outcome ($N=52$; 82.5%) and the Dermatology Life Quality Index (DLQI) as patient-reported outcome ($N=52$; 82.5%) to guide DR (Table 4). Some experts did not want to include a physician- or patient-reported outcome as they found patient satisfaction more important; also, patient-reported outcomes were found time consuming and unreliable. Figure 3 shows that experts preferred different absolute PASI scores as thresholds at which they would initiate DR (ranging from ≤0 to ≤3) or return to the standard/previous effective dose (ranging from ≥2 to ≥5). Also, different DLQI scores were preferred at which experts would initiate DR (ranging from ≤0 to ≤3); but the majority would return to the standard/previous effective dose at a DLQI score of ≥5. However, some participants would return to the standard/previous effective dose at a DLQI score >10.

Results were comparable for the sensitivity analysis including answers of the SC ($N=7$).

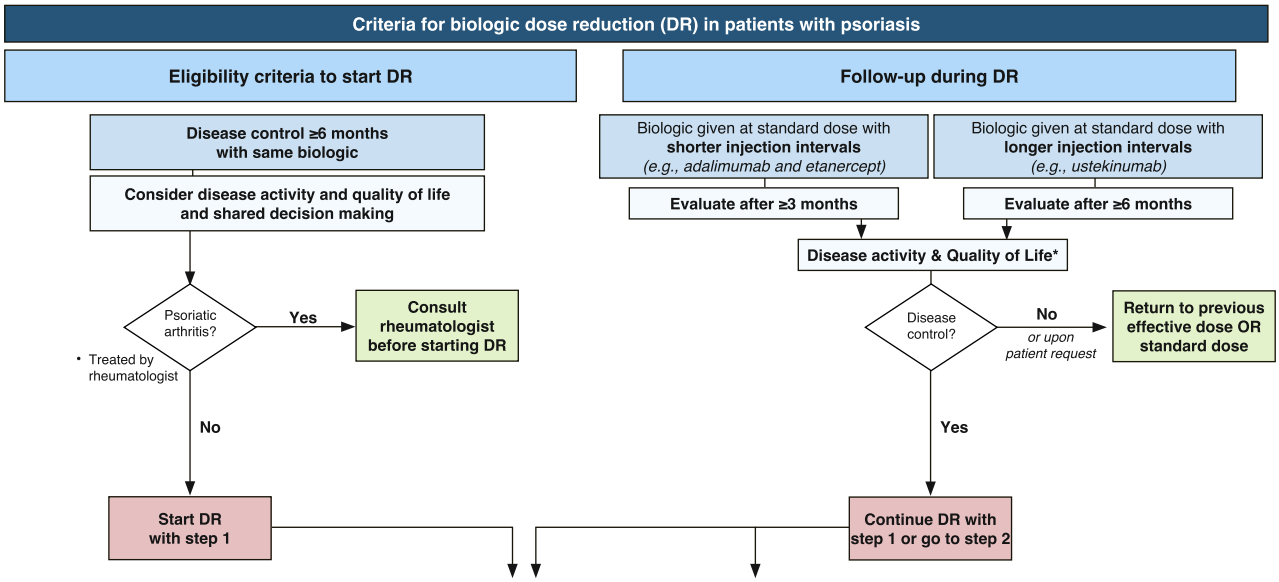
TABLE 3 Overview of the 2 revised statements of round 2 ($N = 62$) with the results per statement shown as frequencies (%).

	Agree (rating level of agreement 7-9)	Disagree (rating level of agreement 1-3)	Neutral (rating level of agreement 4-6)	Consensus (agree ≥70% and disagree <15%)
8. The time between a first and potential second step of DR could be based on the original interval of the biologic e.g.: • At least 3 months for biologics with a short injection interval in the standard dose (e.g. adalimumab, etanercept). • At least 6 months for biologics with a longer injection interval in the standard dose (e.g. ustekinumab). In addition, the time between first and potential second step of DR can also be individualized based on physicians' and patients' preferences.	47 (75.8%)	4 (6.5%)	11 (17.7%)	Yes
11. Dose reduction by two-step injection interval prolongation (67% and consequently 50% of the standard dose) can be considered for the newer biologics (IL-17 or IL-23 inhibitors), but the DR steps can be individualized based on physicians' and patients' preferences while awaiting more scientific evidence	51 (82.3%)	1 (1.6%)	10 (16.1%)	Yes

DISCUSSION

With this international modified eDelphi study, consensus was reached on criteria regarding dose reduction (DR) by interval prolongation of biologics for adult patients with psoriasis resulting in an internationally agreed algorithm for biologic DR (Figure 2). Psoriasis experts from almost all continents participated and reached consensus on all 11 statements within two rounds. Experts agreed that prior to initiation of biologic DR, disease activity should be controlled for ≥6 months with the same biologic. The decision to initiate DR should be based on shared decision-making, disease activity and quality of life and a rheumatologist should be consulted in case of concomitant psoriatic arthritis. After initiation, disease activity needs to be monitored by a combination of at least one physician- and at least one patient-reported outcome on disease activity and disease-related quality of life. Regarding the DR strategy, experts agreed that DR of TNFαi (adalimumab, etanercept) and the IL-12/23i (ustekinumab) should preferably be applied by two-step injection interval prolongation, with the first step resulting in 67% of the standard dose (1.5-fold extension of the interval in standard dose) and the second step resulting in 50% of the standard dose (2-fold extension of the interval in standard dose). It should be considered to return to the standard or previous effective dose when disease activity increases due to DR, or when patients do not feel comfortable with their lowered dose. In general, experts deemed ≥3 months acceptable as time between the first and second DR step of a biologic with a short interval, but it was agreed that it should be longer (≥6 months) for a biologic with a longer interval. In general, it was stressed by the experts that there should also be room for individualization of the DR schedule. It was deemed acceptable to already apply DR for IL-17i and IL-23i in individual cases, in anticipation of more scientific evidence.

The statements on the DR strategy of the two-step injection interval prolongation specific for adalimumab, etanercept and ustekinumab are based on a large body of evidence regarding safety and efficacy.[1–14] Additionally, a previous prospective cohort study showed that most patients were able to achieve their prior PASI scores when returning to the standard dose after DR failed.[16] Also, previous studies on continuous or interrupted treatment of biologics showed that most patients responded adequately to retreatment by the standard dose.[27–29] Infliximab, a TNFαi, was excluded from the statements on purpose as a previous systematic review showed that patients developed increased levels of antidrug antibodies (ADAs) against infliximab when the dose was reduced by interval prolongation.[30] Previous studies on ADA development in patients on DR of adalimumab, etanercept and ustekinumab showed no (relevant) ADA development, nor a significant difference in ADA levels between DR and standard dose for adalimumab (in $n = 7$ in Benzaquen et al.[31] and $n = 25$ in Atalay et al.[32]) and ustekinumab (in $n = 20$ in Atalay et al.[32] and $n = 302$ in Blauvelt et al.[12]).[12,31,32] The more cautious wording in the statement on DR of the newer biologics (IL-17i and IL-23i) is due to the fact that the available evidence prior to this eDelphi, where the statements were based on, was limited to studies each focusing on a single biologic (IL-17i is secukinumab and brodalumab, and IL-23i guselkumab, with variable results).[33–35] After completion of this eDelphi, additional studies on DR of individual IL-17i and IL-23i have been published including one randomized controlled trial (RCT). This RCT evaluated early intervention with, and prolonging the injection interval for, guselkumab in super responders and showed non-inferiority of 100 mg every 16 weeks versus every 8 weeks (GUIDE study).[36] These super responders were patients that achieved PASI 0 at both 20 and 28 weeks with guselkumab, illustrating the specific nature of this group which may hamper the generalizability to the overall population of psoriasis patients on biologics. Other additional studies were case reports or small retro−/prospective cohort studies on secukinumab, ixekizumab, bimekizumab, risankizumab and tildrakizumab.[37–42] Despite their lower level of evidence, they all showed promising results of



Biologic	STANDARD dose	Dose Reduction (DR) STEP 1 (67% of standard dose)	Dose Reduction (DR) STEP 2 (50% of standard dose‡)
Adalumimab	40 mg every 2 weeks	40 mg every 3 weeks	40 mg every 4 weeks
Etanercept	50 mg every week	50 mg every 10 days	50 mg every 2 weeks
Ustekinumab	45 or 90 mg every 12 weeks	45 or 90 mg every 18 weeks	45 or 90 mg every 24 weeks
IL-17i and IL-23i	According to registered dose	67% of registered dose† = 1.5-fold extension of	50% of registered dose† = 2-fold extension of interval

*Combine at least one physician-reported outcome on disease activity and one patient-reported outcome on disease-related quality of life to evaluate disease control

If preferred by the physician and/or patient:

*** It is possible to add additional steps at 15 and 21 weeks*

‡ Interval prolongation beyond 50% of the standard dose can be applied but with an individualized schedule

†: Dose reduction by interval prolongation can be considered in individual patients, steps can be individualized based on physicians' and patients' preferences while awaiting more scientific evidence

FIGURE 2 Algorithm for biologic dose reduction (DR) in patients with plaque psoriasis. The algorithm is the result of the statements that reached consensus in this international eDelphi study.

DR; though, larger randomized trials are needed. The results of an international, multicentre, randomized, controlled, non-inferiority study (the BeNeBio trial) on DR of IL-17i and IL-23i are expected to be published in the coming year.[43]

The multiple choice questions (MCQs) at the end of the first consensus round were added to provide insight in experts' thoughts and beliefs regarding the use of physician- and patient-reported outcomes to guide DR. The majority preferred the PASI and DLQI to guide DR, which is in line with previous studies. However, the experts of this eDelphi study mainly preferred lower thresholds for PASI and DLQI to initiate DR compared to the thresholds of ≤5 in a Dutch eDelphi,[22] and also lower than most of the PASI scores used as a threshold in previous studies, which had a wide range up to PASI <8.[2,4,6–9,44,45] Over time, dermatologists could have adjusted their opinion on these thresholds as nowadays they are more experienced with the highly effective biologic treatment of psoriasis. Important to note is that thresholds guiding DR are not treatment goals but serve as upper limits to be able to act in clinical practice and are not goals that need to be achieved when applying DR. It would be valuable to reach consensus on thresholds of physician- and patient-reported outcomes to guide DR, enabling more concise policymaking. However, as the preferred thresholds within the panel varied considerably, the feasibility of such a consensus study in a global context is questionable. Our current algorithm is adaptable to the current leading outcomes and thresholds within a dermatologist's clinical practice making it applicable for everyone.

To our knowledge, this is the first international consensus on DR of biologics for adult patients with psoriasis. One of the strengths is that participants were pseudonymized and blinded for each other's answers during each consensus round to minimize risk of bias. Also, members of the SC participated in both consensus rounds, but to ensure that no bias was introduced, their votes were only included in a sensitivity analysis, which did not result in different results. All continents were represented in this consensus; however, it should be noted that the majority of participants were from Europe/Western countries. This could be due to the greater access to dermatological care and biologics in these countries compared to, for example, Africa, making dermatologists more keen to participate. Not every country allows or reimburses DR, resulting in the continued use of fixed, registered doses of biologics. For these countries in particular, this consensus could contribute to the uptake of DR, as it shows that DR is an accepted part of current scientific and clinical psoriasis practice. In addition, previous studies

TABLE 4 Overview of the 2 multiple choice questions of round 1 ($N = 63$) with the results shown as frequencies (%).

Which physician-reported outcome on disease activity would you prefer to guide dose reduction? (multiple answers possible)	***N*** **(%)**
Absolute Psoriasis Area and Severity Index (PASI)	52 (82.5%)
Relative PASI (compared to PASI at the start of the biologic, e.g. PASI90)	10 (15.9%)
Static Physician Global Assessment (PGA)	23 (36.5%)
Body Surface Area (BSA) (absolute)	23 (36.5%)
Other (please specify)	4 (6.3%)
I do not want to include a physician-reported outcome on disease activity to guide dose reduction (please specify)	2 (3.2%)
Which patient-reported outcome on quality of life would you prefer to guide dose reduction? (multiple answers possible)	***N*** **(%)**
Dermatology Life Quality Index (DLQI)	52 (82.5%)
Skindex-29	2 (3.2%)
Other (please specify)	7 (11.1%)
I do not want to include a patient-reported outcome on quality of life to guide dose reduction (please specify)	5 (7.9%)

have shown that dermatologists worldwide are pending consensus or a guideline on biologic DR. This consensus potentially provides a starting point for future guidelines, both nationally and internationally. It is important to note that local guidelines are decisive for local policy, despite (inter-)national guidelines. Therefore, individual clinics would already be able to implement biologic DR based on this consensus while awaiting (inter-)national guidelines.

There are also some limitations. This consensus might be less generalizable due to a relatively small number of experts that participated considering the large networks used to invite experts. Despite the smaller panel, the expert panel was above sufficient to generate reliable results as, in general, at least 23 participants who are similarly trained and have a general understanding in the field of interest are considered sufficient for a Delphi consensus study.[46,47] The expert panel of this eDelphi consisted of dermatologists and dermatology residents who were all experienced in the field of psoriasis and biologics, including world-leading psoriasis experts. In addition, the number of participants remained remarkably consistent throughout the two consensus rounds, thereby enhancing the

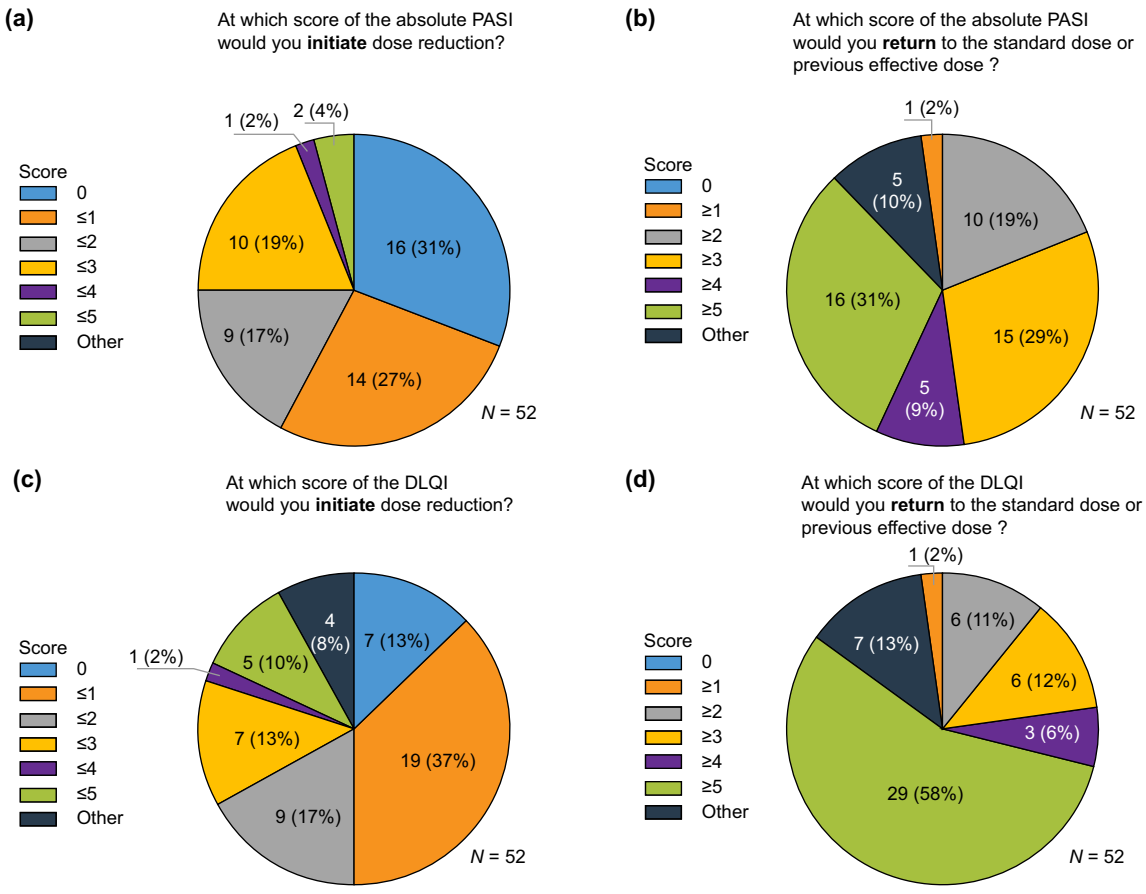


FIGURE 3 Overview of the scores of the absolute PASI and DLQI at which participants would initiate dose reduction (a, c) and would return to the standard dose or previous effective dose (b, d). Only participants who preferred the absolute PASI as the physician-reported outcome ($N = 52$) and those who preferred the DLQI as the patient-reported outcome ($N = 52$) were able to respond. DLQI, Dermatology Life Quality Index; *N*, number of participants; PASI, Psoriasis Area and Severity Index.

reliability of the results. Around 10% of the participants had no experience with biologic DR; therefore, their ability to rate the statements could be questioned. However, each statement was accompanied by a summary of available evidence facilitating access to the current literature, enabling every participant to rate the statements.

In conclusion, this eDelphi provides the first international consensus on when and how to apply biologic DR for adult patients with psoriasis including a clear algorithm for DR of adalimumab, etanercept and ustekinumab. To reach future consensus on a specific DR strategy for IL-17i and IL-23i, additional high-quality evidence is needed. This evidence is expected in the near future, possibly enabling an update to this consensus study within the next one to two years. Future research is also needed to identify both thresholds guiding DR and treatment goals separately on a global scale, to enable more concise policymaking regarding biologic DR internationally. This consensus can be the start of an international guideline on biologic DR for psoriasis leading towards international implementation of biologic DR, which would be beneficial for patients, physicians and healthcare systems.

AUTHOR CONTRIBUTIONS

C. A. M. van Riel: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing—original draft, writing—review and editing. **W.-H. Boehncke:** conceptualization, methodology, validation, writing—review and editing. **J. L. W. Lambert:** conceptualization, methodology, validation, writing—review and editing. **P. I. Spuls:** conceptualization, methodology, validation, writing—review and editing. **L. S. van der Schoot**: conceptualization, methodology, validation, writing—review and editing. **I. van Ee:** conceptualization, writing—review and editing. **E. M. G. J. de Jong:** conceptualization, funding acquisition, methodology, project administration, supervision, validation, visualization, writing—review and editing. **J. M. P. A. van den Reek:** conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

CAMR has no conflicts of interest to disclose. W-HB has received honoraria as a speaker and/or advisor from Abbvie, Almirall, Eli Lilly, Leo, Novartis and UCB. JLWL has received research grants from and/or acted as consultant/speaker for and has acted as consultant for AbbVie, Almirall, Amgen, Argenx, Eli Lilly, Janssen-Cilag, LEO Pharma, Novartis, Pfizer and UCB. All funding is not personal and goes to an independent research account of the department of dermatology of Ghent University Hospital, Ghent, Belgium. PS is Chief Investigator (CI) of the systemic and phototherapy atopic eczema registry (TREAT NL/BE) for adults and children and receives departmental independent research grants for TREAT NL/BE registry from Pharma since December 2019. She is member of the TREAT Registry Taskforce (TrT) Executive Committee. The TrT receive research grants for specific projects to combine data of different national registries. PS is involved in performing clinical trials with many pharmaceutical industries that manufacture drugs used for the treatment of, for example psoriasis and atopic dermatitis, for which financial compensation is paid to the department/hospital. PS was involved in the development of one of the HOME core outcome instruments (Recap of atopic eczema (RECAP)), and in the development of the Outcome Measures for VAscular Malformations (OVAMA) questionnaire for vascular malformations. PS is project lead of the governmental funded UPDATE trial to investigate NB-UVB in atopic dermatitis. She has recently done a consultancy for Takeda (2025). LSS carried out clinical trials for Janssen and Novartis and received speaking fees from Janssen and Eli Lilly. All funding is not personal but goes to the independent Research Fund of the Department of Dermatology of the Radboud University Medical Center Nijmegen, The Netherlands. IE has no conflicts of interest to disclose. EMGJJ has received research grants for the independent research fund of the department of dermatology of the Radboud university medical center Nijmegen, the Netherlands from AbbVie, BMS, Janssen Pharmaceutica, Leo Pharma, Novartis and UCB for research on psoriasis and has acted as consultant and/or paid speaker for and/or participated in research sponsored by companies that manufacture drugs used for the treatment of psoriasis or eczema including AbbVie, Amgen, Almirall, Celgene, Galapagos, Janssen Pharmaceutica, Lilly, Novartis, Leo Pharma, Sanofi and UCB. All funding is not personal but goes to the independent research fund of the department of dermatology of Radboud University medical center

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DATA AVAILABILITY STATEMENT

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

ETHICAL APPROVAL

This study was conducted according to the ICH GCP guidelines and the principles of the Declaration of Helsinki. Data collection was performed in accordance with the Dutch Act on Implementation of the General Data Protection Regulation; in Dutch: 'Uitvoeringswet AVG'. This study was exempted for the Medical Research Involving Human Subjects Act (WMO) by the Medical Ethical Committee Arnhem-Nijmegen.

ETHICS STATEMENT

Consent was obtained from all participants that filled in the questionnaires. All data were pseudonymized.

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REFERENCES

1. Fotiadou C, Lazaridou E, Sotiriou E, Ioannides D. Adalimumab for psoriasis in Greece: clinical experience in a tertiary referral centre. J Eur Acad Dermatol Venereol. 2012;26(10):1298–303.
2. Lopez-Ferrer A, Vilarrasa E, Gich IJ, Puig L. Adalimumab for the treatment of psoriasis in real life: a retrospective cohort of 119 patients at a single Spanish centre. Br J Dermatol. 2013;169(5):1141–7.
3. Baniandres O, Rodriguez-Soria VJ, Romero-Jimenez RM, Suarez R. Dose modification in biologic therapy for moderate to severe psoriasis: a descriptive analysis in a clinical practice setting. Actas Dermosifiliogr. 2015;106(7):569–77.
4. Piaserico S, Gisondi P, De Simone C, Marinello E, Conti A, Amerio P, et al. Down-titration of adalimumab and etanercept in psoriatic patients: a multicentre observational study. Acta Derm Venereol. 2016;96(2):251–2.
5. Romero-Jimenez RM, Escudero-Vilaplana V, Baniandres Rodriguez O, Garcia-Gonzalez X, Sanjurjo Saez M. Efficiency of biological therapies in patients with moderate to severe psoriasis: impact of a pharmacotherapeutic protocol. J Dermatolog Treat. 2016;27(3):198–202.
6. van Bezooijen JS, van Doorn MBA, Schreurs MWJ, Koch BCP, Te Velthuis H, Prens EP, et al. Prolongation of biologic dosing intervals in patients with stable psoriasis: a feasibility study. Ther Drug Monit. 2017;39(4):379–86.
7. Atalay S, van den Reek J, den Broeder AA, van Vugt LJ, Otero ME, Njoo MD, et al. Comparison of tightly controlled dose reduction of biologics with usual care for patients with psoriasis: a randomized clinical trial. JAMA Dermatol. 2020;156(4):393–400.
8. Atalay S, van der Schoot LS, Vandermaesen L, van Vugt LJ, Eilander M, van den Reek J, et al. Evaluation of a one-step dose reduction strategy of adalimumab, etanercept and ustekinumab in patients with psoriasis in daily practice. Acta Derm Venereol. 2021;101(5):adv00463.
9. Atalay S, van den Reek J, Groenewoud JMM, van de Kerkhof PCM, Kievit W, de Jong E. Two-year follow-up of a dose reduction strategy trial of biologics adalimumab, etanercept, and ustekinumab in psoriasis patients in daily practice. J Dermatolog Treat. 2022;33(3):1591–7.
10. Di Altobrando A, Magnano M, Offidani A, Parodi A, Patrizi A, Campanati A, et al. Deferred time of delivery of biologic therapies in patients with stabilized psoriasis leads to a 'perceived satisfaction': a multicentric study. J Dermatolog Treat. 2022;33(1):415–9.
11. Hansel K, Bianchi L, Lanza F, Bini V, Stingeni L. Adalimumab dose tapering in psoriasis: predictive factors for maintenance of complete clearance. Acta Derm Venereol. 2017;97(3):346–50.
12. Blauvelt A, Ferris LK, Yamauchi PS, Qureshi A, Leonardi CL, Farahi K, et al. Extension of ustekinumab maintenance dosing interval in moderate-to-severe psoriasis: results of a phase IIIb, randomized, double-blinded, active-controlled, multicentre study (PSTELLAR). Br J Dermatol. 2017;177(6):1552–61.
13. Taniguchi T, Noda S, Takahashi N, Yoshimura H, Mizuno K, Adachi M. An observational, prospective study of monthly adalimumab therapy for disease maintenance in psoriasis patients: a possible new therapeutic option for good responders to the initial induction treatment. J Eur Acad Dermatol Venereol. 2013;27(11):1444–7.
14. Lee EB, Thomas LW, Egeberg A, Wu JJ. Dosage adjustments in patients with psoriasis on adalimumab – a retrospective chart review. J Eur Acad Dermatol Venereol. 2018;32(7):e292-e3.
15. van Riel CAM, Michielsens CAJ, van Muijen ME, van der Schoot LS, van den Reek J, de Jong E. Dose reduction of biologics in patients with plaque psoriasis: a review. Front Pharmacol. 2024;15:1369805.
16. van der Schoot LS, Atalay S, Otero ME, Kievit W, van den Reek J, de Jong E. Regaining adequate treatment responses in patients with psoriasis who discontinued dose reduction of adalimumab, etanercept or ustekinumab. Br J Dermatol. 2022;187(6):1028–30.
17. van Muijen ME, van der Schoot LS, van den Reek J, de Jong E. Attitudes and behaviour regarding dose reduction of biologics for psoriasis: a survey among dermatologists worldwide. Arch Dermatol Res. 2022;314(7):687–95.
18. van Muijen ME, van der Schoot LS, Bovenschen HJ, Dodemon SRP, van Lümig PPM, van Enst WA, et al. Dosisvermindering van biologics voor psoriasis. Ned Tijdschr Dermatol Venereol. 2021;31(1):22–6.
19. Schots L, Grine L, Soenen R, Lambert J. Dermatologists on the medical need for therapeutic drug monitoring of biologics in psoriasis: results of a structured survey. J Dermatolog Treat. 2022;33(3):1473–81.
20. Logullo P, van Zuuren EJ, Winchester CC, Tovey D, Gattrell WT, Price A, et al. ACcurate COnsensus Reporting Document (ACCORD) explanation and elaboration: guidance and examples to support reporting consensus methods. PLoS Med. 2024;21(5):e1004390.
21. Michielsens CAJ, van Muijen ME, Verhoef LM, van den Reek J, de Jong E. Dose tapering of biologics in patients with psoriasis: a scoping review. Drugs. 2021;81(3):349–66.
22. van der Schoot LS, Baerveldt EM, van Enst WA, Menting SP, Seyger MMB, Wanders SL, et al. National consensus on biologic dose reduction in psoriasis: a modified eDelphi procedure. J Dermatolog Treat. 2022;34:2154570.
23. Castor EDC. Castor Electronic Data Capture 2019. [cited 2019 Aug 27]. Available from: https://castoredc.com.
24. Gerbens LA, Boyce AE, Wall D, Barbarot S, de Booij RJ, Deleuran M, et al. TREatment of ATopic eczema (TREAT) Registry Taskforce: protocol for an international Delphi exercise to identify a core set of domains and domain items for national atopic eczema registries. Trials. 2017;18(1):87.
25. De Bruin-Weller M, Biedermann T, Bissonnette R, Deleuran M, Foley P, Girolomoni G, et al. Treat-to-target in atopic dermatitis: an

international consensus on a set of core decision points for systemic therapies. Acta Derm Venereol. 2021;101(2):adv00402.
26. Thorlacius L, Ingram JR, Villumsen B, Esmann S, Kirby JS, Gottlieb AB, et al. A core domain set for hidradenitis suppurativa trial outcomes: an international Delphi process. Br J Dermatol. 2018;179(3):642–50.
27. Shi L, Lian N, Liu L, Chen M. Tapering and discontinuation of systemic medications in psoriasis patients with low disease activity. Dermatol Ther. 2020;33(4):e13599.
28. Gordon KB, Gottlieb AB, Langely RG, van de Kerkhof P, Belasco KT, Sundaram M, et al. Adalimumab retreatment successfully restores clinical response and health-related quality of life in patients with moderate to severe psoriasis who undergo therapy interruption. J Eur Acad Dermatol Venereol. 2015;29(4):767–76.
29. Menter A, Tyring SK, Gordon K, Kimball AB, Leonardi CL, Langley RG, et al. Adalimumab therapy for moderate to severe psoriasis: a randomized, controlled phase III trial. J Am Acad Dermatol. 2008;58(1):106–15.
30. Lichtenstein L, Ron Y, Kivity S, Ben-Horin S, Israeli E, Fraser GM, et al. Infliximab-related infusion reactions: systematic review. J Crohns Colitis. 2015;9(9):806–15.
31. Benzaquen M, Munshi M, Bossart S, Feldmeyer L, Emelianov V, Yawalkar N, et al. Long-term dose optimization of adalimumab via dose spacing in patients with psoriasis. Bioengineering Basel. 2022;9(8).
32. Atalay S, Berends SE, Groenewoud HMM, Mathot RAA, Njoo DM, Mommers JM, et al. Serum drug levels and anti-drug antibodies in the context of dose tapering by interval prolongation of adalimumab, etanercept and ustekinumab in psoriasis patients: results of the CONDOR trial. J Dermatolog Treat. 2022;33(5):2680–4.
33. Reich K, Puig L, Szepietowski JC, Paul C, Lacour JP, Tsianakas A, et al. Secukinumab dosing optimization in patients with moderate-to-severe plaque psoriasis: results from the randomized, open-label OPTIMISE study. Br J Dermatol. 2020;182(2):304–15.
34. Herranz-Pinto P, Alonso-Pacheco ML, Feltes-Ochoa R, Mayor-Ibarguren A, Servera-Negre G, Busto-Leis JM, et al. Real-world performance of a new strategy for off-label use of guselkumab in moderate to severe psoriasis: super-responder patients as the epitome of efficacy and optimisation. Clin Drug Investig. 2023;43(7):517–27.
35. Lebwohl M, Strober B, Menter A, Gordon K, Weglowska J, Puig L, et al. Phase 3 studies comparing Brodalumab with Ustekinumab in psoriasis. N Engl J Med. 2015;373(14):1318–28.
36. Eyerich K, Asadullah K, Pinter A, Weisenseel P, Reich K, Paul C, et al. Noninferiority of 16-week vs 8-week guselkumab dosing in super responders for maintaining control of psoriasis: the GUIDE randomized clinical trial. JAMA Dermatol. 2024;160(9):953–63.
37. Dauden E, Escario E, Martos-Cabrera L, Armesto S, Herrera-Acosta E, Vidal D, et al. Dose reduction is a feasible strategy in patients with plaque psoriasis who achieve sustained response with secukinumab: a retrospective, multicenter cohort study in daily practice setting. Int J Dermatol. 2024;63(4):503–11.
38. Luz M, Torres T. Real-world evidence on dose spacing of IL-23 inhibitors in the treatment of psoriasis. Am J Clin Dermatol. 2024;25(6):1019–21.
39. Abbad-Jaime De Aragon C, Berna-Rico E, Jaen P, Blauvelt A, Gonzalez-Cantero A. Bimekizumab as-needed dosing in patients with psoriasis: a case series. J Dermatolog Treat. 2025;36(1):2492197.
40. Mastorino L, Dapavo P, Ortoncelli M, Bongiovanni E, Liao Y, Leo F, et al. Dose modulation strategies in psoriatic patients: real-life pilot comparison between risankizumab and guselkumab up to 12 months after dose spacing. Exp Dermatol. 2025;34(2):e70062.
41. Wang C, Liu Y, Yang Y, Ning J, Xing X, Jian P, et al. Extension of Secukinumab and Ixekizumab dose for moderate-to-severe psoriasis in low disease activity intervals. Exp Dermatol. 2025;34(5):e70122.
42. Yatsuzuka K, Muto J, Yoshida S, Shiraishi K, Fujisawa Y. Sustained efficacy and safety of tildrakizumab in psoriasis vulgaris despite multiple prolonged treatment interruptions: a case report. Cureus. 2025;17(7):e87927.
43. van der Schoot LS, van den Reek J, Grine L, Schots L, Kievit W, Lambert JLW, et al. Dose reduction of the new generation biologics (IL-17 and IL-23 inhibitors) in psoriasis: study protocol for an international, pragmatic, multicenter, randomized, controlled, non-inferiority study-the BeNeBio study. Trials. 2021;22(1):707.
44. Bardazzi F, Loi C, Prignano F, Ricceri F, Giordano F, Patrizi A, et al. Down-titration of infliximab: the real-life use in psoriatic patients. J Drugs Dermatol. 2016;15(12):1584–6.
45. Ovejero-Benito MC, Munoz-Aceituno E, Sabador D, Reolid A, Llamas-Velasco M, Prieto-Perez R, et al. Polymorphisms associated with optimization of biological therapy through drug dose reduction in moderate-to-severe psoriasis. J Eur Acad Dermatol Venereol. 2020;34(6):e271–e275.
46. Akins RB, Tolson H, Cole BR. Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. BMC Med Res Methodol. 2005;5:37.
47. Savic LC, Smith AF. How to conduct a Delphi consensus process. Anaesthesia. 2023;78(2):247–50.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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