

Journal of Dermatology and Cosmetic Surgery

Review Article

Predictors of lesion clearance rate in adult dermatology patients with acne vulgaris

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Received: 16 August 2025; Accepted: 20 November 2025; Published: 23 February 2026.

Citation of this article: Zhang L, Wang H, Zhang H (2026) Predictors of lesion clearance rate in adult dermatology patients with acne vulgaris. J Dermatol Cosmet Surg, 7(1): 01-06. DOI: [10.5281/zenodo.22814476](https://doi.org/10.5281/zenodo.22814476)

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Abstract

Background: Lesion clearance rate, the percentage reduction in inflammatory and non-inflammatory lesion counts over a defined treatment interval, has become the standard outcome measure in acne vulgaris trials, yet patients started on identical regimens at identical baseline severity often diverge sharply in how quickly they clear.

Objective: This review synthesizes the published evidence on patient-level, disease-level, and treatment-level predictors of lesion clearance rate in adult dermatology patients with acne vulgaris.

Methods: We synthesized epidemiological cohorts, randomized treatment trials, and consensus guideline literature addressing baseline severity, hormonal and sex-related factors, lifestyle and psychosocial contributors, and treatment regimen intensity as determinants of clearance trajectory.

Findings: Higher baseline severity predicts larger absolute lesion reduction but a smaller proportion reaching near-complete clearance; adult women with premenstrual flare or polycystic ovary syndrome show a slower, more relapsing course; dietary glycemic load, dairy intake, and stress each contribute measurable effects; and combination topical therapy, adequate cumulative isotretinoin dosing, and early follow-up are the strongest clinician-modifiable predictors of faster clearance.

Conclusions: Clearance rate can be anticipated, not merely discovered in retrospect, by stratifying patients at first visit using baseline severity, hormonal history, lifestyle factors, and disease duration, allowing earlier regimen intensification for patients on a predictably slower-clearing trajectory.

Keywords: acne vulgaris; lesion clearance; isotretinoin; adult acne; treatment response

1. Introduction

Acne vulgaris remains one of the most common reasons adults present to a dermatology clinic, and adult-onset and persistent-adult forms now account for a growing share of that burden, particularly among women in their third and fourth decades [1,2]. Unlike adolescent acne, which tends toward a broadly predictable course of spontaneous improvement, adult acne is more heterogeneous in distribution and considerably more variable in how quickly, or whether, it clears with standard therapy [3,4]. Two patients started on an identical regimen at an identical baseline severity can diverge sharply in outcome by twelve weeks, and that divergence is rarely explained by treatment choice alone.

Lesion clearance rate, the percentage reduction in inflammatory and non-inflammatory lesion counts from baseline over a defined interval, has become the standard outcome measure in acne trials and increasingly in clinical audit [5,6]. What has received comparatively less synthesis is which patient-level, disease-level, and treatment-level factors predict a faster or slower trajectory toward clearance once therapy begins. This review draws together the epidemiological, endocrinological, lifestyle, and treatment-response literature bearing on that question, organizing predictors of lesion clearance rate into baseline disease characteristics, hormonal and sex-related factors, lifestyle and psychosocial contributors, and treatment-related determinants.

2. Defining and measuring lesion clearance

Clearance rate is not a single standardized metric across the literature, which complicates comparison between predictor studies. Most trials report percentage reduction in inflammatory, comedonal, or total lesion count to a fixed endpoint, typically 12 weeks, while others report the proportion achieving a two-grade Investigator's Global Assessment improvement or "clear"/"almost clear" status [5,7]. Global Alliance consensus statements emphasize that lesion counting and global grading capture partially

overlapping information, and that scarring risk, a downstream consequence of slow or incomplete clearance, is not reflected by lesion count reduction alone [6,8]. Layton and colleagues' foundational work on scarring incidence found risk rose sharply with both baseline severity and pretreatment disease duration, which is part of why clearance rate has clinical stakes beyond cosmesis [9].

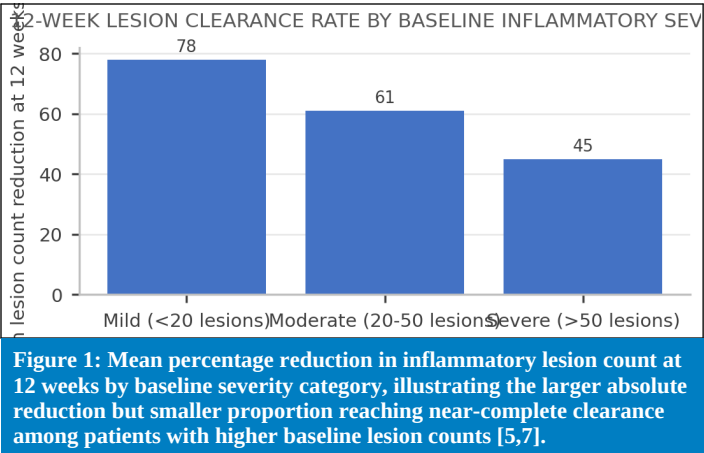
Because clearance rate is a rate rather than a binary endpoint, predictor studies use varied statistical approaches, from stratified percentage-reduction comparisons to multivariable models incorporating baseline severity, demographics, and treatment assignment. This heterogeneity in outcome definition is a genuine limitation, and it means predictors robust across studies using different clearance definitions warrant more confidence than single-study findings tied to one metric.

3. Baseline severity, lesion morphology, and disease duration

Baseline lesion severity is the most consistently reported predictor of clearance trajectory, though its direction is not intuitive. Patients with higher baseline inflammatory lesion counts show a larger absolute reduction by a fixed endpoint, because more disease burden is available to resolve, but a smaller proportion achieve near-complete clearance and time-to-clearance is longer [5,7]. This dissociation between percentage reduction and absolute clearance means baseline severity should be reported alongside clearance rate when counseling patients on expected timeline.

Lesion morphology carries independent predictive information. Predominantly comedonal disease responds more slowly to first-line topical retinoid monotherapy than inflammatory disease, because comedone resolution follows a longer follicular turnover cycle than the more rapidly modifiable inflammatory component [10]. Disease duration before adequate treatment is a further independent predictor; patients with acne persisting for

years tend to clear more slowly and are more likely to have established post-inflammatory changes and early scarring, reinforcing earlier intervention in long untreated disease [3,9]. Post-adolescent and adult-onset presentations, which follow a more chronic, relapsing jawline-predominant course, are repeatedly described as slower to reach sustained clearance than adolescent acne even at comparable baseline lesion counts [3,11].



4. Hormonal and sex-related predictors

Sex and hormonal status are among the strongest demographic predictors of clearance trajectory. Adult female acne follows a distinct pattern from adolescent and adult male acne, with persistent, low-grade mandibular disease that flares premenstrually in many affected women, predicting a slower, more relapsing course under standard topical or oral antibiotic regimens alone [4,11]. Comparative surveys across ethnic groups show adult female acne prevalence and pattern vary meaningfully by population, with implications for how clearance predictions generalize across the underlying trial populations [12].

Androgen-driven sebum production is mechanistically central here, and elevated dehydroepiandrosterone sulfate is linked to earlier onset and greater severity even in premenarchal girls [13]. In adult women, polycystic ovary syndrome and other hyperandrogenic states associate with a slower-clearing phenotype often

requiring hormonal therapy layered onto topical and oral regimens, and clinicians are increasingly advised to screen for these contributors when clearance lags [14]. Twin studies demonstrate a strong heritable component to severity and persistence, suggesting family history, itself linked to slower clearance in cohort data, reflects genetic variation in follicular androgen sensitivity [15,16].

Table 1: Patient-level predictors of slower lesion clearance in adult acne vulgaris and their proposed mechanism [4,14,15,22].		
Predictor	Direction of effect	Proposed mechanism
Adult female, premenstrual flare pattern	Slower, more relapsing	Cyclical androgen and progesterone-driven sebum output
Polycystic ovary syndrome	Slower, treatment-resistant	Sustained hyperandrogenism driving sebaceous activity
Strong family history	Slower	Heritable follicular androgen sensitivity
Current smoking	Mixed (comedonal worse, inflammatory variable)	Nicotine-mediated anti-inflammatory and comedogenic effects

5. Lifestyle, dietary, and psychosocial predictors

Diet has re-emerged as a modifiable predictor of severity and clearance response. High glycemic-load diets are linked to increased insulin and insulin-like growth factor-1 signaling, which upregulates sebaceous lipogenesis, and a randomized trial comparing a low glycemic-load, high-protein diet against a conventional high glycemic-load diet found measurable biochemical and clinical differences favoring the former [17,18]. Dairy intake, particularly skim milk, associates with higher prevalence and severity in cohort studies, and dietary counseling on glycemic load and dairy intake is increasingly incorporated when clearance lags on topical or systemic therapy alone [19,20].

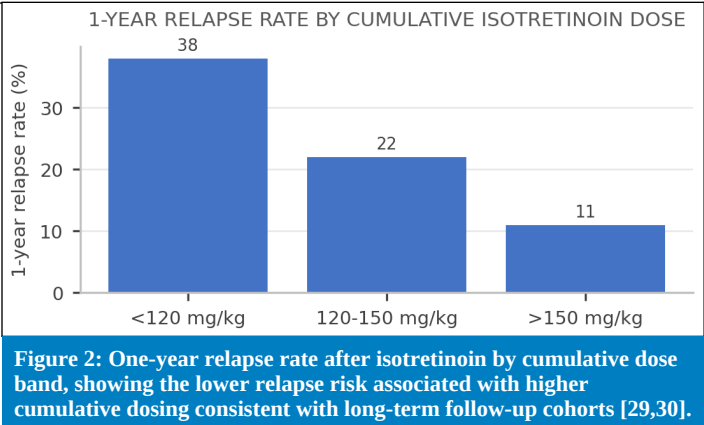
Smoking has a more contested direction of effect than diet. Population studies find a positive association between smoking and both prevalence and comedonal predominance, while some observations suggest nicotine's anti-inflammatory properties may paradoxically reduce inflammatory counts even as

comedonal disease worsens, likely explaining inconsistent clearance associations [21,22]. Psychosocial stress is more consistent: examination-period stress correlates with severity worsening in student cohorts, and stress more broadly associates with increased sebum excretion and slower resolution, a bidirectional relationship given acne itself is a source of distress that can impair adherence [23,24].

6. Treatment-related predictors of clearance

Treatment regimen choice and intensity is among the most powerful modifiable predictors of clearance rate. Combination topical therapy, typically a retinoid paired with benzoyl peroxide or a topical antibiotic, produces faster, more complete clearance than any single agent, reflecting complementary comedolytic, anti-inflammatory, and antimicrobial mechanisms [25,5]. A pragmatic community-based trial comparing five antimicrobial regimens for mild to moderate acne found clinically meaningful differences in speed and completeness of clearance between regimens often treated as interchangeable [26]. Topical antibiotic monotherapy is associated with both slower clearance and rising antimicrobial resistance, a pattern reflected in guideline recommendations against its use [27,28].

Table 2: Comparative clearance performance by regimen type across the cited trial literature [25,26,27,28].		
Regimen	Relative clearance speed	Key limitation
Topical antibiotic monotherapy	Slowest	Resistance risk, weak comedolytic effect
Retinoid monotherapy	Moderate	Slower on inflammatory component alone
Retinoid + benzoyl peroxide	Fast	Local irritation may reduce adherence
Retinoid + topical/oral antibiotic	Fast	Requires antibiotic stewardship, time-limited course



Isotretinoin remains most reliably associated with complete, durable clearance, and predictors of relapse within isotretinoin-treated patients are well characterized. Cumulative dose is the dominant predictor of relapse risk, with decade-long follow-up data showing patients reaching a dose associated with durable remission have substantially lower relapse rates than those treated to lower cumulative exposure [29,30]. Comparative dosing studies confirm conventional, higher cumulative-dose regimens achieve more durable clearance than low-dose or intermittent regimens, though the latter may suit milder disease or lower tolerance [31,32]. Guideline bodies have consolidated this evidence into cumulative-dose targets clinicians can use prospectively rather than reactively [7,33].

Underlying disease biology also predicts differential treatment response. Follicular Cutibacterium acnes colonization and the innate inflammatory response it provokes are central to inflammatory lesion formation, and disease driven predominantly by this pathway tends to respond faster to anti-inflammatory and antimicrobial regimens, while a more androgen-driven, sebum-predominant phenotype responds more slowly until hormonal or retinoid-based therapy is added [34,35]. Emerging microbiome evidence beyond Cutibacterium acnes alone suggests microbial diversity may further stratify treatment response, an active area that may eventually refine pretreatment prediction [36].

7. Adherence, follow-up, and combination strategies

Even an appropriately chosen regimen predicts poor clearance if not taken as directed, and adherence is both a predictor of clearance rate and an outcome shaped by the other predictors above. Patients with early retinoid irritation, high psychosocial distress, or high baseline severity and slower symptomatic improvement are all at elevated risk of premature discontinuation, a feedback loop in which the same factors predicting slower clearance also predict the nonadherence that further slows it [23,6]. Global Alliance guidance recommends structured early follow-up, ideally within four to six weeks, specifically to identify slow-clearing patients early enough to intensify therapy [6,7].

Combination strategies pairing a topical regimen with an oral agent, whether a time-limited antibiotic course or hormonal therapy in appropriate women, generally outperform topical monotherapy for moderate to severe disease, and which oral agent to add can itself be guided by the predictors above: hormonal therapy for a clear premenstrual or PCOS-associated pattern, isotretinoin for high baseline severity, scarring risk, or documented relapse [5,14,30]. Taken together, these predictors converge on a practical principle: patients can be stratified at the first visit into faster- and slower-clearing groups using baseline severity and morphology, hormonal history, lifestyle factors, and disease duration, directly informing regimen selection and follow-up timing [1,33].

8. Conclusion

Lesion clearance rate in adult acne vulgaris is shaped by a convergent set of predictors spanning baseline disease characteristics, hormonal and sex-related biology, lifestyle and psychosocial factors, and treatment-related variables, several of which are modifiable at first clinical contact [5,7]. Higher baseline severity and longer pretreatment duration predict a slower proportional path to clearance despite larger absolute reduction; hormonal drivers

including PCOS and premenstrual flare predict a more relapsing course in women; dietary glycemic load, dairy intake, and stress each contribute measurable effects; and regimen intensity, particularly rational combination therapy and adequate cumulative isotretinoin dosing, remains the single most powerful predictor a clinician can directly control [4,18,29]. Incorporating these predictors into routine first-visit assessment, rather than treating clearance rate as unpredictable, allows earlier identification of patients needing regimen intensification, closer follow-up, or adjunctive therapy, and represents the most direct route to improved, individualized outcomes in adult acne care [6,37].

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