





# Beyond Skin Clearance: Personalized Strategies for DLQI Improvement in Psoriasis -Insights From a Shanghai Prospective Cohort

Xin Ma <sup>1,2,\*</sup>, Quanruo Xu <sup>3,\*</sup>, Le Kuai<sup>4,\*</sup>, Fanlingzi Shen<sup>3</sup>, Zhen Duan<sup>3</sup>, Xiangjin Gao <sup>1</sup>, Rui Zhang<sup>1</sup>, Ruiping Wang <sup>1,3</sup>

<sup>1</sup>Clinical Research Center, Shanghai Skin Diseases Hospital, School of Medicine, Tongji University, Shanghai, People's Republic of China; <sup>2</sup>Department of Traditional Chinese Medicine, Shanghai Skin Diseases Hospital, School of Medicine, Tongji University, Shanghai, People's Republic of China; <sup>3</sup>School of Public Health, Shanghai University of Traditional Chinese Medicine, Shanghai, People's Republic of China; <sup>4</sup>Department of Dermatology, Yueyang Hospital of Integrated Traditional Chinese and Western Medicine, Shanghai University of Traditional Chinese Medicine, Shanghai, People's Republic of China

\*These authors contributed equally to this work

Correspondence: Ruiping Wang, Clinical Research Center, Shanghai Skin Diseases Hospital, School of Medicine, Tongji University, 1278 Baode Road, Jing'an District, Shanghai, 200443, People's Republic of China, Email w19830901@126.com

**Introduction:** Psoriasis is a chronic immune-mediated disease that significantly impacts patients clinically and psychologically. Physician-assessed severity measures, including Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Physician Global Assessment (PGA), often fail to capture patient-reported outcomes, particularly when clinical improvement and perceived quality-of-life gains are misaligned.

**Purpose:** To clarify the association between clinical improvements and Dermatology Life Quality Index (DLQI) outcomes, identify predictors of substantial DLQI improvement ( $\geq 90\%$  reduction), and explore reasons for suboptimal DLQI responses in patients achieving skin clearance.

**Methods:** In this 12-week prospective study, 551 psoriasis patients were enrolled at Shanghai Skin Diseases Hospital. Data on demographics, clinical severity (PASI, BSA, and PGA), DLQI scores, and treatment modalities were collected. Logistic regression analyses were employed to assess the dose-response relationships between improvements in clinical parameters and DLQI reduction, and to identify factors of suboptimal DLQI improvement among patients achieving significant skin clearance.

**Results:** Median DLQI improved significantly (8.0 to 3.0) at week 12, with 24.1% of patients achieving  $\geq 90\%$  DLQI reduction. Strong dose-response associations existed between clinical severity improvements (PASI, BSA, PGA) and DLQI gains. PASI<sub>75</sub> responders were significantly more likely to achieve substantial DLQI improvement (OR = 2.48, 95% CI: 1.51–4.07). However, only 33.3% of PASI<sub>75</sub> achievers reached  $\geq 90\%$  DLQI improvement. Early clinical response (as early as week 4) strongly predicted superior DLQI outcomes. Female sex, older age, lower baseline DLQI scores, and shorter disease duration were associated with achieving high skin clearance but suboptimal DLQI improvement.

**Conclusion:** Early clinical response effectively predicts substantial DLQI improvement, whereas demographic and disease-related factors help identify patients at risk for suboptimal quality-of-life gains despite significant skin clearance. These insights support personalized therapeutic strategies aimed at improving patient satisfaction beyond skin clearance alone.

**Keywords:** psoriasis, quality of life, biologic agents, cohort study

## Introduction

Psoriasis is a chronic, immune-mediated inflammatory disorder that affects approximately 100 million individuals worldwide.<sup>1</sup> It is characterized by well-demarcated, erythematous plaques with silvery scales and is frequently accompanied by pruritus, pain, and significant psycho-social distress.<sup>2</sup> Beyond its dermatological manifestations, psoriasis is closely linked to cardiovascular disease, metabolic syndrome, and mood disorders, all of which further complicate disease management and

intensify the overall patient burden.<sup>3</sup> The disorder also imposes substantial socioeconomic costs, stemming from increased healthcare expenditures, lost productivity, and social isolation due to the stigma of visible lesions.<sup>4,5</sup>

Although recent therapeutic advances, particularly with biologic therapies, have markedly enhanced skin clearance, physician-reported measures<sup>6,7</sup> such as the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Physician Global Assessment (PGA) do not fully capture the broader impact on patients' daily functioning and quality of life.<sup>8,9</sup> To address this gap, the Dermatology Life Quality Index (DLQI) has emerged as a critical tool for evaluating the multidimensional burden of psoriasis. Compared to generic quality-of-life instruments such as the EQ-5D or SF-36, the DLQI demonstrates greater sensitivity to dermatology-specific changes and is therefore more suitable for evaluating treatment outcomes in psoriasis.<sup>10,11</sup>

Treatment targets have increasingly incorporated both physician and patient reported outcomes. PASI<sub>75</sub> and PASI<sub>90</sub> are widely accepted as objective benchmarks for treatment response,<sup>12–14</sup> a  $\geq 5$ -point improvement in DLQI has been proposed as a clinically meaningful threshold for patient-reported benefit.<sup>15</sup> These dual endpoints have been adopted in European guidelines, which recommend continuing treatment when PASI improvement is 50–75% and DLQI  $\leq 5$ , and suggest treatment adjustment if DLQI remains  $>5$  despite clinical response.<sup>12,16</sup> In clinical settings, these thresholds also guide therapeutic decision-making.<sup>17</sup> According to Chinese guidelines, biologic therapies are indicated not only for patients with PASI  $\geq 10$ , but also for those with substantial physical or psychological burden—as reflected by a DLQI  $>10$ —regardless of PASI level.<sup>18</sup>

Despite these advances, real-world studies have reported that some patients fail to achieve meaningful DLQI improvement even after substantial PASI reduction, highlighting a disconnect between clinical and patient-perceived outcomes.<sup>19</sup> Factors such as residual lesions in visible areas, psychological distress, or unmet treatment expectations may contribute to this disparity.<sup>20</sup> However, predictors of poor DLQI response remain insufficiently explored, limiting the implementation of individualized care strategies.

In this prospective study conducted at Shanghai Skin Diseases Hospital (2022–2024), we examined the association between early clinical improvements and quality-of-life outcomes in 551 patients with psoriasis. By integrating demographic, clinical, and treatment-related data, we aimed to identify key factors associated with substantial DLQI improvement and to clarify why some patients derive limited quality of life benefit despite achieving high skin clearance. These insights may inform personalized treatment strategies that address both visible symptoms and patient-centered needs.

## Methods

### Data Source and Study Population

This observational study was conducted at Shanghai Skin Diseases Hospital between 2022 and 2024. Patients with psoriasis were recruited from a prospectively established cohort, and all participants provided written informed consent. Eligible patients were aged  $\geq 18$  years with a clinical diagnosis of psoriasis vulgaris in accordance with global diagnostic and treatment guidelines. Exclusion criteria included planned relocation within one year, inability to provide informed consent, and the presence of significant neurological or psychiatric disorders. The study protocol was approved by the Institutional Ethical Review Board of Shanghai Skin Diseases Hospital (2022–25). We have registered this study in the Chinese clinical trial registry (ChiCTR2200066894), and performed it in line with the Declaration of Helsinki and STROBE guidelines.

### Sample Size Calculation

In this study, we applied the sample size calculation formula  $n = [\mu\alpha^2 \times p(1-p)] / \delta^2$  for observational study. We set  $p = 30\%$  for the  $\geq 90\%$  of PASI score reduction at week 12 compared to baseline, type I error  $\alpha = 0.05$ , the allowed error  $\delta = 15\%$  of  $p$ , and a non-response rate of 10%, the sample size calculation result indicated that at least 445 psoriasis patients should be recruited. Ultimately, 551 psoriasis patients were successfully enrolled and completed the full 12-week follow-up, with no missing data for any key variables included in the final analysis.

## Data Collection

Patients underwent a standardized physical examination during routine clinic visits, during which dermatologists assessed disease severity using PASI, PGA, and BSA. Simultaneously, structured questionnaires were used to collect detailed information on demographic characteristics (age, sex, marital status, education level, monthly income, and residency status), lifestyle factors (tobacco smoking, alcohol consumption, body mass index [BMI, kg/m<sup>2</sup>], and other relevant habits), and clinical assessments and medical history, including baseline psoriasis severity (evaluated by PASI, BSA, and PGA), quality of life (DLQI), disease duration, non-communicable disease comorbidities, and family history of psoriasis. Treatment information was also documented and patients were classified based on the therapy received. Follow-up assessments of PASI, BSA, and PGA were performed at weeks 4, 8, and 12, while DLQI was re-evaluated at week 12.

## Definitions and Classifications

Psoriasis severity was evaluated using the PASI (range 0–72), BSA (percentage of affected skin), and PGA (scale 0–5), with higher scores indicating greater severity. Treatment response was defined as PASI<sub>75</sub> for a ≥75% reduction and PASI<sub>90</sub> for a ≥90% reduction from baseline. Quality of life was assessed with the DLQI, a 10-item questionnaire with scores ranging from 0 (no impairment) to 30 (maximum impairment), categorized as 0–1 (no impact), 2–5 (mild impact), 6–10 (moderate impact), and >10 (severe impact). Each question is scored on a four-point scale, reflecting the extent to which individual's life quality is adversely affected by the skin condition: not at all/not relevant (0), a little (1), a lot (2), and very much (3). For subgroup analyses, patients were stratified by the percentage reduction in DLQI at week 12, and a reduction of at least 90% is considered optimal.

A smoker was defined as an individual who has consumed at least 100 cigarettes in their lifetime, while a drinker was defined as someone who consumed alcohol more than twice per week for at least six months. Disease duration was defined as the interval between psoriasis onset and the current investigation, categorized as <5, 5–10, or >10 years. A positive family history of psoriasis was defined as having at least one first-degree relative (parents, siblings, or children) with the disease. A medical history of non-communicable diseases (NCDs) was defined as the presence of at least one of the following: diabetes mellitus, hypertension, hyperlipidemia, hyperuricemia, coronary atherosclerotic heart disease, nonalcoholic fatty liver disease, tumors, or chronic renal insufficiency.

Additional variables were classified as follows: age (<35, 35–45, 46–60, and >60 years); education level (primary or lower, junior high, senior high, and college and above); monthly income (<3000, 3000–5000, 5001–10,000, and >10,000 RMB); residency status (urban or rural); and marital status (married, unmarried, or divorced/widowed/widower/others). BMI was calculated as weight (kg) divided by height (m<sup>2</sup>) and categorized as <23.9 kg/m<sup>2</sup> (low/normal), 24.0–28.0 kg/m<sup>2</sup> (overweight), and >28.0 kg/m<sup>2</sup> (obesity). Treatment modalities were grouped as follows: acitretin (25–50 mg daily), methotrexate (15–20 mg per week with folic acid supplementation), narrowband UVB (NB-UVB, 2–4 sessions per week), and biologic agents (ustekinumab, risankizumab, secukinumab).

## Statistical Analysis

Data in this study was analyzed by applying the SAS 9.4. All variables were complete with no missing data. Normality testing was performed for continuous variables using the Shapiro–Wilk test. Variables that followed a normal distribution were presented as means ± standard deviations and compared using the Student's *t*-test; otherwise, they were expressed as medians with interquartile ranges (IQRs) and compared using the Mann–Whitney *U*-test. Categorical variables were expressed as frequencies and percentages, with group comparisons conducted using the chi-square test. Logistic regression was performed to identify factors associated with achieving a ≥90% DLQI reduction, and odds ratios (ORs) with 95% confidence intervals (CIs) were reported. Subgroup analyses were conducted to assess the differences by sex, age, and treatment modality. In this study, a two-tailed *P* value <0.05 was considered statistically significant.

## Results

In this study, 551 psoriasis patients were enrolled (Table 1), including 417 males (75.7%) and 134 females (24.3%), with a mean age of 45.8 ± 18.2 years. Approximately 40% of participants had a college education or higher. About two-thirds

**Table 1** The Baseline Characteristics of Patients with Psoriasis in Shanghai<sup>a</sup>

| Characteristics                             | Total (n=551)   | Male (n=417)    | Female (n=134)  | P Value |
|---|-----------------|-----------------|-----------------|---------|
| Age (years), mean (SD)                      | 45.8 (18.2)     | 45.2 (18.8)     | 47.6 (16.2)     | 0.146   |
| Age group, (n, %)                           |                 |                 |                 | 0.157   |
| <35 years                                   | 169 (30.7)      | 136 (32.6)      | 33 (24.6)       |         |
| 35–45 years                                 | 97 (17.6)       | 66 (15.8)       | 31 (23.1)       |         |
| 46–60 years                                 | 132 (24.0)      | 100 (24.0)      | 32 (23.9)       |         |
| >60 years                                   | 153 (27.8)      | 115 (27.6)      | 38 (28.4)       |         |
| Education, (n, %)                           |                 |                 |                 | 0.140   |
| Primary and lower                           | 108 (19.6)      | 91 (21.8)       | 17 (12.7)       |         |
| Junior high                                 | 107 (19.4)      | 79 (18.9)       | 28 (20.9)       |         |
| Senior high                                 | 114 (20.7)      | 85 (20.4)       | 29 (21.6)       |         |
| College and above                           | 222 (40.3)      | 162 (38.8)      | 60 (44.8)       |         |
| Monthly income, (RMB)                       |                 |                 |                 | <0.001  |
| <3000                                       | 90 (16.3)       | 84 (20.1)       | 6 (4.5)         |         |
| 3000–5000                                   | 137 (24.9)      | 99 (23.7)       | 38 (28.4)       |         |
| 5001–10,000                                 | 290 (52.6)      | 210 (50.4)      | 80 (59.7)       |         |
| >10,000                                     | 34 (6.2)        | 24 (5.8)        | 10 (7.5)        |         |
| Residency status, (n,%)                     |                 |                 |                 | 0.466   |
| Urban                                       | 364 (66.1)      | 272 (65.2)      | 92 (68.7)       |         |
| Rural                                       | 187 (33.9)      | 145 (34.8)      | 42 (31.3)       |         |
| Marital status, (n, %)                      |                 |                 |                 | <0.001  |
| Married                                     | 379 (68.8)      | 276 (66.2)      | 103 (76.9)      |         |
| Unmarried                                   | 80 (14.5)       | 54 (12.9)       | 26 (19.4)       |         |
| Divorced/widow/widower/others               | 92 (16.7)       | 87 (20.9)       | 5 (3.7)         |         |
| BMI (kg/m <sup>2</sup> ), mean (SD)         | 25.0 (3.9)      | 25.4 (3.9)      | 23.8 (3.9)      | <0.001  |
| BMI (kg/m <sup>2</sup> ), n (%)             |                 |                 |                 | 0.002   |
| <23.9 (low or normal weight)                | 229 (41.6)      | 156 (37.4)      | 73 (54.5)       |         |
| 24.0–28.0 (overweight)                      | 210 (38.1)      | 169 (40.5)      | 41 (30.6)       |         |
| >28.0 (obesity)                             | 112 (20.3)      | 92 (22.1)       | 20 (14.9)       |         |
| Tobacco smoking, n (%)                      | 282 (51.2)      | 261 (62.6)      | 21 (15.7)       | <0.001  |
| Alcohol drinking, n(%)                      | 57 (10.3)       | 52 (12.5)       | 5 (3.7)         | 0.004   |
| NCD comorbidity, n (%)                      | 235 (42.6)      | 194 (46.5)      | 41 (30.6)       | 0.001   |
| Family history of psoriasis, n (%)          | 109 (19.8)      | 79 (18.9)       | 30 (22.4)       | 0.384   |
| Disease duration (year), median (IQR)       | 12 (6–21)       | 12 (6–21)       | 14 (6–22)       | 0.513   |
| PASI at week0, median (IQR) <sup>b,c</sup>  | 11.4 (8.0–16.8) | 12.0 (8.8–17.2) | 9.6 (6.8–14.6)  | <0.001  |
| BSA at week0 (%), median (IQR) <sup>d</sup> | 14.2 (9.0–25.3) | 15.0 (9.7–26.0) | 12.0 (8.0–21.0) | 0.038   |
| PGA at week0, median (IQR) <sup>e</sup>     | 2.7 (2.0–3.0)   | 3.0 (2.0–3.0)   | 2.0 (2.0–3.0)   | <0.001  |
| Treatment plan, n (%)                       |                 |                 |                 | 0.208   |
| Acitretin                                   | 46 (8.3)        | 36 (8.6)        | 10 (7.5)        |         |
| Methotrexate                                | 174 (31.6)      | 129 (30.9)      | 45 (33.6)       |         |
| NB-UVB                                      | 139 (25.2)      | 98 (23.5)       | 41 (30.6)       |         |
| Biologics ((ustekinumab, etc)               | 192 (34.8)      | 154 (36.9)      | 38 (28.4)       |         |

**Notes:** <sup>a</sup>Data represented as mean (SD), median (IQR) or frequency (%) as appropriate. <sup>b</sup>BMI was calculated as weight in kilograms divided by height in meters squared. <sup>c</sup>PASI indicate the severity of psoriasis, with a higher value represents a more severe condition (0[better]–72[worse]). <sup>d</sup>BSA indicate the affected body surface, with a higher value represents a more severe condition (0%[better]–100%[worse]). <sup>e</sup>PGA indicate the physician's overall evaluation of psoriasis with a higher score represents a more severe condition (0[better]–5[worse]).

**Abbreviations:** SD, standard deviation; RMB, Chinese Yuan; BMI, body mass index; IQR, Interquartile range; PASI, psoriasis area and severity index; BSA, body surface area; PGA, Physician's Global Assessment; NCD, non-communicable diseases; NB-UVB, narrow band ultraviolet.

resided in urban areas, and marital status varied significantly ( $P < 0.001$ ), with 76.9% of females married compared to 66.2% of males. The overall mean BMI was  $25.0 \pm 3.9$  kg/m<sup>2</sup>, with males exhibiting a higher BMI (25.4 kg/m<sup>2</sup>) than females (23.8 kg/m<sup>2</sup>). Additionally, 51.2% of patients were smokers and they were predominantly males (62.6%), the NCD comorbidities were also more common in males (46.5% vs 30.6%). Measures of disease severity demonstrated sex-related differences: the overall median PASI was 11.4 (IQR: 8.0–16.8), with males scoring higher (12.0 vs 9.6); median BSA was 14.2% (IQR: 9.0–25.3), higher in males (15.0% vs 12.0%); and the median PGA was also higher in males (3.0 vs 2.0).

## Overall DLQI Improvement

At baseline, the median DLQI was 8.0 (IQR: 4.5–14.0), with no significant sex differences. After 12 weeks of treatment, the median DLQI significantly decreased to 3.0 (IQR: 1.0–7.0), with a mean reduction of  $4.7 \pm 6.3$  points (Table 2). Initially, 68.1% of patients had DLQI scores in the higher ranges (6–10 and >10). By week 12, 37.0% had shifted to the 0–1 range, 29.9% to the 2–5 range, and only 11.1% remained in the >10 category. Moreover, 24.1% achieved a  $\geq 90\%$  reduction in DLQI, which was significantly more common in males (26.4%) than in females (17.2%;  $P = 0.030$ ). Figure 1 illustrates a marked shift across each items of DLQI from baseline to week 12, with the greatest improvements observed in embarrassment/sadness (Q2) and sore, itchy, painful skin (Q1).

## Early and Threshold-Dependent Predictors of DLQI Improvement

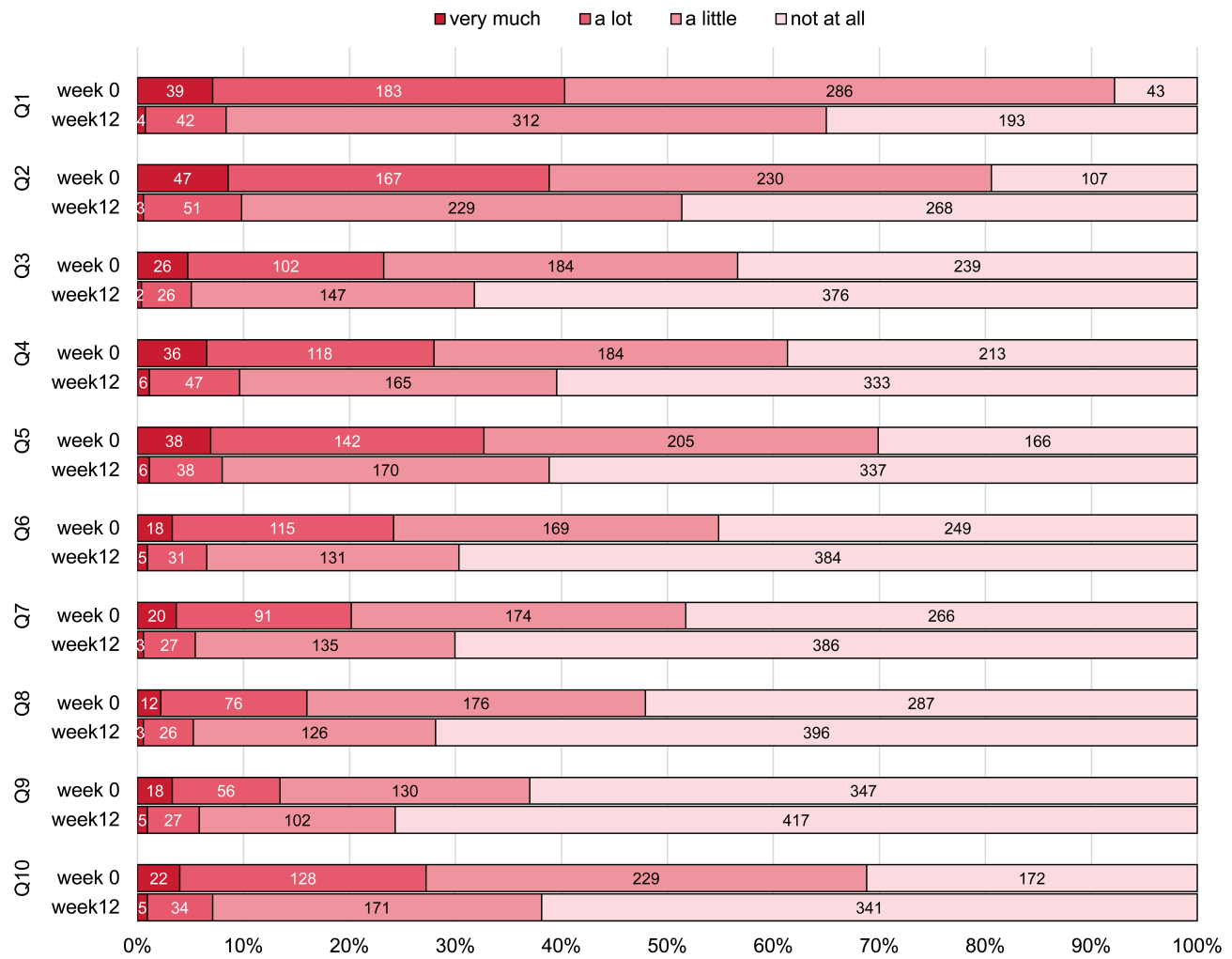
In multivariable analyses (Table 3), both early clinical gains and attainment of key clearance thresholds robustly predicted  $\geq 90\%$  DLQI reduction at week 12. After adjusting for demographic and treatment factors (Model C), each one-point decrease in PASI at week 4 increased the odds of substantial DLQI improvement by 6% (OR: 0.94; 95% CI:

**Table 2** The Dermatology Life Quality Index (DLQI) Score Among Patients with Psoriasis in Shanghai<sup>a</sup>

| DLQI Score <sup>b</sup>                             | Total (n=551)  | Male (n=417)   | Female (n=134) | P Value |
|---|----------------|----------------|----------------|---------|
| Total score at week0, mean (SD)                     | 9.3 (6.2)      | 9.3 (6.3)      | 9.6 (6.0)      | 0.543   |
| Total score at week0, median (IQR)                  | 8.0 (4.5–14.0) | 8.0 (4.0–14.0) | 9.0 (5.0–13.0) | 0.367   |
| Score at week0 by group A, n (%)                    |                |                |                | 0.681   |
| 0–1   | 38 (6.9)       | 31 (7.4)       | 7 (5.2)        |         |
| 2–5   | 138 (25.0)     | 107 (25.7)     | 31 (23.1)      |         |
| 6–10  | 179 (32.5)     | 135 (32.4)     | 44 (32.8)      |         |
| >10   | 196 (35.6)     | 144 (34.5)     | 52 (38.8)      |         |
| Score at week0 by group B, n (%)                    |                |                |                | 0.369   |
| $\leq 10$   | 355 (64.4)     | 273 (65.5)     | 82 (61.2)      |         |
| >10   | 196 (35.6)     | 144 (34.5)     | 52 (38.8)      |         |
| Total score at week12, mean (SD)                    | 4.6 (5.0)      | 4.6 (5.2)      | 4.8 (4.3)      | 0.660   |
| Total score at week12, median (IQR)                 | 3.0 (1.0–7.0)  | 3.0 (1.0–7.0)  | 4.0 (1.0–7.0)  | 0.086   |
| Score at week12 by group A, n (%)                   |                |                |                | 0.175   |
| 0–1   | 204 (37.0)     | 164 (39.3)     | 40 (29.9)      |         |
| 2–5   | 165 (29.9)     | 121 (29.0)     | 44 (32.8)      |         |
| 6–10  | 121 (22.0)     | 85 (20.4)      | 36 (26.9)      |         |
| >10   | 61 (11.1)      | 47 (11.3)      | 14 (10.4)      |         |
| Score at week12 by group B, n (%)                   |                |                |                | 0.792   |
| $\leq 10$   | 490 (88.9)     | 370 (88.7)     | 120 (89.6)     |         |
| >10   | 61 (11.1)      | 47 (11.3)      | 14 (10.4)      |         |
| Score change at week 12 <sup>c</sup> , mean (SD)    | 4.7 (6.3)      | 4.7 (6.3)      | 4.9 (6.3)      | 0.804   |
| Score change at week 12 <sup>d</sup> , median (IQR) | 4.0 (1.0–8.0)  | 4.0 (1.0–8.0)  | 4.0 (1.0–9.0)  | 0.937   |
| Score decreased $\geq 90\%$ at week12, n (%)        | 133 (24.1%)    | 110 (26.4)     | 23 (17.2)      | 0.030   |

**Notes:** <sup>a</sup>Data represented as mean (SD), median (IQR) or frequency (%) as appropriate. <sup>b</sup>DLQI score indicate the life quality affected by skin diseases among patients, with a higher value represents a more severe condition (0[better]–30[worse]). <sup>c</sup>The DLQI score change between week 12 and week 0 among patients with psoriasis was statistically significant, by paired sample t test. <sup>d</sup>The DLQI score change between week 12 and week 0 among patients with psoriasis was statistically significant, by paired sample Wilcoxon Signed Ranks test.

**Abbreviations:** DLQI, dermatology life quality index; SD, standard deviation; IQR, Interquartile range.



**Figure 1** Changes in the distribution of responses for the 10 DLQI items from baseline to week 12. Q1: Sore, itchy, painful skin; Q2: Embarrassment or self-consciousness; Q3: Impact on shopping or housework; Q4: Influence on clothing choices; Q5: Effect on social/leisure activities; Q6: Effect on sports/entertainment; Q7: Impact on work/study; Q8: Interpersonal problems; Q9: Sexual difficulties; Q10: Treatment difficulties.

0.91–0.98), strengthening to OR 0.90 (95% CI: 0.85–0.95) at week 8 and OR 0.78 (95% CI: 0.71–0.86) at week 12. Parallel dose–response trends were observed for BSA and PGA, indicating that even modest early reductions in skin severity forecast later quality-of-life benefits.

**Table 3** Treatment Effect Evaluation by PASI, BSA, PGA at week 4, week 8 and week 12 and Their Association with DLQI Score Decreased for at Least 90% at week 12 in Psoriasis Patients in Shanghai

| Treatment Effect Evaluation           | Total Patients (n=551) | DLQI Score Decreased ≥90%, (OR, 95% CI) |                  |                  |
|---------------------------------------|------------------------|---|------------------|------------------|
|                                       |                        | Model A                                 | Model B          | Model C          |
| <b>At week 4</b>                      |                        |   |                  |                  |
| PASI, median (IQR)                    | 5.7 (3.0–10.2)         | 0.95 (0.91–0.98)                        | 0.94 (0.90–0.98) | 0.94 (0.91–0.98) |
| BSA, median (IQR)                     | 9.0 (5.0–18.0)         | 0.98 (0.97–1.00)                        | 0.98 (0.96–0.99) | 0.97 (0.96–0.99) |
| PGA, median (IQR)                     | 2.0 (1.0–2.0)          | 0.63 (0.50–0.80)                        | 0.59 (0.46–0.75) | 0.67 (0.52–0.87) |
| PASI <sub>75</sub> achievement, n (%) | 117 (21.2)             | 2.46 (1.58–3.82)                        | 2.42 (1.55–3.79) | 1.73 (1.07–2.80) |
| PGA (0/1) rate, n (%)                 | 211 (38.3)             | 2.39 (1.61–3.56)                        | 2.72 (1.80–4.11) | 2.38 (1.54–3.69) |

(Continued)

**Table 3** (Continued).

| Treatment Effect Evaluation           | Total Patients (n=551) | DLQI Score Decreased $\geq 90\%$ , (OR, 95% CI) |                  |                  |
|---------------------------------------|------------------------|---|------------------|------------------|
|                                       |                        | Model A   | Model B          | Model C          |
| At week 8                             |                        |   |                  |                  |
| PASI, median (IQR)                    | 3.6 (1.6–7.2)          | 0.89 (0.85–0.94)                                | 0.89 (0.84–0.94) | 0.90 (0.85–0.95) |
| BSA, median (IQR)                     | 6.0 (2.0–13.0)         | 0.96 (0.94–0.99)                                | 0.96 (0.93–0.98) | 0.96 (0.94–0.98) |
| PGA, median (IQR)                     | 1.0 (1.0–2.0)          | 0.62 (0.49–0.78)                                | 0.60 (0.47–0.76) | 0.67 (0.52–0.87) |
| PASI <sub>75</sub> achievement, n (%) | 203 (36.8)             | 2.70 (1.81–4.02)                                | 2.77 (1.85–4.17) | 2.10 (1.34–3.29) |
| PGA (0/1) rate, n (%)                 | 313 (56.8)             | 2.00 (1.32–3.03)                                | 2.14 (1.40–3.27) | 1.93 (1.24–3.02) |
| At week 12                            |                        |   |                  |                  |
| PASI, median (IQR)                    | 2.4 (0.9–4.9)          | 0.76 (0.70–0.84)                                | 0.76 (0.69–0.83) | 0.78 (0.71–0.86) |
| BSA, median (IQR)                     | 3.0 (0.7–8.0)          | 0.91 (0.88–0.96)                                | 0.91 (0.87–0.95) | 0.92 (0.89–0.97) |
| PGA, median (IQR)                     | 1.0 (1.0–2.0)          | 0.49 (0.39–0.63)                                | 0.48 (0.37–0.62) | 0.55 (0.42–0.71) |
| PASI <sub>75</sub> achievement, n (%) | 300 (54.4)             | 3.30 (2.13–5.12)                                | 3.40 (2.18–5.32) | 2.48 (1.51–4.07) |
| PASI <sub>90</sub> achievement, n (%) | 167 (30.3)             | 2.84 (1.89–4.26)                                | 2.86 (1.89–4.32) | 1.94 (1.22–3.10) |
| PGA (0/1) rate, n (%)                 | 361 (65.5)             | 2.66 (1.66–4.26)                                | 2.96 (1.83–4.79) | 2.44 (1.48–4.04) |

**Notes:** PASI<sub>75</sub> is defined as patients achieving at least 75% improvement in PASI score and calculated by the formula  $[(\text{PASI at baseline} - \text{PASI at week } t)/\text{PASI at baseline}] \times 100\%$ . PASI<sub>90</sub> is defined as patients achieving at least 90% improvement in PASI score and calculated by the formula  $[(\text{PASI at baseline} - \text{PASI at week } t)/\text{PASI at baseline}] \times 100\%$ . Model A: univariate logistic regression. Model B: multivariate logistic regression with the adjustment of age and sex. Model C: multivariate logistic regression with the adjustment of age, sex, income, marital status, diseases duration, treatment plan and non-communicable disease comorbidities.

**Abbreviations:** DLQI, dermatology life quality index; SD, standard deviation; IQR, Interquartile range; PASI, psoriasis area and severity index; BSA, body surface area; PGA, Physician's Global Assessment; OR, odds ratio; CI, confidence interval.

Achievement of clearance milestones further amplified this effect: by week 12, patients who reached PASI<sub>75</sub> had 2.48-fold higher odds of  $\geq 90\%$  DLQI reduction (95% CI: 1.51–4.07), those achieving PASI<sub>90</sub> had 1.94-fold greater odds (95% CI: 1.22–3.10), and patients with PGA 0/1 experienced a 2.44-fold increase in the likelihood of substantial DLQI gains (95% CI: 1.48–4.04). Moreover, patients achieving PASI<sub>75</sub> or PGA 0/1 as early as week 4 had over twice the odds of high DLQI reduction by week 12 (OR was 2.46 for PASI<sub>75</sub> and 2.39 for PGA 0/1), underscoring the prognostic value of rapid skin clearance.

## Dose–Response Patterns at Week 12 and Persistent DLQI Discordance

Dose–response analyses at week 12 (Table 4) demonstrated that greater clinical improvements corresponded to progressively higher odds of achieving  $\geq 90\%$  DLQI reduction. Compared with the lowest PASI change quartile, patients in the highest quartile (12.7–45.8 point reduction) had more than double the odds of substantial DLQI improvement (OR: 2.10; 95% CI: 1.21–3.65). Similar patterns were seen for BSA change (quartile 4, OR: 2.49; 95% CI: 1.37–4.52) and PGA change (quartile 4, OR: 3.61; 95% CI: 1.91–6.85). When evaluating percentage improvements, the top quartile of PASI reduction (76–100%) conferred a 6.70-fold increase in odds (95% CI: 2.01–22.40), with comparable enhancements for

**Table 4** Dose–Response Evaluation Between Score Change of PASI, BSA, PGA at week 12 and the DLQI Score Decreased for at Least 90% at week 12 in Psoriasis Patients in Shanghai

| Treatment Effect Evaluation | Proportion, n (%) | DLQI Score, Decreased $\geq 90\%$ , n (%) | DLQI Score Decreased $\geq 90\%$ , (OR, 95% CI) |                  |
|-----------------------------|-------------------|---|---|------------------|
|                             |                   |   | Model A   | Model B          |
| PASI score change at wk12   |                   |   |   |                  |
| Quartile1 (–6.2 to 4.8)     | 139 (25.2)        | 27 (19.4)                                 | 1.00  | 1.00             |
| Quartile2 (4.9 to 8.2)      | 137 (24.9)        | 25 (18.2)                                 | 0.93 (0.51–1.69)                                | 1.01 (0.55–1.86) |
| Quartile3 (8.3 to 12.7)     | 137 (24.9)        | 34 (24.9)                                 | 1.37 (0.77–2.43)                                | 1.36 (0.76–2.42) |
| Quartile4 (12.7 to 45.8)    | 138 (25.0)        | 47 (25.0)                                 | 2.14 (1.24–3.71)                                | 2.10 (1.21–3.65) |

(Continued)

**Table 4** (Continued).

| Treatment Effect Evaluation    | Proportion, n (%) | DLQI Score,<br>Decreased $\geq 90\%$ , n (%) | DLQI Score Decreased $\geq 90\%$ , (OR, 95% CI) |                   |
|--------------------------------|-------------------|--|---|-------------------|
|                                |                   |  | Model A   | Model B           |
| BSA score change at wk12       |                   |  |   |                   |
| Quartile1 (-32.6 to 4.4)       | 140 (25.4)        | 21 (15.0)                                    | 1.00  | 1.00              |
| Quartile2 (4.5 to 10.0)        | 146 (26.5)        | 33 (22.6)                                    | 1.66 (0.91–3.03)                                | 1.89 (1.02–3.51)  |
| Quartile3 (10.1 to 19.0)       | 128 (23.2)        | 38 (29.7)                                    | 2.40 (1.31–4.36)                                | 2.38 (1.30–4.36)  |
| Quartile4 (19.1 to 80.0)       | 137 (24.9)        | 41 (29.9)                                    | 2.42 (1.34–4.37)                                | 2.49 (1.37–4.52)  |
| PGA score change at wk12       |                   |  |   |                   |
| Quartile1 (-2.0 to 0.7)        | 142 (25.8)        | 21 (14.8)                                    | 1.00  | 1.00              |
| Quartile2 (0.8 to 1.0)         | 154 (27.9)        | 30 (19.5)                                    | 1.39 (0.76–2.57)                                | 1.42 (0.77–2.64)  |
| Quartile3 (1.1 to 2.0)         | 169 (30.7)        | 48 (28.4)                                    | 2.29 (1.29–4.05)                                | 2.30 (1.29–4.10)  |
| Quartile4 (2.1 to 4.0)         | 86 (15.6)         | 34 (39.5)                                    | 3.77 (2.00–7.10)                                | 3.61 (1.91–6.85)  |
| PASI change percentage at wk12 |                   |  |   |                   |
| Quartile 1 (-178% to 25%)      | 41 (7.4)          | 3 (7.3)                                      | 1.00  | 1.00              |
| Quartile 2 (26% to 50%)        | 72 (13.1)         | 8 (11.1)                                     | 1.58 (0.40–6.33)                                | 1.60 (0.40–6.44)  |
| Quartile 3 (51% to 75%)        | 138 (25.0)        | 22 (15.9)                                    | 2.40 (0.68–8.48)                                | 2.51 (0.71–8.88)  |
| Quartile 4 (76% to 100%)       | 300 (54.4)        | 100 (33.3)                                   | 6.33 (1.91–21.02)                               | 6.70 (2.01–22.40) |
| BSA change percentage at wk12  |                   |  |   |                   |
| Quartile 1 (-959% to 25%)      | 73 (13.2)         | 7 (9.6)                                      | 1.00  | 1.00              |
| Quartile 2 (26% to 50%)        | 80 (14.5)         | 8 (10.0)                                     | 1.05 (0.36–3.05)                                | 1.15 (0.39–3.36)  |
| Quartile 3 (51% to 75%)        | 100 (18.1)        | 22 (22.0)                                    | 2.66 (1.07–6.62)                                | 2.82 (1.12–7.05)  |
| Quartile 4 (76% to 100%)       | 298 (54.1)        | 96 (32.2)                                    | 4.48 (1.98–10.13)                               | 4.75 (2.09–10.83) |
| PGA change percentage at wk12  |                   |  |   |                   |
| Quartile 1 (-100% to 25%)      | 125 (22.7)        | 17 (13.6)                                    | 1.00  | 1.00              |
| Quartile 2 (26% to 50%)        | 184 (33.4)        | 32 (17.4)                                    | 1.34 (0.71–2.53)                                | 1.37 (0.72–2.60)  |
| Quartile 3 (51% to 75%)        | 115 (20.9)        | 27 (23.5)                                    | 1.95 (1.00–3.81)                                | 1.99 (1.01–3.91)  |
| Quartile 4 (76% to 100%)       | 127 (23.0)        | 57 (44.9)                                    | 5.17 (2.78–9.61)                                | 5.33 (2.85–9.99)  |

**Notes:** Quartile1 is the range of percentile 0 and percentile 25 of the score change value. Quartile2 is the range of percentile 25 and percentile 50 of the score change value. Quartile3 is the range of percentile 50 and percentile 75 of the score change value. Quartile4 is the range of percentile 75 and percentile 100 of the score change value. Model A: univariate logistic regression. Model B: multivariate logistic regression with the adjustment of age and sex.

**Abbreviations:** DLQI, dermatology life quality index; PASI, psoriasis area and severity index; BSA, body surface area; PGA, Physician's Global Assessment; OR, odds ratio; CI, confidence interval.

BSA (OR: 4.75; 95% CI: 2.09–10.83) and PGA (OR: 5.33; 95% CI: 2.85–9.99). Nevertheless, notable discordance persisted: of the 54.4% of patients achieving PASI<sub>75</sub> by week 12, only 33.3% attained  $\geq 90\%$  DLQI reduction, highlighting that significant clinical clearance does not guarantee commensurate improvements in quality of life and that additional patient-centered factors must be addressed.

## Determinants of DLQI Improvement Among Responders with $\geq 75\%$ Skin Clearance

Table 5 summarizes patient characteristics stratified by DLQI reduction quartiles (0–25%, 26–50%, 51–75%, 76–100%) in those achieving  $\geq 75\%$  improvement in skin lesions. Among patients achieving PASI<sub>75</sub>, those in the highest DLQI reduction quartile (76–100%) were disproportionately male (83.5%), younger (mean age 41.1 years), and had longer disease duration (17.0 years) and higher baseline DLQI scores (11.0), while also being far more likely to receive biologic therapy (71.1%) compared with those in the lowest quartile. Parallel trends in the BSA and PGA subgroups reinforce that greater initial quality-of-life burden and access to advanced systemic treatments are key drivers of pronounced DLQI gains, even among patients with comparable clinical clearance.

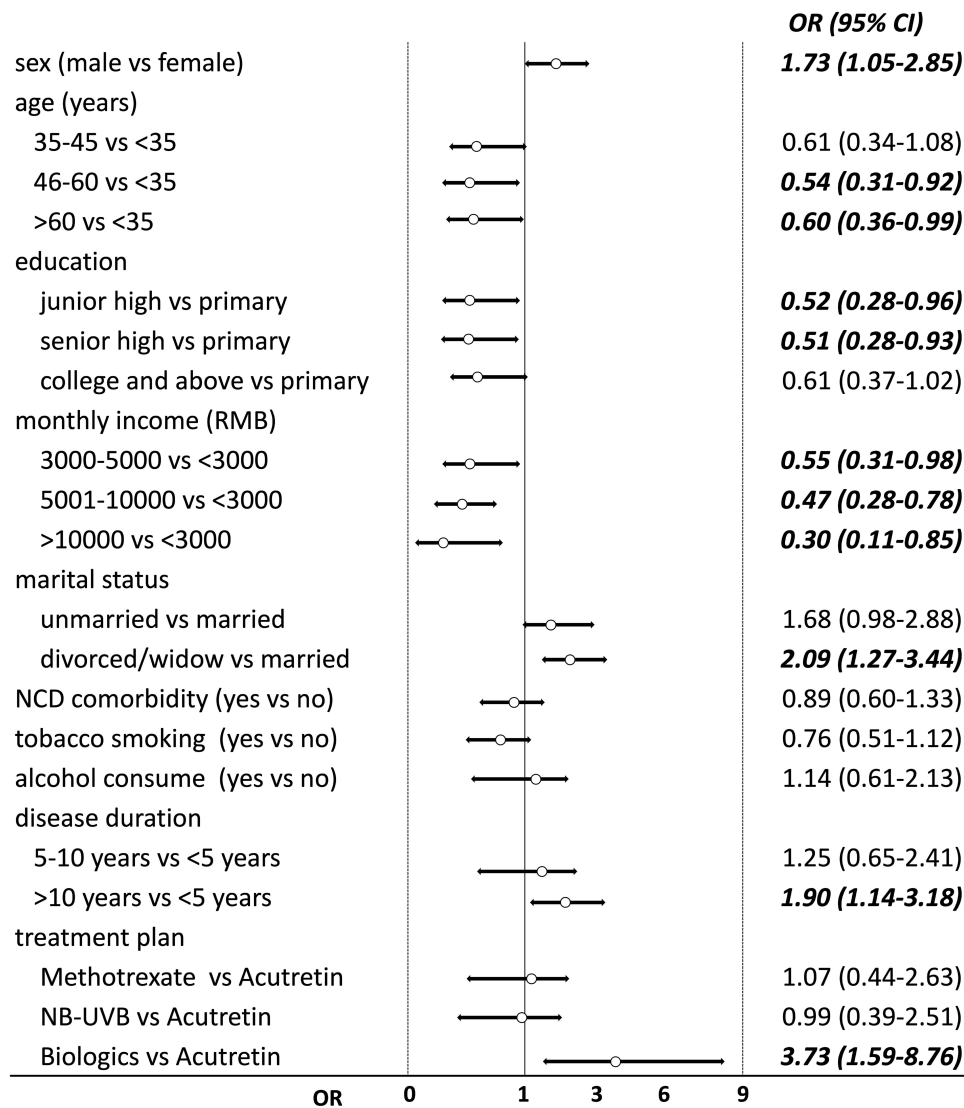
## Demographic, Disease, and Treatment Predictors of DLQI Discordance

Figure 2 depicts adjusted odds ratios for failing to achieve  $\geq 90\%$  DLQI reduction despite clinical clearance. After controlling for treatment and baseline disease burden, female patients had substantially lower odds of optimal DLQI

**Table 5** Feature Comparison Between Different DLQI Score Decrease Percentage in Psoriasis Patients with at Least 75% Improvement in Skin Lesions Based on PASI, BSA, and PGA in Shanghai

| Evaluation Indexes in Week 12               | DLQI Score Decrease Percentage (%) at Week 12 |                  |                  |                  |
|---|---|------------------|------------------|------------------|
|   | 0%–25%  | 26%–50%          | 51%–75%          | 76%–100%         |
| <b>PASI score decreased &gt;75% (n=300)</b> |   |                  |                  |                  |
| Sex (male), n (%)                           | 45 (68.2)                                     | 29 (69.0)        | 61 (64.2)        | 81 (83.5)        |
| Age (years), mean (SD)                      | 47.8 (18.3)                                   | 43.2 (17.0)      | 47.4 (19.4)      | 41.1 (19.3)      |
| Married, n (%)                              | 48 (72.7)                                     | 28 (66.7)        | 66 (69.5)        | 56 (57.7)        |
| BMI, median (IQR)                           | 25.4 (22.6–27.3)                              | 24.7 (22.4–26.8) | 24.0 (21.9–27.1) | 24.5 (22.6–28.6) |
| Year of disease, median (IQR)               | 11.5 (5.0–25.0)                               | 11.5 (4.0–22.0)  | 12.0 (7.0–24.0)  | 17.0 (9.0–22.0)  |
| DLQI at week0, median (IQR)                 | 4.0 (3.0–9.0)                                 | 7.0 (4.0–14.0)   | 9.0 (6.0–16.0)   | 11.0 (5.0–15.0)  |
| NCD comorbidity, n (%)                      | 29 (43.9)                                     | 10 (23.8)        | 52 (54.7)        | 39 (40.2)        |
| Tobacco smoking, n (%)                      | 34 (51.5)                                     | 14 (33.3)        | 38 (40.0)        | 42 (43.3)        |
| Treatment plan                              |   |                  |                  |                  |
| Acitretin                                   | 3 (4.5)                                       | 2 (4.8)          | 2 (2.1)          | 1 (1.0)          |
| Methotrexate                                | 17 (25.8)                                     | 15 (35.7)        | 23 (24.2)        | 19 (19.6)        |
| NB-UVB                                      | 24 (36.4)                                     | 9 (21.4)         | 23 (24.2)        | 8 (8.2)          |
| Biologics (ustekinumab, etc)                | 22 (33.3)                                     | 16 (38.1)        | 47 (49.5)        | 69 (71.1)        |
| <b>BSA score decreased &gt;75% (n=298)</b>  |   |                  |                  |                  |
| Sex (male), n (%)                           | 46 (69.7)                                     | 31 (70.5)        | 65 (68.4)        | 77 (82.8)        |
| Age (years), mean (SD)                      | 46.4 (17.4)                                   | 43.3 (17.1)      | 46.9 (19.3)      | 42.4 (19.4)      |
| Married, n (%)                              | 48 (72.7)                                     | 30 (68.2)        | 65 (68.4)        | 56 (60.2)        |
| BMI, median (IQR)                           | 24.9 (22.9–26.8)                              | 24.8 (22.6–26.4) | 24.1 (21.9–27.2) | 24.5 (22.6–28.6) |
| Year of disease, median (IQR)               | 11.0 (4.0–21.0)                               | 13.0 (4.5–22.0)  | 12.0 (7.0–24.5)  | 18.0 (9.0–21.0)  |
| DLQI at week0, median (IQR)                 | 6.0 (3.0–11.0)                                | 7.0 (4.0–14.0)   | 9.0 (6.0–15.0)   | 10.0 (5.0–16.0)  |
| NCD comorbidity, n (%)                      | 28 (42.4)                                     | 13 (29.5)        | 52 (54.7)        | 39 (41.9)        |
| Tobacco smoking, n (%)                      | 34 (51.5)                                     | 16 (36.4)        | 38 (40.0)        | 41 (44.1)        |
| Treatment plan                              |   |                  |                  |                  |
| Acitretin                                   | 2 (3.0)                                       | 0 (0.0)          | 2 (2.1)          | 1 (1.1)          |
| Methotrexate                                | 14 (21.2)                                     | 14 (31.8)        | 22 (23.2)        | 19 (20.4)        |
| NB-UVB                                      | 27 (40.9)                                     | 11 (25.0)        | 23 (24.2)        | 11 (11.8)        |
| Biologics (ustekinumab, etc)                | 23 (34.8)                                     | 19 (43.2)        | 48 (50.5)        | 62 (66.7)        |
| <b>PGA score decreased &gt;75% (n=127)</b>  |   |                  |                  |                  |
| Sex (male), n (%)                           | 11 (55.0)                                     | 14 (82.4)        | 23 (67.6)        | 46 (82.1)        |
| Age (years), mean (SD)                      | 42.6 (18.9)                                   | 38.4 (16.7)      | 48.5 (17.9)      | 42.1 (18.2)      |
| Married, n (%)                              | 12 (60.0)                                     | 10 (58.8)        | 26 (76.5)        | 35 (62.5)        |
| BMI, median (IQR)                           | 23.3 (21.8–25.9)                              | 24.8 (23.1–26.2) | 24.1 (22.4–26.7) | 24.0 (21.9–26.5) |
| Year of disease, median (IQR)               | 3.5 (1.0–9.0)                                 | 9.0 (4.0–14.0)   | 8.5 (6.0–14.0)   | 9.0 (5.0–15.0)   |
| DLQI at week0, median (IQR)                 | 13.5 (7.5–21.5)                               | 11.0 (5.0–22.0)  | 12.0 (7.0–24.0)  | 18.0 (9.5–21.0)  |
| NCD comorbidity, n (%)                      | 8 (40.0)                                      | 3 (17.6)         | 18 (52.9)        | 18 (32.1)        |
| Tobacco smoking, n (%)                      | 8 (40.0)                                      | 6 (35.3)         | 16 (47.1)        | 21 (37.5)        |
| Treatment plan                              |   |                  |                  |                  |
| Acitretin                                   | 0 (0.0)                                       | 0 (0.0)          | 0 (0.0)          | 0 (0.0)          |
| Methotrexate                                | 5 (25.0)                                      | 2 (11.8)         | 6 (17.6)         | 11 (19.6)        |
| NB-UVB                                      | 8 (40.0)                                      | 4 (23.5)         | 10 (29.4)        | 4 (7.1)          |
| Biologics (ustekinumab, etc)                | 7 (35.0)                                      | 11 (64.7)        | 18 (52.9)        | 41 (73.2)        |

**Abbreviations:** SD, standard deviation; BMI, body mass index; IQR, Interquartile range; DLQI, dermatology life quality index; PASI, psoriasis area and severity index; BSA, body surface area; PGA, Physician's Global Assessment; NCD, non-communicable diseases; NB-UVB, narrow band ultraviolet.



**Figure 2** Forest Plot of Factors Associated with a  $\geq 90\%$  Reduction in DLQI at Week 12. The vertical line at odds ratio (OR)=1 indicates no effect; points to the right suggest an increased likelihood, whereas points to the left suggest a decreased likelihood of reaching the DLQI improvement threshold. Bold italics indicate statistically significant differences.

**Abbreviations:** CI, confidence interval; RMB, Chinese Yuan; NCD, non-communicable diseases; NB-UVB, narrowband ultraviolet B.

improvement than males, and patients aged 46–60 years (OR: 0.54) or >60 years (OR: 0.60) were similarly less likely to report major quality-of-life gains compared with those <35 years old. Married status was also associated with reduced odds, whereas single or divorced patients were over twice as likely to achieve  $\geq 90\%$  DLQI reduction (OR: 2.09; 95% CI: 1.27–3.44). Notably, higher socioeconomic status—reflected by education and monthly income—was linked to reduced likelihood of substantial DLQI gains (adjusted ORs <1).

Longer disease duration (>10 years) was positively associated with achieving  $\geq 90\%$  DLQI reduction, and biologic therapy conferred a more than three fold increase in odds compared with acitretin (OR: 3.73; 95% CI: 1.59–8.76). Consistent dose–response relationships between quartile improvements in PASI, BSA, and PGA and the probability of  $\geq 90\%$  DLQI reduction were observed across sex and treatment modalities (Figures S1–S3), with the strongest effect sizes in male patients and those receiving biologic agents. To further illustrate treatment-related differences, we compared DLQI outcomes across four treatment groups (Figure S4). Biologics showed the greatest benefit, with 39.6% of patients achieving  $\geq 76\%$  DLQI improvement, compared to 15.2% for acitretin.

## Discussion

Psoriasis poses significant challenges for both patients and society due to its chronic nature and multifaceted impact. This burden underscores the necessity of proactive treatment strategies that not only target disease severity but also improve patients' overall quality of life. While physician-reported measures such as PASI, BSA, and PGA are effective in evaluating skin clearance, they do not adequately reflect the broader functional and psychological impact of the disease.<sup>21,22</sup> This disconnect emphasizes the importance of understanding patients' treatment expectations and aligning therapeutic strategies with their individual goals through shared decision-making. In this study, we systematically collected comprehensive data on clinical severity (using PASI, BSA, and PGA) and patient-reported quality of life (DLQI), along with detailed demographic, lifestyle, and treatment information. Our findings highlight that integrating objective clinical indicators with patient-level characteristics and treatment choices can more accurately enhance quality of life and help achieve meaningful therapeutic outcomes.

Previous studies have shown that although changes in PASI and DLQI are moderately correlated, the PASI response alone does not reliably reflect improvements in quality of life.<sup>11,19</sup> Our results build on these findings by demonstrating a robust dose–response relationship between improvements in objective clinical measures (PASI, BSA, and PGA) and DLQI reductions, though this relationship was not entirely linear. The most pronounced quality-of-life benefits occur in patients who achieved near-complete skin clearance, corresponding to the 76–100% improvement range in clinical indicators. Notably, patients achieving a PASI improvement of 75% were over six times more likely to experience a  $\geq 90\%$  reduction in DLQI, with similar thresholds observed for both BSA and PGA. This finding aligns with previous work,<sup>23</sup> suggesting that a PASI<sub>75</sub> response represents a critical benchmark for meaningful patient-perceived benefits, while improvements below this threshold are substantially less influential. In other words, relying solely on PASI may underestimate overall benefits if the improvement does not reach this critical level. Conversely, the DLQI provides a more patient-centered assessment by capturing the broader impact of psoriasis on daily life.<sup>24</sup> However, beyond a certain point—typically PASI<sub>90</sub>—additional improvements in PASI yield diminishing returns in DLQI.<sup>25</sup> Notably, our findings highlight the potential of DLQI as a dynamic tool for early treatment guidance. Patients lacking early PASI response were much less likely to achieve meaningful DLQI improvement, suggesting that concurrent monitoring of DLQI can help identify non-responders and inform timely treatment adjustments to optimize outcomes.

Furthermore, our study underscores the prognostic value of early clinical response. Reductions in PASI, BSA, and PGA as early as week 4 were predictive of achieving a  $\geq 90\%$  DLQI improvement by week 12, with patients achieving PASI<sub>75</sub> early being over twice as likely to experience marked quality-of-life gains. Similar associations were observed at weeks 8 and 12. These results echo previous studies that early treatment responses are strong predictors of long-term outcomes, particularly in patients receiving biologics.<sup>26</sup> For example, early improvements at weeks 4 and 6 with ixekizumab have been shown to predict PASI<sub>75</sub> achievement at week 12 with over 90% accuracy.<sup>27</sup> Furthermore, the optimal thresholds for achieving a DLQI score of 0 or 1 were identified as a PASI<sub>75</sub> achievement rate for ixekizumab and a PASI 50 achievement rate for ustekinumab at week 4.<sup>28</sup> Overall, our findings underscore that early and sustained clinical improvements are associated with meaningful quality-of-life improvement over the 12-week period.

Subgroup analyses revealed that sex significantly influenced DLQI outcomes, with male patients more likely to achieve  $\geq 90\%$  DLQI improvement, especially when substantial PASI, BSA, or PGA gains were observed. Prior studies have shown that while female patients often present with lower clinical severity,<sup>29,30</sup> they report greater psychological distress,<sup>31</sup> reduced quality-of-life,<sup>29</sup> higher treatment expectations,<sup>32</sup> and an increased incidence of drug-related adverse events and drug-related discontinuation rates.<sup>33</sup> In contrast, greater disease burden in male patients is often linked to higher BMI,<sup>34</sup> more comorbidities,<sup>35</sup> and lifestyle factors such as smoking and alcohol use.<sup>36,37</sup> These sex-based differences may also reflect broader sociocultural influences—such as gender norms, stigma, and healthcare access—that vary by region and ethnicity.<sup>38,39</sup> These findings underscore the need for sex-specific and culturally informed management strategies, and suggest that global psoriasis policies should consider local social contexts alongside biological differences to optimize patient-centered care.<sup>32,33</sup>

In this study, age and marital status further modulated the likelihood of optimal DLQI response. Younger patients generally exhibited better improvements, potentially attributable to fewer comorbidities, shorter disease duration, and higher treatment adherence.<sup>40,41</sup> Similarly, unmarried or divorced/widowed individuals showed higher rates of DLQI

improvement. This may reflect greater autonomy and fewer caregiving responsibilities, which could enhance treatment adherence. In contrast, married patients may experience greater psychosocial strain related to household or caregiving duties, negatively impacting treatment outcomes and perceived quality of life.<sup>42,43</sup>

Our findings further suggested that patients with higher education and higher monthly income tended to correlate with a lower likelihood of achieving  $\geq 90\%$  DLQI improvement. This apparent paradox may stem from multiple factors. First, individuals with lower income and less educational attainment tended to present with higher disease activity and more extensive skin involvement;<sup>44</sup> our previous researches suggested that patients with higher baseline DLQI scores experienced greater improvements in quality of life. Second, highly educated patients may express lower satisfaction, potentially due to more realistic or cautious treatment expectations,<sup>45</sup> which could influence the overall treatment outcomes and satisfaction. Furthermore, high-income individuals may experience increased stress and anxiety,<sup>46</sup> which are factors known to negatively impact the treatment outcomes and satisfaction.<sup>45</sup> Consequently, clinicians should engage in discussions about realistic outcomes tailored to the patient's level of understanding. Ensuring that all patients maintain accurate expectations may enhance treatment engagement and overall satisfaction.

Treatment modality emerged as a key determinant of DLQI improvement. Patients receiving biologics consistently achieved the largest quality-of-life gains across all quartiles of PASI, BSA, and PGA improvement, reflecting their rapid and durable efficacy.<sup>47,48</sup> Meanwhile, conventional therapies such as methotrexate and NB-UVB still provided meaningful DLQI improvement in select patients, highlighting their relevance as cost-effective options, particularly in resource-limited settings.<sup>49</sup> Notably, real-world data suggest methotrexate may outperform other traditional agents in terms of long-term survival and tolerability, making it a viable option when biologics are inaccessible.<sup>50</sup> However, treatment response is not uniform. Factors such as male sex, NCD comorbidities, alcohol consumption, and lack of prior biologic exposure were associated with suboptimal outcomes for both methotrexate and acitretin users, suggesting the need for careful patient stratification.<sup>50</sup> Real-world data from Japan and Germany further support the long-term value of biologics, showing better adherence, reduced healthcare burden, and improved persistence despite variations in access.<sup>51,52</sup> These insights underscore the need to move beyond severity-driven decisions and adopt multidimensional treatment strategies—guided by early clinical response, psychosocial burden, and cost-effectiveness—to achieve equitable, patient-centered psoriasis care.

This study has several limitations. First, the observational design precludes definitive causal inferences between clinical improvements and DLQI outcomes. Second, as all patients were recruited from a single tertiary care center, the generalizability of our findings may be limited. Third, potential residual confounding factors including the unmeasured socioeconomic or behavioral variables may have influenced DLQI outcomes among psoriasis patients and should be addressed in future studies. Lastly, the relatively short follow-up period of 12 weeks may not fully capture the long-term sustainability of quality-of-life improvements. Future multi-center studies with extended follow-up and randomized designs are warranted to validate and expand upon these findings.

## Conclusion

This study demonstrates that early and sustained clinical improvement strongly predicts meaningful DLQI gains in psoriasis patients. Integrating patient characteristics, treatment modality, and early PASI response enables better identification of those likely to benefit from targeted strategies. While conventional therapies remain important, broader access to biologics—particularly for those with high DLQI burden—may offer greater long-term value. Routine DLQI monitoring in the early treatment phase can help guide timely adjustments, ensuring that both skin and quality-of-life goals are achieved.

## Data Sharing Statement

The data for this study are available upon request from the corresponding author. The request should state the title and aim of the research for which the data are requested.

## Ethics Approval and Informed Consent

The study was approved by the Institutional Ethical Review Board of Shanghai Skin Diseases Hospital (2022–25) and registered in the Chinese clinical trial registry (ChiCTR2200066894). We performed this study in line with the Declaration of Helsinki and STROBE guidelines.

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## Disclosure

All authors report no conflicts of interest in this work.

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