Avoiding Infection and Reducing Administration Burden: A Discrete Choice Experiment Study on Treatment Preferences of Older Adults with Psoriasis

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Abstract

Background: Therapeutic choice for older adults with psoriasis is often complex due to age-related immunosenescence, the high prevalence of comorbidities, and polypharmacy. This study aimed to quantify preference weights for targeted therapy attributes and identify related key factors.

Materials and methods: A discrete choice experiment (DCE) included patients with psoriasis aged 60 years or older. Five attributes were evaluated: skin clearance, serious infection risk, impact on chronic disease medications, administration method and frequency, and monthly out-of-pocket cost. Preference coefficients were estimated using a conditional logit model.

Results: In total, 311 valid respondents were included. Serious infection risk, skin clearance, impact on chronic disease medications, and administration method and frequency significantly influenced treatment choices. Using the standard attribute-level part-worth range method, serious infection risk had the highest relative importance (32.5%), followed by administration method and frequency (29.7%), impact on comorbidity medications (19.5%), and skin clearance (18.3%). Injections every 3 months were preferred over daily oral regimens and monthly injections. Significant preference heterogeneity was observed for sex and treatment status; no statistically significant preference difference was detected between patients aged 65–74 years and those aged 75 years or older (likelihood ratio [LR] = 9.25, degrees of freedom [df] = 5, P = 0.10).

Conclusions: Therapeutic safety and administration convenience are associated with treatment prioritization among older patients with psoriasis. Infection avoidance and extended-interval injection regimens were preferred. Shared decision-making (SDM) strategies should be personalized to align with patient sex and prior treatment experience.

Keywords: older psoriasis patients; discrete choice experiment; therapeutic choice

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Introduction

Psoriasis is a chronic, systemic immune-mediated inflammatory disease that imposes a significant epidemiological burden worldwide[1–3]. As global populations age, the prevalence of psoriasis among older adults has demonstrated a corresponding upward trajectory[4,5]. In China, the geriatric cohort represents a complex demographic characterized by unique physiological profiles, including immunosenescence and a high prevalence of chronic comorbidities such as cardiovascular disease, metabolic syndrome, and chronic kidney disease[6]. These conditions often necessitate extensive polypharmacy, which significantly complicates therapeutic management[4]. Furthermore, the age-related decline in organ function increases the risk of treatment-related toxicities, resulting in a substantial impact on the overall quality of life for these patients[7].

The therapeutic paradigm for moderate-to-severe psoriasis has shifted from traditional systemic agents such as methotrexate and cyclosporine toward advanced targeted therapies[8,9]. This transition aligns with updated clinical recommendations, including the 2023 Chinese Guidelines for the Diagnosis and Treatment of Psoriasis and the American Academy of Dermatology (AAD)/National Psoriasis Foundation (NPF) guidelines[6]. The rapid development of biologic agents (specifically tumor necrosis factor-α, interleukin [IL]-17, and IL-23 inhibitors) alongside oral small molecule inhibitors such as Janus kinase and phosphodiesterase 4 inhibitors, has significantly altered clearance expectations[10]. Moreover, the inclusion of multiple targeted therapies in China's National Reimbursement Drug List (NRDL) between 2019 and 2023 has markedly enhanced accessibility[11]. Despite these advancements, clinical decision-making for older patients remains challenging[12]. Biologics provide superior efficacy, but serious infection and viral reactivation risks require careful, agent-specific assessment in older patients with comorbidities[13]. Conversely, while oral small molecules offer administration convenience, they require rigorous monitoring of cardiovascular and thromboembolic risks, particularly in patients with pre-existing cardiometabolic conditions[14,15].

Integrating shared decision-making (SDM) into dermatological care is essential for aligning medical interventions with patient-centered goals[16,17]. Effective SDM relies on a precise understanding of patient preferences regarding various treatment attributes, including efficacy, safety, and administration burden[16]. Discrete choice experiments (DCEs), grounded in random utility theory, have emerged as a robust methodology for quantifying these preferences by simulating real-world clinical trade-offs[18,19]. Although previous preference research has identified rapid skin clearance as a primary driver in general adult populations[18,20], these findings may not be generalizable to older adults, who may prioritize therapeutic safety and regimen simplicity over absolute efficacy maximization. Currently, empirical evidence regarding the preferences of older Chinese patients facing choices between biologic agents and small molecule inhibitors remains scarce, especially in the context of recent healthcare policy shifts.

Therefore, this study aimed to quantify the preference weights of older patients with psoriasis for targeted therapy attributes and to identify the most significant factors associated with their therapeutic choices. The analysis focused on five core attributes: skin clearance degree, serious infection risk, impact on comorbid medication management, combined administration method and frequency, and monthly out-of-pocket cost. Based on the clinical profile of the geriatric population, three primary hypotheses were tested: first, clinical safety regarding infection risk would be valued more highly than therapeutic efficacy; second, administration convenience, characterized by dosing frequency and route, would significantly influence patient choices; and third, distinct preference patterns would emerge based on patient sex and prior treatment experience.

Materials and methods

Study design and participant selection

A cross-sectional DCE was conducted to elicit patient preferences for targeted psoriasis therapies. The target population comprised older adults diagnosed with moderate-to-severe plaque psoriasis enrolled from multiple tertiary dermatological centers: Department of Dermatology and Venerology, Shaanxi Provincial People's Hospital, Xi'an, China; Department of Dermatology, The People's Hospital of Yan'an, Yan'an, China; Department of Dermatology, Qian County

People's Hospital, Xianyang, China. The predefined inclusion criteria were: (1) aged 60 years or older; (2) confirmed clinical diagnosis of psoriasis. Exclusion criteria encompassed cognitive impairment, consent refusal, incomplete survey submissions, and implausibly short completion times (below the 5th percentile of survey duration). This study was approved by the Ethics Committee of Shaanxi Provincial People's Hospital (Approval No. 2025R057) and all patients provided written informed consent before enrollment.

Attribute and experimental design

Attributes and levels were developed based on systematic literature reviews and clinical guidelines[6,18]. The final design incorporated five attributes: skin clearance degree (75%, 90%, and 100%), serious infection risk (defined as any infection requiring hospitalization or intravenous antibiotics, with rates expressed as < 1, 2–3, or 5 out of 100 patients per year, based on recent real-world registry data[21]), impact on chronic disease medications (no impact, needs monitoring, and needs adjustment), combined administration method and frequency (daily oral, monthly injection, and every-3-month injection), and monthly out-of-pocket cost (RMB 300, 1,000, or 2,500). A constrained D-optimal fractional factorial design was generated in R using the optFederov algorithm in the AlgDesign package. Of the 243 possible profiles defined by five three-level attributes, nine clinically implausible profiles that fixed the three most favourable levels (100% skin clearance, an injection every 3 months and a monthly cost of RMB 300; one of which was strictly dominant across all five attributes) were excluded, leaving 234 candidate profiles. Sixteen profiles were selected and paired into eight choice sets. The design had a D-efficiency of 0.2153. Each attribute level appeared 5–6 times across the 16 profiles (coefficient of variation [CV] = 0.108), and the maximum absolute pairwise Pearson correlation was 0.20 (skin clearance vs. serious infection risk), with all remaining correlations ≤ 0.096. These metrics supported balanced level representation and parameter identifiability while limiting cognitive burden. Attribute order and item sequence were kept constant across respondents to avoid order effects and to ensure comparability across participants. Investigators received standardized training to explain the attributes using natural frequencies and concrete clinical scenarios, present each task neutrally, and avoid influencing responses. We acknowledge the possibility of display-order effects as a trade-off of this approach. Two hypothetical treatment alternatives were presented without an opt-out option to simulate the clinical setting in which patients with moderate-to-severe psoriasis choose between active targeted therapies after conventional treatment failure. A quantitative pilot study involving 66 older patients confirmed the comprehensibility and cognitive feasibility of the attributes and tasks. Comprehension was confirmed on-site before the survey proceeded. The questionnaire was well understood, and all respondents were able to complete it within an acceptable time frame. The screening and enrollment process is shown in Figure 1, and a sample choice task is provided in Figure 2.

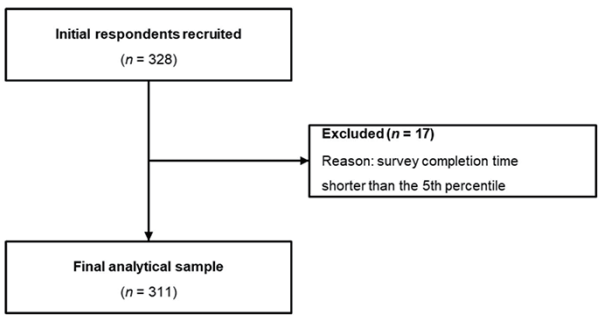


Figure 1: Flowchart of participant screening and enrollment.

Statistical analysis

All statistical analyses were performed using R version 4.5.2 (R Foundation for Statistical Computing, Vienna, Austria). The deterministic utility component was modeled as a linear additive function of treatment attributes. A conditional logit regression estimated model parameters using maximum likelihood techniques. The utility function was defined as follows:

$$U_{ij} = \beta_1 \cdot \text{Clearance}_{ij} + \beta_2 \cdot \text{Infection}_{ij} + \beta_3 \cdot \text{Comorbidity}_{ij} + \beta_4 \cdot \text{Admin_oral}_{ij} + \beta_5 \cdot \text{Admin_inject_1m}_{ij} + \varepsilon_{ij}$$

Model goodness-of-fit was assessed using the log-likelihood, Akaike Information Criterion (AIC), McFadden pseudo R^2, and prediction accuracy, defined as the proportion of model-predicted choices consistent with

Please select the treatment option you prefer:

Treatment attributes	Treatment A	Treatment B
Degree of skin clearance	90% clearance	100% clearance
Serious infection risk *(Hospitalization/IV antibiotics required)*	2–3 per 100 patients/year	< 1 per 100 patients/year
Impact on comorbidity medications	Needs monitoring	No impact
Administration method & frequency	Daily oral pill	Injection every 3 months
Monthly out-of-pocket cost	1,000 RMB	2,500 RMB
	◯ **Choose A**	◯ **Choose B**

Figure 2: Example of a discrete choice experiment task.

respondents' observed selections. Relative attribute importance was calculated from the four-attribute main model after excluding cost. For each attribute, the range between its highest and lowest part-worth utility was divided by the sum of the ranges across all four attributes. Cost sensitivity analyses examined continuous linear, logarithmic, and categorical dummy specifications. The conditional logit model was prespecified as the primary model; observed preference heterogeneity was evaluated through subgroup models and likelihood ratio (LR) tests based on age, sex, treatment status, and comorbidities. Statistical significance was set at $P < 0.05$.

The minimum sample size was determined using the Johnson–Orme rule of thumb[22]. With the largest number of levels ($c = 3$), eight choice sets (s), and two alternatives (a), the final sample of 311 valid respondents exceeded the calculated overall minimum. However, the subgroup aged 75 years or older remained small, and age-stratified comparisons may therefore have been underpowered.

Results

Participant screening and baseline characteristics

The initial survey deployment yielded 328 responses. Following the exclusion of 17 individuals whose survey completion time fell below the 5th percentile, the final analytical sample comprised 311 valid respondents. The cohort had a mean age of 67.5 ± 4.7 years, with 61.1% aged between 65 and 74 years. The sex distribution included 160 male (51.4%) and 151 female (48.6%) participants. Concomitant chronic diseases were present in 79.1% of the sample. At data collection, 64.3% of respondents were actively receiving pharmacological treatment for psoriasis (Table 1).

Preference coefficient estimation

The results of the primary conditional logit model estimating the influence of individual attributes on treatment selection are detailed in Table 2. All non-cost clinical and administrative attributes were statistically significant ($P < 0.001$). The attribute for skin clearance yielded a positive coefficient ($\beta = 3.108$; $P < 0.001$), confirming that older patients derive utility from higher probabilities of skin clearance. Conversely, the attribute representing serious infection risk produced a negative coefficient ($\beta = -0.307$; $P < 0.001$), indicating aversion to therapies with inferior safety profiles. Treatments that had no impact on existing medications for chronic comorbidities were positively associated with patient preference ($\beta = 0.413$; $P < 0.001$), indicating a strong desire to avoid pharmacological interference.

With a subcutaneous injection every 3 months as the reference, a monthly subcutaneous injection was associated with a significant utility decrement ($\beta = -1.136$; $P < 0.001$). Because the route was held constant in this

Table 1: Sample baseline characteristics ($N = 311$).

Variable	Category	N	Value
Sample size		311	
Age (year)	Mean ± SD	311	67.5 ± 4.7
	Median (IQR)		67.0 (64.0–72.0)
	Range		60–80
Age group	< 65	101	32.5%
	65–74	190	61.1%
	≥ 75	20	6.4%
Sex	Male	160	51.4%
	Female	151	48.6%
Disease duration (year)	Mean ± SD	311	10.1 ± 5.7
	Median (IQR)		10.0 (5.0–15.0)
Currently receiving treatment	No	111	35.7%
	Yes	200	64.3%
Number of comorbidities	No comorbidity	65	20.9%
	1 comorbidity	246	79.1%
Monthly income	< RMB 2,000	77	24.8%
	RMB 2,000–4,999	118	37.9%
	RMB 5,000–9,999	90	28.9%
	≥ RMB 10,000	26	8.4%
Insurance type	Urban-rural resident	119	38.3%
	Urban employee	120	38.6%
	Other	8	2.6%
	New rural cooperative	64	20.6%
Survey duration (minutes)	Mean ± SD	311	4.5 ± 2.8
	Median (IQR)		3.4 (2.8–4.1)

Abbreviations: SD, standard deviation; IQR, interquartile range.

Table 2: Conditional logit model results.

Attribute	Coefficient	SE	Z-value	P-value
Skin clearance (continuous: 0.75–1.00)	3.108	0.320	9.70	< 0.001***
Serious infection risk (continuous: 0.50–5.00 per 100 patients)	−0.307	0.029	−10.71	< 0.001***
Impact on comorbidity medications (per one-level improvement; ordinal score 0–2)	0.413	0.040	10.24	< 0.001***
Daily oral regimen (vs. injection every 3 months)	−1.262	0.089	−14.13	< 0.001***
Monthly injection (vs. injection every 3 months)	−1.136	0.125	−9.12	< 0.001***

Model fit: Log-likelihood = −1,552.0, McFadden $R^2 = 0.100$, AIC = 3,114.1.
Prediction accuracy = 70.2%. *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$.
Reference category: Injection every 3 months (combined administration method and frequency).
Abbreviations: SE, standard error.

comparison, the result supports a negative preference for increasing injection frequency from every 3 months to monthly. The daily oral regimen was also associated with lower utility ($\beta = -1.262$; $P < 0.001$); however, because this level differs from the reference in both route and frequency, its coefficient represents the composite daily oral regimen and should not be interpreted as an isolated frequency effect.

The conditional logit model exhibited a log-likelihood value of −1,552.0. The McFadden pseudo R^2 was calculated at 0.100. Prediction accuracy reached 70.2% (Fig. 3).

Relative importance of treatment attributes

Using the standard attribute-level part-worth range method and the main model without cost, serious infection risk had a utility range of 1.3806 and the highest relative importance (32.5%).

The utility range for combined administration method and frequency was 1.2625, calculated as the difference between the highest level utility (0 for injection every 3 months) and the lowest level utility (−1.2625 for the daily oral regimen), yielding a relative importance of 29.7%. The monthly-injection coefficient was not added

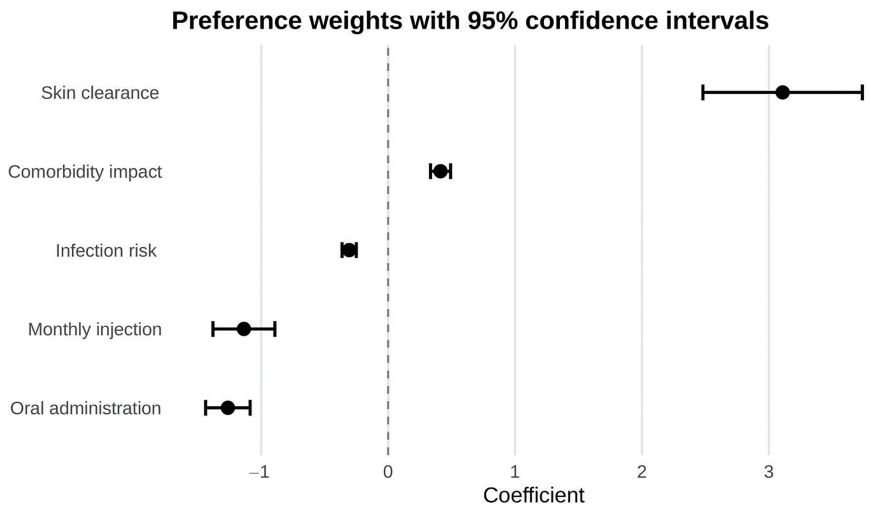


Figure 3: Preference weights with 95% confidence intervals for targeted therapy attributes.

separately. Impact on comorbidity medications had a range of 0.8260 and a relative importance of 19.5%, while skin clearance had a range of 0.7770 and a relative importance of 18.3%. The sum of the ranges across the four attributes was 4.2462 (Fig. 4).

Subgroup analysis and preference heterogeneity

The study population was stratified by age, sex, current treatment status, and chronic comorbidity status. LR tests detected preference heterogeneity by sex ($LR = 15.72$; degrees of freedom [df] = 5; $P = 0.008$) and treatment status ($LR = 26.54$, $df = 5$; $P < 0.001$). No statistically significant preference difference was detected between patients aged 65–74 years and those aged 75 years or older ($LR = 9.25$; $df = 5$; $P = 0.10$). Likewise, no statistically significant difference was detected by chronic comorbidity status ($LR = 4.44$; $df = 5$; $P = 0.49$). These non-significant findings do not establish equivalence between subgroups.

Analysis of the sex-stratified data (Table 3) showed that male patients had a stronger negative preference for the daily oral regimen ($\beta = -1.524$) than female patients

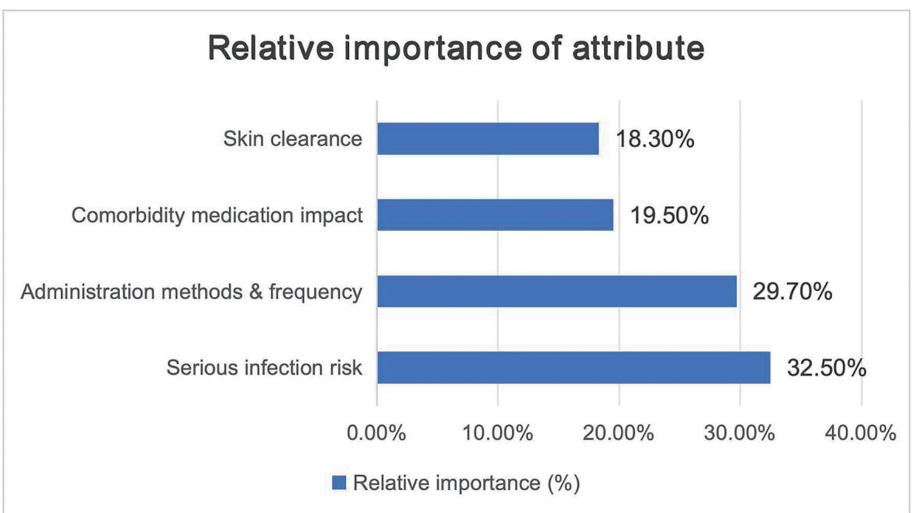


Figure 4: Relative importance of targeted therapy attributes calculated using the standard attribute-level part-worth range method.

Table 3: Subgroup analysis: preference weights.

Attribute	Overall ($N = 311$)	Age < 65 ($N = 101$)	Age 65–74 ($N = 190$)	Age ≥ 75 ($N = 20$)	Male ($N = 160$)	Female ($N = 151$)	On Tx ($N = 200$)	Not Tx ($N = 111$)	No comorb ($N = 65$)	With comorb ($N = 246$)
Skin clearance	3.108***	2.377*	2.794***	6.217	3.606***	2.465***	4.090***	1.525	2.380	3.508***
Infection risk	–0.307***	–0.308***	–0.338***	0.050	–0.305***	–0.281***	–0.272***	–0.321***	–0.411**	–0.318***
Comorbidity impact	0.413***	0.449***	0.497***	0.114	0.365***	0.390***	0.352***	0.518***	0.562**	0.434***
Daily oral regimen	–1.262***	–1.154***	–1.329***	–1.448	–1.524***	–1.121***	–1.135***	–1.314***	–1.534***	–1.257***
Injection (monthly)	–1.136***	–1.070**	–1.114***	–0.261	–1.297***	–0.946***	–1.157***	–0.755*	–1.580**	–1.110***

Conditional logit models without cost. *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$.

Reference: Injection every 3 months.

Subgroup preference heterogeneity (LR tests): Age (65–74 vs. ≥ 75 years): $LR = 9.25$, $df = 5$, $P = 0.10$ (no statistically significant difference detected); sex (male vs. female): $LR = 15.72$, $df = 5$, $P = 0.008$; treatment status (on treatment vs. not on treatment): $LR = 26.54$, $df = 5$, $P < 0.001$; comorbidity (none vs. ≥ 1): $LR = 4.44$, $df = 5$, $P = 0.49$ (no statistically significant difference detected).

Abbreviations: Tx, treatment; Comorb, comorbidity.

($\beta = -1.121$). Male respondents also assigned greater utility to skin clearance ($\beta = 3.606$) than female respondents ($\beta = 2.465$).

Participants actively receiving systemic therapy demonstrated a preference for maximizing skin clearance ($\beta = 4.090$; $P < 0.001$). For individuals not currently receiving treatment, the skin clearance attribute failed to reach statistical significance ($\beta = 1.525$).

Model diagnostics and cost sensitivity analysis

In the initial full model, the continuous linear cost coefficient was close to zero and not statistically significant ($\beta = 0.0002$; $P = 0.836$). A logarithmic specification was also not significant ($\beta = -0.144$; $P = 0.157$), and an LR test showed that adding continuous cost did not improve model fit ($LR = 0.04$; $df = 1$; $P = 0.84$). In a categorical dummy model using RMB 1,000 as the reference, both RMB 300 ($\beta = 1.596$; $P < 0.001$) and RMB 2,500 ($\beta = 2.235$; $P < 0.001$) had positive coefficients. In particular, the positive coefficient for the highest cost implied greater utility for paying RMB 2,500 than RMB 1,000, contrary to the expected negative marginal utility of out-of-pocket cost, and was therefore unsuitable for valid willingness-to-pay estimation. Cost was therefore excluded from the parsimonious main model and retained in Table S1 as a sensitivity analysis. All relative-importance estimates were calculated after cost exclusion.

Discussion

Older adults with psoriasis demonstrated a preference structure that prioritized clinical safety and administration convenience over maximum skin clearance. Serious infection risk had the highest relative importance, followed by combined administration method and frequency. Injections every 3 months were preferred over both the daily oral regimen and monthly injections. Preference heterogeneity by sex and current treatment status supports personalized SDM.

The prioritization of safety aligns directly with the biological consequences of immunosenescence[23,24]. Older adults are at increased risk of severe complications from infectious events[25]. Advanced targeted therapies induce varying degrees of immunosuppression, elevating the risk of serious infections[26]. Older patients actively penalize treatment regimens carrying elevated infection probabilities, accepting modest compromises in skin clearance to mitigate these risks[27,28]. This safety-first paradigm contrasts with previous DCEs in general adult populations in Europe and North America[18,20], which

frequently identify rapid skin clearance as the dominant driver of choice[20]. However, it aligns with emerging preference research focusing specifically on older adults or on patients with significant comorbidities, who consistently report a shift toward safety prioritization[29].

The administration attribute combined route and frequency to preserve clinical realism because systemic psoriasis treatments are typically offered as daily oral small molecules or biologic injections at monthly or longer intervals. The within-route comparison between monthly and every-3-month subcutaneous injections isolates frequency and supports a preference for less frequent injections. In contrast, the negative coefficient for the daily oral regimen cannot be attributed solely to route or dosing frequency. Nevertheless, 79.1% of participants had chronic comorbidities, and additional daily medication may contribute to pill burden and regimen fatigue[30,31]. This finding differs from DCEs in broader psoriasis populations that reported preferences for oral treatment over injections[32]. Extended-interval injections may reduce daily treatment-management burden[33], but treatment decisions must still account for real-world infection risk and individual clinical suitability. The preference for treatments that do not disrupt existing comorbidity medications further supports minimizing interference with established care routines[27].

Monthly out-of-pocket cost was excluded from the final preference model because neither the continuous linear coefficient ($P = 0.836$) nor the logarithmic specification ($P = 0.157$) provided evidence of a valid cost effect. The categorical model produced a non-monotonic pattern, including a positive coefficient for RMB 2,500 versus RMB 1,000, which would imply a preference for the higher payment and therefore could not support valid willingness-to-pay estimation. This differs from a recent DCE in which cost was the most important attribute[34]. The high insurance coverage in this cohort (303/311, 97.4%; participants classified as "Other" were treated as uninsured; Table 1) and the inclusion of targeted therapies in China's NRDL may have reduced sensitivity to the stated out-of-pocket range. Some respondents may also have interpreted higher prices as a signal of treatment quality, although this explanation remains speculative. We therefore treated cost coding as a sensitivity analysis and based relative importance on the four clinically interpretable attributes in the main model.

Significant preference heterogeneity based on sex and prior treatment experience demonstrates the need for personalized clinical communication. Male patients exhibited a stronger negative preference for the daily oral regimen and assigned higher utility to skin clearance than female patients. This divergence may relate to sex-based differences in risk perception, medication management, immune responses, health-seeking behavior, and adherence[35,36]. Treatment-experienced individuals placed greater weight on skin clearance, whereas skin clearance was not a statistically significant driver among those not currently receiving treatment. This pattern is consistent with preference construction through prior experience[37]. No statistically significant age-group or comorbidity-status difference was detected, but these results should not be interpreted as evidence that subgroup preferences are equivalent, particularly given the small oldest-age subgroup.

The integration of these quantitative preference weights into clinical practice mandates the implementation of structured SDM protocols. Guided by the theory of preference construction, clinicians should adopt a stratified management approach: returning to an efficacy-driven strategy for patients currently receiving systemic therapy, while prioritizing a safety-driven approach for those not currently treated. Clinicians must proactively assess the individual's existing pill burden and specific infection risk tolerance. Utilizing decision aids that explicitly quantify the trade-offs between a daily pill and an infrequent injection optimizes patient satisfaction and safeguards long-term adherence[16].

Several limitations should be considered. The cross-sectional design cannot show how preferences change with disease progression or increasing frailty. The forced choice between two active therapies may not represent patients who would decline systemic treatment. Combining administration route and frequency preserved clinically realistic profiles but prevents separation of route and frequency effects for the daily oral regimen. The fixed attribute order and item sequence may have introduced display-order effects despite reducing

cognitive burden for older respondents. The conditional logit model assumes homogeneous preferences, and the absence of a mixed logit robustness analysis means that unobserved random preference heterogeneity may remain. Cost could not be validly identified, precluding reliable willingness-to-pay estimates. Finally, only 20 participants were aged 75 years or older (6.4% of the total sample and 9.5% of participants aged 65 years or older), limiting power to detect subtle age-related preference differences; preference shifts among the oldest-old or frail patients therefore cannot be excluded. Future prospective studies should use larger oldest-age samples, randomized or pseudo-randomized presentation where feasible, and mixed logit models to examine preference heterogeneity.

Conclusion

Older patients with psoriasis prioritized clinical safety and administration convenience. Avoiding serious infection and reducing treatment-management burden through extended-interval injections were valued more highly than maximizing skin clearance. Preference heterogeneity by sex and prior treatment experience supports personalized clinical communication and individualized SDM.

Author contributions

Lei Zhang and Wei Liu contributed equally to this article. Lei Zhang and Wei Liu conceived the study, conducted the survey, and drafted the manuscript. Yaling Shi and Kexin Shi provided resources and reviewed the manuscript. Jun Tian and Li Yang provided resources, reviewed the manuscript, and supervised the work. All authors reviewed, edited, and approved the final version of the manuscript and agreed to its publication.

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Ethics statement

This study was conducted in accordance with the Declaration of Helsinki. This study was approved by the Institutional Review Board (IRB) of Shaanxi Provincial People's Hospital (Approval No. 2025R057) and all patients provided written informed consent before enrollment.

All figures are either original to this work or properly attributed. No original images have been previously published, and all images comply with research integrity standards without inappropriate manipulation or misrepresentation.

Patient consent statement

Written informed consent was obtained from all participants for publication of this study and its accompanying materials.

Data availability statement

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

AI statement

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were used in the preparation, analysis, writing, image generation, or image processing of this manuscript.

Conflicts of interest

The authors declare no conflicts of interest.

Supplementary files

Supplementary material is available in the online version of this article at https://doi.org/10.2738/SKIN.2026.0037 and is accessible for authorized users.

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