



Mapping Dermatology Life Quality Index with EQ-5D health utility index score in Chinese patients with moderate to severe psoriasis

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Aim: To establish correlation between Dermatology Life Quality Index (DLQI) and EuroQol 5-Dimension questionnaire (EQ-5D) utility score in Chinese moderate-to-severe psoriasis patients and develop mapping models for health utility prediction. **Materials & methods:** A total of 287 patients with moderate to severe psoriasis and at least one clinical visit with assessments for both DLQI and EQ-5D in a Chinese tertiary hospital were included. These patients were randomly split into a training set ($n = 231$) and a testing set ($n = 56$). Correlation analyses were performed to assess the relationship between DLQI (total score and item score) and EQ-5D utility index score. Twelve predictive models were developed using three statistical model approaches (ordinary least squares model, Tobit model and generalized linear model), incorporating various combinations of DLQI scores and patient characteristics (age, sex, education and comorbidities). Models were evaluated using root mean square error and mean absolute error (MAE). **Results:** A strong and significant correlation was found between DLQI total score and EQ-5D utility index score ($r = -0.645$, $p < 0.001$). The best-performing model, (ordinary least squares model using DLQI total score, had the lowest root mean square error (0.122) and MAE (0.076). Validation of this model in the testing set yielded a predicted utility score with an MAE of 0.072, and an MAE-to-utility ratio of 0.084, below the validation threshold of 0.1. **Conclusion:** DLQI scores can reliably predict health utility values, offering a useful tool for clinical decision-making and health economic evaluations. The model shows strong predictive accuracy and has potential applications in the management of msPsO in China.

Plain language summary: Understanding the relationship between skin-specific & general health measures in Chinese patients with moderate to severe psoriasis (msPsO)

What is this article about? This study focuses on exploring the relationship between a skin-specific quality-of-life measure, called the Dermatology Life Quality Index (DLQI), and health utility, which indicates overall well-being and often measured by the EQ-5D-5L questionnaire, in Chinese patients with msPsO. By using this relationship, future studies can directly convert DLQI score to health utilities that are commonly needed to assess the cost-effectiveness of psoriasis treatments.

What were the results? A strong link between DLQI scores and health utility was confirmed in Chinese patients with msPsO. Among the tested prediction models, ordinary least squares model had the best performance by only using DLQI total score to predict health utility.

What do the results mean? Since DLQI has been routinely used to assess psoriasis in clinical practices, the developed prediction model from this study will allow future research to easily estimate health utility and fill the current evidence gap for health utility in Chinese patients with msPsO.

Shareable abstract: This study maps the Dermatology Life Quality Index (DLQI) to EQ-5D utility index scores in Chinese patients with moderate to severe psoriasis. A strong negative correlation ($r = -0.645$, $p < 0.001$) was found between DLQI total score and EQ utility index score. The best-performing model, an ordinary least squares model only using DLQI total score as the predictor, had the highest predictive accuracy (root mean square error: 0.122, mean absolute error: 0.076) among the tested models. The validation analysis confirmed that this developed predictive model offers a reliable tool to bridge the gap between dermatology-specific and generic quality-of-life measures.

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Keywords: DLQI • EQ-5D • health utility • mapping • psoriasis

Background

Psoriasis is a chronic autoimmune skin condition marked by red, inflamed and scaly patches [1]. When psoriasis reaches moderate to severe levels, it extends beyond physical discomfort, impacting emotional health, social interactions and overall quality of life [2]. Treatment response in patients with moderate to severe psoriasis (msPsO) can be assessed through various clinical measures and patient-reported outcomes, such as the Dermatology Life Quality Index (DLQI), which evaluates the impact of psoriasis on a patient's quality of life. Improvements in DLQI scores reflect better treatment response and reductions in psoriasis-related burdens on daily activities, work, relationships and emotional well-being [3]. However, DLQI is a dermatology-specific instrument, and not a generic tool for assessing quality of life in health economics research, which is vital for evaluating the cost-effectiveness of treatments. To address this, mapping DLQI scores to a generic quality-of-life measure like the EuroQol 5-Dimension (EQ-5D) questionnaire is crucial for economic evaluation of treatment in patients with msPsO.

Existing evidence shows a moderate to strong correlation between DLQI and EQ-5D utility values in patients with psoriasis [4–6]. Various regression models, such as linear, logistic and Tobit, have been used to map DLQI to EQ-5D utility index scores [5–8], however, no single mapping function has gained universal acceptance. The relationship between DLQI and EQ-5D may also vary across populations due to cultural, healthcare and socioeconomic differences. Additionally mapping studies from other countries may not fully apply to Chinese populations, given differences in healthcare systems and quality of life perceptions. Unlike DLQI, EQ-5D is not routinely used in China to assess psoriasis severity or treatment response, therefore a dedicated mapping study could help bridge the gap in utility data for Chinese patients with psoriasis, particularly those with moderate to severe disease – who are a key consideration for treatment reimbursement in China.

Materials & methods

This study is a retrospective observational analysis that leverages existing psoriasis patient follow-up data from the Department of Dermatology, Xiangya Hospital of Central South University in Changsha, China. Since 2014, the department has routinely collected patient characteristics (including disease severity) and treatment information from all visiting patients with psoriasis. In August 2023, the EuroQol 5-Dimension 5-Level (EQ-5D-5L) tool was added to the routine assessment for quality of life in psoriasis patients. Thus, the patients with psoriasis who visit this clinic allow researchers a unique opportunity to conduct this study to map DLQI with EQ-5D-5L utility index scores among Chinese patients with msPsO. The protocol of this study was prepared for the ethics review but not published. This study was approved by the ethics review committee of Xiangya Hospital. This study did not involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research due to its retrospective nature.

Patient identification

This study developed the following defined inclusion and exclusion criteria to identify patients with the sufficient information for eligibility assessment and data analysis addressing the study objectives. This study included adult patients (aged 18 years or above) diagnosed with msPsO, defined as Psoriasis Area and Severity Index (PASI) score ≥ 3 , body surface area involvement of $\geq 3\%$, DLQI score ≥ 6 [9]. In addition, the included patients must also have at least one clinical visit with assessments for both DLQI and EQ-5D-5L. Patients with psoriatic arthritis, other autoimmune diseases (including but not limited to rheumatoid arthritis, systemic lupus erythematosus and

inflammatory bowel disease), and/or those participating in clinical trials during the patient identification period (August 2023 to May 2024) were excluded to control for potential confounding effects in the mapping analysis.

Study dataset

Patient information from the latest clinical visit with both DLQI and EQ-5D-5L assessment during the patient enrollment period, were exported from the patient follow-up database. The exported information included patient demographics, patient social economic status, disease severity (measured by PASI and body surface area), skin lesion site, quality of life measured by DLQI and EQ-5D-5L and comorbidities. The collected EQ-5D-5L response data were converted to utility index score using the validated EQ-5D-5L China value set [10]. All study eligible patients were randomly split into two groups by a ratio of 4:1 to create a training dataset and a testing dataset. The training dataset was used to construct health utility predictive models using the associated DLQI and EQ-5D-5L data from patients in this group. The testing dataset was used to validate the developed health utility predictive model by comparing the predicted utility (from the training dataset) and the utility calculated based on data from patients within the testing group.

Data analysis

This study used the training dataset to verify the conceptual overlap between DLQI and EQ-5D-5L utility index score, develop a mapping function converting DLQI into utility values using various regression models, and assess the performance of the developed health utility predictive models. The developed health utility predictive model with best performance was further applied to the testing dataset for validation. Descriptive statistical methods were used to summarize the patient characteristics of both datasets. The two datasets were compared using student *t*-test and Chi-square test to prove the balance of their patients' characteristics.

To verify the assumption of sufficient conceptual overlap between DLQI and generic health utility values, this study conducted Spearman's rank correlation analysis to calculate the correlation coefficient between the DLQI total score and EQ-5D-5L utility index score, along with the respective correlation coefficient between each DLQI item score and EQ-5D-5L utility index score. The degree of correlation was defined according to the ranges of correlation coefficient (very weak: 0–0.19; weak: 0.20–0.39; moderate: 0.40–0.59; strong: 0.60–0.79; very strong: 0.80–1.00) [11]. To develop a mapping function converting DLQI scores to utility values, this study first conducted multivariate linear regression analysis to identify the patient characteristics with significant associations to utility index scores. These identified patient characteristics were further combined with a DLQI total score or item score to develop the mapping functions for utility index score using an ordinary least squares (OLS) model, Tobit model and generalized linear model. These models used four sets of independent variables (DLQI total score only, DLQI total score combined with the identified patient characteristics, 10 DLQI item scores and 10 DLQI item scores combined with the identified patient characteristics) to establish the mapping function between DLQI and EQ-5D-5L utility index score.

All constructed health utility predictive models were applied to patients in the training dataset to calculate the predicted utility scores. The performance of these constructed predictive models was assessed by calculating root mean squared error (RMSE) and mean absolute error (MAE) through their predicted utility values and converted utility index score from their EQ-5D-5L response data. The calculated RMSE and MAE for these predictive models were ranked to identify the model with best performance, which was defined as having the lowest RMSE and MAE. The constructed health utility predictive model with best performance was applied to the testing dataset for validation, which was based on the comparison of predicted health utility values with converted utility index score from the EQ-5D-5L response data, using MAE as the key metric. A predictive model is considered to have sufficient validation if the MAE is less than 10% of the mean of observed values from the testing dataset.

The data analyses described above were conducted using statistical software R. Statistical significance was defined as a *p*-value less than 0.05.

Results

This study identified 561 patients visiting the study site during the defined patient enrollment period. Overall, 287 patients met both inclusion and exclusion criteria and were randomly split into two groups to create the training set (*n* = 231) and testing set (*n* = 56). The patient identification process is illustrated in [Figure 1](#). The two patient sets had well balanced patient characteristics for demographics, disease severity, skin lesion areas and quality of life ([Table 1](#)).

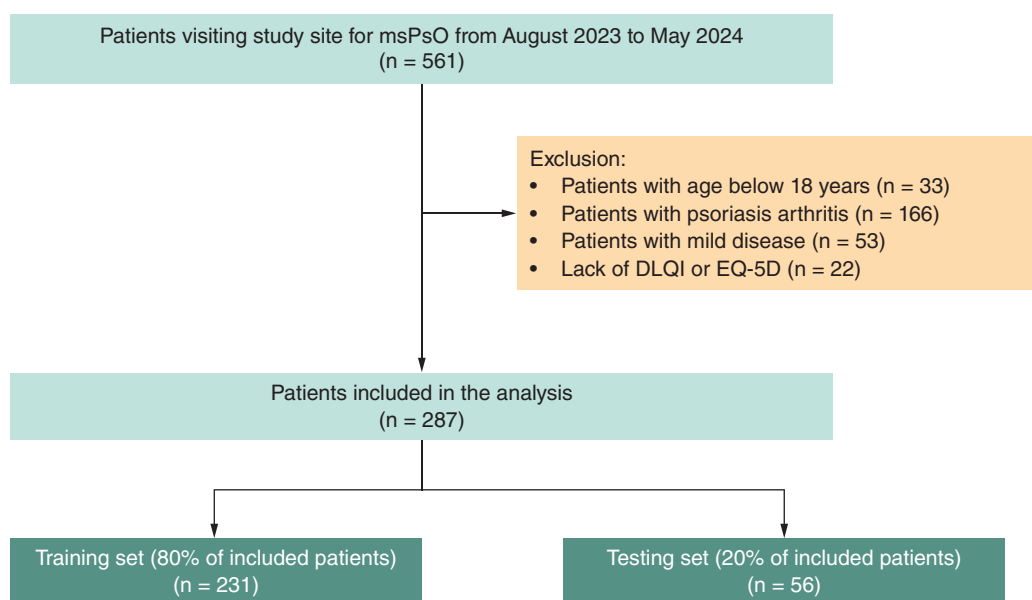


Figure 1. Patient identification process.

DLQI: Dermatology Life Quality Index; EQ-5D: EuroQol 5-Dimension questionnaire; msPsO: Moderate to severe psoriasis.

Conceptual overlap between DLQI & EQ-5D-5L utility index score

The correlation analysis identified a strong and significant correlation between DLQI total score and utility index score (correlation coefficient: -0.645 , $p < 0.001$). Further correlation analyses for DLQI item scores indicated that the utility index score was significantly and moderately correlated with DLQI item score for symptoms (correlation coefficient: -0.517 , $p < 0.001$), feelings (correlation coefficient: -0.482 , $p < 0.001$), daily activities (correlation coefficient: -0.490 , $p < 0.001$), clothing (correlation coefficient: -0.427 , $p < 0.001$), social activities (correlation coefficient: -0.446 , $p < 0.001$), personal relationship (correlation coefficient: -0.418 , $p < 0.001$) and treatment (correlation coefficient: -0.451 , $p < 0.001$). The correlation between DLQI and utility index score is illustrated in Figure 2.

Performance of developed mapping functions between DLQI & utility index score

A total of 12 health utility predictive models were developed using three model approaches with the independent variables based on four combinations of DLQI outcome measurement (DLQI total score and 10 DLQI item scores) and identified patient characteristics (age, male, college education or above, comorbidity with chronic hepatitis B and comorbidity with fatty liver) showing significant association with EQ-5D-5L utility index score (Supplementary Table 1–2). The results of the developed mapping functions from the 12 models are summarized in Supplementary Table 3–5. The comparisons of the predicted utility index score from these models and the converted utility index score from the EQ-5D-5L response data identified substantially varied RMSE (0.122–1.684) and MAE (0.076–0.469). Of these developed models, the OLS model with DLQI total score as the only independent variable was considered to have the best performance based on RMSE (0.122) and MAE (0.076). The calculated RMSE and MAE of the developed 12 health utility predictive models are summarized in Table 2.

Validation of the health utility predictive model with the best performance

Based on the performance of the 12 developed health utility predictive models, the model with the best performance (utility value = $0.970 - 0.012 \times \text{DLQI total score}$) was applied to patients in the testing set to calculate their predicted utility index scores (mean: 0.868), which were further compared with their utility index score (mean: 0.859) converted from EQ-5D-5L response data. The calculated RMSE and MAE from these data were 0.113 and 0.072, respectively. The ratio between MAE and the measured utility index was 0.084, which is below the defined cut-off for validation (0.1).

Table 1. Patient characteristics of the created training set and testing set.

Characteristics	Training set		Testing set		p-value
	Mean, %	SD	Mean, %	SD	
Age (years)	43.1	14.6	42.6	13.8	0.851
Male (%)	69.3		58.9		0.139
BMI (kg/m ²)	24.6	3.8	25.4	4.1	0.270
Education (%)					
Below high school	45.9		41.1		0.516
High school	17.7		17.9		0.985
College and above	34.6		35.7		0.879
Unknown	1.7		5.4		0.273
Residence location (%)					
Provincial capital city	20.8		17.9		0.625
Regional city	14.3		8.9		0.289
County	19.9		16.1		0.512
Rural area	43.7		51.8		0.277
Not reported	1.3		5.4		0.166
Disease severity					
PASI	7.9	6.7	8.7	8.9	0.777
Affected BSA (%)	8.2	10.2	10.9	15.2	0.784
DLQI	8.6	5.9	8.4	5.7	0.896
Distribution of disease severity (%)					
Moderate	45.9		46.4		0.942
Severe	54.1		53.6		
Skin lesion location (%)					
Lower limbs	83.5		73.2		0.074
Trunk	74.0		67.9		0.352
Upper limbs	72.7		64.3		0.211
Head	68.4		67.9		0.938
Buttocks	61.5		57.1		0.552
Face and neck	28.6		25.0		0.593
Hands and feet	19.0		16.1		0.607
Perineum	3.9		3.6		1.000
Not reported	4.3		10.7		0.123
Comorbidities (%)					
Coronary heart disease	35.9		39.3		0.640
Hypertension	22.5		30.4		0.218
Diabetes	18.6		12.5		0.279
Hyperlipidemia	17.3		10.7		0.227
Fatty liver	1.7		1.8		1.000
Chronic hepatitis B	2.2		0.0		0.587
Gout	2.2		3.6		0.897
Anxiety and depressive disorders	0.4		0.0		1.000
EQ-5D-5L measurement					
Utility index score	0.865	0.143	0.859	0.144	0.811
VAS	75.2	15.9	77.6	13.7	0.406

BSA: Body surface area; DLQI: Dermatology Life Quality Index; EQ-5D-5L: EuroQol 5-Dimension 5-Level questionnaire; PASI: Psoriasis Area and Severity Index; SD: Standard deviation; VAS: Visual analog scale.

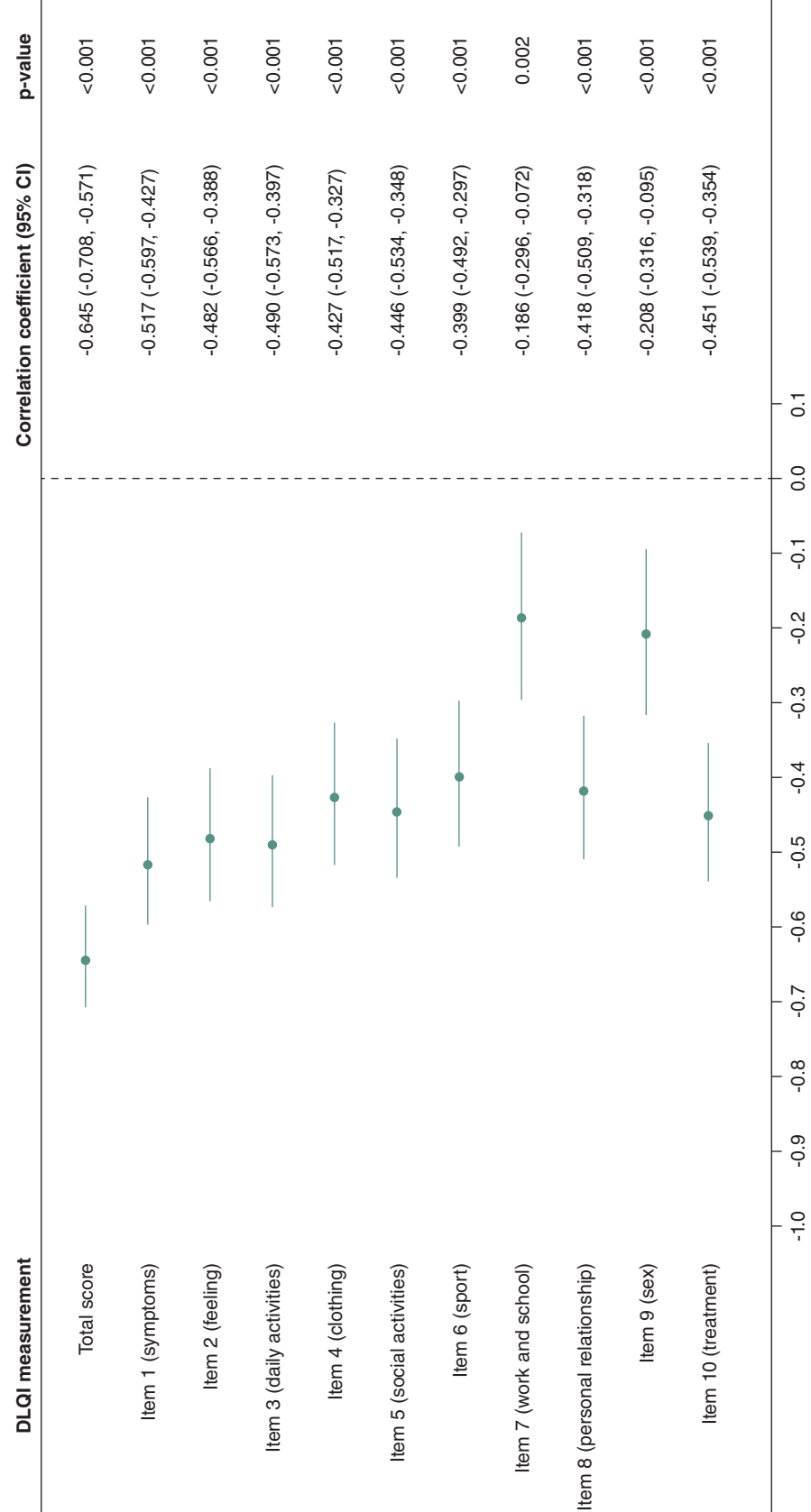


Figure 2. Correlation between Dermatology Life Quality Index and utility index scores.
CI: Confidence interval; DLQI: Dermatology Life Quality Index.

Table 2. The performance rank of the developed health utility predictive models by mean absolute error.

Performance rank	Model approach	Independent variable	MAE	RMSE
1	OLS	DLQI total score	0.076	0.122
2	OLS	DLQI item scores + patient characteristics	0.082	0.124
3	GLM	DLQI item scores + patient characteristics	0.082	0.125
4	GLM	DLQI total score	0.077	0.125
5	GLM	DLQI total score + patient characteristics	0.078	0.126
6	GLM	DLQI item scores	0.079	0.127
7	OLS	DLQI item scores	0.080	0.130
8	OLS	DLQI total score + patient characteristics	0.080	0.132
9	Tobit	DLQI item scores + patient characteristics	0.404	1.617
10	Tobit	DLQI item scores	0.421	1.684
11	Tobit	DLQI total score + patient characteristics	0.430	1.437
12	Tobit	DLQI total score	0.469	1.564

DLQI: Dermatology Life Quality Index; GLM: Generalized linear model; MAE: Mean absolute error; OLS: Ordinary least squares; RMSE: Root mean square error.

Discussion

This study aimed to develop and validate a mapping function to convert DLQI scores into EQ-5D utility index scores for Chinese patients with msPsO. The findings of this study not only reinforce the feasibility of this mapping technique but also highlight the strong negative correlation between DLQI and EQ-5D-5L, indicating that DLQI can be a valuable surrogate for health utility measures in patients with psoriasis when EQ-5D-5L data are unavailable.

The primary result of the study demonstrated a significant and strong negative correlation between DLQI and EQ-5D-5L utility index scores (correlation coefficient: -0.645, $p < 0.001$). This finding is consistent with the hypothesis that as psoriasis has a more detrimental impact on dermatology-specific quality of life (higher DLQI scores), the general health-related quality of life (as measured by EQ-5D-5L) declines. The DLQI is particularly focused on the specific ways psoriasis affects a patient's life, including symptoms, daily activities and emotional well-being [12]. Given this strong correlation, the results suggest that DLQI, although originally designed as a dermatology-specific tool, captures the broader impacts of the disease that are also reflected in generic health utility measures like EQ-5D. The detailed correlation analyses between individual DLQI items and the EQ-5D-5L utility index score further support the robustness of this relationship. For example, symptoms, feelings, daily activities and social interactions exhibited moderate but significant correlations with EQ-5D-5L scores, indicating that these aspects of psoriasis particularly affect patients' overall health-related quality of life. This suggests that the impact of psoriasis is not limited to visible skin lesions but extends deeper into a patient's psychological and social functioning, serving as an observation that could inform both clinical care and health economic evaluations.

The study's development and validation of predictive models for estimating EQ-5D-5L utility index scores from DLQI data yielded a range of results, with the OLS model based solely on the DLQI total score performing best. This model had the lowest RMSE (0.122) and MAE (0.076), indicating that it was the most accurate in predicting EQ-5D-5L scores. This is an important result for health economics because it shows that even a relatively simple model using only the DLQI total score can provide highly accurate estimates of health utility values. In practice, this means that healthcare providers and policymakers can confidently use DLQI data to estimate utility scores, thus facilitating the inclusion of psoriasis treatments in economic evaluations where EQ-5D-5L data may not be available. The ability to map DLQI to EQ-5D-5L utility values is particularly significant in the context of health economics and policy in China. Psoriasis, especially msPsO, imposes a substantial burden not only on patients but also on the healthcare system [13,14]. Cost-utility analyses, which compare the costs and quality-adjusted life years of different treatments, are crucial for informing decisions about the allocation of healthcare resources, pricing and reimbursement. However, the absence of routine EQ-5D-5L data in Chinese patients with psoriasis has historically made it difficult to incorporate psoriasis-specific quality of life impacts into these economic evaluations. By providing a validated mapping function, this study addresses that gap, enabling more accurate and relevant economic evaluations of psoriasis treatments in China. In China, health technology assessment is increasingly becoming a key element in determining the reimbursement and pricing of medications [15,16]. The

mapping function developed in this study may therefore serve as a valuable tool in future health technology assessment analyses, particularly among patients with msPsO, a population that is often considered in treatment reimbursement decisions. As a result, this study's findings have the potential to significantly influence the inclusion of psoriasis treatments in China's national reimbursement drug list, potentially increasing access to more effective therapies for patients.

One of the major strengths of this study is its utilization of a real-world dataset from the Xiangya Hospital psoriasis follow-up database. By focusing on a real-world clinical setting and a diverse patient population, the study's findings are both highly relevant and generalizable to the broader population of patients with psoriasis in China. Furthermore, the study's robust methodological approach strengthens its findings. The use of multiple regression models (OLS, Tobit and generalized linear model) allowed for a thorough exploration of the relationship between DLQI and EQ-5D-5L. The validation process using a separate testing dataset demonstrated that the OLS model with DLQI total score as the only independent variable was both accurate and reliable, making it a practical tool for health economics research.

Despite its strengths, this study also has limitations. One limitation is its cross-sectional design, which only captures the relationship between DLQI and EQ-5D-5L at a single time point. Psoriasis is a chronic condition, and patients' disease severity and quality of life can fluctuate over time, particularly in response to treatment. Longitudinal studies that track these changes would provide more nuanced insights into how DLQI and EQ-5D-5L scores change together over the course of treatment. Additionally, while the exclusion of patients previously treated with biologics and patients with psoriatic arthritis and other autoimmune diseases helped reduce confounding factors, it also limits the generalizability of the results to patients with psoriasis who have comorbid conditions, which represents a significant portion of the psoriasis population. In addition, exclusion of the patients without DLQI or PASI data could further reduce the generalizability of the developed mapping models. Another limitation is that this study focused exclusively on the patients visiting one hospital setting, which means the results may not be directly applicable to other hospital settings. Future studies should validate the mapping function in other settings and explore whether the function is applicable to Chinese patients irrespective of their social economics status, disease severity, treatment response and comorbidities.

Conclusions

This study successfully developed a robust and validated mapping function to convert DLQI scores into EQ-5D utility values for Chinese patients with msPsO visiting a large tertiary hospital. The strong negative correlation between DLQI and EQ-5D underscores the relevance of DLQI in reflecting not only dermatology-specific but also broader health-related quality of life impacts. By bridging the gap between dermatology-specific and generic QoL measures, this study provides a valuable tool for healthcare providers, policymakers and researchers seeking to improve the management of msPsO in China.

Summary points

- Psoriasis is a chronic autoimmune skin condition that extends beyond physical discomfort, impacting emotional health, social interactions and overall quality of life.
- In clinical practice, the impact of psoriasis on a patient's quality of life is often assessed using the Dermatology Life Quality Index (DLQI), but measures of overall well-being are rarely utilized.
- DLQI total scores showed a significant negative correlation with EuroQoL 5-Dimension questionnaire (EQ-5D) utility index scores in Chinese patients with moderate to severe psoriasis.
- The EQ-5D utility index score was significantly and moderately correlated with DLQI item score for symptoms, feelings, daily activities, clothing, social activities, personal relationship and treatment.
- Of the developed 12 models from the training set, the ordinary least squares model using DLQI total score alone had the best performance to predict EQ-5D utility index scores.
- The developed mapping algorithm converting DLQI total scores into EQ-5D utility index scores had sufficient validity in the testing set with different moderate to severe psoriasis patients from the same setting.
- The developed ordinary least squares model, using the DLQI total score as the sole independent variable, offers a practical tool to address the current need for utility evidence in health economic evaluations.
- External validation of the mapping algorithm developed to convert DLQI total scores into EQ-5D utility index scores is required to ensure its applicability in future research and clinical practice.

Supplementary data

To view the supplementary data that accompany this paper please visit the journal website at: <https://becarispublishing.com/doi/epdf/10.57264/cer-2025-0039>

Author contributions

L Jian, Y Kuang, J Li, W Chen, X Wang, W Li and P Wang formulated the research idea and developed the study protocol. Tingyin Chen developed and implemented EQ-5D-5L electronic data collection tool for this study. L Jian, Y Duan, K Hu and M Zhang conducted the study subject identification and data collection. L Tan and W Chen performed the data analysis with the support from W Li and P Wang. L Jian, Y Kuang, J Li, T Chen, W Chen and X Wang developed the manuscript draft. All authors have critically reviewed the manuscript and approved its submission.

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Competing interests disclosure

L Tan and W Chen are the employees of Changsha Normin Medical Technology Ltd, which received funding from Bristol Myers Squibb to conduct this study. X Wang is the employee of Bristol Myers Squibb. The authors have no other competing interests or relevant affiliations with any organization or entity with the subject matter or materials discussed in the manuscript apart from those disclosed.

Writing disclosure

No funded writing assistance was utilized in the production of this manuscript.

Ethical conduct of research

Reviewed and approved by Xiangya Hospital of Central South University (approval #2024060716).

Data sharing statement

The data that support the findings of this study are available from Xiangya Hospital but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the corresponding authors upon reasonable request and with permission of Xiangya Hospital.

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