

# Willingness-to-pay and time-trade-off as the measures of burden of psoriasis: A pooled analysis of community, hospital, and web-based samples

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## Research

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# Abstract

## Background

The study aimed to compare willingness-to-pay (WTP) and health utility measured by time-trade-off (TTO) in psoriasis.

## Methods

A pooled sample from a community-based cohort, a hospital, and an online registry were used. WTP was elicited for control and for cure. Psoriasis Area and Severity Index (PASI) and Dermatology Life Quality Index (DLQI) were used as references. Data distribution, concurrent validity, and area under the receiver operating characteristic curve (AUC) were compared.

## Results

A total of 479 patients were enrolled. WTP for control demonstrated a positive association with PASI among mild psoriasis, while TTO showed an inverse correlation to DLQI. The AUC of WTP for control (0.66) was higher than that of TTO (0.48) in discriminating PASI>10, and the AUC of TTO (0.64) was higher than that of WTP for control (0.62) in discriminating DLQI>10.

## Conclusion

WTP for control shows superiority in detecting objective severity, while TTO may be more sensitive in measuring impaired quality of life.

# Background

Psoriasis, an immune-mediated chronic, relapsing, inflammatory, polygene genetic disease, is one of the most common skin disorders that affects 1–3% of the general population <sup>1</sup>. Although lots of therapies are available on the market, there is no cure for psoriasis so far <sup>2</sup>. Patients with psoriasis not only suffer from itchiness and pain, but also experience considerable physical discomfort, social stigmata, and isolation, which adversely affects their quality of life (QoL) <sup>3</sup>. To date, several tools have been developed for measuring the QoL of psoriasis patients, and they can be divided into two main categories: interval-based metrics and preference-based metrics <sup>4</sup>. The interval-based instruments, divided into generic (e.g., EQ-5D, SF-36), specialty-specific (e.g., the Dermatology Life Quality Index, DLQI), were well-established and widely used in dermatology. However, the application of preference-based metrics in dermatology was scarce.

Utility evaluates the desirability of certain health states. A commonly accepted assessment of utility is the time-trade-off (TTO) method <sup>5,6</sup>. The TTO method asks a person to make a trade-off between a shorter life expectancy without the condition and a longer life expectancy with the condition <sup>6</sup>. It captures the patient's preference over different health states, but is simpler than Standard Gamble (SG), which is

based on the expected utility theory. In previous studies, the reported utility in skin diseases ranged from 0.64 in bullous disorders, to 0.907 in psoriasis, and 1.0 in alopecia, cosmetic concerns, and urticaria <sup>7</sup>. According to previous data, TTO seems to fail to distinguish the burden of different minor skin diseases <sup>7</sup>.

Willingness-to-pay (WTP), asking how much the responder is willing to pay for a hypothetical treatment, is also considered as a preference-based measure of disease burden in monetary terms <sup>7</sup>. The WTP method shows its potential in dermatology since the burden of many skin conditions tends to be transient and relatively mild and respondents are not willing to accept a shorter life expectancy without the skin disease in TTO or even a small probability of death in SG <sup>8</sup>. In the last two decades, the WTP metrics have been introduced in the field of dermatology and occasionally used in several skin diseases, such as psoriasis, atopic eczema, vitiligo, port wine stains, and rosacea <sup>9-16</sup>. Among which, both Schiffner R. et al. and Lundberg L. et al. reported TTO and WTP in psoriasis patients <sup>9,13</sup>; however, their properties of detecting different emphasis on the burden of psoriasis regarding data distribution, concurrent validity, and discrimination have not been thoroughly compared previously. Furthermore, to our knowledge, there is no previous study in dermatology that used community-based patients to capture the patients' WTP, and there is no literature that elicited WTP of patients with psoriasis in China before. Our study aims to estimate WTP and TTO of in a pooled sample of psoriasis patients, and to compare WTP and TTO regarding the sensitivity in measuring the burden of psoriasis.

## Methods

### Study Design and Patients

This was a cross-sectional study with a pooled sample of patients with diagnosed psoriasis recruited from one of the following settings (Figure S1).

- 1) The Dongfeng-Tongji cohort <sup>17</sup>: The cohort recruited retired workers initially, and it began to recruit workers in-service since 2017 in addition to the previously recruited subjects. We used a sample of participants enrolled between July 2017 and October 2018. Certified dermatologists participated in the field survey and diagnosed skin diseases including psoriasis. Patients with psoriasis were included in the pooled analysis.
- 2) The dermatology clinic of a tertiary hospital in Changsha: Patients with psoriasis who gave their consent were consecutively recruited throughout 2017.
- 3) The Chinese Psoriasis Online Voluntary Registry <sup>18</sup>: The registry is a non-profit and coordinated effort to collect information directly from patients who are at least 18 years of age or older and have been diagnosed with psoriasis. With over 140,000 registered participants, the registry helped patients with psoriasis in the field of health education and social support. Unfortunately, this registry was not mentioned in a review of on psoriasis registry worldwide owing to a lack of publications <sup>19</sup>. We randomly

invited a group of 250 patients to participate in this survey in September 2017. A subsidy was offered if a patient finished the survey to facilitate the response rate.

## Measures of Clinical Severity and QoL

In this study, PASI was used as the gold standard to measure the clinical severity of psoriasis. Despite certain limitations such as the lack of consideration of symptoms, PASI is the most extensively used psoriasis clinical severity score and the most thoroughly validated instruments<sup>20</sup>. The following cut-off points were used: mild (0–10), moderate (11–15), and severe (> 15). For the web-based patients, we used the self-reported clinical severity (0–10). The self-reported clinical severity was elicited by asking “how severe do you rate your clinical symptoms today (0–10)”; among which, “0” represents free from any psoriasis symptom, and “10” represents the most severe symptoms. The self-reported clinical severity was also categorized into three groups: mild (0–3), moderate (4–7), and severe (8–10).

In this study, DLQI<sup>21</sup> was used to measure the QoL for all participants. DLQI is the most widely used QoL instruments in dermatology, and its psychometric properties in psoriasis have been widely validated. Unlike PASI score, DLQI may provide more subjective information and quality-of-life consideration beyond that described by PASI score. DLQI was categorised into three groups: mild (0–10), moderate (11–20), and severe (21–30).

## Measurement of WTP

WTP was elicited using the contingent valuation method<sup>22</sup>, a widely used approach for the valuation of goods and services by potential consumers. Before the WTP amounts were elicited, the participants received education about psoriasis and that all payments were out-of-pocket with no insurance coverage. WTP was elicited for two scenarios: WTP for controlling the disease and WTP for curing the disease. For WTP<sub>cure</sub>, an open-ended question was used to ask about the total amount of money that they would be willing to pay to cure psoriasis. In order to directly compare WTP and TTO in percentage manner, we used relative WTP in this study. Rather than asking absolute money as WTP<sub>cure</sub>, the WTP<sub>control</sub> was elicited by asking about the percentage of monthly income that the participant patients would like to pay to fully control the clinical symptoms of psoriasis. All hypothetical questions assumed no occurrence of side effects. The WTP<sub>cure</sub> in this study is expressed in USD with an exchange rate of 1 USD = 6.9523 CNY (2017).

## Measurement of Utility by TTO

In this study, the TTO approach asks the subject to choose between a fixed guaranteed life duration in his or her current health with psoriasis or a shorter duration with no psoriasis. In order to elicit accurately, simply, and understandably, we obtained the life expectancy for Chinese population<sup>23</sup> and informed participants their average life expectancies. Before elicitation, we thoroughly inquired the participants about their health status, including skin health and health status in general<sup>24</sup>. Participants were asked to choose from two options, option (A), remaining life-years (A years) with psoriasis in current status, or option (B), a shorter life duration (B years) without psoriasis or comorbid conditions. Ping-pong fashion

was followed until arrival the maximum of time that patients are willing to trade-off for no-psoriasis status. The life duration in option B is varied until the respondent is indifferent between option A and option B. The TTO-derived utility of psoriasis is then calculated as  $B/(A + B)$ .

## Other Variables

Age, gender, educational level, monthly income level, and duration of psoriasis were collected in the survey. Duration of psoriasis was dichotomized at the median (10 years) for the convenience of comparison.

## Statistical Analysis

Medians and interquartile ranges (IQR) were used to describe the distribution of WTP and TTO, and Kruskal-Wallis H test was used to test the differences among groups. Concurrent validity was examined by correlations to PASI and DLQI. Spearman correlation coefficients were first estimated between WTP and TTO with PASI, DLQI, and self-reported severity. The locally estimated scatterplot smoothing (LOESS) method was then used to examine the nonlinear correlations<sup>25</sup>. The receiver operating characteristic (ROC) curve and AUC were used to compare the capability of WTP and TTO to discriminate patients with moderate-to-severe psoriasis from mild cases. A bootstrap method was used for the multiple comparisons of the AUCs among the groups. Income and duration of disease were adjusted for in models. Statistical analysis was performed using the R software; the R packages “ggplot2” and “pROC” were used for plotting<sup>26,27</sup>. A  $P < 0.05$  was considered statistically significant.

## Results

### Patient Characteristics

A total of 479 patients were enrolled from the Dongfeng-Tongji cohort (88 psoriasis patients out of 16,758 cohort participants; prevalence rate: 5.25/1000), the hospital (175), and the online registry (216 out of 250 distributed questionnaires; response rate: 86.4%), respectively. The mean age of the participants was  $44.2 \pm 13.3$  years. Patients from the Dongfeng-Tongji cohort were the oldest, had the longest duration of psoriasis, and had the highest QoL (Table 1). The mean PASI was  $8.9 \pm 8.4$  and  $4.2 \pm 6.0$  for hospital and cohort patients, respectively.

Table 1  
 Characteristics of the participants

	Setting			
	Total	Community	Hospital	Web
N	479	88	175	216
Age, y	44.2 ± 13.3	57.5 ± 13.7	38.3 ± 13.0	43.6 ± 9.4
Gender				
Male	318 (66.4)	56 (63.6)	65 (50.4)	151 (57.6)
Female	161 (33.6)	32 (36.4)	64 (49.6)	111 (42.4)
Marital status				
Unmarried	114 (23.8)	8 (9.1)	26 (14.8)	80 (37.0)
Married	345 (72.0)	77 (87.5)	142 (81.1)	126 (58.3)
Divorced	20 (4.2)	3 (3.4)	7 (4.0)	10 (4.6)
Educational level				
Primary school and below	40 (8.3)	11 (12.5)	21 (12.0)	8 (3.7)
Middle school	207 (43.2)	21 (23.9)	79 (45.1)	107 (49.5)
High school	157 (32.8)	24 (27.3)	61 (34.9)	72 (33.3)
College and above	75 (15.7)	32 (36.3)	14 (8.0)	29 (13.4)
Monthly income, USD				
< 216	158 (33.0)	0 (0.0)	100 (57.1)	58 (26.9)
216–431	55 (11.5)	6 (6.8)	38 (21.7)	11 (5.1)
432–863	108 (21.9)	23 (26.1)	25 (14.3)	60 (27.8)
≥ 864	158 (33.0)	59 (67.0)	12 (6.8)	87 (40.3)
Course of psoriasis, y	11.4 ± 10.5	18.6 ± 15.3	7.0 ± 8.3	11.3 ± 7.9
PASI (0–72)	7.4 ± 8.0	4.2 ± 6.0	8.9 ± 8.4	N/A
Self-reported severity (0–10)	5.7 ± 2.3	N/A	N/A	5.7 ± 2.3
DLQI (0–30)	11.0 ± 7.7	5.2 ± 6.1	9.6 ± 5.8	14.0 ± 7.7
PASI: Psoriasis Area and Severity Index. DLQI: Dermatology Life Quality Index.				

## WTP & TTO in Psoriasis Patients

The median  $WTP_{\text{cure}}$  (USD) was \$1438 (IQR: \$432–\$2877); it was not significantly associated with the source of patient, income, and duration of psoriasis (Table 2). The median  $WTP_{\text{control}}$  (%) was 29% (IQR: 10–50%) of monthly income; it was slightly higher in women. The median of  $WTP_{\text{control}}$  was lower in cohort-based patients (10%; IQR: 0–30%) than hospital-based patient (30%; IQR: 10–50%) and web-based patients (30%; IQR: 20–50%), although the difference was not statistically significant ( $P = 0.115$ ).

Table 2  
Medians and interquartile ranges of WTP and TTO across patient characteristics

	WTP <sub>cure</sub> , USD		WTP <sub>control</sub> , %		TTO	
	Median (IQR)	P	Median (IQR)	P	Median (IQR)	P
<b>Setting</b>						
Community	1438 (0–7192)	0.558	10 (0–30)	0.115	0.90 (0.85–0.92)	< 0.001
Hospital	1438 (432–2877)		30 (10–50)		0.90 (0.80–0.92)	
Web	1438 (432–2877)		30 (20–50)		0.80 (0.58–0.90)	
<b>Gender</b>						
Male	1438 (432–2877)	0.984	30 (12–50)	0.005	0.90 (0.73–0.93)	0.097
Female	1438 (467–2697)		32 (20–51)		0.87 (0.70–0.90)	
<b>Marital status</b>						
Unmarried	1438 (720–2877)	0.195	30 (20–51)	0.167	0.85 (0.65–0.90)	0.219
Married	1150 (432–2877)		30 (10–50)		0.90 (0.78–0.92)	
Divorced	719 (432–1438)		40 (19–70)		0.90 (0.48–0.95)	
<b>Educational level</b>						
Primary school and below	1438 (647–4315)	0.005	30 (10–73)	0.886	0.90 (0.71–0.90)	0.811
Middle school	719 (432–1438)		30 (19–50)		0.87 (0.70–0.90)	

	WTP <sub>cure</sub> , USD		WTP <sub>control</sub> , %		TTO	
High school	1438 (719–2877)		30 (20–50)		0.90 (0.70–0.90)	
College and above	1438 (503–2877)		22 (12–51)		0.90 (0.74–0.95)	
Monthly income, USD						
< 216	719 (432–2877)	0.232	30 (10–50)	0.264	0.90 (0.73–0.92)	0.275
216–431	1438 (575–2877)		30 (20–56)		0.90 (0.80–0.90)	
432–863	1438 (575–2877)		30 (19–50)		0.85 (0.63–0.90)	
≥ 864	1438 (719–2877)		27 (15–50)		0.86 (0.72–0.95)	
Course of psoriasis						
< 10 y	1438 (432–2877)	0.782	30 (10–50)	0.370	0.90 (0.70–0.92)	0.218
≥ 10 y	1438 (432–2877)		25 (10–50)		0.85 (0.70–0.90)	

The median TTO was 0.9 (IQR: 0.70–0.92). Community patients (0.90; IQR: 0.85–0.92) and hospital patients (0.90; IQR: 0.80–0.92) showed significantly higher TTO than web patients (0.80; IQR: 0.58–0.90). TTO was not associated with income and duration of psoriasis.

## Data Distribution

The WTP<sub>cure</sub> showed a normal distribution after logarithmic transformation, while TTO showed a right-skewed distribution (Fig. 1). The distribution of WTP<sub>control</sub> largely overlapped across PASI and DLQI groups. The Kruskal-Wallis tests showed consistent results with the visual description: the medians of WTP<sub>cure</sub> were not significantly different across PASI or DLQI groups (Table S1). In contrast, the distributions of WTP<sub>control</sub> were well separated across PASI and DLQI groups. The distributions of TTO overlapped across PASI groups, but were well separated across DLQI groups. Statistical tests also showed consistent results (Table S1). The medians of WTP and TTO were not significantly different

across the groups of self-reported severity. In addition,  $WTP_{\text{control}}$  showed a floor effect (3% range in the lower 10% centile) while TTO showed a ceiling effect (0.05 range in the upper 10% centile, Table S2).

## Concurrent validity

$WTP_{\text{control}}$  was significantly associated with PASI ( $r = 0.36, P < 0.001$ ) but not with DLQI, while TTO was significantly associated with DLQI ( $r = -0.20, P = 0.001$ ), but not with PASI (Table S3). Partial correlation coefficients adjusting for income and duration of psoriasis were consistent with the unadjusted results.

Nonlinear associations were further examined.  $WTP_{\text{cure}}$  was associated with neither PASI nor DLQI. The association of  $WTP_{\text{control}}$  with PASI was significant among the patients with mild psoriasis, while the confidence interval of the curve became very wide among those with moderate-to-severe psoriasis (Fig. 2). TTO was significantly inversely associated with DLQI, but was not correlated with PASI.

## Discrimination

The AUC of  $WTP_{\text{control}}$  (AUC = 0.66, 95% CI: 0.58–0.74) was statistically significant in discriminating PASI > 10, while the AUCs of  $WTP_{\text{cure}}$  (AUC = 0.52, 95% CI: 0.44–0.61) and TTO (AUC = 0.48, 95% CI: 0.40–0.60) were not significant (Table 3 & Figure S2). In contrast, the AUC of TTO (AUC = 0.64, 95% CI: 0.58–0.70) was significantly larger than that of  $WTP_{\text{cure}}$  (AUC = 0.55, 95% CI: 0.58–0.74) and  $WTP_{\text{control}}$  (AUC = 0.62, 95% CI: 0.56–0.67) in the discrimination for DLQI > 10, using the bootstrap method.

Table 3

Comparisons of the area under the receiver operating characteristic curves using the bootstrap method

	PASI > 10			DLQI > 10		
	AUC	95% CI	P	AUC	95% CI	P
AUCs						
$WTP_{\text{cure}}$ , USD	0.52	0.44–0.61	0.457	0.54	0.48–0.60	0.852
$WTP_{\text{control}}$ , %	0.67	0.58–0.74	< 0.001	0.62	0.56–0.67	< 0.001
TTO	0.48	0.40–0.60	0.768	0.64	0.58–0.70	< 0.001
Comparison of AUCs						
$WTP_{\text{cure}}$ vs. $WTP_{\text{control}}$			0.047			0.017
$WTP_{\text{cure}}$ vs. TTO			0.272			< 0.001
$WTP_{\text{control}}$ vs. TTO			0.008			0.031

## Discussion

For the first time, the study reported WTP of Chinese psoriasis patients and, investigated WTP and utilities (TTO) in real-world patients with psoriasis. To our knowledge, the previous literature on WTP and TTO of psoriasis patients were based on hospital sample; and this may lead to a bias to capture the overview of impaired QoL in patients with psoriasis. This study included both community and hospital samples, providing a more comprehensive estimate of the burden of psoriasis in China. The median TTO estimate of our study population was 0.9 (IQR: 0.70–0.92), which was close to the upper limit of previous estimates<sup>7</sup>. Since our pooled sample is more representative for the patient population in China, the utilities elicited from the presenting study are more convincing and valuable.

This study was among the first to systematically compare the properties of WTP and TTO as measures for the burden of psoriasis regarding data distribution, ceiling and floor effects, linear and nonlinear correlation, and capability of discrimination. In order to compare WTP and TTO in a more unified and direct approach, we used relative WTP in the present study since absolute WTP fails to generalised outside China. The results indicated that the WTP for monthly control (%) was highly correlated with the clinical severity of psoriasis (PASI) while TTO was highly correlated with non-preference-based QoL measure (DLQI).  $WTP_{cure}$  in absolute monetary terms was relevant to neither the clinical severity nor the QoL, which was in accordance with the conclusions from previous studies that relative WTP might be a better indicator compared with absolute WTP<sup>7</sup>.

In our study, TTO showed a unique capability of representing QoL across all groups. TTO, a classic method to elicit health state utility, has been widely used across diseases. By asking people “how many years of current life with a certain illness they would like to give up in exchange for the rest living free from this condition,” it allows direct comparisons of QoL across different disease areas. In this study, TTO demonstrated a consistent positive correlation with DLQI in patients with varying levels of scores. This result is interesting but not surprising. Several previous studies substantiated that DLQI is good at detecting impaired QoL<sup>28,29</sup>. The more the patients felt embarrassed or self-conscious, or ashamed of their physical appearance, or experienced difficulties in social interactions, the more they are willing to accept a shorter life expectancy without psoriasis. However, in our study, TTO showed ceiling effect and failed to show superiority in detecting clinical severity compared to  $WTP_{control}$ , especially when psoriasis is in a mild status. Since TTO serves as a ruler of comparison across all diseases, the tool cannot be fine enough to detect nuances, especially in skin diseases with rare death or disability. We also identified a ceiling effect that the range of TTO in the upper 10% of patients with psoriasis was only 0.05. Indeed, even when their QoL was truly impaired, it was hard for patients with a skin disease to trade their life in return of free from cutaneous signs and symptoms.

Consistent with the suggestions from Chen S. et al.<sup>8</sup>, we continue to advocate the application of the WTP metrics in psoriasis. Indeed, WTP, as a monetary indicator, has inherent flaws such as its correlation to income level. However, our results showed  $WTP_{control}$  as a percentage of income could mitigate the effect of income originally existing in absolute WTP. In our study, the distribution of WTP for disease control (%)

was well separated across PASI and DLQI groups, especially among those in a mild disease status (PASI < 10), indicating that WTP rather than TTO estimates can better reflect disease burden in mild psoriasis. Paralleled with the clinical severity of psoriasis, the dynamic conceptualization of the money paid out-of-pocket for a possible treatment may be more straightforward and sensitive to the patients when comparing with TTO. These findings, if generalised, could provide further evidence to support the use of relative WTP to measure the burden of disease in dermatology, since most of the skin diseases are relatively mild and temporary compared to other major diseases.

There are limitations in this study. First, there is a lack of gold standard for measuring the burden of psoriasis. However, PASI and DLQI itself are generally acknowledged tools to capture the burden of patients with psoriasis, and they are complementary to each other in the evaluation of psoriasis<sup>30</sup>. As a result, PASI and DLQI were used as the references. Second, the sample size of patients with PASI > 10 was relatively small, and a robust conclusion could hardly be drawn among those with moderate-to-severe psoriasis. Further study is needed to verify our findings in larger samples and different populations. Despite the limitations, our study can serve as an essential contribution to the existing literature. By the use of a pooled sample from a population-based cohort, a tertiary hospital, and the biggest psoriasis online registry in China, the current study reports the first data of WTP of psoriasis patients in China and can be more comprehensive than hospital-based studies. The characteristics of the patients varied substantially across the different sources of sample, which further demonstrates the heterogeneity of patients in different settings and underscores the importance of including different patient populations in the sample. More importantly, we found that WTP<sub>control</sub> is superior in detecting minor clinical severity status of psoriasis compared to TTO, while TTO is a more sensitive indicator for the impaired health-related QoL associated with psoriasis. In general, relative WTP and TTO are both recommended to depict the complete picture of the burden of psoriasis regarding multifaceted emphases.

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## List Of Abbreviations

AUC: area under the curve. DLQI: Dermatology Life Quality Index. IQR: interquartile range. LOESS: locally estimated scatterplot smoothing. PASI: Psoriasis Area and Severity Index. QoL: quality of life. ROC: receiver operating characteristic. TTO: time-trade-off. WTP: willingness-to-pay.

## Declarations

### Ethics approval and consent to participate

This study was conducted according to the guidelines laid down in the Declaration of Helsinki. All procedures involving patients were approved by the institutional research ethics boards of Xiangya Hospital, Central South University (Changsha, China). Written (cohort and hospital participants) or electronic (web participants) informed consent was obtained from all participants.

### Consent for publication

No patient's individual data was presented.

### Availability of data and materials

The data is available upon appropriate request to the corresponding authors.

## Competing interests

The authors declare no competing interest.

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## Authors' contribution

All authors participated in field survey and data collection. Y.X., M.S., and X.C. designed the study. M.S. analyzed the data. Y.X. wrote the manuscript. M.L., X.G., P.S., J.T., M.H., W.Z., and X.C. interpreted the data and critically revised the manuscript. X.C. and M.S. obtained the funding.

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## Supplementary Information

**Table S1.** Medians and interquartile ranges of WTP and TTO among patients with different severities of psoriasis.

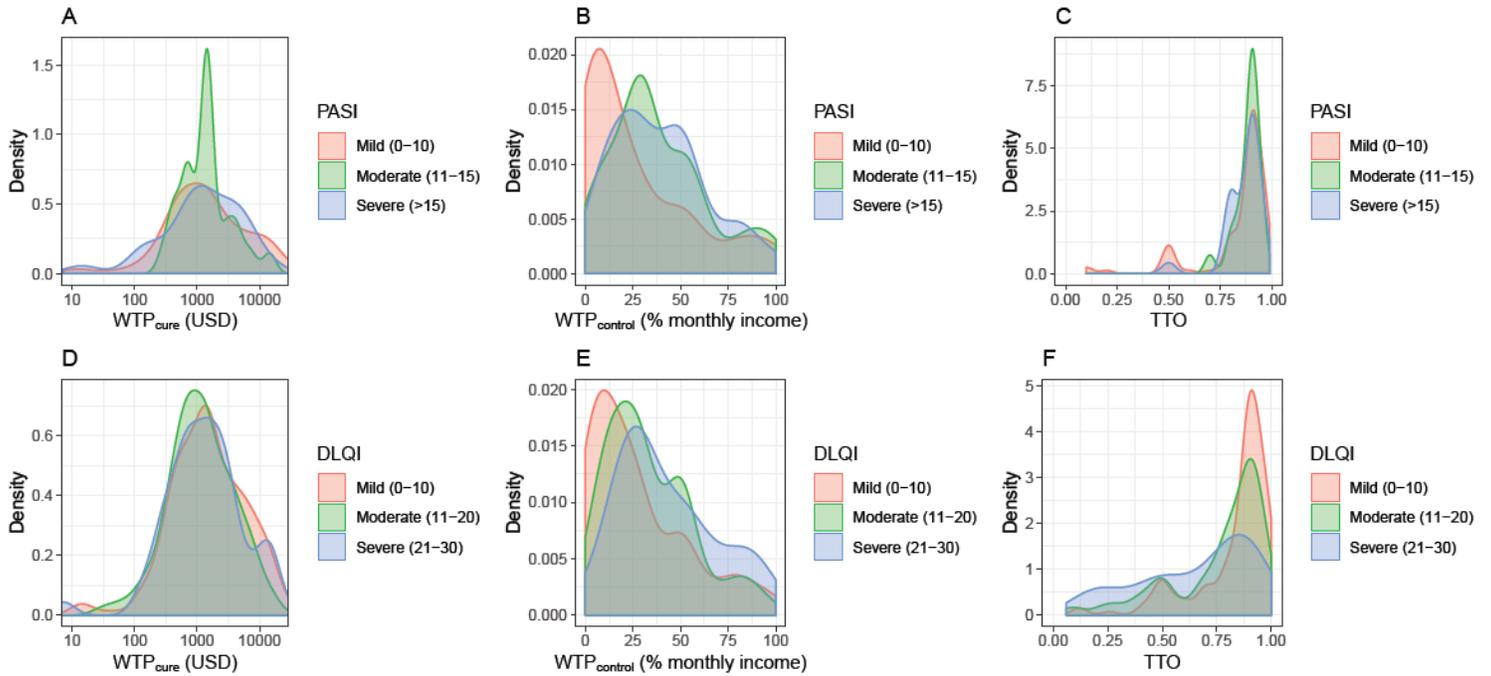
**Table S2.** Ceiling and floor effects of WTP and TTO in patients with psoriasis

**Table S3.** Spearman correlation coefficients between WTP and TTO and PASI and DLQI.

**Figure S1.** Flowchart of the study.

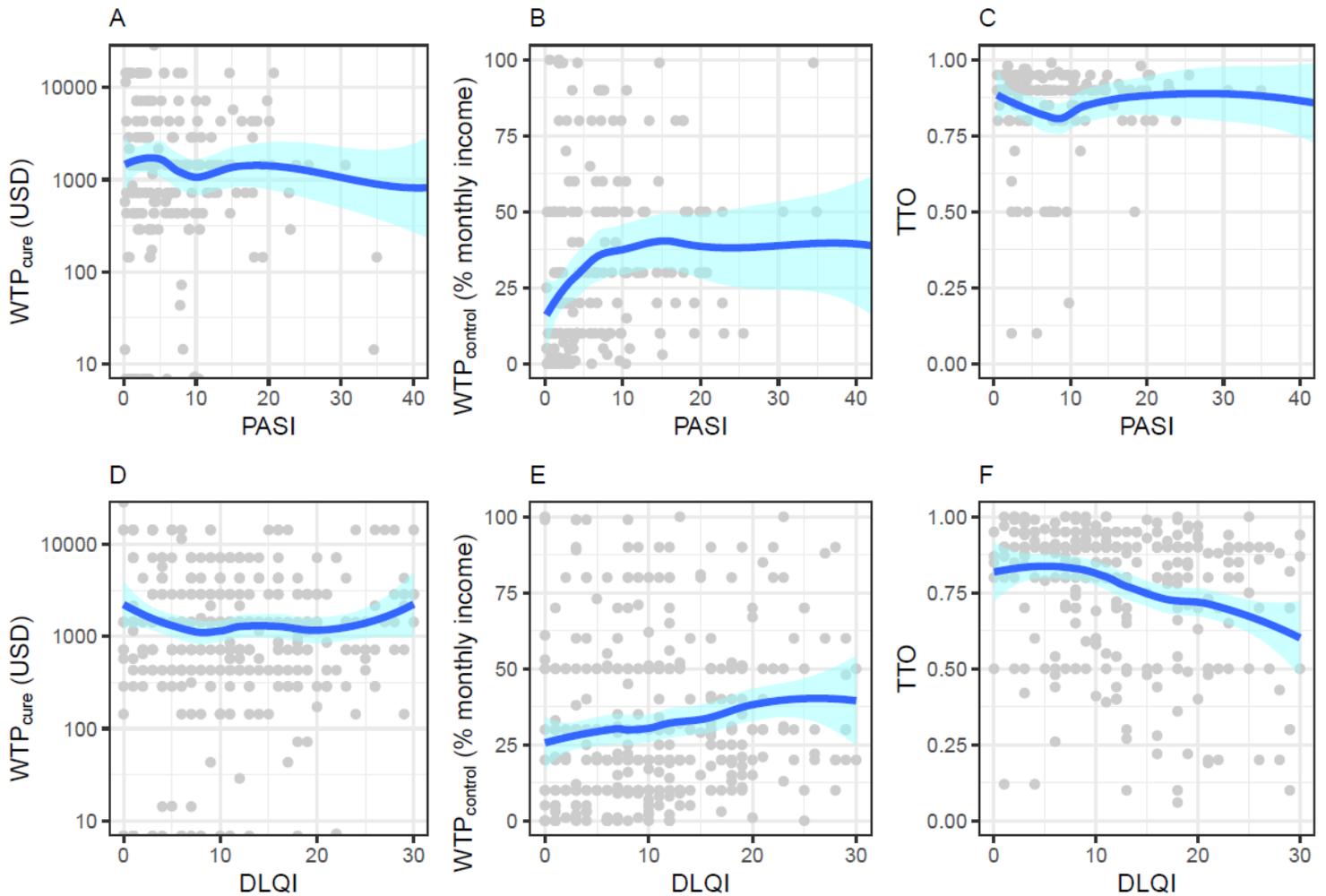
**Figure S2.** Receiver operating characteristic curves. The blue lines signify the ROC curves, and the light blue bands signify the 95% confidence intervals of the sensitivities. (A) ROC curve of  $WTP_{cure}$  (USD) to discriminate  $PASI > 10$ . (B) ROC curve of  $WTP_{control}$  (% monthly income) to discriminate  $PASI > 10$ . (C) The ROC curve of TTO to discriminate  $PASI > 10$ . (D) ROC curve of  $WTP_{cure}$  to discriminate  $DLQI > 10$ . (E) ROC curve of  $WTP_{control}$  to discriminate  $DLQI > 10$ . (F) ROC curve of TTO to discriminate  $DLQI > 10$ .

# Figures



**Figure 1**

Distribution of WTP and TTO by the severity of psoriasis. (A) Distribution of WTP<sub>cure</sub> (USD), stratified by PASI group (mild, moderate, severe); logarithmic coordinate axis was used for WTP<sub>cure</sub>. (B) Distribution of WTP<sub>control</sub> (% monthly income), stratified by PASI group. (C) Distribution of TTO, stratified by PASI group. (D) Distribution of WTP<sub>cure</sub>, stratified by DLQI group (mild, moderate, severe). (E) Distribution of WTP<sub>control</sub>, stratified by DLQI group. (F) Distribution of TTO, stratified by DLQI group.



**Figure 2**

Correlation of WTP and TTP to PASI and DLQI using a locally estimated scatterplot smoothing method. The blue lines signify the estimated curves and the light blue bands signify the 95% confidence intervals. (A) Association of WTP<sub>cure</sub> (USD) with PASI; logarithmic coordinate axis was used for WTP<sub>cure</sub>. (B) Association of WTP<sub>control</sub> (% monthly income) with PASI. (C) Association of TTO with PASI. (D) Association of WTP<sub>cure</sub> with DLQI. (E) Association of WTP<sub>control</sub> with DLQI. (F) Association of TTO with DLQI.

## Supplementary Files

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