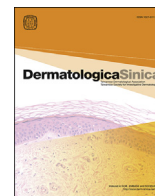


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## ORIGINAL ARTICLE

# Health state utility, willingness to pay, and quality of life among Taiwanese patients with psoriasis

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## ABSTRACT

**Background/Objective:** Past studies have found a correlation between the Dermatology Life Quality Index (DLQI) and the Psoriasis Area and Severity Index (PASI) for Caucasian psoriasis patients. This study examined the relationships between health state utility and willingness to pay (WTP) and the DLQI, as well as between the PASI and the DLQI, health-related utilities, and WTP in Taiwanese patients.

**Methods:** A total of 480 psoriasis patients from five hospitals across Taiwan were interviewed between August 2009 and February 2010. Health state utilities were elicited using the time trade-off (TTO) method, a visual analog scale (VAS), and the EuroQOL-five dimensions (EQ-5D). WTP for a cure was elicited by double-bounded binary-choice questions followed by a bidding game. Psoriasis severity was graded as mild (PASI < 3), moderate, or severe (PASI ≥ 10).

**Results:** The mean DLQI values for mild ( $n = 117$ ), moderate ( $n = 208$ ), and severe ( $n = 155$ ) psoriasis were 5.73, 7.62, and 11.29, respectively. The mean health state utilities were 0.87 (EQ-5D), 0.72 (VAS), and 0.74 (TTO). The monthly maximum WTP value was US\$145.3–318.8. EQ-5D and VAS scores were negatively correlated with all DLQI domains. WTP and DLQI also had a strong correlation in the expected direction. TTO had the weakest correlation with the DLQI. A smaller TTO was found for Taiwanese patients than for Caucasians. When considering different PASI severity levels, EQ-5D and VAS scores remained consistent measures for the DLQI, but the correlation between the TTO and DLQI weakened.

**Conclusion:** The EQ-5D, VAS, and WTP are consistent measures for the DLQI in assessing the well-being of psoriasis patients in Taiwan.

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## Introduction

Psoriasis is a chronic, noncontagious skin disease with a wide range of prevalences in different ethnic groups. Previous studies have shown a prevalence rate of 0.226% among Taiwanese people, as well as a male to female ratio of 2:1. On average, females have a younger age of onset, while 20% of patients have a family history of the disease.<sup>1,2</sup>

Conflicts of interest: The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in this article.

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Although psoriasis is rarely life threatening, it results in a poor quality of life (QOL),<sup>3–6</sup> with an impact comparable with that of diabetes.<sup>7</sup> In addition to suffering from the physiological effects of the illness, psoriasis patients have to face psychological issues such as frustration, helplessness, and lack of self-confidence because of changes in the appearance of their skin.<sup>8</sup> A good correlation between the severity of psoriasis, measured by the Psoriasis Area and Severity Index (PASI), and QOL was previously demonstrated in many pivotal studies investigating Caucasian patients with moderate to severe psoriasis.<sup>9</sup> At present, the study instruments used to measure patients' subjective QOL indexes include generic instruments short form-36 (SF-36), specific instruments, health state utilities, and contingency valuation methods.<sup>10,11</sup>

The Dermatology Life Quality Index (DLQI) and the SF-36 are the most frequently used measures. In fact, the recent argument that higher treatment efficacy of PASI90 (rather than PASI75) should be

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sought for psoriasis in the era of biologics is based on DLQI statistics.<sup>12</sup> Similarly, our own previous study regarding unreimbursed use of adalimumab for psoriasis also found a DLQI score of 0–1 to be a critical factor.<sup>13</sup> Other measures of health state utilities are used relatively infrequently. As the various domains of the different generic and specific instruments will generate different values, the use of a multidimensional approach in describing the overall health-related QOL has advantages in terms of better reflecting a patient's health condition across multiple domains. In addition, studies showing correlations among these measurements in milder psoriasis are limited,<sup>14,15</sup> and their correlations, if any, among Asian patients with psoriasis have yet to be investigated. There have only been a limited number of studies that focused on the correlations between preference-based scales and health profile-based scales. For example, Lundberg et al.<sup>12</sup> compared the relationships among health state utilities, willingness to pay (WTP), and QOL scales for 366 patients with psoriasis and atopic eczema, but that study did not take disease severity into account, and there has been, to our knowledge, no previous study conducted in Asia that has compared the relationships among the DLQI, health state utilities, and WTP. In a small case series involving 40 patients, WTP was not correlated with the severity of psoriasis (as measured by the body surface area involved).<sup>17</sup> In the current study, we examined how different measures of health state utilities and WTP are related to the DLQI, and how their correlations vary over differing levels of PASI scores, among Taiwanese patients with psoriasis.

## Methods

### Patient interviews

Well-trained nurses carried out face-to-face interviews with 480 psoriasis patients aged at least 20 years, from August 2009 to May 2010, at dermatology outpatient clinics in five hospitals located in northern, central, and southern Taiwan after obtaining approval by the respective institutional review boards. Patients were stratified into three severity groups: (1) mild: PASI < 3; (2) moderate:  $3 \leq$  PASI < 10; and (3) severe: PASI  $\geq$  10. The numbers of patients interviewed in each group were 117, 208, and 155, respectively.

### Instruments for outcome measurements

Instruments used during the interviews to measure the patients' QOL included the following. (1) Dermatology Life Quality Index. The DLQI is a validated instrument that contains 10 questions that assess the impact of skin disease on six aspects of QOL (specifically, symptoms and feelings, daily activities, leisure, work or school performance, personal relationships, and treatment).<sup>16</sup> The total score for the DLQI ranges from 0 to 30, with a higher score denoting greater QOL impairment; a total score of  $\geq$  10 points is associated with substantial QOL impairment.<sup>18</sup> (2) Health state utilities. Three types of health state utilities were measured in the study.<sup>19</sup> (i) Visual analog scale. This is a psychometric scale measurement, scores for which range from 0 to 100 points, on which respondents self-report their overall state of health on that day according to their personal perspective. (ii) Time trade-off: This is a preference-based utility measure that asks about a respondent's willingness to forego years of their life in exchange for a state of perfect health. The maximum number of years a respondent could trade off was determined by the given respondent's age. It was 50 years for respondents aged 20–30 years and younger, 40 years for those aged 31–40 years, 30 years for those aged 41–50 years, and finally, 20 years for those aged 51–60 years and older. (iii) EuroQOL-five dimensions. The EuroQOL-five dimensions (EQ-5D) contains five questions that measure five dimensions, namely, mobility, self-

care, usual activities, pain/discomfort, and anxiety/depression. The scoring method for the EQ-5D used in our study followed the scoring formula developed by Dolan and Gudex,<sup>20</sup> such that a value of utility ranging from 0 to 1 would be obtained. (3) Willingness to pay. The WTP for relief from psoriasis was elicited by double-bounded binary-choice questions followed by a bidding game question to determine the maximum WTP, as suggested in prior studies.<sup>21,22</sup> The specified first-bid price was pretested in order to better capture the extremes of the WTP. In the end, the specified first-bid prices were divided into 10 subsamples: United States (US)\$15.6, US\$31.25, US\$62.5, US\$93.8, US\$125, US\$156.3, US\$187.5, US\$250, US\$312.5, and US\$625. Double-bounded binary-choice questions randomly set a reasonable initial price and then let the respondents determine the WTP. If a respondent is willing to pay a given price, the price is set higher for the second inquiry. If a respondent is unwilling to pay, the price is set lower for the second inquiry.<sup>23</sup>

### Statistical analysis

First, the distributions of DLQI scores, WTP values, and utility weights calculated based upon the EQ-5D, visual analog scale (VAS), and time trade-off (TTO) were reported. Second, correlation tests were performed to examine the relationships between the DLQI scores and the utility weights from the EQ-5D, VAS, and TTO methods, as well as the WTP. As the WTP values elicited from the double-bounded dichotomous questions were interval censored with a right-skewed distribution, a log-normal model in the survival analysis was estimated using the maximum-likelihood method. The logarithm of the WTP was assumed to be normally distributed, with a mean comprising a linear function of individual characteristics. The regression-adjusted WTP (RA-WTP) was calculated at the sample mean to represent the WTP for relief from the symptoms of psoriasis among the sampled patients. Finally, subgroup analyses were performed to investigate differences in the associations of DLQI scores with the utility weights and WTP between the different disease severity groups. Descriptive analyses and correlations were performed using SPSS software, version 16.0 (SPSS Inc., Chicago, IL, USA), and the WTP regression was performed using SAS software, version 9.1 (SAS Institute, Cary, NC, USA).

## Results

Characteristics of the patients are shown in [Table 1](#). There were 360 (75.0%) male patients and 120 (25.0%) female patients, and their average age was 44.52 years. The average disease duration was 10.9 years. In terms of disease severity, 117 (24.4%) respondents had mild psoriasis (PASI < 3), 208 (43.3%) had moderate psoriasis ( $3 \leq$  PASI < 10), and 155 (32.3%) had severe psoriasis (PASI  $\geq$  10).

[Table 2](#) shows the descriptive statistics for all the QOL measures stratified by disease severity. The average score in each dimension of the DLQI and the mean values of both the maximum WTP and the RA-WTP increased with the level of disease severity.

Results of the correlation analysis are shown in [Table 3](#), and indicate that the EQ-5D and VAS were significantly correlated with every dimension ( $p < 0.01$ ) of the DLQI, with the strongest correlations being with the "symptoms and feelings," "daily activities," and "leisure" dimensions. The TTO was also significantly correlated with the same three dimensions of the DLQI, but to a lesser extent, while both the "work and school" and the "treatment" dimension were not significantly correlated with the TTO. The RA-WTP was significantly correlated with all the dimensions of the DLQI, with the strongest correlations being with the "leisure," "treatment," and "daily activities" dimensions. Overall, the health utility measures and WTP were significantly correlated with the overall DLQI

**Table 1** Selected patient characteristics.

	PASI < 3		3 ≤ PASI < 10		PASI ≥ 10		All (n = 480)	
	Mild (n = 117)		Moderate (n = 208)		Severe (n = 155)			
	No.	%	No.	%	No.	%	No.	%
Gender								
Male	73	62	156	89	131	85	360	75
Female	44	38	52	30	24	15	120	25
Age, y, mean ± s.d.	44.77 ± 16.48		44.54 ± 15.06		44.30 ± 13.81		44.52 ± 15.01	
Marital status								
Single	41	35	73	35	66	43	180	38
Married	76	65	135	65	89	57	300	63
Employment								
Full time	62	53	124	60	104	67	290	60
Part time	6	5	9	4	11	7	26	5
Unemployed	49	42	75	36	40	26	164	34
Household monthly income (US\$)								
<937.5	23	20	26	13	24	15	73	15
937.5–1562.4	27	23	36	17	34	22	97	20
1562.5–2187.4	18	15	44	21	25	16	87	18
2187.5–3124.9	20	17	28	13	36	23	84	18
3125–4687.4	19	16	40	19	19	12	78	16
4687.5–6249.9	3	3	14	7	9	6	26	5
>6250	7	6	20	10	8	5	35	7
Education								
Elementary	17	15	23	11	12	8	52	11
Junior high school	12	10	18	9	16	10	46	10
High school	26	22	54	26	50	32	130	27
University	52	44	90	43	64	41	206	43
Graduate school	10	9	23	11	13	8	46	10
Disease history, y, mean ± s.d.	9.35 ± 9.65		10.38 ± 8.85		12.77 ± 8.16		10.9 ± 8.93	

PASI = Psoriasis Area and Severity Index; s.d. = standard deviation.

**Table 2** Health state utilities, DLQI, and WTP stratified according to PASI levels.

	PASI < 3			3 ≤ PASI < 10			PASI ≥ 10			All cases		
	Mild (n = 117)			Moderate (n = 208)			Severe (n = 155)			(N = 480)		
	Mean	Median	s.d.	Mean	Median	s.d.	Mean	Median	s.d.	Mean	Median	s.d.
Health utility												
EQ-5D	0.89	1	0.21	0.9	1	0.15	0.83	0.85	0.2	0.87	1	0.18
VAS	0.75	0.8	0.17	0.75	0.8	0.15	0.67	0.7	0.16	0.72	0.75	0.16
TTO	0.81	0.88	0.25	0.73	0.8	0.28	0.71	0.8	0.28	0.74	0.83	0.27
DLQI												
Symptoms & feelings	1.74	2	1.33	2.36	2	1.46	3.03	3	1.47	2.42	2	1.51
Daily activities	0.95	0	1.33	1.31	1	1.39	2.15	2	1.66	1.5	1	1.54
Leisure	1.03	0	1.52	1.37	1	1.43	2.23	2	1.78	1.56	1	1.64
Work & school	0.59	0	0.89	0.77	1	0.86	1.07	1	0.95	0.83	1	0.92
Personal relationships	0.69	0	1.09	0.86	0	1.13	1.5	1	1.51	1.02	1	1.3
Treatment	0.74	1	0.76	0.95	1	0.93	1.32	1	1.03	1.02	1	0.95
Overall DLQI score	5.73	4	5.22	7.62	7	5.26	11.29	11	6.43	8.34	7	6.05
Maximum WTP	145.3	93.8	218.7	261.6	156.3	456.3	318.8	187.5	327.8	254.4	156.3	376.6
Regression-adjusted WTP	166	159.9	67.9	244.7	6978.5	218.1	412.9	395.2	143.1	281.9	249.5	145.8

DLQI = Dermatology Life Quality Index; EQ-5D = EuroQOL-five dimensions; PASI = Psoriasis Area and Severity Index; s.d. = standard deviation; TTO = time trade-off; VAS = visual analog scale; WTP = willingness to pay.

**Table 3** Health state utilities, WTP, and their association with the DLQI among patients with psoriasis.

DLQI	Health utilities			Willingness to pay*	
	EQ-5D (n = 480)	VAS (n = 480)	TTO (n = 480)	Maximum WTP (n = 451)	Regression-adjusted WTP (n = 451)
Symptoms & feelings	−0.348**	−0.348**	−0.149**	0.046	0.124**
Daily activities	−0.352**	−0.315**	−0.184**	0.077	0.211**
Leisure	−0.400**	−0.302**	−0.167**	0.127**	0.284**
Work & school	−0.246**	−0.228**	−0.06	0.022	0.123**
Personal relationships	−0.246**	−0.238**	−0.184**	0.099*	0.174**
Treatment	−0.260**	−0.213**	−0.065	0.046	0.241**
Overall DLQI score	−0.416**	−0.369**	−0.188**	0.098*	0.257**

\* Statistically significant at the 0.05 level (2 tailed).

\*\* Statistically significant at the 0.01 level (2 tailed).

DLQI = Dermatology Life Quality Index; EQ-5D = EuroQOL-five dimensions; TTO = time trade-off; VAS = visual analog scale; WTP = willingness to pay.

scores; the strongest correlation was with the EQ-5D and the weakest correlation with the maximum WTP.

A subgroup analysis showed that the EQ-5D and VAS remained significantly correlated with the DLQI across the three disease severity groups, with the exception of any associations between the EQ-5D and the “work and school” dimension for mild cases or between the VAS and the “personal relationships” and “treatment” dimensions for severe cases (Tables 4–6). The correlations between the dimensions of the DLQI and the TTO became weaker in the subgroup analysis, and some of them did not reach statistical significance. The maximum WTP was significantly correlated with the “daily activities,” “leisure,” and “personal relationships” dimensions among mild cases, but it was not significantly correlated with the other two dimensions at any severity level or with the “daily activities,” “leisure,” and “personal relationships” dimensions among moderate and severe cases. The strong correlations of all dimensions of the DLQI with the RA-WTP were reduced in the subgroup analysis. The RA-WTP was significantly associated with the “symptoms and feelings” dimension for both mild and moderate cases, and with the overall DLQI score for moderate and severe cases. The RA-WTP was also significantly correlated with the “work and school” dimension for moderate cases, and with the “leisure” and “treatment” dimensions for severe cases.

## Discussion

Psoriasis has a major impact on patients' QOL. Most early studies on the health-related QOL of dermatology patients used a single QOL scale to reflect the disease burden on patients<sup>24,25</sup> or a QOL scale to measure certain features before and after treatment.<sup>26</sup> Garduno et al<sup>27</sup> conducted a systematic review of studies on health-related QOL over a recent 5-year period and found that 54.8% of studies used the DLQI as a measurement instrument. The various domains of the DLQI are significant indicators for dermatology patients. More recently, health state utilities (such as the EQ-5D, VAS, and TTO) and contingent valuation methods (such as the WTP) have also gradually been applied in an increasing number of dermatological studies.<sup>12,28–30</sup> Health state utilities and contingent valuation methods have the advantage of using one value to reflect an overall QOL. The disadvantage of these approaches is that they constitute more complex methods of measurement.<sup>18,31–36</sup>

Our study examined how different measures of health state utilities and WTP were related to the DLQI, and how those correlations varied according to the level of PASI scores among Taiwanese patients with psoriasis. Our results showed that the average score of the EQ-5D among Taiwanese patients was 0.87, which was higher than 0.75, the average score of the EQ-5D in a German study.<sup>25</sup> Our results also showed that the average score of the VAS was 0.72, while that of the TTO was 0.74. A study conducted by Lundberg et al<sup>12</sup> on 234 Swiss patients with psoriasis showed that the average score of the VAS was 0.69, which was similar to that in

our study, while the average score of the TTO was 0.88, which was higher than that in our study.

The DLQI domains and the EQ-5D, VAS, and TTO were negatively correlated in our study, indicating that lower EQ-5D, VAS, and TTO scores were associated with higher DLQI scores. The EQ-5D had the strongest correlations with the DLQI domains, the VAS had the second strongest correlations, and the TTO had the weakest correlations. Although the TTO has a better theoretical basis than the VAS, correlations between the TTO and the DLQI domains were lower than those between the VAS and the DLQI domains. This might have been due to the fact that the VAS question was more straightforward and comprehensible for patients to answer than the TTO question.<sup>12,37,38</sup> The psychometric measurement scales had good reliability and validity, and were easy to use. Moreover, the fact that the correlations between health state utilities and the scales have been shown to be high implies that the health state utilities have higher validity.<sup>39,40</sup>

An in-depth analysis of the correlations between the DLQI domains and the health utility measures showed that the EQ-5D had a significant negative correlation with each of the DLQI domains ( $p < 0.01$ ). This indicated that lower EQ-5D scores were associated with higher DLQI scores, a finding that was consistent with and similar to the results of many previous studies.<sup>25,41,42</sup> The VAS was also negatively related to every DLQI domain ( $p < 0.01$ ), a result consistent with and similar to those of other studies.<sup>12,41</sup>

Finally, negative correlations between the TTO and most of the DLQI domains were also consistent with results reported by Lundberg et al,<sup>12</sup> which indicated that the higher the TTO, the lower the level of each aspect of QOL, as defined by the DLQI domains. However, there were differences in the statistical significance of the correlations between the TTO and two of the DLQI domains. First, our study showed that the TTO and the “personal relationships” domain were negatively correlated at a statistically significant level of 0.01, indicating that respondents with poorer personal relationships would be willing to exchange more life years for perfect health. The “personal relationships” domain was defined using the following questions: “how much has your skin created problems with your partner or any of your close friends or relatives?” and “how much has your skin caused any sexual difficulties?” When a disease is visible, even if it is noncontagious, social activities of patients might be affected because of changes in appearance.<sup>43</sup> Compared with previous studies of Caucasian psoriasis patients, the impacts of psoriasis on relationships with family, friends, and sexual partners among Taiwanese patients were better reflected in the results of the TTO.<sup>12</sup> This may have been due to the fact that Taiwanese people in general are less aware of the noncontagious nature of psoriasis, which results in poorer personal relationships and a stigma associated with Taiwanese psoriasis patients. Second, in our study, the negative correlation between the TTO and the “treatment” domain did not reach statistical significance. The distress caused by treatment was defined by the following

**Table 4** Health state utilities, WTP, and their associations with the DLQI among patients with mild psoriasis.

	Health utilities			Willingness to pay	
	EQ-5D (n = 117)	VAS (n = 117)	TTO (n = 117)	Maximum WTP (n = 106)	Regression-adjusted WTP (n = 106)
Symptoms & feelings	–0.254**	–0.246**	–0.181	0.133	–0.236*
Daily activities	–0.421**	–0.286**	–0.133	0.257**	–0.011
Leisure	–0.454**	–0.244**	–0.210*	0.282**	0.155
Work & school	–0.125	–0.186*	0.026	–0.016	–0.114
Personal relationships	–0.210*	–0.222*	–0.235*	0.221*	–0.11
Treatment	–0.243**	–0.225*	0.025	0.148	0.076
Overall DLQI score	–0.404**	–0.317**	–0.182*	0.246*	–0.047

\* Statistically significant at the 0.05 level (2 tailed).

\*\* Statistically significant at the 0.01 level (2 tailed).

DLQI = Dermatology Life Quality Index; EQ-5D = EuroQOL-five dimensions; TTO = time trade-off; VAS = visual analog scale; WTP = willingness to pay.

**Table 5** Health state utilities, WTP, and their associations with the DLQI among patients with moderate psoriasis.

	Health utilities			Willingness to pay	
	EQ-5D (n = 208)	VAS (n = 208)	TTO (n = 208)	Maximum WTP (n = 199)	Regression-adjusted WTP (n = 199)
Symptoms & feelings	−0.302**	−0.339**	−0.037	−0.034	−0.349**
Daily activities	−0.227**	−0.263**	−0.169*	0.053	−0.127
Leisure	−0.322**	−0.255**	−0.094	0.097	−0.039
Work & school	−0.207**	−0.167*	−0.032	0.022	−0.142*
Personal relationships	−0.238**	−0.253**	−0.122	0.066	−0.001
Treatment	−0.245**	−0.171*	0.009	0.001	−0.096
Overall DLQI score	−0.361**	−0.346**	−0.111	0.049	−0.182*

\* Statistically significant at the 0.05 level (2 tailed).

\*\* Statistically significant at the 0.01 level (2 tailed).

DLQI = Dermatology Life Quality Index; EQ-5D = EuroQOL-five dimensions; TTO = time trade-off; VAS = visual analog scale; WTP = willingness to pay.

**Table 6** Health state utilities, WTP, and their associations with the DLQI among patients with severe psoriasis.

	Health utilities			Willingness to pay	
	EQ-5D (n = 155)	VAS (n = 155)	TTO (n = 155)	Maximum WTP (n = 149)	Regression-adjusted WTP (n = 149)
Symptoms & feelings	−0.421**	−0.314**	−0.174*	−0.027	0.107
Daily activities	−0.361**	−0.262**	−0.159*	−0.084	0.115
Leisure	−0.379**	−0.263**	−0.153	0.013	0.243**
Work & school	−0.322**	−0.230**	−0.08	−0.071	0.069
Personal relationships	−0.208**	−0.121	−0.175*	0.021	0.032
Treatment	−0.236**	−0.146	−0.127	−0.024	0.315**
Overall DLQI score	−0.428**	−0.298**	−0.196*	−0.034	0.192*

\* Statistically significant at the 0.05 level (2 tailed).

\*\* Statistically significant at the 0.01 level (2 tailed).

DLQI = Dermatology Life Quality Index; EQ-5D = EuroQOL-five dimensions; TTO = time trade-off; VAS = visual analog scale; WTP = willingness to pay.

statement: “Disease has made the home dirty or treatment takes time.” This indicated that respondents with greater distress caused by treatment were not willing to give up more years of life in exchange for perfect health, which was possibly due to the convenience of accessing medical resources in Taiwan resulting from the nation's national health insurance program. This seems to indicate that the TTO is not a valid measure for reflecting the distress caused by psoriasis treatment.

The results of our study further showed that the maximum WTP had significant positive correlations with the “leisure” and “personal relationships” domains, and with the overall DLQI score. This suggests that, among Taiwanese psoriasis patients, the impacts of social activities on QOL were particularly well reflected in the maximum WTP. By contrast, Lundberg et al<sup>12</sup> found that only the “treatment” domain had a significant positive correlation with the maximum WTP. Furthermore, they found that the correlations of the other domains with the maximum WTP were not significant or were even negative.

The RA-WTP had significantly positive correlations with all the domains of the DLQI, which is largely consistent with the findings of previous studies.<sup>24,26</sup> Lundberg et al,<sup>12</sup> for example, found that the regression-based WTP had positive correlations with the DLQI domains; however, the correlations with the “work and school” and “personal relationships” domains did not achieve statistical significance. Nonetheless, the results of this study showed that the RA-WTP can be used to reflect the QOL in each DLQI domain among Taiwanese patients with psoriasis.

The mean and median RA-WTP values in our study were US\$218.9 and US\$249.5, respectively. These results are similar to the results reported by Lundberg et al<sup>12</sup> (US\$157.8–246.3 per month). By contrast, a study conducted by Finlay and Coles<sup>44</sup> showed that patients with severe psoriasis were willing to pay US\$6752.8 per month on average. This was much higher than the WTP of patients with severe psoriasis in our study. This disparity might have been due to (1) differences in disease severity, (2) differences in perceptions of QOL between developed and developing countries, and (3) the 15-year gap between the two studies.

When patients were divided into the three groups of mild, moderate, and severe psoriasis, the results indicated that the DLQI domains remained strongly correlated with the EQ-5D and VAS in the three patient subgroups; however, the correlations between the TTO and each DLQI domain changed after stratification by severity of disease. In patients with mild psoriasis, the TTO had significant negative correlations with only the “leisure” and “personal relationships” domains, as well as with the overall DLQI score. The TTO of patients with moderate psoriasis had a significant negative correlation only with the “daily activities” domain. For patients with severe psoriasis, the TTO had significant negative correlations with the “symptoms and feelings,” “daily activities,” and “personal relationships” domains, as well as with the overall DLQI score.

After stratification by severity of disease, an increased number of DLQI domains showed a significant positive correlation with the maximum WTP in patients with mild psoriasis. These were the “daily activities,” “leisure,” and “personal relationships” domains, in addition to the overall DLQI score. The maximum WTP and the DLQI domains were not significantly correlated in patients with moderate and severe psoriasis.

The RA-WTP and DLQI domains showed negative correlations and even achieved significant levels in patients with mild and moderate psoriasis. It might be that the RA-WTP was not applicable to patients with mild and moderate psoriasis; however, there were positive correlations of the RA-WTP with DLQI domains in patients with severe psoriasis. In particular, the “leisure” and “treatment” domains, as well as the overall DLQI score, achieved statistical significance. It could therefore be inferred that the RA-WTP is more applicable in measuring the QOL of patients with severe psoriasis.

In our study, the average score of the DLQI was 8.34 for all three disease severity levels combined. This was similar to the results of a German study in which the average score was 8.6.<sup>25</sup> The study conducted by Lundberg et al<sup>12</sup> in patients with mild psoriasis found that the average score of the DLQI was 5.93. This was similar to the results of our study, which showed the DLQI of patients with mild psoriasis to be 5.73. Our study also showed that disease severity was significantly correlated with most of the DLQI domains. The

degree of correlation between the PASI and DLQI found in the studies conducted by Touw et al<sup>45</sup> and Salek et al<sup>46</sup> on the efficacy of medications used by patients was also similar to that found in our study. Our study found that after other variables were controlled for; personal relationships of patients with moderate psoriasis were no worse than those of patients with mild psoriasis. This might have been due to the fact that personal relationships are a psychological indicator, while the PASI is a clinical indicator. The PASI is not a good indicator for predicting psychological QOL.<sup>47,48</sup> Therefore, the difference in scores in the domain of “personal relationships” of patients with mild and moderate psoriasis was not significant.

The severity of psoriasis was defined by the PASI in our study. However, there is some debate as to what defines mild, moderate, and severe psoriasis. In addition, the correlation of PASI scores with body surface area involvement is not linear, especially for lesions of < 10% of the body surface area. Although the participants in our study consisted of patients from northern, central, and southern Taiwan, they do not represent all the affected patients in Taiwan. The other limitation is that all the study participants were recruited from hospitals, and patients who seek treatment at hospitals may be different from those who receive treatment at private practices, from practitioners of Chinese medicine, or in pharmacies.

A high PASI score was associated with high DLQI scores. However, even with mild psoriasis, 39.4% of patients reported at least moderate effects on their QOL. A considerable overlap in terms of the WTP existed for moderate and severe psoriasis patients, which may reflect a similar effect on QOL among the two groups of patients. In addition, our results indicate that both the EQ-5D and the VAS can be chosen as measurement instruments for use in Taiwanese patients with psoriasis to assess the costs and consequences of treatment options. By contrast, the TTO seems to be a less valid instrument for distinguishing QOL among patients with psoriasis, especially those with mild psoriasis.

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