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ORIGINAL PAPER

Willingness to pay and quality of life in patients with pruritic skin disorders

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Abstract

Pruritic dermatosis is a frequent and burdensome disease. The objectives of this study were (1) to assess the willingness to pay (WTP) and the health-related quality of life (HRQoL) in patients with pruritic dermatoses and (2) to compare the results with data on socio-demographic data, and clinical features/symptoms of the patients. One hundred and three patients with pruritic dermatosis had participated in a non-interventional, cross-sectional study. Socio-demographic data, clinical features/symptoms, a health-related quality of life (HRQoL)-based and a dermatology-specific instrument (SF-6D and DLQI, respectively), and two utility indicators such as rating scale (RS) and time-trade-off (TTO) as well as willingness to pay (WTP) were recorded. In our study, there was a significant correlation between DLQI scores and WTP ($p < 0.001$). Time-trade-off (TTO) was also statistically correlated with SF-6D ($p = 0.001$). Regression models showed that daily duration and pruritus intensity were associated with lower HRQoL. Furthermore, WTP was the only measure revealing demographic and socio-economic characteristics such as age, education level, family status and income as predicting factors. No significant differences between groups of varying skin diseases were observed. HRQoL and WTP proved to be valid tools to assess the burden of disease in patients with pruritic dermatosis. However, further research with a larger number of patients is needed to validate the present findings.

Keywords Health-related quality of life · SF-6D · DLQI · Time-trade-off · Willingness to pay

Introduction

Skin diseases have been demonstrated to result in significant impairment in health-related quality of life (HRQoL), comparable with that of life-threatening diseases such as cancer, angina and diabetes [15, 24]. Pruritus is the most frequently described dermatological symptom, and is estimated to affect all patients with atopic eczema and urticaria, and 80% of psoriatic patients [30, 33]. The prevalence of acute pruritus is 8–9% in the general population. Chronic pruritus (> 6 weeks duration) seems to increase with age, and about 60% of the elderly suffer from mild to severe pruritus, implying a public health problem [33]. However, assessing pruritus severity is difficult because of its subjective and multidimensional nature. Various generic, dermatology-specific and disease-specific questionnaires have been used to evaluate its effect on HRQoL, but their interrelationships are generally unknown [8–11, 15, 20, 28, 34]. Furthermore, patient preferences for health states—known as utilities—are central to cost-utility analyses [10, 31], and can be elicited via specific preference-based instruments or through willingness to pay (WTP) valuation for application in cost-benefit analyses [1, 22].

The optimal method for eliciting preferences from patients with skin diseases remains undefined. Previously, EQ-5D, time-trade-off (TTO), rating scale (RS) and WTP have been successfully used in patients with psoriasis and atopic eczema [19, 26, 27, 32], acne [8] and port-wine stains [25]. In an effort to contribute to the debate on the most appropriate instrument type in this disease group, the objectives of this study were: (i) to examine the effects of pruritus

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on patients' preferences, i.e., health state utilities derived from SF-6D, RS and TTO, and on WTP, (ii) to assess the correlation among these measures, and the dermatology-specific instrument, dermatology life quality index (DLQI) and (iii) to detect potential correlations between all the measures of outcome and demographic, socio-economic and clinical factors.

Patients and methods

Study population

New consecutive patients visiting the dermatology outpatient clinic of University Hospital of Heraklion, and suffering from pruritus over a 4-month period were enrolled. Inclusion criteria were age +18 years and able to understand the Greek language. After providing written informed consent, the patients were interviewed in a quiet office, in a standardized manner by the same investigator. The survey consisted of two parts: a self-administered survey and a face-to-face interview, to minimize data bias. The self-administered component included socio-demographic questions (gender, age, marital status, level of education, profession/occupation, residence and annual household income) and the Greek versions of the SF-6D and DLQI. The face-to-face interview included the measurement of health state utilities (HSU), medical history and pruritus assessment. The study was approved by the ethics committee of the hospital.

Instruments and data collection

The SF-6D uses 11 items from the widely used generic Short Form-36 Health Survey to form six dimensions (physical functioning, role participation, social functioning, bodily pain, mental health, vitality). Responses are converted to a utility score by means of available preference weights obtained from a sample of the UK general population using the standard gamble (SG) valuation technique [7], ranging from 0.296 to 1 (full health). The Greek version has been shown to have good psychometric properties [18]. The DLQI is a widely used, dermatology-specific questionnaire consisting of ten questions covering six domains (symptoms, daily activities, leisure, work/school, personal relationships and treatment). The total score can range from 0 to 30 and the higher the score, the greater the disability [4, 12].

The TTO method employed in the present study was modified, compared to standard practice, to provide the patient with an easier imaginable time frame. Specifically, patients were asked to choose between living for 10 years in their current health state with pruritus or receiving an imaginary therapy that would cure the problem. A (hypothetical) prerequisite for taking this therapy would be to "sacrifice" life years in exchange for receiving therapy. The elimination task was framed as a dichotomous "yes/no" choice. The 10-year time horizon was visually represented on a horizontal calibrated line, on which willing patients were asked to mark the number of years they would agree to trade off. The HSU score was then calculated by dividing the number of remaining years, without pruritus, by 10. The more years the patient was willing to "offer", the higher the perceived burden of pruritus on HRQoL. The RS method was implemented by asking pruritus patients to value their current health, by placing a mark on a 10 cm calibrated line anchored by 0 (death) and 10 (perfect health). The HSU was obtained by dividing the number on the scale by 10.

Given that WTP studies are, to date, practically unknown in the Greek medical community and also considering the generally low educational and income level of the patients in our sample, it seemed important that the elicitation format not create suspicions about the intent of the survey. The participants were first asked whether they would be hypothetically willing to pay, out of pocket and with no support from insurance, for a new treatment that could immediately and completely cure their health problem, without side effects. It was emphasized that this was only hypothetical and that no payments whatsoever would be requested. This dichotomous question was followed by an open-ended question, where the respondent was asked to state the maximum amount he would be willing to pay to be relieved of pruritus. Patients were instructed to consider that paying this amount would imply that other needs might not be satisfied and to try to respond realistically. The choices were marked on a predefined payment scale of unequally spaced prices (100 €, 500 €, 2000 €, 5000 €, 7500 €, 10,000 €). A higher WTP value was perceived as a higher symptom burden. WTP was also calculated as a percentage of annual household income, because WTP values may vary by ability to pay [19, 27].

Finally, medical history data, including diagnosis, comorbidities and clinical characteristics of pruritus were collected. To assess objective disease severity, eczema area and severity index (EASI) in patients suffering from eczema, and psoriasis area and severity index (PASI) in psoriatics were used. Collected clinical characteristics included duration (months), frequency (daily, three times a week, once weekly), daily duration (< 6 h, 6–12 h, 12–18 h, all day), time of day (morning, evening, night), sleep disturbances (awakening, sleeplessness), body surface area affected as percentage calculated using the Wallace rule of nines, intensity assessment with verbal description (mild, moderate, severe), and VAS 0–10 intensity rating.

Analysis

Categorical variables were presented as absolute and relative frequencies, whereas continuous variables via means,

standard deviations and medians. As data were skewed, non-parametric methods were applied. Chi-square test was used to compare data from dichotomous methods and socio-demographic and clinical factors, and Mann–Whitney or Kruskal–Wallis tests for independent group comparisons of continuous variables. Correlations between instrument dimensions and/or scores were assessed. A multivariate regression was carried out to determine the most significant predictors of patients' preferences. A two-tailed significance level of 0.05 was used and analyses were performed with SPSS for Windows (version 21.0; SPSS, Chicago, IL, USA).

Results

One hundred and three patients (mean age 58.8 years, range 18–88) were recruited to participate in the study, with a 93.6% response rate (103 out of 110 patients) (Table 1). Most respondents were female (55.3%), married (77.7%) and retired (51.5%), while only 18.4% were currently employed. Over half (58.3%) had completed only primary school and 57.3% had an annual income under 10,000 €. Clinical data is summarized in Table 2. Twenty different skin diseases were represented in the study population. The most frequent were eczema (31.1%, mean EASI score 12.6) and psoriasis (23.3%, mean PASI score 13.9). In 62% of the patients, comorbidities were documented (cardiovascular diseases, asthma, diabetes). The mean duration of pruritus was 19.2 months, and most patients experienced pruritus < 6 h per day (46.6%) and on a daily basis (75.7%). The majority experienced it at night (29.3%) and complained of severe itch (54.4%) or rated it between 6 and 10 in the VAS assessment (68.0%). Associated sleep disturbances such as awakening (18.1%) and sleeplessness (13.4%) were noted.

As presented in Table 3, the mean SF-6D score was 0.71 ± 0.12 (median 0.70, IQR 0.17), and statistically significant score differences were observed with duration: patients with chronic pruritus showed a higher impairment of HRQoL than patients with acute itch ($p = 0.014$); duration per day: scores were significantly worse in subjects with pruritus 12–18 h per day versus < 6 h ($p = 0.022$); intensity: statistically significant difference was noted between severe and moderate pruritus ($p = 0.004$). Accordingly, the mean DLQI score was 9.22 ± 5.8 (median 8, IQR 7), and differences were in the expected directions and significant for by duration per day, particularly between duration whole day versus < 6 h ($p < 0.001$) and intensity: between severe and moderate pruritus ($p = 0.004$).

The mean RS utility score was 0.77 ± 0.15 (median 0.8, IQR 0.2), i.e., on average patients rated their current health with pruritus equivalent to 77% of perfect health. There was a significant independent association between lower RS values and comorbidities ($p = 0.006$) and malignant skin disease ($p = 0.006$). Similarly, the mean TTO score was 0.88 ± 0.23, i.e., on average patients were willing to trade up to 1.2 years of the future decade, to obtain 8.8 years of perfect health without pruritus. Significant differences were observed with pruritus characteristics, duration per day and intensity, i.e., TTO values obtained from participants of up to 6 h duration versus whole day ($p = 0.001$) and between those with severe versus mild pruritus ($p = 0.033$).

On average, patients were willing to pay 1239 ± 2474 € for a hypothetical treatment that would relieve them of pruritus (median 100 €, IQR 1000 €). It is interesting that a significant association between WTP values and some socio-demographic factors were observed, such as age, marital status, education and income. Younger patients (18–40 years) demonstrated a significantly greater WTP than patients over 65 years with the dichotomous choice method ($p = 0.028$). However, when WTP was calculated as an absolute value and as a proportion of annual income, there was no significant age difference recorded. Higher WTP values were

Table 1 Socio-demographics of study patients (N = 103)

Characteristics	*N* (%)
Age (mean ± SD), median (IQR)	58.8 ± 17.3, 63 (45.7)
Gender, female	57 (55.3)
Age (years)	
18–40	19 (18.4)
41–60	28 (27.2)
61+	56 (54.4)
Marital status	
Married	80 (77.7)
Divorced/widowed	14 (13.6)
Single	9 (8.7)
Education	
Primary school	60 (58.3)
Secondary/high school	28 (27.2)
University	15 (14.5)
Occupational status	
Employed	19 (18.4)
Retired	53 (51.5)
Housekeeping	15 (14.6)
Unemployed	16 (15.5)
Residence	
Rural	53 (51.5)
Urban	50 (48.5)
Annual household income (€)	
< 10,000	59 (57.3)
10,000–19,999	35 (34.0)
20,000–39,999	7 (6.7)
40,000–79,999	1 (1.0)
> 80,000	1 (1.0)

Table 2 Clinical characteristics of pruritus and dermatological diagnoses of patients and instrument scores

Characteristics	*N* (%)	Diagnosis	*N* (%)
Frequency		Eczema	32 (31.1)
Daily	78 (75.7)	Psoriasis	24 (23.3)
3 times a week	24 (23.3)	Urticaria	11 (10.7)
Once a week	1 (1)	Bullous pemphigoid	7 (6.8)
Duration per day		Lichen planus	5 (4.9)
< 6 h	48 (46.6)	Cutaneous T lymphoma	4 (3.9)
6–12 h	34 (33)	Lupus erythematosus	3 (2.9)
12–18 h	14 (13.6)	Prurigo	3 (2.9)
Whole day	7 (6.8)	Stevens–Johnson syndrome	3 (2.9)
Time of day		Actinic keratoses	2 (1.9)
Morning	54 (23.3)	Basal cell carcinoma	2 (1.9)
Evening	37 (15.9)	Squamous cell carcinoma	1 (1)
Night	68 (29.3)	Dermatofibroma	1 (1)
Sleeplessness	31 (13.4)	Others	5 (5)
Awakening	42 (18.1)		
Intensity		Prognostic category	
Mild	12 (11.7)	Benign skin disease	98 (95.1)
Moderate	35 (34)	Malignant skin disease	5 (4.9)
Severe	56 (54.4)		
Intensity (VAS)		Instrument scores	(Mean ± SD), median
1–2	3 (2.9)	SF-6D	0.71 ± 0.12, 0.7
3–4	11 (10.7)	DLQI	9.22 ± 5.80, 8.0
5	19 (18.4)	RS	0.77 ± 0.15, 0.8
6	9 (8.7)	TTO	0.88 ± 0.23, 1.0
7	17 (16,5)	WTP	1239 ± 2474, 100.0
8	14 (13.6)		
9	16(15.5)		
10	14 (13.6)		
	(Mean ± SD), median		
Duration (months)	19.2 ± 28.7, 6.0		
Body surface area	18.9 ± 17.6, 11.5		
EASI ($N=32$)	12.60 ± 9, 9.0		
PASI ($N=24$)	13.90 ± 13, 9.8		

VAS visual analogue scale, *EASI* eczema area and severity index, *PASI* psoriasis area and severity index, *SF-6D* short-form six-dimension, *DLQI* dermatology life quality index, *RS* rating scale, *TTO* time-trade-off, *WTP* willingness to pay

observed from single patients ($p=0.016$), more educated ($p=0.022$) and with annual income > 20,000 € ($p=0.001$). Significant differences were also found with pruritus characteristics, such as frequency (daily occurrence compared with once weekly, $p=0.027$), daily duration (< 6 h and 6–12 h, $p<0.0005$) and intensity with the dichotomous method ($p=0.020$). On the other hand, no significant differences were found, with any measurement method, between groups of differing skin diseases (eczema, psoriasis, other skin disease), e.g., RS eczema 0.73 versus psoriasis 0.75 ($p=0.194$), TTO eczema 0.9 versus psoriasis 0.88 ($p=0.779$), WTP eczema 1574 versus psoriasis 1245 ($p=0.775$).

Spearman's correlation coefficients between instruments, utilities and WTP are presented in Table 4. There was a statistically significant correlation between SF-6D and DLQI (rho = − 0.617, $p<0.001$). Additionally, all correlations between SF-6D and other measurement methods were also significant and in the expected direction: RS (rho = 0.414, $p<0.001$), TTO (rho = 0.317, $p=0.001$); WTP (rho = − 0.196, $p=0.048$). Similarly, the DLQI was found to be significantly correlated with HSU and WTP: RS (rho = − 0.313, $p=0.001$); TTO (rho = 0.310, $p=0.001$) WTP (rho = 0.422, $p<0.001$). An insignificant correlation was noted only between RS and TTO scores (rho = 0.124, 0.212). Correlations between DLQI dimensions and HSU

Table 3 Instrument scores by socio-demographic and clinical characteristics

	SF-6D (SD)	DLQI (SD)	RS (SD)	TTOd *N* (%)	TTO (SD)	WTPd *N* (%)	WTP (SD)
Age, years							
18–40	0.68 (0.12)	10.15 (6.39)	0.83 (0.17)	6 (31.6)	0.83 (0.32)	18 (94.7)	773 (823)
41–60	0.73 (0.12)	9.35 (5.83)	0.77 (0.11)	8 (28.6)	0.94 (0.11)	20 (71.4)	1378 (2757)
> 61	0.70 (0.11)	8.89 (5.63)	0.74 (0.16)	16 (28.6)	0.88 (0.11)	35 (62.5)	1326 (2702)
p-sig	0.682	0.631	0.053	0.924	0.792	**0.028**	0.239
Marital status							
Married	0.71 (0.11)	9.23 (5.91)	0.76 (0.16)	25 (31.3)	0.90 (0.21)	59 (73.8)	1270 (2540)
Divorced/ widowed	0.68 (0.14)	8.35 (5.86)	0.76 (0.11)	2 (14.3)	0.87 (0.29)	6 (42.9)	335 (632)
Single	0.70 (0.13)	10.77 (4.73)	0.78 (0.13)	3 (33.3)	0.81 (0.34)	9 (100)	2366 (3281)
p-sig	0.784	0.265	0.813	0.418	0.818	**0.009**	**0.016**
Education							
Primary	0.71 (0.11)	9.0 (5.49)	0.75 (0.16)	16 (26.7)	0.87 (0.26)	35 (58.3)	1056 (2365)
Secondary	0.71 (0.11)	9.10 (5.73)	0.76 (0.15)	9 (32.1)	0.88 (0.21)	24 (85.7)	1367 (2648)
University	0.68 (0.14)	9.10 (5.73)	0.85 (0.07)	5 (33.3)	0.92 (0.15)	14 (93.3)	1726 (2653)
p-sig	0.766	0.841	0.064	0.897	0.875	**0.004**	**0.022**
Annual income							
< 10,000€	0.67 (0.10)	9.10 (5.46)	0.78 (0.14)	16 (27.1)	0.88 (0.24)	36 (61)	750 (1998)
10,000–20,000 €	0.73 (0.14)	9.65 (6.27)	0.74 (0.17)	12 (34.3)	0.88 (0.25)	29 (82.9)	1465 (2456)
> 20,000 €	0.70 (0.09)	8.66 (6.55)	0.76 (0.08)	2 (22.2)	0.96 (0.07)	9 (100)	3555 (3924)
p-sig	0.369	0.798	0.518	0.679	0.898	**0.011**	**0.001**
Duration							
< 1.5 mo	0.77 (0.13)	8.82 (6.10)	0.78 (0.12)	4 (23.5)	0.90 (0.24)	11 (64.7)	1564 (2682)
> 1.5 mo	0.69 (0.11)	9.33 (5.75)	0.76 (0.15)	26 (30.2)	0.88 (0.23)	62 (72.1)	1174 (2441)
p-sig	0.014	0.351	0.681	0.772	0.799	0.772	0.643
Frequency							
Daily	0.70 (0.12)	9.69 (5.68)	0.76 (0.15)	25 (32.1)	0.87 (0.24)	61 (78.2)	1378 (2551)
3times/week	0.70 (0.10)	8.0 (6.0)	0.80 (0.12)	3 (27.3)	0.86 (0.30)	6 (54.5)	1481 (3191)
Once/week	0.76 (0.10)	7.38 (6.31)	0.80 (0.17)	2 (15.4)	0.96 (0.09)	6 (46.2)	292 (687)
p-sig	0.274	0.120	0.441	0.582	0.523	**0.012**	**0.027**
Duration per day							
< 6 h	0.74 (0.11)	6.93 (3.81)	0.80 (0.12)	8 (16.7)	0.96 (0.10)	25 (52.1)	700 (1761)
6-12 h	0.70 (0.11)	9.70 (6.21)	0.75 (0.15)	13 (38.2)	0.89 (0.18)	27 (79.4)	1298 (2806)
12–18 h	0.64 (0.09)	14.42 (6.64)	0.67 (0.18)	5 (35.7)	0.90 (0.16)	14 (100)	2700 (3477)
Whole day	0.69 (0.15)	12.57 (5.41)	0.81 (0.15)	4 (57.1)	0.34 (0.47)	7 (100)	1728 (1612)
p-sig	**0.022**	**< 0.001**	0.054	**0.047**	**0.001**	**< 0.001**	**< 0.001**
Intensity							
Mild	0.72 (0.12)	7.33 (5.81)	0.85 (0.07)	0 (0)	0 (0)	5 (41.7)	1258 (2868)
Moderate	0.75 (0.10)	7.65 (5.02)	0.78 (0.13)	10 (28.6)	0.93 (0.12)	23 (65.7)	808 (1858)
Severe	0.69 (0.16)	10.66 (5.94)	0.74 (0.17)	20 (35.7)	0.83 (0.26)	45 (80.4)	1503 (2716)
p-sig	**0.004**	**0.004**	0.110	**0.047**	**0.033**	**0.020**	0.129
Comorbidities							
With	0.70 (0.11)	9.46 (5.97)	0.74 (0.14)	21 (32.8)	0.87 (0.25)	44 (68.8)	1087 (2285)
Without	0.71 (0.12)	8.89 (5.54)	0.81 (0.15)	9 (23.10)	0.91 (0.20)	29 (74.4)	1487 (2768)
p-sig	0.696	0.772	**0.006**	0.406	0.209	0.701	0.500
Prognostic category							
Benign	0.70 (0.12)	9.55 (5.9)	0.75 (0.15)	27 (28.7)	0.89 (0.22)	69 (73.4)	1312 (2565)
Malignant	0.73 (0.09)	6.11 (3.3)	0.88 (0.09)	3 (33.3)	0.87 (0.34)	25 (26.6)	466 (870)
p-sig	0.480	0.064	**0.006**	0.718	0.754	0.149	0.112

Table 3 (continued)

Statistical significant values are in bold

SF-6D short-form six-dimension, *DLQI* dermatology life quality index, *RS* rating scale, *TTO* time-trade-off, *TTOd* time-trade-off dichotomous choice, *WTP* willingness to pay, *WTPd* willingness to pay dichotomous choice

Table 4 Spearman's correlation coefficients between SF-6D, DLQI, DLQI dimensions, RS, TTO and WTP

	DLQI	RS	TTO	WTP	WTP%
SF-6D	−0.617***	0.414***	0.317***	−0.196*	0.212*
DLQI	1	−0.313***	0.310***	0.422***	0.448***
Symptoms		−0.191	−0.314***	0.366***	0.393***
Daily activities		−0.159	−0.272**	0.290**	0.316***
Leisure		−0.303**	−0.222*	0.303**	0.316***
Work/school		−0.193	−0.313***	0.233*	0.255**
Personal relationships		0.292**	0.029	0.345***	0.355***
Treatment		−0.168	−0.087	0.136	0.129
RS		1	0.124	−0.206*	−0.196*
TTO score			1	−0.282**	−0.315***
WTP				1	0.986***
WTP proportion					1

*$p<0.05$, **$p<0.01$, ***$p<0.001$

and WTP were also assessed. WTP was significantly correlated with all DLQI dimensions except treatment, as was the TTO method, which was not correlated to personal relationships as well. Less significant relationships were noted for the RS, which was significantly correlated only with leisure and personal relationships.

Moreover, while TTO and WTP were found to be significantly correlated, it is interesting that with the dichotomous questions of WTP, 73 (70.8%) respondents were willing to pay compared with only 30 (29.1%) who were willing to trade-off life years with the TTO technique.

We also evaluated the preference-based values in subgroups of the two most frequent dermatoses, namely eczema and psoriasis. Regarding clinical disease severity, significant differences were found between mild (EASI < 10) and moderate-to-severe eczema (EASI > 10) with TTO scores ($p=0.035$) and WTP values ($p<0.001$). There were no significant differences with the RS. In the case of psoriasis, no significant differences with RS, TTO and WTP were noted between mild (PASI < 10) and moderate-to-severe psoriasis (PASI > 10). Finally, regarding comorbidities, there were no significant differences with RS, TTO and WTP between eczema or psoriasis patients without and with comorbidities.

The multivariate regression analysis using a stepwise variable inclusion method revealed some predictors of preference elicitation methods (Table 5). There was a significant association between lower RS scores and prolonged daily duration of pruritus (> 12hs) ($\beta=-0.091$, $p=0.028$), as well as with presence of comorbidities ($\beta=-0.067$, $p=0.045$). Conversely, a significant association between higher scores and university level of education was found ($\beta=0.082$, $p=0.05$). For TTO, there was a significant inverse relationship with rural residence ($\beta=-0.079$, $p=0.021$), whole day duration of pruritus ($\beta=-0.583$, $p<0.001$) and disturbance of sleep manifested as sleeplessness ($\beta=-0.137$, $p<0.001$). As for WTP, higher values were significantly associated with male gender ($\beta=1260$, $p=0.003$), income exceeding 20,000 € ($\beta=3178$, $p<0.001$), as well with experiencing pruritus in the morning ($\beta=1343$, $p=0.003$) and when it provokes sleeplessness ($\beta=2227$, $p<0.001$).

Discussion

Problems associated with pruritus include discomfort, difficulty in wearing clothes, sleep impairment and emotional embarrassment. Furthermore, it is associated with high direct and indirect costs, particularly affecting families with lower income [30]. Direct costs are related to consumption of medical care and prescribed drugs and over-the-counter products such as creams and lotions and indirect costs are due to loss of productivity or enjoying leisure activities. However, pruritus is still an underestimated health condition, especially when focusing on HRQoL. To capture the full range of HRQoL aspects of a patient, a dermatology-specific instrument should be used alongside a generic questionnaire [12, 14, 14]. Preference-based methods, such as HSU measures and WTP provide a more individualistic approach which takes into consideration each patient's

Table 5 Linear regression models of patient preferences

Preference measure	β Coefficients									Final model	
	Male gender	University level	Rural residence	Income > 20,000€	Daily duration of pruritus	Sleeplessness	Occurrence in morning	Comorbidity	Constant	R^2	F
RS		0.082*			> 12 h, −0.091*			−0.067*	0.77	0.192	5.8***
TTO			0.079*		All day, −0.583***	−0.137***			1.01	0.496	32.4***
WTP€	1260***			3178***		2227***	1343***		−977	0.345	12.9***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

unique "life plan". Utility is defined as the level of desirability that people associate with a particular outcome when faced with uncertainty, and the values for particular health state descriptors may come from patients or from society [1, 10, 31].

We used two validated questionnaires and three preference-based techniques to assess HRQoL of patients with pruritus and skin diseases. Significant correlations, in the expected direction, were found between SF-6D, DLQI, TTO and WTP, however, this does not imply that they are measuring the same aspects of HRQoL, but rather suggesting that the underlying constructs overlap to some extent. TTO was more strongly correlated to the generic SF-6D, whereas WTP was more closely related with the DLQI. This may be because TTO measured mostly overall health status, whereas WTP was more skin condition directed [19]. In addition, an insignificant correlation was noted between RS and TTO. Accordingly, TTO and WTP may be more appropriate for measuring pruritus.

In accordance with previous studies, the different methods of indirect and direct utility measurement yielded different results for the same health state [1]. The mean TTO score yielded the highest value (0.88), followed by RS (0.76) and SF-6D (0.71), but the score differences from the three methods were not significant. A possible explanation could be that generic questionnaires do not assess positive aspects of lives that would boost utility values (benefits from family, friends, work) [1]. In addition, and since most participants were reluctant to trade years, the RS yielded lower scores than TTO.

The preferred method for eliciting preferences remains controversial. The TTO has roots in decision theory and was developed by Torrance as an alternative to the SG, but under the condition of certainty [31]. RS has a weaker theoretical underpinning than SG and TTO, since the rating is made under the condition of certainty and there is no trade off. As a consequence, RS gives "values" rather than "utilities". In our study, RS was not significantly correlated with TTO, and was significantly influenced by comorbidities. WTP appears to be a promising measure used both for assessing patients' HRQoL and also for health economic evaluations. As expected, income was significantly related to WTP [27]. Because WTP may be biased by individual ability to pay and, to minimize this problem, in our study WTP was also calculated as a percentage of annual income.

We evaluated whether various demographic and clinical factors affected the instruments' scores. In general, persistent and intense pruritus that continued during the day or/and can worsen at night, leading to sleep impairment, were the most important clinical characteristics with an impact on the HRQoL of patients. Moreover, a significant association was found between WTP and age, marital status, education

and income. This most likely reflects the fact that single patients with pruritus in the 18–40 age group, and with a higher education level experience more problems, possibly related to their expectations of establishing social relationships, entering the workforce and focusing on their career and their finances, aspects of life not captured with the other instruments.

Preferences for health outcomes are affected by framing effects, context, duration of disease, individual's values and attitudes towards risk [1, 16]. In our population, the patients were unwilling to trade many life years, as suggested by the ceiling effect of the TTO score. This fact may be an indication of patients' adversity to trade life years and/or that it is more common for people with pruritus to understand money rather than time. The high mean TTO score could be due to religious factors or a coping mechanism, where patients with chronic conditions learn to adapt to their situation. In contrast, we believe that WTP approach has promise in patients with pruritus, because our participants seemed willing to trade money for health. Notably, significantly higher WTP was observed from a sample of 504 dialysis patients with similar socio-demographic characteristics in Greece [16], whereas this finding was not identified from a similar population in Canada [21]. It is known that the HRQoL of hemodialysis patients is among the worst reported for chronic medical conditions [6].

Previous studies have provided elicitation of patients' preferences in skin diseases, such as preferences for treatment options [8, 25], preferences for different health states and/or for different health state domains [19, 26, 27]. However, they generated some inconsistent findings in patients with eczema and psoriasis. Lundberg et al. reported a significant correlation between DLQI scores and TTO utilities [19]. In contrast, Schmitt et al. found that TTO values were independent of the impact on HRQoL with DLQI [26]. The WTP method was significantly correlated with DLQI scores [19, 26] in both studies.

The main problem with the data reported in similar studies is the lack of utilities for specific health states. Zug et al. assessed utilities of mild, moderated and severe psoriasis by means of the TTO technique and Schmitt et al. between controlled and uncontrolled eczema and psoriasis in patients and in participants from the general population. No mention on health condition of pruritus was noted [26, 36]. Pruritus was found to be a significant predictor of sleep interference in patients with psoriasis with profound impact on HRQoL [29] and people affected by atopic eczema are usually restless in their sleep and wake up more often because of pruritus [28]. Recently, Zhu at al. suggested that pruritus is an important mediator in psoriasis between disease severity and HRQL, and improvement in PASI that do not include improvement in pruritus might have limited impact on HRQL benefits [35]. In our population, statistically significant differences were found between mild and moderate-to-severe eczema with TTO scores and WTP values. This finding could be explained by the fact that pruritus is a cardinal symptom of eczema, and its severity reflects on eczema severity [3].

To the best of our knowledge, this is the first study that has assessed the correlation between willingness to pay (WTP) and pruritus. Previous published studies had assessed WTP and psoriasis [9], atopic dermatitis [5], port-wine stains[25], vitiligo [23], melanoma [2, 17] and scar length [13] but not pruritus. Our results showed that patients with pruritus were willing to pay 1239 ± 2474 € for a hypothetical treatment that would relieve them of pruritus (median 100 €, IQR 1000 €) that is higher than that in other studies assessing WTP and psoriasis [9], atopic dermatitis [5], acne [8], port-wine stains[25], melanoma [2, 17] and scar length [13] but lower than a study that assessed WTP and vitiligo [23]. The WTP in our study had a significant positive correlation with the DLQI which is largely consistent with previous studies assessing WTP and other skin disorders [2, 5, 9, 17, 23, 25]. In our study, WTP was positively correlated with annual income > 20,000 €, higher education, younger patients and single patients. Our study also looked into frequency and intensity of symptoms of pruritus that was not previously assessed by other studies and found significant positive correlations with WTP.

In conclusion, we have demonstrated the feasibility of measuring TTO and WTP in patients with pruritus and skin diseases. A benefit of HSU and WTP is their ability to be compared with other disease states. Knowledge of patient preferences may improve compliance with therapy, by incorporating patient's expectations into medical decision making. Our study has some limitations. The small number of subjects when divided by diagnoses limited our analyses. However no statistically significant differences between groups of skin diseases (eczema, psoriasis, other disease) were found. Another point of view is to consider that the reliability and validity of preference-based methods could vary in a cross-culture context, and the compatibility of results to those from other countries is limited. More research involving a broader range of skin diseases, as well as different health states of each skin disease such as association of pruritus should be considered with patients and community-based samples, expecting to see much more from this field in the near future.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed consent Informed consent was obtained from all the participants in this study.

Ethical approval Ethical approval was obtained for this study.

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