

Willingness to pay and quality of life in patients with atopic dermatitis

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Abstract Atopic dermatitis (AD) is a frequent and burdensome disease. The objectives of this study were (1) to assess the willingness to pay (WTP) and quality of life (QoL) in AD patients and (2) to compare the results with data on other chronic skin diseases. To collect data, a non-interventional, cross-sectional nationwide postal survey on adult patients with clinically diagnosed AD was performed; socio-demographic data, clinical features/symptoms, WTP and QoL were recorded. WTP was assessed in three different approaches, including relative and absolute figures. Data from $n = 384$ AD patients (mean age 42.0, range 18–92, 69.8 % female) were analyzed. WTP for complete healing was on median €1,000 (average €11,884) and exceeded WTP in rosacea (median €500) but not in vitiligo (median €3,000). Mean Dermatology Life Quality Index (DLQI) was 8.5 (vitiligo 7.0; psoriasis 6.7; rosacea 4.3) and correlated with pruritus, xerosis and disturbed sleep. WTP and DLQI correlated only marginally ($r_s = 0.134$, $p = 0.01$). In conclusion, AD patients show high WTP and markedly reduced QoL compared to other chronic skin diseases.

Keywords Atopic dermatitis · Atopic eczema · Quality of life · Willingness to pay · Dermatology life quality index · EQ-5d

Introduction

Atopic dermatitis (AD) is a common chronic inflammatory skin disease with a complex, multifactorial pathogenesis and a strong association to other atopic disorders such as allergic rhinitis and bronchial asthma [2]. Over the last three decades, industrialized countries face an increased AD prevalence by 2–3 folds.

While in children and adolescents prevalence rates between 7.4 and 37 % have been reported [1, 12, 16, 22, 30, 34], a recent study on German employees revealed an AD prevalence of 1.4 % in adults [3]. In the vast majority of cases, the first symptoms of AD appear in early childhood; before 5 years of age, 85 % of AD patients are already affected [16]. Clinical features including facial lesions and characteristic symptoms such as e. g., intense pruritus, skin dryness, sleep disturbances negatively influence both physical and psychosocial wellbeing [11]. In addition, the lack of causal treatments can still increase patients' frustration. Undoubtedly, AD is difficult to manage which contributes to the considerable disease burden for patients and their relatives [9, 15]. Various studies reflect the negative effect of AD on patients' psychosocial life [10, 11, 24] with some studies showing an association of AD and psychiatric comorbidities such as anxiety disorders and depression [7, 32].

A complete medical assessment should include patients' health-related quality of life (HRQoL), which nowadays plays a crucial role in decision-making and for the evaluation of the therapeutic outcome. Well-established disease specific (DLQI) [14] and generic (EQ-5d) [13] QoL tools exist for the assessment of HRQoL which have already been applied to AD [21, 27]. Besides the substantial morbidity related to AD, relevant direct and indirect costs for the payers, the patients and society arise from this disorder. In times of global

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financial crises, massive economic pressure on national health care systems and severely limited economic resources, cost benefit analyses by measuring health utilities are crucial for health policy making and resource allocation. Willingness to pay (WTP), defined as the amount of money an individual is willing to spend in a hypothetical scenario to achieve a complete sustainable cure has been assessed in various dermatological disorders to measure patient-defined utilities [6, 8, 20, 23, 26, 29]. First data on the WTP in AD have already been published showing a considerable WTP in this population [20, 25, 29, 31]. However, most of the studies were performed in selected patient populations only or in restricted regions. While most authors measure the absolute WTP which may depend on patients income, only one study on a small number of patients ($n = 6$) reported results of the relative WTP in an AD population. This potentially non-salary dependent concept deserves further exploration to differentiate the association between the relative WTP and both patients' income and HRQoL, respectively. In the present study, the WTP of AD patients has, for the first time, been investigated with the approach of relative WTP in a larger population and compared to other chronic skin diseases such as vitiligo, psoriasis and rosacea on a national level. Thus, the objectives were (1) to assess WTP in AD with three different approaches (absolute sum (total)/absolute sum per month/percentage of the monthly income patients were willing to spend for complete cure) and (2) to compare the results with other chronic skin diseases such as vitiligo, psoriasis and rosacea.

Materials and methods

Study design

This non-interventional, cross-sectional study on patients with AD was performed throughout Germany using a standardized questionnaire. Addresses of the participants were obtained from "Deutscher Neurodermitis Bund" (German atopic dermatitis league). This organization is the largest AD patient advocacy group in Germany. Membership is voluntary and obtained by simple application. Patients with AD aged ≥ 18 years were enrolled in this study after having granted written informed consent. An excess of 3,080 questionnaires was sent to all patients identified and to the local patient advocacy groups nationwide. Prior to the study, the approval of the ethics committee of the State Medical Council Hamburg was obtained.

Study questionnaire

First, sociodemographic and clinical data including age, gender, weight, employment status, educational level, AD-

related symptoms, duration of disease, family history and comorbidities were addressed. The extent of the AD lesions was recorded using a validated, grid-lined body scheme [33] which consisted of 1,426 grid points. Based on the percentage of marked points, the affected body surface area was calculated. Patients assessed the intensity of the symptoms of nine different body areas (e.g., face, neck, genital area) on a five step scale ranging from 0 (not affected) to 4 (extremely affected).

WTP was recorded by three standardized questions revealing the amount of money patients were willing to pay:

- Absolute sum (open question) to achieve a complete cure.
- Absolute sum patients were willing to spend per month for a complete healing (nine predefined categories: no payment, up to €50, up to €100, up to €150, up to €200, up to €250, up to €300, up to €400, more than €400).
- Percentage of the patient's monthly income to obtain cure whilst the payment is executed (possible answers 0–10, 10–20, 20–30, 30–40, 40–50, 50–60 %, more than 60 %).

HRQoL was measured using the EuroQol visual analogue scale (EQ-5d VAS) [13] and the German version of the Dermatology Life Quality Index (DLQI) [4].

Comparator groups

Comparative data on QoL and WTP in psoriasis, vitiligo and rosacea were obtained from three nationwide studies in non-selected patient cohorts from the respective advocacy groups [6, 18, 26]. Mean age was 44.4 ± 14.2 years (national survey on 1,023 patients with vitiligo) [26], 55.8 ± 11.9 (national survey on 475 rosacea patients) [6] and 57.0 ± 11 years (national survey on 2,449 patients with psoriasis) [18], respectively, the proportion of female patients was 71.5 [26], 79.9 [6] and 44.8 % [18].

Statistical analysis

For all parameters, descriptive statistics were calculated including mean, median and the scattering (SD, range). Statistical correlation analyses were performed by the Spearman's rank test. In addition, multiple regression models were calculated to predict quality of life, health state and WTP by pruritus, skin dryness, sleep disturbances, age, gender, facial involvement, genital involvement and affected body surface. In the case of a metrical dependant variable (QoL and health state), a linear multiple regression was calculated. WTP as dependant variable was first dichotomized by median cut and then a binary logistic regression was performed. All statistical tests were two

tailed and the alpha level was set at 5 % ($p \leq 0.05$) and, for high significance, at 0.1 % ($p \leq 0.001$). The statistical assessments were performed with SPSS version 18.0 (SPSS, Chicago, IL, USA).

Results

A total of 550 questionnaires were returned to the study center. Of these, 35 questionnaires were not completed and 131 were excluded because of lack of inclusion criteria, in most cases because patients being ≤ 18 years of age. Thus, data of 384 adult patients with diagnosed AD were included in the analysis. The mean age of the participants was 42.0 years (± 14.3 , range 18–92), 69.8 % ($n = 263$) were female (Table 1).

Almost half of the patients ($n = 152$, 48.9 %) reported an onset of the AD symptoms at the age of 10 years or less. The mean duration of AD disease (starting with the first onset of symptoms) was 28.2 ± 15.8 years ranging

from 1 to 76 years. On average, 9.7 % of the body surface area of the participants was affected by AD lesions with the hands (2.2 ± 1.3 , scale 0–4), the upper extremity (2.1 ± 1.1), the face (2.0 ± 1.2) and the neck (2.0 ± 1.3) being the most intensely affected regions. First grade relatives of almost fifty percent of the patients (46.8 %) also suffered from AD.

Willingness to pay

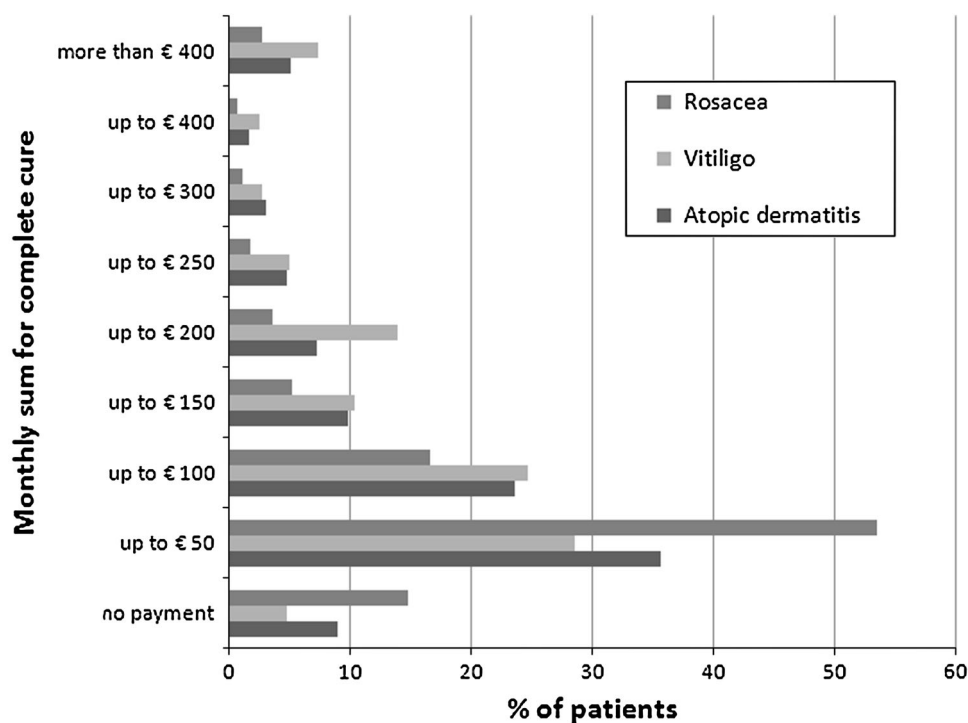
On average, patients with AD would pay €1,000 on median (average $\text{€}11,884 \pm 80,690$, range 0–1,000,000) for a sustainable healing, compared to median €500 in rosacea (average $\text{€}2879.8 \pm 16,783.7$, range €0–300,000) [6] and median €3,000 in vitiligo (average $\text{€}7,359.7 \pm 41,969.7$, range 0–1,000,000) [26]. Asked to name an absolute sum patients were willing to spend per month for a complete cure of their disease, more than one-third (35.7 %) of the AD patients would accept to spend up to €50 (Fig. 1), almost one-fourth up to €100 (23.6 %), another fourth up to €300 (25 %) and 6.8 % more than €300. 9 % do not consider a monthly investment in the cure of their skin disease. The median category chosen by AD patients was $\leq \text{€}100$.

In the third question, the AD patients were asked to specify a percentage of their monthly income which they consider to invest for a complete healing whilst the payment is executed (relative WTP). More than 40 % (41.6 %) of the patients were willing to invest 0–10 % of their monthly income for a complete cure, while 36.2 % would

Table 1 Sociodemographic data ($n = 384$)

	<i>n</i>	%
Actively working/not working ($n = 3$ missing)	274/107	71.9/28.1
Living in community/single	274/110	71.4/28.6
German A-levels/none A-levels	207/177	53.9/46.1
Monthly income $> \text{€}1,600 < \text{€}1,600$ (33 missing)	221/130	63/37

Fig. 1 Absolute willingness-to-pay per month in atopic dermatitis ($n = 384$), vitiligo (1,023) [26] and rosacea ($n = 475$) [6]



invest 10–20 %, 11.5 % would spend 20–30 % and 10.9 % more than 30 % of their monthly salary; the median percentage reported was the category 10 to ≤ 20 % of the patients' monthly income. The relative WTP correlated slightly positively with the affected body surface area ($r_s = 0.143$, $p = 0.007$) and the disease specific quality of life (DLQI; $r_s = 0.134$, $p = 0.01$). Negative correlations to patients' WTP were identified for the age at AD onset ($r_s = -0.110$, $p = 0.04$) and the EQ-5d VAS ($r_s = -0.114$, $p = 0.033$). For the relative WTP, no significant correlation to the duration of symptoms, age and gender was found. While the monthly income correlated significantly to the absolute WTP (Spearman correlation coefficient $r_s = 0.268$ (monthly payment); $r_s = 0.279$ (single payment); $p = 0.000$), the relative WTP (monthly percentage patients were willing to pay) did not correlate with the income ($r_s = -0.095$, $p = 0.086$).

Predicting absolute WTP (single payment), the chosen variables explained 15.1 % of the variance (Nagelkerke's

R -Square = 0.151). Gender (OR = 0.430, 95 % CI = 0.209–0.886, $p < 0.022$) and facial involvement (OR = 1.564, 95 % CI = 1.227–1.993, $p < 0.000$) were significant predictors with a higher relative possibility of men and patients with an extensive facial involvement being willing to pay more for the complete cure of their disease (Table 2).

Quality of life

DLQI

The mean DLQI total score in AD was 8.5 ± 6.0 (range 0–28, Fig. 2), compared to 7.0 ± 5.9 (range 0–27) in vitiligo [26], 6.7 ± 6.2 (range 0–30) in psoriasis [18] and 4.3 ± 4.6 (range 0–26) in rosacea [6].

In AD, differences in the DLQI total scores between age groups were not significant. However, impairment of QoL measured by DLQI correlated positively with the affected

Table 2 Logistic regression analysis predicting absolute WTP (single payment, $n = 265$), Nagelkerke's $R^2 = 0.151$

Variable ^a	β	SE	p	Odds ratio (expB)	CI 95 %
Age	0.007	0.011	0.534	1.007	0.985–1.030
Gender	−0.844	0.369	0.022	0.430	0.209–0.886
Skin dryness	0.300	0.197	0.129	1.349	0.916–1.987
Sleep disturbances	−0.175	0.125	0.159	0.839	0.657–1.071
Pruritus	0.002	0.183	0.989	1.002	0.700–1.435
Facial involvement	0.447	0.124	0.000	1.564	1.227–1.993
Genital involvement	−0.054	0.149	0.716	0.947	0.707–1.269
Affected body surface	0.002	0.001	0.097	1.002	1.000–1.004

^a Age = years; Gender: male = 1, female = 2; Skin dryness/sleep disturbances/pruritus: scale from 0 = never to 4 = always; facial and genital involvement: scale from 0 = not affected to 4 = extremely affected; affected body surface = number of marked points in grid-lined body scheme

Fig. 2 DLQI distribution of severity (from the left) in atopic dermatitis ($n = 384$), rosacea ($n = 475$) [6], psoriasis ($n = 2,449$) [18] and vitiligo ($n = 1,023$) [26]

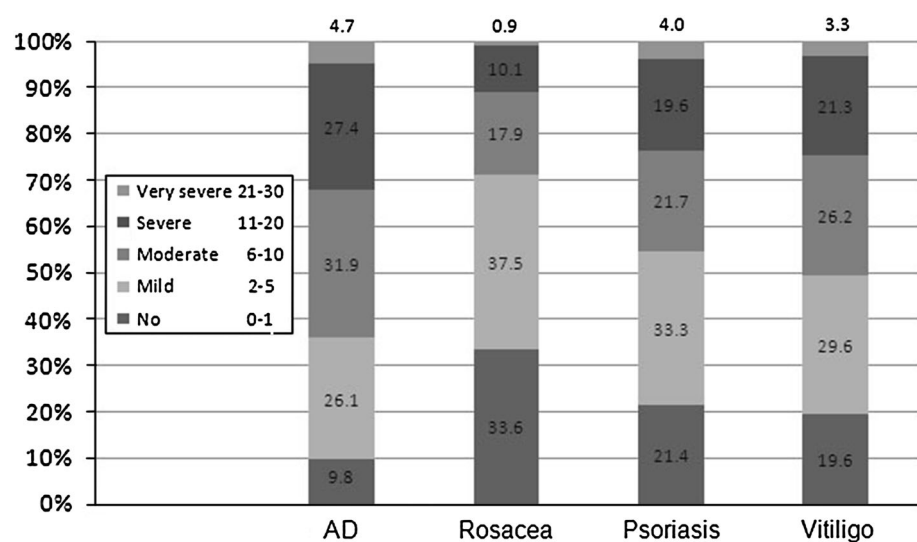


Table 3 Multiple regression analysis predicting quality of life (DLQI, $n = 318$)

Variable ^a	<i>R</i>	<i>R</i> ²	β	<i>p</i>
	0.632	0.400		
Age			−0.024	0.610
Gender			0.060	0.201
Skin dryness			0.148	0.007
Sleep disturbances			0.123	0.016
Pruritus			0.269	0.000
Facial involvement			0.226	0.000
Genital involvement			0.128	0.010
Affected body surface			0.178	0.000

^a Age = years; Gender: male = 1, female = 2; Skin dryness/sleep disturbances/pruritus: scale from 0 = never to 4 = always; facial and genital involvement: scale from 0 = not affected to 4 = extremely affected; affected body surface = number of marked points in grid-lined body scheme

Table 4 Multiple regression analysis predicting state of health (EQ-5d VAS, $n = 313$)

Variable ^a	<i>R</i>	<i>R</i> ²	β	<i>p</i>
	0.585	0.342		
Age			−0.144	0.004
Gender			−0.051	0.299
Skin dryness			−0.082	0.152
Sleep disturbances			−0.180	0.001
Pruritus			−0.334	0.000
Facial involvement			−0.153	0.002
Genital involvement			−0.043	0.418
Affected body surface			−0.046	0.378

^a Age = years; Gender: male = 1, female = 2; Skin dryness/sleep disturbances/pruritus: scale from 0 = never to 4 = always; facial and genital involvement: scale from 0 = not affected to 4 = extremely affected; affected body surface = number of marked points in grid-lined body scheme

body surface area ($r_s = 0.460$, $p = 0.00$). Moreover, the extent of facial ($r_s = 0.356$, $p = 0.00$) and anogenital ($r_s = 0.241$, $p = 0.00$) involvement showed a significant but moderate positive correlation with DLQI. Characteristic AD symptoms such as pruritus ($r_s = 0.513$, $p = 0.00$), skin dryness ($r_s = 0.431$, $p = 0.00$) and sleep disturbances ($r_s = 0.344$, $p = 0.00$) also correlated significantly with the DLQI total score. As expected, DLQI total score and ED-5D-VAS in AD correlated highly in a reciprocal way ($r_s = -0.569$, $p = 0.00$).

In the multiple regression model predicting QoL, the variables selected explained 40.0 % of the variance. Skin dryness ($\beta = 0.148$, $p < 0.007$), sleep disturbances ($\beta = 0.123$, $p < 0.016$), pruritus ($\beta = 0.269$, $p < 0.000$), facial involvement ($\beta = 0.226$, $p < 0.000$), genital

involvement ($\beta = 0.128$, $p < 0.010$) and the affected body surface area ($\beta = 0.178$, $p < 0.000$) were significant predictors of QoL (Table 3).

EQ-5d

The mean EQ-5d VAS score in AD patients was 61.9 ± 22.0 (range 5–100) for this study population compared to 72.2 in vitiligo (range 5–100) [26], 62.0 ± 21.0 in psoriasis (range 0–100) [18] and 67.3 ± 20.6 in rosacea (range 0–100) [6]. A fair or good general health status defined as a EQ-5d VAS value > 50 was reported by 63.8 % of the AD patients.

In the AD cohort, the EQ-5d VAS correlated negatively with the affected body surface area ($r_s = -0.358$, $p = 0.00$) and the extent of facial ($r_s = -0.270$, $p = 0.00$) and anogenital ($r_s = -0.196$, $p = 0.00$) involvement. As in DLQI, in AD patients pruritus ($r_s = -0.504$, $p = 0.00$), skin dryness ($r_s = -0.388$, $p = 0.00$) and sleep disturbances ($r_s = -0.397$, $p = 0.00$) also showed significant correlations with the EQ-5d VAS. However, in AD differences between age groups and gender differences were non-existent.

In the multiple regression model predicting the individual health state as measured by EQ-5d VAS, the variables selected explained 34.2 % of the variance. Sleep disturbances ($\beta = -0.180$, $p < 0.001$), pruritus ($\beta = -0.334$, $p < 0.000$), age ($\beta = -0.144$, $p < 0.004$) and facial involvement ($\beta = -0.153$, $p < 0.002$) were significant predictors (Table 4).

Discussion

The objectives of this study were the evaluation of the WTP in AD by three different approaches and the comparison of both WTP and HRQoL to other chronic skin diseases. To avoid possible bias by social desirability and regional factors, this study was conducted nationwide using the patient address database of the “Deutscher Neurodermitis Bund” (German atopic dermatitis league) for patient contacts.

Few data on the WTP in AD and no comparative analyses with other chronic skin diseases have been published. Asked to name the absolute sum they were willing to spend, AD patients were prepared to pay considerably more than rosacea patients [6] (median €1,000 vs. €500), but less than vitiligo patients [26] (median €3,000). To date, no further publications on AD using this approach have been published. Using another technique, Schmitt et al. [29] reported a median monthly WTP of €50/€150 in 58 AD patients with controlled/uncontrolled AD, respectively. The results of our study ($n = 384$, median monthly

WTP $\leq$ €100) were in a similar range, confirming the findings by Schmitt et al. In a Swedish study by Lundberg et al. on 132 AD patients a mean WTP of Swedish crowns (SEK) 1083.4 (€120) per month was detected.

A point of criticism on the WTP concept has been its dependence on sociodemographic factors, namely on patients' income [28]. This includes that patients with a higher income are willing to invest a higher amount of money for a sustainable cure of their disease which impairs the comparability of the WTP. While some authors found no correlation between WTP and patients' income [5], other studies clearly showed this relationship [6, 20, 28, 29]. To exclude this potential bias by socio-economic factors, we used the relative WTP, which is directly related to income ("percentage of monthly income"), as a second measure. This resulted in a median relative WTP of 10 to $\leq$ 20 % of the patients' monthly income. In a small number of AD subjects ($n = 6$), Seidler et al. [31] found a considerably lower relative WTP of 3.2 % of patients' annual income. Published relative WTP data on rosacea patients (median 0 to $\leq$ 10 %) [6] revealed a slightly lower percentage, while data for psoriasis were in a similar range (mean 11.5–13.8 %) [28]. In the present study, the relative WTP showed a low correlation with DLQI ($r_s = 0.134$, $p = 0.01$), a finding which has previously been shown for AD [29] and other dermatological disorders [6, 26] on the absolute WTP.

The absolute WTP (single payment) was significantly predicted by patients' gender (OR = 0.430, 95 % CI = 0.209–0.886, $p < 0.022$) and facial involvement (OR = 1.564, 95 % CI = 1.227–1.993, $p < 0.000$).

In this study population, more than one-third of patients reported a rather satisfying QoL (35.9 %) defined as a DLQI ≤ 5 ; this figure is substantially lower than in patients with rosacea (71.1 %), psoriasis (54.7 %) and vitiligo (49.2 %).

With respect to other AD cohorts, the participants of this study seem to perceive a rather good average QoL: While in the present study mean DLQI was 8.5, published data on QoL in AD revealed DLQI total scores ranging from 4.5 to 21.4 [19]. Thus, it needs to be accurately controlled which subgroups of patients and which treatment conditions have been observed. In particular, it has been shown in many publications that an effective treatment of AD leads to marked reductions of DLQI. For this, comparability of studies is limited.

The mean EQ-5d VAS score in this study (61.9) was significantly below the level in the general population of the same age (Fig. 3) [17]. This indicates that AD is a major disease of great negative impact to the patients' QoL.

For both QoL parameters (DLQI, EQ-5d VAS), a moderate correlation (between $r_s = -0.358$ and

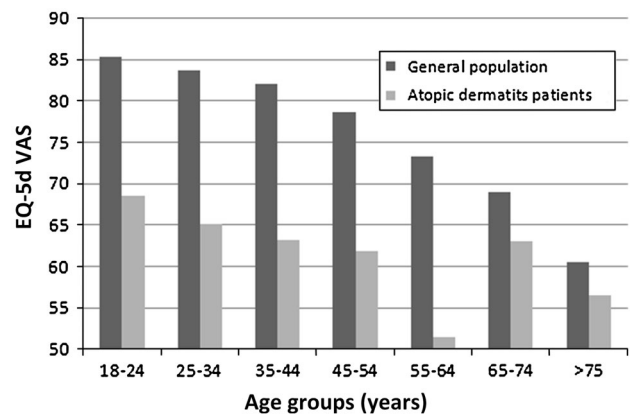


Fig. 3 Health status measured by EQ-5d VAS in the German general population ($n = 3,552$) [17] and in atopic dermatitis ($n = 384$)

$r_s = 0.460$) with the percentage of the affected body surface area and the extent of facial and genital lesions was observed. As expected, QoL is reduced when visible body areas or regions important for social or sexual interaction (face/genitals) are involved. Moreover, key AD symptoms like pruritus, skin dryness and sleep disturbances are associated with limitations of QoL.

Furthermore, both QoL parameters (DLQI, EQ-5d VAS) were predicted by sleep disturbances, pruritus and facial involvement. In addition, measured using the DLQI, skin dryness, genital involvement and the affected body surface area also predicted the limitations of QoL.

The generalizability of these results is limited because of the comparably low number of participants of the study ($n = 384$), differences in the study population, study objectives and national health care systems. Moreover, in this study, as in any survey based on self-reports, the patients' answers might be biased by the lacking ability of the patient to correctly assess himself. Because of the design of the study as postal survey, objective measures of disease activity such as the SCORAD were not applicable and the presented results are based on the patients' self-assessment only. Another limitation of the present study is the unknown size of the patient cohort reached, since questionnaires were not only personally distributed but also sent to local patient advocacy groups. Thus, probably only a part of the 3,080 questionnaires has reached eligible patients and the proportion of 17.9 % (550 from 3,080) returned questionnaires conceivably reflects an underestimation of the real response rate.

Furthermore, one could speculate that patients organized in patient advocacy groups, like in this study, might be selected by the burden of their disease. However, DLQI total scores in this study tended to be lower than in other published studies on QoL in AD [19], which is contradictory to this hypothesis. When comparing the results of

different studies on WTP in dermatological disorders, one faces multiple challenges: First, the use of WTP in surveys on dermatological disorders is not yet standardized. The majority of researchers choose the potentially salary-dependent absolute WTP, while others prefer the relative WTP to avoid this potential bias. Secondly, some studies measure the WTP for a complete cure of the disease and others assess WTP to compare different treatment options. Finally, the fact that WTP results are reported in different currencies also makes the comparison of data on WTP a complex issue.

In conclusion, in this nationwide cohort of AD patients a marked proportion of patients showed limitations of QoL and a moderate-to-high WTP. The WTP of AD patients was higher than in rosacea but lower than in vitiligo patients. QoL limitations were higher than in most other chronic skin diseases such as rosacea, vitiligo and psoriasis. Relative WTP proved to be a feasible non-salary dependent parameter.

For the further improvement of patients' QoL in routine care, an evaluation of the current quality and extent of AD care should be performed using valid quality indicators to identify potential deficits in patient care. Moreover, patient education, "real world" studies such as registries and a better compliance with the AD guideline might lead to a better management and consecutively to a higher QoL of AD patients.

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

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