ORIGINAL REPORT

Determinants of Quality of Life in Patients with Atopic Dermatitis and Psoriasis: A Multivariate Approach

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Health-related quality of life (HRQoL) is reduced in atopic dermatitis and psoriasis. Several factors impact HRQoL including sociodemographic and skin disease-related characteristics, health behaviours, cardiometabolic comorbidities, and psychological conditions. However, their differential and unique effects on HRQoL are not well studied. In this cross-sectional online survey, adult patients with atopic dermatitis ($n = 155$) or psoriasis ($n = 246$) provided data on features of their respective skin diseases, health behaviours, and cardiometabolic comorbidities. Validated self-report measures assessed HRQoL, psychopathology (Patient Health Questionnaire-4), and stress (Perceived Stress Scale). Linear regression analyses were used to determine key predictors of HRQoL. In atopic dermatitis, linear regression analyses revealed that self-rated disease severity (Patient-Oriented Eczema Measure), anxiety, and stress were significant predictors of the Dermatology Life Quality Index (DLQI), explaining 59% of the variance. In psoriasis, disease severity (Psoriasis Symptoms and Signs Diary) and depression significantly predicted DLQI, with an explained variance of 57%. Health behaviours and cardiometabolic comorbidities did not impact DLQI scores. While skin disease severity is the most important determinant of HRQoL, stress and anxiety are important in atopic dermatitis, whereas depression is relevant in psoriasis. These findings hold implications for both clinical practice and research.

Key words: atopic dermatitis; cardiometabolic comorbidities; health behaviours; health-related quality of life; psoriasis; psychological factors.

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SIGNIFICANCE

Health-related quality of life is reduced in patients with atopic dermatitis and psoriasis, and skin disease severity is its major determinant in both conditions. Additionally, stress and anxiety impact the quality of life in those with atopic dermatitis, while depression is relevant in those with psoriasis. In contrast, neither age, sex, health behaviours nor cardiometabolic comorbidities influence the quality of life among those affected by atopic dermatitis or psoriasis. Both clinical practice and research should consider not only disease severity but also psychological factors when addressing quality of life in chronic inflammatory skin diseases.

Atopic dermatitis (AD) and psoriasis (PSO) are the most common chronic inflammatory skin diseases, and affect approximately between 2% (PSO) and 4.5% (AD) of the adult general population worldwide (1, 2). Due to their chronic, often relapsing, and remitting course, both conditions cause considerable disease burden including reduced health-related quality of life (HRQoL) (3–5). HRQoL is of major importance for patients and has become a decisive outcome in clinical trials (6). Thus, knowledge of its correlates and determinants might be helpful for both clinical practice and research.

HRQoL in both AD and PSO is associated with numerous comorbidities, particularly cardiometabolic factors, such as hypertension, diabetes, dyslipidaemia, and obesity (7–9). Moreover, it is also impacted by stress and poor mental health including depression and anxiety (3, 9–11). The lifestyle of affected individuals, i.e., their smoking habits, alcohol consumption, and physical activity, may additionally influence their respective skin diseases as well as bodily and mental comorbidities (6, 8, 9). The complex interactions of cardiometabolic factors, poor mental health, and inadequate health behaviour are likely to result in reduced HRQoL in patients with AD and PSO, respectively (3, 12).

Disease characteristics, especially disease severity, have emerged as the most important determinants of HRQoL in both conditions as indicated by systematic reviews and meta-analyses (4, 5, 13–15). However, several other factors have been identified to additionally interfere with HRQoL including sociodemographic features and health behaviour, as well as cardiometabolic comorbidities and concomitant psychopathology (5, 12,

16). For example, more impairments in HRQoL have been reported in women relative to men and among younger individuals, but findings are inconclusive, particularly in AD patients (5, 12, 16). Similarly, the associations between dysfunctional health behaviour, cardiometabolic conditions, comorbid psychological impairments, and HRQoL have predominantly been established using bivariate analysis (17, 18). Because these bivariate approaches do not account for other determinants of HRQoL, they may result in an overestimation of the effects attributed to an individual factor. Thus, the differential and unique contributions of lifestyle, cardiometabolic, and psychological factors remain to be resolved. Moreover, studies applying multivariate analyses have focused on either psychological dimensions (19–21), partly in combination with health behaviour (22, 23), or exclusively on cardiometabolic comorbidities (17).

However, understanding the unique associations of HRQoL with age, sex, health behaviours, cardiometabolic, and psychological factors may be important for two reasons. First, it can help specify which dimensions and variables need to be considered in research on HRQoL in patients with AD and PSO, respectively, potentially reducing participants' burden and preserving researchers' time and finances without loss of information. Second, it may aid in refining and prioritizing clinicians' interventions to improve patients' HRQoL. In line with these considerations, our exploratory study aimed to determine the differential and unique effects of sociodemographic and skin disease-related characteristics, lifestyle factors, and concurrent cardiometabolic and psychological conditions in adult patients with AD and PSO, respectively.

MATERIALS AND METHODS

Study design and procedure

Adult participants with either PSO or AD were recruited through an online survey posted on websites likely to be visited by affected individuals (i.e., websites of the involved departments and offices, support groups, self-help resources, etc.). Additionally, the study was made public through a poster notice in the respective departments and offices. The survey took place between July 2023 and April 2024. After providing informed consent, participants completed an assessment battery that included questions on general demographic data and several self-report measures (see below). Anonymity was guaranteed, and there was no monetary or other compensation for completing the full survey. The study was approved by the institutional review board of the University Medical Center Rostock on 29 March 2023 (approval number A 2023-0051) and conformed to the principles of the Declaration of Helsinki.

Personal and medical history, health behaviour, and cardiometabolic comorbidities

Sociodemographic factors, features of the respective skin disease, health behaviours, and cardiometabolic comorbidities were self-reported. Marital status was categorized into three categories: single/unmarried, married/steady partnership, and divorced/separated/widowed. Educational level was classified along the International Standard Classification of Education, adapted to align with the structure of the German school system. Respondents reported their age at symptom onset of AD or PSO (used to calculate disease duration); PSO participants were asked whether they had ever experienced PSO-related arthritis. Among respondents with AD, disease severity was measured using the Patient-Oriented Eczema Measure (POEM [24]) following globally accepted standards (25). The POEM is the preferred self-report instrument for the assessment of AD symptom severity in clinical trials and observational studies and is composed of seven questions evaluating dryness, itching, flaking, cracking, bleeding, and weeping of the skin as well as sleep disturbance in the past week. The POEM has extensively been validated with adequate reliability and validity (25). The disease severity of participants with PSO was assessed with the internationally well-established and validated Psoriasis Symptoms and Signs Diary (PSSD [26]). Respondents are asked to refer to the past week when rating five symptoms and six signs of PSO. The PSSD has strong psychometric properties (26, 27). Physical activity was assessed on a scale from 1 to 4, where 1 = no sports, 2 = sports once a week, 3 = 2 to 4 times a week, and 4 = 5 times a week or more. Smoking status was classified as never smoked (= 0), former smoker (= 1), or current smoker (i.e,. smoking 1 or more cigarettes per day;= 2). Alcohol misuse was assessed using the AUDIT (Alcohol Use Disorders Identification Test), a simple, effective, and internationally well-established screening tool (28). Participants were also asked if they had been diagnosed with hypertension, diabetes mellitus, or dyslipidaemia by a physician. They provided their current weight (in kilograms) and height (in metres), which were used to calculate the body mass index (BMI).

Assessment of psychological factors

HRQoL was the main outcome of this study and was captured using the Dermatology Life Quality Index (DLQI), a well-established, generic measure of HRQoL over the past week in patients with skin diseases (29). The ten items on the DLQI address the impact of skin problems on six aspects of life, categorized into individual domains: symptoms and feelings (including shame), daily activities, leisure, work and school performance, personal relationships, and treatment. The items are rated on a four-point Likert scale from 0 (not at all) to 3

(very much), with higher sum scores indicating a lower skin-related quality of life. The reliability and validity of the DLQI have been well established in numerous studies (30).

The Patient Health Questionnaire-4 (PHQ-4) is an ultra-brief screening instrument for depression and anxiety (31). Two items assess the core symptoms of depression (PHQ-2), and another two items capture the core symptoms of anxiety (GAD-2) over the past two weeks. Each item is scored on a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day), with higher sum scores indicating greater levels of depression and anxiety, respectively. There is ample evidence for the reliability and validity of the PHQ-4 and its subscales (31).

The Perceived Stress Scale (PSS-10) is a widely used instrument to assess the extent of perceived psychological stress, specifically the subjective experience of stress from uncontrollable, unpredictable, potentially overwhelming situations, over the past month (32). Its ten items are to be rated on a five-point Likert scale, ranging from 0 ("almost never") to 4 ("very often"). The total score, ranging from 0 to 40, indicates the level of perceived stress. The German translation of the PSS-10 was found to be reliable and valid (33).

Statistical analysis

A stepwise regression analysis was performed to identify the key predictors of HRQoL, as measured by the DLQI. Both forward selection and backward elimination methods were used to determine the most significant predictors from a pool of variables that showed significant bivariate associations with the DLQI (Spearman's ρ). Variables were included in the model with a significance level of $p<0.05$, and the Akaike Information Criterion (AIC) was applied for variable selection. During the backward elimination phase, variables with $p>0.10$ were removed. Analyses were conducted separately for AD and PSO. The results are presented with adjusted explained variance (adj. R^2), unstandardized regression coefficients (B), standard errors (SE), and standardized regression coefficients (β). Collinearity was assessed and ruled out, as the variance inflation factor (VIF) was below 2.5 for all variables. To determine the practical significance of the predictors, Cohen's f^2 was calculated for each final model (34). F^2 values were interpreted as small (0.02), medium (0.15), or large (0.35). All analyses were performed using the Statistical Package for the Social Sciences (SPSS, version 27.0, IBM Corp, Armonk, NY, USA).

RESULTS

Of the 467 individuals participating in this survey, 66 (14.1%) were excluded due to missing data in the variables of interest. Of the remaining 401 participants with complete data, 155 (38.7%) suffered from AD and 246 (61.3%) from PSO, respectively. **Table I** depicts the

Table I. Sociodemographic characteristics and health-related quality of life (HRQoL) of the 2 study samples

Variables	AD patients ($n=155$)	PSO patients ($n=246$)
Age (years; mean±SD)	37.2±14.4	46.7±15.4
Sex		
Female	109 (70.3%)	149 (60.6%)
Male	46 (29.7%)	97 (39.4%)
Marital status		
Single/unmarried	81 (52.3%)	89 (36.2%)
Married/steady partner	60 (38.7%)	135 (54.9%)
Separated/widowed	14 (9.0%)	22 (8.9%)
Education*		
Level 2	52 (33.5%)	122 (49.6%)
Level 3	100 (64.5%)	116 (47.2%)
Other[a]	3 (1.9%)	8 (3.3%)
Disease features		
Disease severity	13.4±6.9	25.7±23.7
Disease duration	26.9±14.9	22.3±17.0
PSO arthritis	–	98 (40.2%)
Health behaviours		
Physical activity	1.96±0.89	1.91±0.92
Smoking		
Never	84 (54.2%)	92 (37.4%)
Former	26 (16.8%)	64 (26.0%)
Current	45 (29.0%)	90 (36.6%)
Alcohol misuse	63 (40.6%)	91 (37.0%)
DLQI, 0–30 (M±SD)	8.53±6.57	6.62±6.48
POEM, 0–28 (M±SD)	13.4±6.9	–
PSSD, 0–100 (M±SD)	–	25.7±23.7
PHQ-2, 0–6 (M±SD)	2.29±1.70	2.01±1.66
GAD-2, 0–6 (M±SD)	2.43±1.84	2.24±1.81
PSS-10, 0–40 (M±SD)	30.3±7.2	28.9±7.5

DLQI: Dermatology Life Quality Index; POEM: Patient-Oriented Eczema Measure; PSSD: Psoriasis Symptoms and Signs Diary; PHQ-2: Patient Health Questionnaire-2; GAD-2: Generalized Anxiety Disorder-2; PSS: Perceived Stress Scale.
AD: atopic dermatitis; PSO: Psoriasis; *according to the International Standard Classification of Education. [a]This category includes "still in school", "no graduation", "special school", and "other".

Table II. Bivariate correlations (Spearman's ρ) of Dermatology Life Quality Index (DLQI) with disease features, health behaviours, metabolic comorbidities, and psychosocial factors in patients with atopic dermatitis (AD) and psoriasis (PSO)

Variables	AD patients ρ	PSO patients ρ
Sociodemographic features		
Age	−0.24**	−0.33***
Sex	−0.20*	−0.06
Disease features		
Disease severity (POEM)	0.74***	
Disease severity (PSSD)		0.72***
Disease duration	−0.10	−0.11
PSO arthritis	–	0.01
Health behaviours		
Physical activity	−0.02	−0.15*
Smoking	−0.10	−0.08
Alcohol misuse	−0.11	−0.15*
Metabolic comorbidities		
Hypertension	−0.10	0.00
Diabetes	0.05	−0.06
Dyslipidaemia	−0.02	−0.04
Body mass index, kg/m²	−0.05	0.01
Psychosocial factors		
PHQ-2	0.57***	0.54***
GAD-2	0.54***	0.50***
PSS-10	0.48***	0.39***

POEM: Patient-Oriented Eczema Measure; PSSD: Psoriasis Symptoms and Signs Diary; PHQ-2: Patient Health Questionnaire-2; GAD-2: Generalized Anxiety Disorder-2; PSS-10: Perceived Stress Scale.

sociodemographic characteristics and DLQI values for both subsamples.

Table II summarizes disease features, health behaviours, concurrent metabolic conditions, and psychological factors for AD and PSO, as well as their bivariate associations with the DLQI. Neither disease duration, smoking, nor any of the cardiometabolic comorbidities were associated with the DLQI in either AD or PSO. While physical activity and alcohol misuse were linked to DLQI scores in PSO, this was not the case for AD. The presence of PSO arthritis was not associated with HRQoL.

In AD, the final model included the POEM, PSS-10 and GAD-2, which significantly predicted the DLQI and explained 59% of the variance ($R^2 = 0.593$, $F(3, 151) = 75.730$, $p < 0.001$) (cf. **Table III**). In PSO, disease severity measured by the PSSD and depression assessed using the PHQ-2 were significant predictors of the DLQI. The final model explained 57% of the variance ($R^2 = 0.565$, $F(2, 243) = 160.064$, $p < 0.001$). Both final models explained a substantial proportion of the variance, demonstrating strong predictive power. In both conditions, self-reported disease severity was the most important predictor of HRQoL. While in AD – beside self-reported disease severity – a combination of stress and anxiety best predicted DLQI scores, in PSO, depression played the central role. For each unit increase in depression measured by the PHQ-2, the DLQI score increased by 0.94 points indicating a decrease in HRQoL. Notably, 57% of the variance in DLQI scores were explained by just two variables, representing a large effect size ($f^2 = 1.31$, according to Cohen). The effect size of the final model for AD was even larger ($f^2 = 1.50$).

DISCUSSION

HRQoL in patients with AD and PSO is influenced by a variety of factors, including sociodemographic characteristics, disease features, health behaviour, cardiometabolic comorbidities, and psychological dimensions (3, 6–9). The objective of our study was to analyse the differential and unique contributions of these factors to HRQoL using a multivariate approach. Two main findings emerged from our analysis. First, disease severity was identified as the most important determinant of HRQoL in both AD and PSO, aligning with prior research highlighting its relevance for HRQoL (4, 5, 13–15). Second, psychological factors were also found to impact HRQoL, but they showed differential effects in the 2 skin diseases: While perceived stress and anxiety, but not depression, were significantly related to DLQI scores in AD, it was depression, but neither anxiety nor stress, in PSO. Sociodemographic features and health behaviours that were significantly related to HRQoL in bivariate analyses did not emerge as relevant factors in our multivariate approach.

Several studies indicate that psychological factors impact HRQoL in AD (10, 22, 23), but only very few investigations have used a multivariate approach. One study among 300 patients with moderate–severe AD reported that depression but not anxiety, as assessed with the Hospital Anxiety Depression Scale, was related to DLQI scores in regression analyses also including itch intensity, sleep quality, and disease severity (35). This finding is in contrast to our results and may be explained by methodological differences: While we used the dimensional DLQI scores as the dependent variable in the linear regression equation, a binary logistic regression approach with the categories of high (DLQI < 6) and low HRQoL (DLQI ≥6) was applied by Ferrucci and co-workers (35); furthermore, self–reported stress was not assessed, which emerged as a relevant determinant of HRQoL in our study. Future research is warranted to clarify the differential and unique impact of depression, anxiety, and stress on HRQoL in AD patients.

Similarly, our finding that only depression, but not anxiety and stress, emerged as significant psychological predictors of HRQoL in PSO is partly in line with the literature. While the impact of depression on HRQoL is well established (10, 11, 20, 21), the same is true for anxiety and stress (10, 21). However, only one study of 100 adult PSO patients assessed these psychological factors simultaneously and found all of them to be significantly associated with reduced HRQoL (19), which does not align with our results.

Although previous studies have suggested that women with PSO experience greater impairment in HRQoL than men (5, 12, 16), our multivariate analysis did not reveal any sex differences. In AD, findings on sex differences are equivocal, with the majority of studies suggesting no significant HRQoL differences between women and men (16), which is consistent with our results. Similarly, the association between age and HRQoL in both AD and

Table III. Prediction of the Dermatology Life Quality Index (DLQI) (linear regression)

	AD patients			PSO patients		
Final model	B ± SE	β	p	B ± SE	β	p
Disease severity (POEM)	0.57 ± 0.05	0.60	< 0.001			
Disease severity (PSSD)				0.17 ± 0.01	0.62	< 0.001
PSS-10	0.15 ± 0.07	0.17	0.026			
GAD-2	0.56 ± 0.28	0.16	0.044			
PHQ-2				0.94 ± 0.18	0.24	< 0.001
Adj. R^2	0.59, $p < 0.001$			0.57; $p < 0.001$		

Adj. R^2: adjusted explained variance; B ± SE: unstandardized regression coefficient with standard error; β: standardized regression coefficient; POEM: Patient-Oriented Eczema Measure; PSSD: Psoriasis Symptoms and Signs Diary; PHQ-2: Patient Health Questionnaire-2; GAD-2: Generalized Anxiety Disorder-2; PSS-10: Perceived Stress Scale.

PSO remains inconclusive. Our data suggest that age does not significantly impact HRQoL.

Another finding was the lack of associations between HRQoL and cardiometabolic comorbidities in bivariate analyses. This partly aligns with the results of another study by Fernandez-Torres et al. (17), which found no association between the metabolic syndrome and HRQoL in patients with plaque-type PSO. Moreover, multivariate analyses in their study did not reveal any link between cardiometabolic comorbidities and DLQI scores.

Although lifestyle factors such as physical activity, smoking, and alcohol intake are important in both AD and PSO, their associations with HRQoL have not been well elucidated (6, 36, 37). In AD, no bivariate correlations were found between HRQoL and health behaviours (physical activity, smoking, and alcohol misuse), which is in line with a study indicating that AD patients with or without addictions (including alcohol and smoking) did not differ in their DLQI scores (38). In PSO, we found significant and inverse correlations between HRQoL and physical activity as well as alcohol misuse; however, the effect sizes were small, and no significant associations were found in multivariate analyses, suggesting that lifestyle factors do not contribute uniquely to HRQoL.

Before concluding, some methodological limitations must be discussed. First, our recruitment strategy may have introduced a self-selection bias; thus, the generalizability of our results remains unclear. Second, the cross-sectional design prevents any temporal or causal inferences. Specifically, psychological factors may lead to reduced HRQoL, but conversely, low HRQoL may exacerbate stress, anxiety, or depression – the relationship is likely bidirectional. Third, the exclusive reliance on self-report measures, i.e., the disregard of expert assessments, may represent another limitation. Moreover, we did not consider lesion location or the age of skin disease onset (e.g., childhood onset) as potentially important determinants of HRQoL (38, 39). Not measuring the skin area affected by eczema, e.g., by applying the Patient-Oriented SCORing Atopic Dermatitis (PO-SCORAD; 40), might be regarded as another limitation. However, this shortcoming was accepted in order not to overburden the participants. Finally, the mean DLQI scores were in the moderate range, below the cut-off indicating severe effects.

Despite these limitations, the findings of our multivariate approach indicate that skin disease severity is the most important determinant of HRQoL in AD and PSO. Additionally, stress and anxiety impact HRQoL in patients with AD, while depression is a key correlate of HRQoL in patients with PSO. In contrast, sociodemographic characteristics, health behaviours, and metabolic comorbidities are not decisive for HRQoL in these two conditions. Pending replication, both clinical practice and future research should consider not only disease severity but also psychological factors when addressing HRQoL in chronic inflammatory skin diseases.

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Data availability statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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