ORIGINAL ARTICLE

Psychological burden of psoriatic patients in a German university hospital dermatology department

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Abstract
Psoriasis has a strong impact on patients’ lives and is closely linked to psychiatric disorders such as depression, anxiety and substance-related disorders, especially dependence on alcohol and nicotine. The aim of our study was to systematically assess the psychiatric comorbidity and possible associations between psychological factors, disease severity and dermatology-related quality of life in psoriatic patients from a high-need university hospital dermatology department. Consecutive psoriatic patients (new and permanent patients) at the Department of Dermatology, University Hospital Essen, Germany, were asked to fill out a paper-based questionnaire. In the first part of the questionnaire, baseline demographics, pre-existing mental disorders and data on substance abuse were collected. In the second part of the questionnaire, mental and physical health was explored using different validated self-rating tests. The current Psoriasis Area and Severity Index (PASI) was documented by a dermatologist. Patients with signs of mental disorders were offered an appointment with a board-certified psychiatrist. Between August 2016 and February 2019, 228 consecutive psoriatic patients (138 men [60.5%], 90 women [39.5%]; mean age, 48.3 years [standard deviation, 13.6; range, 18–80]) participated in the study. Approximately 50% of the patients had evidence of suffering from mental health problems, mostly depression and anxiety, as well as alcohol dependence. Patients with a PASI of 3 or more showed a statistically significant reduced Dermatology Life Quality Index (DLQI) and a significantly impaired psychological as well as physical quality of life. DLQI correlated with all psychological test results. The data indicate a significant psychological burden in a tertiary psoriatic population. Our findings underscore the importance of screening psoriatic patients for psychiatric disorders, with a focus on depression, anxiety as well as alcohol and nicotine dependence, in a multidimensional approach involving psychiatrists and psychologists.

KEYWORDS
depression, Patient Health Questionnaire, psoriasis, psychological burden, Short Form Health Survey-36

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Psoriasis is a chronic inflammatory systemic disease with typical cutaneous manifestations, and is one of the most frequent dermatological diseases worldwide.\textsuperscript{1,2} Within the last two decades, it has become clear that psoriasis as a systemic inflammatory disease is associated with other non-dermatological diseases, and currently this is commonly referred to as psoriatic comorbidity.\textsuperscript{3,4} Apart from an increased risk of developing cardiovascular and metabolic diseases, psoriasis is also linked to psychiatric disorders such as depression, anxiety as well as suicidal ideation behavior.\textsuperscript{5–8} Additionally, addiction disorders, especially tobacco and alcohol dependence, are frequently associated with psoriasis.\textsuperscript{9–11} These comorbidities are important because they may influence both psoriasis disease severity and other aspects of patients’ overall health.\textsuperscript{5, 12–15} It is hypothesized that the comorbidities of psoriasis and psychiatric disorders such as depression are in part due to the psychosocial stigmatizing experience of these patients.\textsuperscript{16,17} However, accumulating evidence indicates low-grade peripheral inflammation as one main linking mechanism between psoriasis and depression.\textsuperscript{5, 6, 18–22}

An increased rate of alcohol abuse among psoriatic patients is well documented.\textsuperscript{9–11, 23–25} Disease severity was shown to be significantly associated with alcohol addiction.\textsuperscript{11, 26, 27} However, it remains unclear whether patients with psoriasis have a higher risk of alcohol abuse or whether patients addicted to alcohol have a higher risk of developing psoriasis. By release of pro-inflammatory cytokines from activated Kupffer cells in the liver and from monocytes in the circulation, alcohol may induce a pro-inflammatory state that may directly contribute to the inflammatory process in psoriatic patients.\textsuperscript{23} Recent data indicate that psoriatic patients have an approximately 60\% greater risk of dying due to alcohol-related causes compared with peers of the same age and sex in the general population.\textsuperscript{28}

In addition, an increased prevalence of smoking in patients with psoriasis compared with healthy controls has been observed in studies performed in numerous countries.\textsuperscript{10, 11, 29} Smoking has been identified as an independent risk factor for development of psoriasis and it has also been linked with the clinical severity of the disease.\textsuperscript{14, 30} The exact mechanisms by which smoking influences psoriasis are unknown and likely complex.\textsuperscript{14} In addition, data suggest that illicit drug use is not more common in patients with psoriasis compared with the general population.\textsuperscript{31}

Overall, an increasing number of reports referring to psychiatric comorbidities of psoriasis and the psychosocial burden of the disease has been published in recent years, focusing on this highly important topic, which was insufficiently taken into account in the past.\textsuperscript{8–10, 23, 25, 26, 28–38} To expand knowledge in this field, the specific aim of this study was to clinically assess the psychological burden of psoriatic patients attending a German dermatological tertiary center using a comprehensive test battery of different psychological self-rating questionnaires and to combine these findings with a professional exploration by a board-certified psychiatrist if required and accepted by the patients. By identifying high-risk psoriatic patients, dermatologists can aim for optimal treatment of the disease and thus help alleviate the associated psychiatric burden.\textsuperscript{15} However, broad screening of psoriatic patients for psychiatric comorbidity is not yet well established in Germany.

### METHODS

Between August 2016 and February 2019, 356 consecutive psoriatic patients (new and permanent patients) from the outpatient section of the Department of Dermatology, Venereology and Allergology, University Hospital Essen, were asked to participate in the study. Two hundred and twenty-eight psoriatic patients completed and returned the battery of questionnaires. The study protocol was approved by the local ethics committee at the University of Duisburg-Essen, Essen, Germany (protocol 16-6768-BO), and followed the principles stated in the Declaration of Helsinki.

The key inclusion criteria for this study were age of 18 years or more, confirmed diagnosis of psoriasis and willingness to complete a set of test instruments. Subjects were excluded if any of the following criteria were identified: inadequate comprehension of the German language; (functional) illiteracy; and lacking capacity or unwillingness to supply informed consent. Patients meeting the inclusion criteria were given the opportunity to participate in the study. They were informed by the physicians in the outpatient section of the Department of Dermatology of the objectives and course of the study.

After obtaining written informed consent, clinical severity of psoriasis was scored with the Psoriasis Area and Severity Index (PASI)\textsuperscript{39} and patients were asked to complete a questionnaire battery. Because filling out the questionnaire was time-consuming, patients were allowed to take the questionnaires home and return them at their next appointment. All data were collected in strictly pseudonymous form.

Data collected in the first part of the questionnaire included basic demographics (age, sex, civil status, housing situation, body height and weight), pre-existing mental diseases and corresponding therapy as well as current treatment for psoriasis (topical or systemic). Further, patients were asked to fill out a structured questionnaire on drug and substance use in the last 30 days according to the German version of the European Version of the Addiction Severity Index.\textsuperscript{40} If applicable, patients were asked to indicate the frequency and route of application of the following drugs: heroin, methadone, buprenorphine, other opiates, benzodiazepines, barbiturates, sedatives, hypnotics, tranquilizers, analgesics, cocaine, amphetamines, cannabinoids, hallucinogens, inhalants and others. Patients could specify which analgesic, hypnotics and so forth they had taken.

The second part of the questionnaire started with the assessment of the dermatology-related quality of life (German version of the Dermatology Life Quality Index (DLQI)).\textsuperscript{51} The German version of the Patient Health Questionnaire (PHQ-D) was applied to screen for psychological symptom burden, especially depressive, functional somatic and anxiety symptoms.\textsuperscript{17,42,43} As a generic measure (i.e. independent of a specific diagnosis) of quality of life, the German
version of the Short Form Health Survey-36 (SF-36) was used.\textsuperscript{44} The Alcohol Use Disorders Identification Test (AUDIT) was applied as a screening tool to identify persons with hazardous drinking as well as persons with alcohol dependence.\textsuperscript{45} The Fagerström Test for Nicotine Dependence was used as a psychometric test in order to record important dimensions of tobacco addiction with six questions on smoking behavior.\textsuperscript{46–48} Lastly, adherence of patients to prescribed pharmacological treatment was measured via the Medication Adherence Report Scale-D (MARS-D, German version).\textsuperscript{39,50}

Extended information on the different questionnaires used in the test battery can be found in Appendix S1.

All patients with signs of a mental disorder were offered an appointment with a board-certified psychiatrist who accompanies our psoriasis consultation hours once a week.

Venous blood samples were collected as part of the clinical routine in ethylenediaminetetraacetic acid lithium–heparin-treated tubes (S-Monovette; Sarstedt, Nümbrecht, Germany) in subjects when indicated. Differential blood cell counts, C-reactive protein (CRP), brain natriuretic peptide (BNP), total cholesterol, high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL) and triglycerides were assessed by the Division of Laboratory Research of the University Hospital Essen (Essen, Germany).

Data from patients who attended the clinic more than once during the study period were included only once (first recording).

Information on the psoriatic phenotype and relevant comorbidities such as psoriatic arthritis (PsA) were retrieved from the patients’ electronic records.

2.1 | Statistical analysis

The statistical analyses were performed with SPSS version 26 software (SPSS, Chicago, IL, USA). Outliers in the laboratory values and in the variables of PASI and body mass index (BMI) (defined as 2.5 standard deviations [SD] over mean [M]) were removed from analyses. Variables were tested for normal distribution using the Kolmogorov–Smirnov test. The alpha level was set at 0.05 for all analyses.

In a first analytical step, the sample was divided into two groups based on an absolute PASI of 3. Sixty-four patients were classified as low PASI (≥3) (M, 1.0; SD, 0.9), and the remaining 160 patients as high PASI (≥3) (M, 12.6; SD, 7.8). We chose PASI 3 as cut-off to differentiate between low and high PASI groups because an absolute PASI, mostly of less than 3, is increasingly discussed as a new phenotype in addition to plaque psoriasis. In 20.6% of the patients (n = 47), the scalp was affected as well. Eight patients each (3.5%) also had palmoplantar and guttate psoriasis. Palmoplantar pustulosis was present in addition to plaque psoriasis in 1.3% of the patients (n = 3).

Nearly one-third of the patients (29.4%, n = 67) had comorbid PsA. In 6.6% of the cases (n = 15), the presence of PsA was suspected but not confirmed by a rheumatologist.

Mean DLQI score (n = 228) was 10.4 ± 8.5 (range, 0–30) and overall 100 patients (43.9%) had a DLQI of more than 10, indicating a severely impaired dermatology-related quality of life (Table 1). Patients with a DLQI of more than 10 (n = 100) had a mean PASI of 14.4 ± 8.2 (range, 0–33) corresponding to moderate to severe psoriasis. Mean DLQI did not differ significantly between patients with and without comorbid PsA.

One hundred and forty-five (63.6%) of the patients were already on a systemic antipsoriatic treatment at the time of participation in the study. The spectrum of therapeutics covered all common conventional and biologic therapies.

Mean BMI (n = 217) was 29.5 ± 5.9 kg/m\(^2\) (range, 17.2–47.2). Only 23.5% (n = 51) had a BMI classified as normal by the World Health Organization, which falls between 18.5 and 24.99, whereas 32.7% (n = 71) were overweight (BMI, 25–29.99), 25.3% (n = 55) were moderately obese (BMI, 30–34.99), 12.9% (n = 28) severely obese (BMI, 35–39.99) and 4.6% (n = 10) very severely obese (BMI ≥ 40).

Overall, 70.6% (n = 161) of the patients had relevant physical comorbidities. Obesity was the most common associated disorder in 40.8% of the cases (n = 93), followed by arterial hypertension (30.3%, n = 69) and diabetes mellitus (11.8%, n = 27). A total of 57.5% of the patients were diagnosed with at least one metabolic syndrome-related disorder. A history of cancer was known in 5.7% (n = 13) of the patients. An overview of all relevant physical comorbidities with regard to the whole cohort is presented in Figure 1.

Sociodemographic characteristics of the cohort including marital status, housing situation and sports activities can be found in Table S1.
3.1 Psychiatric diseases

Approximately one-quarter of the patients (26.3%, n = 60) stated to have experience with outpatient treatment because of psychological problems and 8.8% (n = 20) of the patients reported that they had been in inpatient psychiatric treatment/psychotherapy. Of these patients, six had been in inpatient therapy only. Fifty-six patients who had been treated stated a diagnosis that made therapy necessary. This means that nearly one-quarter of the patients (24.6%) reported that at least one psychiatric disorder was known. The most common diagnosis was a mood disorder (n = 41, 18% of the whole cohort), mostly a type of depressive disorder. In addition, 11 patients (4.8%) reported to suffer from anxiety and three patients indicated to be affected by addiction disorders (alcohol and heroin dependence). Altogether, 12 patients noted a second psychiatric diagnosis. In nearly all of these cases, a mood disorder was one of the diagnoses. Two patients had attempted suicide and one patient reported suicidal thoughts in the past. Table 2 provides an overview of the diagnoses named by the patients that led to outpatient or inpatient psychiatric treatment/psychotherapy. Please note that 14 patients had received both inpatient and outpatient therapy, leading to a higher total number of diagnoses.
Table 2 gives an overview of the diagnoses that were made by the board-certified psychiatrist in the examined patients. Current treatment with psychopharmaceuticals was reported by 20 patients (8.8%). Current intake of psychotropic substances apart from alcohol and nicotine was declared by 21 patients (9.2%): cannabis use was indicated by 12 patients (5.2%) and one patient (0.4%) reported cocaine use. Six patients (2.6%) reported treatment with opioids (tilidine, oxycodone, tramadol and buprenorphine) and two patients (0.9%) stated intake of benzodiazepines (diazepam).

Taken together, 87 patients (38.2%) had evidence of suffering from mental health problems, resulting from information provided in the first part of the questionnaire (experience with treatment of mental health disorders, current treatment with psychopharmaceuticals or substance intake) and examination by the board-certified psychiatrist.

### 3.2 | Results of the validated self-rating questionnaires

#### 3.2.1 | PHQ-D

The mean PHQ-9 depression score was 6.9 ± 6.0 (median, 5.5; range, 0–26) indicating on average mild depressive symptoms. Sixty-one patients (27.5%) showed at least moderate depressive symptoms (>10 points), of whom 12 (5.4%) reached a score corresponding to severe depressive symptoms. Patients who were already under a systemic therapy \( n = 145 \) had a significantly lower mean PHQ-9 depression score compared with patients without systemic therapy \( n = 83; M, 6.2 \text{ vs. } 8.1; p = 0.007; \text{ Fig. 2} \). In patients with comorbid PsA there was a trend towards a higher PHQ-9 depression score compared with patients without PsA \( M, 8.2 \text{ vs. } 6.1; p = 0.076 \). Mean PHQ-9 depression scores did not differ significantly in patients with other relevant associated somatic disorders including history of cancer and patients who were healthy apart from psoriasis.

The mean PHQ-15 score was 8.2 ± 5.4 (median, 8.0; range, 0–28) with 27 patients (12.4%) reaching a high somatic symptom severity (score, ≥15). Patients with comorbid PsA and other relevant physical comorbidities had a distinctly higher mean PHQ-15 score compared with patients without PsA \( M, 9.4 \text{ vs. } 7.5; p = 0.031 \) and patients without relevant associated somatic disorders \( M, 8.9 \text{ vs. } 6.8; p = 0.024 \).

Patients with clinically relevant scores in PHQ-9 (≥10) and PHQ-15 (≥15) also had a highly reduced dermatology-related quality of life indicated by DLQI scores of 16.1 and 14.7, respectively.

Criteria indicative of an anxiety disorder were fulfilled by 9.2% \( n = 21 \) of the whole cohort and 5.7% \( n = 13 \) fulfilled criteria indicative of a panic syndrome according to the PHQ-D manual.
According to the PHQ-D manual, 18 patients (7.9% of the whole cohort) showed evidence of an eating disorder (16 with a binge-eating disorder, two with bulimia nervosa) and 11 patients (4.8% of the whole cohort) fulfilled criteria indicative of alcohol misuse. An impairment of social and occupational function was reported by approximately one-quarter of the patients (25.9%, n = 59) with 28 reporting a severe (n = 21) or even extremely severe (n = 7) impairment.

3.2.2 | AUDIT

Nearly three-quarters (74.6%) of the patients indicated drinking alcohol. Assessing alcohol abuse with the AUDIT resulted in a mean score of 3.4 ± 3.8 (range, 0–23; n = 224). Mean AUDIT score in men was statistically significantly higher than in women (men [n = 135]: M, 4.1 ± 4.4 [range, 0–23]; women [n = 89]: M, 2.3 ± 2.4 [range, 0–16]; p = 0.001). The sex difference was also reflected by the number of patients reaching a score indicating hazardous and harmful alcohol consumption (20 men and four women corresponding to 10.5% of the whole cohort). Except for one, all patients with hazardous and harmful alcohol consumption had a PASI of 3 or more.

When also considering significantly abnormal scores resulting from the PHQ-D and AUDIT questionnaires in addition to the results from the first part of the questionnaire, the number of patients with evidence of mental health problems increased to 51.8% (n = 118).

3.2.3 | SF-36

Evaluation of the SF-36 questionnaire showed on average reduced mental and physical health with scores ranging from 44.3% (vitality) to 71.8% (physical functioning). Patients with relevant physical comorbidities had a more strongly limited physical quality of life as indicated by significantly reduced SF-36 scores for physical functioning (M, 66.0% vs. 85.7%; p < 0.001), physical role functioning (M, 56.9% vs. 80.6%; p < 0.001), bodily pain (M, 54.7% vs. 65.0%; p = 0.012) and the physical sum score (M, 40.7 vs. 49.1; p < 0.001) compared with patients without relevant physical comorbidities. Focusing on patients with a history of cancer, it emerged that this group had distinctly lower SF-36 scores for physical functioning (M, 55.4% vs. 72.8%; p = 0.011) and the physical sum score (M, 35.2 vs. 43.6; p = 0.032). Also, patients with PsA showed a more severely impaired physical quality of life compared with patients without PsA, as indicated by significantly lower SF-36 scores for physical functioning (M, 67% vs. 75%; p = 0.027) and bodily pain (M, 27.3% vs. 30%; p = 0.031).

3.2.4 | Fagerström test

In the Fagerström test, 48 patients (21.1%) reported that they had never smoked. Altogether, 76 (33.3%) patients had quit smoking (65, more than 1 year ago; 11, within the last year) and 100 (43.9%) patients were active smokers. Of the active smokers (38 women, 62 men), 22 patients stated that they did not smoke daily, but occasionally. Seventeen patients indicated that they did not smoke cigarettes, but a pipe, cigars or cigarillos at a mean daily number of 14.7 ± 8.0 (range, 3–25). The mean Fagerström score of all smokers was 3.15 ± 2.4. The results of the Fagerström test according to the grade of nicotine dependency and split by sex are summarized in Table 3.
3.2.5 | MARS

Evaluation of the MARS (n = 202) indicated on average good adherence (23.8 ± 1.7 points; range, 15–25).

3.2.6 | Laboratory parameters

A relevant proportion of patients had elevated blood lipids. Most notably, total cholesterol was increased in more than half of the patients (53.5%). Markers of inflammation were mainly within the normal range; however, CRP was elevated in approximately one-third of the patients (31.1%). Results of laboratory parameters did not differ significantly between patients with and without PsA. Results of laboratory parameters can be found in Table 1.

3.2.7 | Comparison of patients with severe and less severe psoriatic symptoms

For further statistical analysis, the sample was divided into two groups, based on a PASI score of 3, aiming to compare patients with severe and less severe psoriatic symptoms. Sixty-four patients were classified with low PASI (<3) (M, 1.0; SD, 0.9), and the remaining 160 patients with high PASI (≥3) (M, 12.6; SD, 7.8).

The high PASI group had a statistically significantly reduced dermatology-related quality of life, as indicated by higher DLQI scores, and a significantly impaired psychological and physical quality of life, as indicated by higher PHQ-9 depressive symptom scores and PHQ-15 somatic symptoms, and a significantly lower general health status as measured with the SF-36 (except for the subscore of general health perception; Table 4). Additionally, patients in the high PASI group had a lower level of adherence as measured with the MARS and significantly higher mean CRP levels (Table 4).

Next, to assess the correlation between PASI and DLQI with each other and psychological parameters, BMI and laboratory results, Spearman’s rank correlation coefficients were calculated. PASI correlated significantly with the DLQI and with several psychological scores. Additionally, PASI correlated with inflammatory parameters, however, only at a low level (leukocytes, \( r_s = 0.14, p = 0.04, n = 214 \); neutrophils, \( r_s = 0.14, p < 0.05, n = 199 \); CRP, \( r_s = 0.17, p = 0.03, n = 167 \)). DLQI correlated significantly with all psychological test results. Results of correlations between PASI and DLQI with each other and psychological parameters are denoted in Table 5. Figure 3 depicts exemplarily the significant bivariate association between DLQI scores and PHQ-9 depressive scores and SF-36 bodily pain. PASI and DLQI did not correlate significantly with BMI. There were no statistically significant correlations between the AUDIT and the Fagerström test results with other assessed variables.

4 | DISCUSSION

Our data suggest a significant psychological burden in psoriatic patients attending a tertiary psoriasis outpatient department. Approximately half of the patients under study had evidence of mental health problems.

The main baseline characteristics of the study population are comparable with psoriatic cohorts in other tertiary psoriasis centers.\(^{11,32,53}\)

In comparison with the prevalence of depressive disorders of 10–11.3 % in the general German population,\(^{54}\) a high proportion of our cohort (27.5%) showed relevant symptoms of depression according to the PHQ-9 screening. Approximately one-fifth of the patients stated to suffer; respectively was diagnosed with a mood disorder, in the vast majority of cases from the circle of depressive disorders. This is in line with data from the published work indicating that depending on the screening methodology, depressive symptoms are present in 9–55% of psoriatic patients.\(^{55}\) Depressive symptoms at baseline may predict a worse clinical response to antipsoriatic treatment.\(^{56}\) Furthermore, therapeutic options for psoriatic patients with comorbid depression are more limited compared with patients without depression. In most of the cases, depression and suicidal ideation behavior represent an exclusion criterion for participation in clinical trials with new compounds. Additionally, caution is required prior to prescribing brodalumab and apremilast.\(^{57}\) Inversely, data indicate that adequate anti-inflammatory treatment improves depressive symptoms.\(^{58,59}\) Compatible with this, patients in our cohort had lower PHQ-9 depression scores in cases that they were under systemic therapy.

The prevalence of anxiety disorders in our sample was approximately 5%, which is lower compared with data from a UK tertiary psoriasis clinic (13.1%).\(^{32}\)
| Low (L) versus high (H) PASI group | M ± SD | Test statistics |
|-----------------------------------|--------|-----------------|
| Age (years)                       |        | z = -1.0; p = 0.31 |
| L 49.9 ± 13.1                     | H 47.8 ± 13.6 |
| BMI, kg/m²                        |        | t = -1.6; p = 0.11 |
| L 28.6 ± 5.3                      | H 29.9 ± 6.1 |
| Leukocytes/nL                     |        | t = 0.1; p = 0.27 |
| L 7.1 ± 1.7                       | H 7.4 ± 2.0 |
| Neutrophils/nL                    |        | z = -0.6; p = 0.53 |
| L 4.5 ± 1.3                       | H 4.6 ± 1.6 |
| CRP (mg/dl)                       |        | t = -2.2; p = 0.03 |
| L 0.2 ± 0.4                        | H 0.5 ± 0.7 |
| Total cholesterol (mg/dl)         |        | t = 1.3; p = 0.19 |
| L 209.8 ± 45.9                    | H 199.3 ± 38.3 |
| HDL (mg/dl)                       |        | t = 1.4; p = 0.16 |
| L 53.9 ± 14.8                     | H 50.2 ± 12.9 |
| LDL (mg/dl)                       |        | t = -0.3; p = 1.0 |
| L 132.2 ± 43.6                    | H 132.4 ± 33.2 |
| Triglycerides (mg/dl)             |        | z = -0.7; p = 0.47 |
| L 165.1 ± 74.5                    | H 158.6 ± 79.0 |
| Lp (a) (mg/dl)                    |        | z = 1.6; p = 0.7 |
| L 15.9 ± 21.6                     | H 24.4 ± 29.2 |
| BNP (pg/ml)                       |        | t = -0.3; p = 0.4 |
| L 18.3 ± 14.7                     | H 21.8 ± 19.3 |
| DLQI                              |        | z = -8.0; p < 0.001 |
| L 3.7 ± 4.8                       | H 13.0 ± 8.2 |
| PHQ-15 somatic symptoms           |        | t = -2.4; p = 0.02 |
| L 6.9 ± 5.0                       | H 8.8 ± 5.5 |
| PHQ-9 depressive symptoms         |        | z = -4.1; p < 0.001 |
| L 4.6 ± 5.3                       | H 7.9 ± 6.1 |
| SF-36 physical functioning        |        | z = -2.7; p = 0.007 |
| L 78.8 ± 25.2                     | H 68.9 ± 27.8 |
| SF-36 physical role functioning   |        | z = -3.4; p = 0.001 |
| L 78.0 ± 35.0                     | H 58.5 ± 40.9 |
| SF-36 bodily pain                 |        | z = -3.9; p < 0.001 |
| L 70.0 ± 27.2                     | H 53.0 ± 28.7 |
| SF-36 general health perception   |        | z = -1.8; p = 0.07 |
| L 54.4 ± 19.8                     | H 48.9 ± 21.2 |
| SF-36 vitality                    |        | z = 3.4; p = 0.001 |
| L 52.2 ± 20.2                     | H 41.2 ± 21.9 |
| SF-36 social functioning          |        | z = -4.6; p < 0.001 |
| L 82.5 ± 24.8                     | H 62.6 ± 29.9 |
| SF-36 emotional role functioning  |        | z = -3.6; p < 0.001 |
| L 82.3 ± 36.6                     | H 62.6 ± 43.1 |
| SF-36 mental health               |        | z = -3.4; p = 0.001 |
| L 68.5 ± 21.4                     | H 58.2 ± 20.6 |

(Continues)
Approximately three-quarters of the patients reported drinking alcohol, which is in line with results from the published work in a comparable psoriatic cohort. An increased rate of patients with diagnosed alcohol abuse, respectively signs of excessive drinking found in our study population (10.5%) confirms the findings of previous studies that excessive drinking habits are more common in psoriasis patients. A smoking prevalence of 43.9% in our previous studies that excessive drinking habits are more common in our study population (10.5%) confirms the findings of psychiatric patients.10,11,61

Intake of substances and illicit drugs was reported by 9.2% of the patients. Most of the patients reported consumption of cannabis. According to the information given in the questionnaire, the six patients who reported intake of opioids took them for medical reasons. Thus, it can be assumed that 6.6% of the patients had signs of drug abuse. In a study in a similar German cohort, 11% of the patients were found to be at risk of drug abuse. However, the screening method used in the study (Drug Abuse Screening Test, DAST-10) was different.

In patients with higher PASI scores (≥3), depressive and somatic symptoms were significantly pronounced compared with patients with PASI of less than 3. Except for one, all patients with an AUDIT score above 8 in men and above 7 in women as indication of hazardous alcohol consumption and/or alcohol dependence had a PASI of 3 or more.

Patients with relevant somatic comorbidities including PsA and history of cancer had a particularly higher somatic symptom burden as indicated by a significantly lower PHQ-15 score and reduced SF-36 scores assessing physical aspects of quality of life.

The PASI correlated with several psychological scores such as the PHQ-9 depressive symptoms score and nearly all SF-36 subscales. This finding largely concords with data from publications indicating that several mental health diseases such as depression, anxiety or alcohol abuse are more common in patients more severely affected by psoriasis.5,8,15,26,54

Additionally, the results of the MARS questionnaire indicated that patients in the high PASI group tend to be less adherent.

Lower dermatology-related quality of life was closely associated with a higher psychological and somatic symptom burden. Using the DLQI alone, clinically important levels of depression, anxiety and addictive behavior may be missed. Patients more severely affected by psoriasis and patients with a significantly impaired dermatology-related quality of life should be paid particular attention regarding assessment of psychiatric conditions. Therapy adherence, especially in patients more seriously affected by psoriasis, should be checked on a regular basis. However, not only patients with a high disease burden should be screened regularly for psychiatric diseases. Assessment of psychiatric comorbidity is essential in every psoriatic patient and should be performed systematically.53,64 As the screening battery used in our study is certainly too time-consuming to use in daily practice, we propose the following approach: as recommended by the German National Conference on Healthcare in Psoriasis, a time-effective screening for depressive symptoms can be performed by using the Two-Question Test: (i) “Have you frequently felt dejected, sad, glum or hopeless during the past month?”; and “Have you taken significantly less pleasure and joy in things, which you otherwise enjoy doing, over the past month?” If patients answer “yes” to both questions, referral to the primary care physician or preferably to a psychiatrist or psychotherapist is indicated in order to clinically detect formal diagnostic criteria.

A well-established method to screen for alcohol consumption and misuse is the AUDIT that was also used in our study.45,64 Another short, feasible to use and easily applied option is the CAGE questionnaire.65

Screening for nicotine abuse should be performed in the context of the anamnesis.64

### Table 4 (Continued)

| Low (L) versus high (H) PASI group | M ± SD | Test statistics |
|-----------------------------------|--------|-----------------|
| **SF-36 physical sum score** | L       | 46.3 ± 9.5      | \( z = -2.6; p = 0.01 \) |
|                                   | H       | 41.9 ± 11.7     |                         |
| **SF-36 psychological sum score** | L       | 48.5 ± 10.9     | \( z = 4.0; p < 0.001 \) |
|                                   | H       | 41.5 ± 12.6     |                         |
| **AUDIT**                         | L       | 2.7 ± 1.9       | \( z = -0.2; p = 0.8 \)  |
|                                   | H       | 3.7 ± 4.3       |                         |
| **Fagerström**                    | L       | 2.5 ± 2.1       | \( z = -1.6; p = 0.11 \) |
|                                   | H       | 3.3 ± 2.4       |                         |
| **MARS**                          | L       | 24.2 ± 1.3      | \( z = -2.5; p = 0.01 \) |
|                                   | H       | 23.7 ± 1.8      |                         |

Statistically significant differences are printed in bold.

Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; BMI, body mass index; BNP, brain natriuretic peptide; CRP, C-reactive protein; DLQI, Dermatology Life Quality Index; HDL, high-density lipoproteins; LDL, low-density lipoproteins; Lp (a), lipoprotein A; M, mean; MARS, Medication Adherence Report Scale; n, number of patients; PASI, Psoriasis Area and Severity Index; PHQ, Patient Health Questionnaire, German version; SD, standard deviation; SF-36, Short Form Health Survey-36.
In our cohort, CRP was elevated in approximately one-third of the cases and was significantly higher in the high PASI group. Additionally, PASI correlated at a low level with the inflammatory parameters of leukocytes, neutrophils and CRP. A significant number of patients had increased blood lipids. These data fit in with a large body of evidence indicating that low-grade peripheral inflammation represents a link to other disorders that are associated with systemic inflammation like metabolic syndrome-related diseases, but also depression. In view of these interrelationships, assessment of metabolic syndrome should be part of the screening activities as a matter of course. The German National Conference on Healthcare in Psoriasis recommended comorbidity screening in mild psoriasis at least every 12 months, and for severe, including systemically treated psoriasis, every 6 months.

This study is not without limitations. First, data were collected from a single, high-need, German university hospital dermatology department and thus may not be generalizable. Another bias may result from the fact that not all patients returned their questionnaires. Due to stigmatization, patients with addictive disorders might have participated less frequently or not disclosed their diagnosis. A further limitation of the study is that most information obtained was based on information provided by the patients. Information on drug use might have been falsely low due to patients’ concerns in providing truthful details. Additionally, a significant part of the data was collected by means of screening tools indicating only probable diagnoses and syndromes. Only a smaller proportion of the patients was additionally examined by a board-certified psychiatrist in the context of the study ensuring proper psychiatric diagnoses. Further, the design of this study as well as the way data were analyzed does not allow any conclusion on the causal relationship between psychological burden, inflammatory parameters and disease severity.

The strengths of the study are that real-world data were obtained from a representative tertiary psoriatic cohort not biased in a clinical trial setting. There were hardly any barriers that would have prevented patients from participating in the study. All data was collected in strictly pseudonymous form and the patients had enough time to complete the questionnaires at home. Psychiatric diagnoses were validated by a board-certified psychiatrist in nearly 10% of the patients. A further strength of the study results from the fact that most information obtained was based on information provided by the patients. Information on drug use might have been falsely low due to patients’ concerns in providing truthful details. Additionally, a significant part of the data was collected by means of screening tools indicating only probable diagnoses and syndromes. Only a smaller proportion of the patients was additionally examined by a board-certified psychiatrist in the context of the study ensuring proper psychiatric diagnoses. Further, the design of this study as well as the way data were analyzed does not allow any conclusion on the causal relationship between psychological burden, inflammatory parameters and disease severity.

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*Table 5: Correlations between PASI and DLQI with each other and psychological parameters as measured by Spearman’s correlation coefficients*

Note: First line, correlation coefficient r; second line, p; third line, n. Statistically significant differences are printed in bold (p < 0.05).

Abbreviations: DLQI, Dermatology Life Quality Index; PASI, Psoriasis Area and Severity Index; PHQ, Patient Health Questionnaire, German version; SF-36, Short Form Health Survey-36.
In summary, the data presented here indicate a high psychological burden of psoriatic patients in a tertiary center. Depressive and somatic symptoms were shown to be linked with disease severity and especially with the dermatology-related quality of life in psoriatic patients. Our findings underscore that clinicians should be highly aware of the impact of comorbid mental but also somatic health disorders in psoriatic patients and the central role they play in identifying patients at risk. Dermatologists should take the opportunity to encourage psoriatic patients to make a change in their lifestyle if necessary by applying patient-centered communication strategies. Psychiatrists and psychologists should be involved wherever indicated.

ACKNOWLEDGMENT
Open Access funding enabled and organized by ProjektDEAL.

CONFLICT OF INTEREST
W. S. received travel expenses for attending meetings and/or (speaker) honoraria from Abbvie, Almirall, Bristol-Myers Squibb, Celgene, Janssen, LEO Pharma, Lilly, MSD, Novartis, Pfizer, Roche, Sanofi Genzyme and UCB. A. K. received travel expenses for attending meetings and/or speaker honoraria from MSD, Pfizer, Biogen, Abbvie, Novartis, LEO Pharma, Janssen, Celgene, Lilly, Almirall, Beiersdorf and Grüenthal. O. F. received travel expenses for attending meetings and/or (speaker) honoraria from AstraZeneca, Janssen-Cilag, Lilly, Otsuka, Pfizer and Takeda. N. S. received honoraria for several activities (advisory boards, lectures, manuscripts) from AbbVie, Camurus, Hexal, Janssen-Cilag, MSD, Medice, Mundipharma, Reckitt-Benckiser/Indivior and Sanofi-Aventis; and in the last 3 years, he participated in clinical trials financed by the pharmaceutical industry.

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**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section.