Two questions may be enough – screening for depression in patients with psoriasis: a multicenter study

Sascha Gerdes¹, Dagmar Wilsmann-Theis², Daniel Celis³, Christian Kromer⁴, Rotraut Mössner⁴

(1) Psoriasis-Center, Department of Dermatology, University Hospital Schleswig-Holstein, Campus Kiel, Kiel, Germany
(2) Department of Dermatology and Allergy, University Bonn, Bonn, Germany
(3) Faculty of Economic Sciences, Georg-August-University Göttingen, Göttingen, Germany
(4) Department of Dermatology, Georg-August-University Göttingen, Göttingen, Germany

Introduction

Psoriasis is a chronic, inflammatory skin disease with a prevalence of approximately 2% [1]. Due to stigmatization and functional disability, the condition has a major negative impact on patients’ health-related quality of life [2–5]. Psoriasis is associated with a range of comorbid disorders, including psoriatic arthritis (PsA) as well as cardiovascular and metabolic diseases [2, 6]. Moreover, the prevalence of psychological disorders such as depression, anxiety, stress-related disorders, and suicidal ideation is elevated in patients with psoriasis [7–10]. This higher rate may be partly explained by physical appearance, stigmatization, avoidance of social interaction, and altered behavior [11], but systemic inflammation also plays a role [12, 13]. Patients with psoriasis may also have other concomitant diseases that increase the risk of developing depression [14, 15].

The prevalence of depression varies between 9 and 55% in psoriasis patients, depending on study design, population, and outcome definition [12] with an odds ratio of 1.57 compared to the general population [11]. Psoriasis patients also take more anti-depressive medication than the general population [16, 17]. Some studies have indicated that the risk of depression depends on disease severity (hazard ratio 1.72 vs. 1.38 for severe and mild psoriasis, respectively) [12], and is higher in women (relative risk: 1.29) [18] and patients with PsA (relative risk: 1.52) [18]. It has also been shown that biological treatment reduces depressive symptoms [12, 19]. A recent study of 3,635 dermatology patients found that depression is frequently underdiagnosed [20]. Treatment is often inappropriate even when cases are recognized [21]. In daily dermatological practice, screening for depressive symptoms is not always routinely performed, partly due to current screening instruments being cumbersome and time-consuming.

To our knowledge, a convenient two-question case-finding instrument (the Whooley questions, named after the first author of the original publication) [22] has not yet been investigated in patients with psoriasis, although it was...
recommended for comorbidity screening in psoriasis patients several years ago [23].

The objective of this study was to (1) describe the prevalence of depression and the current situation of mental health care provision in patients with psoriasis who are treated in specialized psoriasis centers, (2) screen for undiagnosed depressive symptoms using two validated instruments, the Beck Depression Inventory II and the Whooley questions, (3) analyze the impact of patient and disease characteristics on depression scores, and (4) to follow-up patients with a BDI-II score \( \geq 13 \).

**Patients and methods**

**Study design**

In this multicenter cohort study, adult patients with a confirmed diagnosis of psoriasis were enrolled at the outpatient psoriasis clinics of the dermatology departments of the University Medical Centers at Göttingen, Kiel, and Bonn during their regular treatment appointments. The study was carried out according to the Declaration of Helsinki [24] and was approved by the local ethics committees of the participating sites. All patients gave written informed consent prior to study participation.

**Data collection**

Data was collected with a physician-administered questionnaire with respect to age, gender, family history of psoriasis, disease severity (Psoriasis Area and Severity Index [PASI], body surface area [BSA], Physician’s Global Assessment [PGA]), health-related quality of life (Dermatology Life Quality Index [DLQI]), current and former anti-psoriatic therapy, concomitant psoriatic arthritis, comorbidity (hypertension, diabetes and obesity), smoking status and alcohol consumption. The *Alcohol use disorders identification test consumption* questionnaire (AUDIT-C) (which comprises quantity and frequency of alcohol intake) was used to screen for a possible alcohol use disorder [25]. It consists of three questions with five choices for each question. The first possible answer is always valued at 0, while increasing integers are assigned to the subsequent choices (i.e., 1, 2, 3, and 4). A risk of alcohol use disorder is assumed if the sum of the scores of the three questions is \( \geq 3 \) in women and \( \geq 4 \) in men [25]. Moreover, participants were asked whether a depression had ever been diagnosed and if so, how it had been treated. Current depressive symptoms were evaluated using the German version (not validated) of the validated English version of the two-question case-finding instrument (Whooley questions, named after the first author of the original publication) [22]. A positive response to at least one of the two binary questions (1) “During the past month, have you often been bothered by feeling down, depressed, or hopeless?” (German version: “Fühlten Sie sich im letzten Monat häufig niedergeschlagen, traurig, bedrückt oder hoffnungslos?”) and (2) “During the past month, have you often been bothered by little interest or pleasure in doing things?” (German version: “Hatten Sie im letzten Monat deutlich weniger Lust und Freude an Dingen, die Sie sonst gerne tun?”) detects a depression with a sensitivity of 96% and a specificity of 57% [22]. These questions reflect the essential features of depression: depressed mood and anhedonia [26]. In addition, the German version of the revised Beck Depression Inventory (BDI-II), a widely used 21-item self-assessment instrument, was filled out by the patients [27]. The psychometric properties and actual questions of the German BDI-II have been described elsewhere [28, 29]. The scores range from 0 to 63, with scores \( \geq 13 \) indicating at least a mild depression [26, 30]. This cut-off is reported to yield a sensitivity of 86% and a specificity of 79% in healthy individuals and somatic samples [31]. In a retrospective analysis, a chart review was performed on two subgroups (patients with PASI scores \( \leq 5 \) and DLQI scores \( \leq 10 \), and patients with PASI scores \( \leq 5 \) and DLQI scores \( \leq 10 \), matched by age (\( \pm 1 \) year), gender and center of enrolment. We extracted information on involvement of locations with special interest (head, nails, and genital region).

**Statistical analysis**

Statistical analysis and creation of figures was performed with commercially available software (Stata – Data Analysis and Statistical Software®, version 14.1). Cohort characteristics were analyzed descriptively. Differences between the subgroups with BDI-II scores < 13 and \( \geq 13 \) were tested using Pearson’s \( \chi^2 \)-test for discrete-valued variables. Continuous variables were analyzed by applying Student’s t-test and the Wilcoxon rank-sum test for normally and abnormally distributed variables, respectively. Analysis of variance (ANOVA) and Bonferroni post-hoc tests were applied for comparison of more than two variables. The method of analysis is always indicated after the respective p-value (in brackets). Multivariate regression (OLS method) was performed to evaluate the influence of age, gender, PASI, PsA, systemic treatment, and center of recruitment on the BDI-II score. The significance level was set to \( p < 0.05 \).

**Results**

**Cohort characteristics**

Overall, 538 patients were included in the study (Table 1). 38.1% were female; the mean age at onset of disease was...
## Table 1 Patient characteristics.

| Patient characteristic                                | Total patients, n (%)a |
|-------------------------------------------------------|------------------------|
| Number of patients                                    | 538                    |
| Female                                                | 205 (38.1)             |
| Age, years (mean, SD)                                 | 50.0 (13.8)            |
| Age at onset of disease, years (mean, SD)             | 30.0 (41.3)            |
| Disease duration, years (mean, SD)                    | 20.4 (14.0)            |
| Family history of psoriasis                           | 254 (47.2)             |
| Disease severity                                      |                        |
| PASI (mean, SD)                                       | 4.7 (6.0)              |
| PASI (median, IQR)                                    | 3.0 (1.2–5.8)          |
| BSA (mean, SD)                                        | 4.6 (6.9)              |
| BSA (median, IQR)                                     | 3 (1–6)                |
| PGA (0–5), (median, IQR)                              | 2 (1–2)                |
| DLQI (mean, SD)                                       | 5.3 (5.9)              |
| DLQI (median, IQR)                                    | 3 (1–8)                |
| Current therapy                                       |                        |
| Topical therapy                                       | 289 (53.7)             |
| Phototherapy                                          | 21 (3.9)               |
| Systemic therapyb                                     | 406 (75.5)             |
| Glucocorticoids                                       | 13 (2.4)               |
| Methotrexate                                          | 94 (17.5)              |
| Cyclosporine A                                        | 2 (0.4)                |
| Leflunomide                                           | 5 (0.9)                |
| Fumaric acid esters                                   | 72 (13.4)              |
| Acitretin                                             | 19 (3.5)               |
| TNFα inhibitors                                       | 147 (27.3)             |
| Ustekinumab                                           | 90 (16.7)              |
| Any biological                                        | 249 (46.3)             |
| Former therapy                                        |                        |
| Number of former therapies                            | 2.3 (1.8)              |
| Phototherapy                                          | 329 (61.2)             |
| Glucocorticoids                                       | 98 (18.2)              |
| Methotrexate                                          | 220 (40.9)             |
| Cyclosporine A                                        | 59 (11.0)              |
| Leflunomide                                           | 30 (5.6)               |
| Fumaric acid esters                                   | 257 (47.8)             |

### Patient characteristic

| Total patients, n (%)a |
|------------------------|
| Acitretin              | 71 (13.2)             |
| TNF-α inhibitors       | 135 (25.1)            |
| Ustekinumab            | 41 (7.6)              |

### Comorbidity

| Total patients, n (%)a |
|------------------------|
| Psoriatic arthritis    | 220 (40.9)            |
| Age at onset of PsA, years (mean, SD) | 41.8 (13.8) |
| Hypertension           | 195 (36.3)            |
| Diabetes               | 61 (11.3)             |
| BMI (mean, SD)         | 28.5 (6.4)            |
| Obesity (BMI ≥ 30)     | 186 (34.6)            |
| Depression             | 92 (17.1)             |
| No depression          | 445 (82.7)            |
| Number of comedication (mean, SD)c | 2.8 (2.5) |

### Smoking status

| Total patients, n (%) |
|-----------------------|
| Current smoker        | 176 (32.7)           |
| Cigarettes per day (mean, SD) | 13.0 (7.3) |
| Ex-smoker             | 210 (39.0)           |
| Never smokers         | 144 (26.8)           |

### AUDIT-C screening instrument (alcohol)

| Total patients, n (%) |
|-----------------------|
| Alcohol consumption, times per week |
| < 1/month or never | 164 (30.5) |
| 1/month             | 121 (22.5) |
| 2–4/month           | 147 (27.3) |
| 2–3/week            | 70 (13.0) |
| > 3/week            | 36 (6.7) |

### Number of drinks per occasion

| Total patients, n (%) |
|-----------------------|
| 1–2                   | 405 (75.3) |
| 3–4                   | 93 (17.3)  |
| 5–6                   | 28 (5.2)   |
| 7–8                   | 9 (1.7)    |
| > 8                   | 3 (0.6)    |

### Consumption of >6 drinks on one occasion

| Total patients, n (%) |
|-----------------------|
| Never                 | 379 (70.5) |
| < 1/month             | 93 (17.3)  |
| 1/month               | 50 (9.3)   |

Continued
Depression screening in psoriasis

30.0 years, and the mean disease duration was 20.4 years. Every second patient reported a positive family history for psoriasis. The disease severity was well controlled with a median PASI of 3.0 (mean BSA: 4.6, median PGA: 2, and mean DLQI: 3.3). 75.5 % of all patients received systemic anti-psoriatic therapy at baseline, with a mean treatment duration of 33.0 months (SD: 35.9; median: 20.8 months), with most frequent administration of biologicals (46.3 % of all patients). Treatment experience was high with an average of 2.3 therapies (phototherapy and/or systemic therapy) per patient in the past. Among these therapies, those most frequently reported were phototherapy (61.2 % of all patients), fumaric acid esters (47.8 %), and methotrexate (40.9 %). Psoriatic arthritis was diagnosed in 40.9 % of patients. Known metabolic and psychological comorbid diseases were frequent (hypertension: 36.3 %; obesity [BMI ≥ 30]: 34.6 %; depression: 17.1; and diabetes: 11.3 %). Current or former tobacco use was common (32.7 % and 39.0 %, respectively). A risk of alcohol use disorder according to the AUDIT-C screening instrument (i.e. scores of ≥ 3 for women and ≥ 4 for men) was detected in 46.7 % of all patients.

Screening for depression

Screening for depressive symptoms resulted in a mean BDI-II score of 8.3 (median: 6; see Figure 1 for the distribution of the BDI-II score). 24.2 % of all participants reached a BDI-II score ≥ 13, suggestive of at least mild depression (Table 2). 28.2 % of patients were tested as positive with the Whooley questions (sensitivity: 81.1 %, specificity: 89.4 %, taking a BDI-II score ≥ 13 as a measure of depression, p < 0.001 χ²-test). The correlation between the Whooley questions and the BDI-II score is shown in Figure 2.

Subgroup analysis according to a BDI-II score ≥ 13 (“depression risk” cohort) vs. BDI-II < 13 (“no risk” cohort) revealed more severe and wide-spread disease in the depression-risk group (median PASI 3.8 vs. 2.8, p = 0.06 Wilcoxon test; mean BSA 6.4 vs. 4.0, p = 0.0008 t-test) as well as higher DLQI scores (mean DLQI 10.1 vs. 3.7, p < 0.0001 Wilcoxon test; Table 2). The correlations between disease severity (PASI) and BDI-II score as well as impaired quality of life (DLQI) and BDI-II score are displayed in Figures 3 and 4. The contour plot (Figure 5) incorporates the three variables: PASI, DLQI, and BDI-II scores, and shows that BDI-II scores are more strongly correlated to the DLQI than to the PASI. Moreover, there was a subgroup of patients with low PASI scores (≤ 5) and DLQI scores (≥ 10) in which the risk of depression according to the BDI-II threshold of 13 was numerically increased, compared to those with higher PASI scores (> 5) and DLQI scores (> 10) (69.7 % [23/33] vs. 59.2 % [29/49]; not statistically significant). The proportion of patients with BDI-II scores of ≥ 13 was significantly lower in patients with PASI scores < 5 and DLQI scores ≤ 10 compared to patients with the same PASI range but DLQI scores > 10 (14.8 % [42/283] vs. 69.7 % [23/33]; p < 0.001 χ²-test). The subgroup with PASI scores ≤ 5 and DLQI scores > 10 was analyzed retrospectively by chart...
review with respect to involvement of locations of special interest (head, nails, genital region) and compared to a control group with PASI ≤ 5 and DLQI ≤ 10, which was matched by age (± 1 year), gender, and center of enrollment. Affection of locations of special interest tended to be higher in the group with PASI scores ≤ 5 and DLQI scores > 10 than in the control group (involvement of head: 57.6 % [19/33] vs. 39.4 % [11/33], p = 0.14; nails: 33.3 % [11/33] vs. 21.2 % [7/33], p = 0.27; genital region: 18.2 % [6/33] vs. 3.0 % [1/33], p = 0.01; involvement of any location of special interest: 72.7 % [24/33] vs. 51.5 % [17/33], p = 0.08, χ²-tests). Gender, age, and disease duration did not impact the BDI-II score significantly in descriptive analysis. However, the age at onset of disease was lower in the “depression-risk” subgroup (18.8 vs. 32.2 years, p = 0.007, t-test). Current and former therapy and the number of previous therapies did not significantly impact the BDI-II score. However, the mean treatment duration of therapy at the time of study participation was lower in the “depression-risk” subgroup (110.8 vs. 138.5 weeks, p = 0.004 Wilcoxon test). Smoking status and alcohol consumption were not significantly associated with depression according to BDI-II. Patients with a concomitant PsA were more likely to report BDI-II scores ≥ 13 than those without PsA (29.1 % [64/220] vs. 20.0 % [62/310], p = 0.002 χ²-test). Likewise, the presence of diabetes was associated with a higher probability to report BDI-II scores ≥ 13 (34.4 % [21/61] vs. 23.1 % [109/471], p = 0.04, χ²-test). A risk of depression did not significantly depend on

| Characteristic | BDI-II < 13, n (%) | BDI-II ≥ 13, n (%) | p-value (test) |
|----------------|-------------------|-------------------|--------------|
| Number of patients | 404 (75.1) | 130 (24.2) |         |
| Female | 147 (36.6) | 58 (44.6) |         |
| Age, years (mean, SD) | 50.5 (13.9) | 48.4 (13.3) |         |
| Age at onset of disease, years (mean, SD) | 35.2 (33.2) | 18.8 (53.4) | 0.007 (t-test) |
| Disease duration, years (mean, SD) | 21.0 (14.0) | 18.4 (13.9) |         |
| Family history of psoriasis | 190 (47.0) | 64 (49.2) |         |
| Treatment duration, weeks (mean, SD) | 138.5 (143.3) | 110.8 (144.3) | 0.004 (Wilcoxon test) |

Disease severity

| Characteristic | BDI-II < 13, n (%) | BDI-II ≥ 13, n (%) | p-value (test) |
|----------------|-------------------|-------------------|--------------|
| PASI (mean, SD) | 4.4 (6.1) | 5.4 (5.8) | 0.06 (Wilcoxon test) |
| PASI (median, IQR) | 2.8 (1.2–5.0) | 3.8 (1.4–7.4) |         |
| BSA (mean, SD) | 4.0 (5.1) | 6.4 (10.6) | 0.0008 (t-test) |
| BSA (median, IQR) | 2 (1–5) | 3 (1–7.5) |         |
| PGA (0–5), (median, IQR) | 2 (1–2) | 2 (1–3) |         |
| DLQI (mean, SD) | 3.7 (4.4) | 10.1 (7.2) | < 0.0001 (Wilcoxon test) |
| DLQI (median, IQR) | 2 (1–5) | 9 (4–16) |         |

Comorbidity

| Characteristic | BDI-II < 13, n (%) | BDI-II ≥ 13, n (%) | p-value (test) |
|----------------|-------------------|-------------------|--------------|
| Psoriatic arthritis | 151 (37.8) | 69 (52.6) | 0.002 (χ²-test) |
| Age at onset of PsA, yrs. (mean, SD) | 41.9 (14.3) | 41.6 (12.5) |         |
| Hypertension | 150 (37.1) | 45 (34.6) |         |
| Diabetes | 40 (10.0) | 21 (16.2) | 0.04 (χ²-test) |
| BMI (mean, SD) | 28.4 (6.3) | 28.7 (6.7) |         |
| Obesity (BMI ≥ 30) | 136 (33.6) | 49 (36.8) |         |
| Depression | 52 (12.8) | 40 (30.3) | < 0.001 (χ²-test) |
| Number of comediations | 2.7 (2.5) | 2.8 (2.5) |         |

*Only significant or almost significant p-values according to a significance level of p < 0.05 are presented.
*The BDI-II questionnaire was filled out incorrectly or incompletely by four patients. These were excluded from further analysis.
the presence of other metabolic comorbid diseases. A BDI-II score of \( \geq 13 \) was associated with a known current or former depression, with a sensitivity of 43.5 % and a specificity of 79.3 % \( (p < 0.0001, \chi^2\text{-test}) \), see Figure 6. However, 69.7 % of patients in our cohort with a BDI-II score \( \geq 13 \) did not have a diagnosed depression.

**Current provision of mental health care**

9.9 % of all patients stated that they currently received psychiatric or psychological care, and these patients had BDI-II scores of \( \geq 13 \) more frequently than patients without such care, respectively \( 54.0 \% [27/50] \) vs. 21.1 % \( [100/475] \), respectively.
We found that multivariate regression (adjusted for age, gender, PASI, PsA, systemic treatment and medical center) showed that female gender (p = 0.005) and presence of PsA (p = 0.007) were significant predictors of higher BDI-II scores (Table 4). Current treatment with any systemic medication tended to be associated with lower BDI-II scores (p = 0.068).

Discussion

To our knowledge this is the first study to investigate the risk of depression in patients with psoriasis using the Whooley questions as well as the BDI-II score. The results of our cohort were consistent with those in published reports on sociodemographic characteristics, comorbidity and therapy [2, 6, 15, 32–34]. Disease activity was very well controlled in our cohort, with a mean PASI of 4.7 (median PASI: 3.0) and a mean DLQI of 5.3 (median DLQI: 3.0). In comparison, the cross-sectional German healthcare study “PsoHealth3”, which included 1,265 patients with psoriasis from 132 dermatological centers in 2014, found a mean PASI of 8.1 (median PASI 5.2) and a mean DLQI of 5.9 (median DLQI: 4.0) [35]. Furthermore, 75.5 % of the patients in our cohort obtained systemic anti-psoriatic therapy at baseline, while 59.5 % of patients in the “PsoHealth3” study had received some systemic treatment at least once in the last five years [35].

Depression was diagnosed in 17.1 % of our whole cohort. Similarly, a recent systematic review found a prevalence of 12 % based on the International Classification of Diseases codes (ICD), and 19 % based on the Diagnostic and Statistical Manual of Mental Disorders (DSMIV) IV [11]. The mean BDI-II score in our cohort was 8.3. Lee et al. found a score of 11.5 in psoriasis patients, compared to 5.7 in the general population [36], while a systematic review reported a score of 13.3 in psoriasis patients [11]. The relatively low BDI-II score in our cohort may be attributable to the setting of specialized tertiary care centers, where systemic anti-psoriatic therapy was carried out in a high proportion of patients. A BDI-II score of ≥ 13 suggested at least a mild depression in 24.2 % of all patients in our cohort, compared to 28 % in a systematic review [11]. However, 69.7 % of patients in our cohort with a BDI-II score of ≥ 13 were not diagnosed with depression. The discrepancy between diagnosed depression (17.1 %) and elevated BDI-II score (24.2 %) in our cohort is compatible with the commonly unmet need of mental health care among psoriasis patients [20]. However, it has to be kept in mind that a BDI-II score is a screening method, and depression cannot be diagnosed with this test alone. 28.2 % of all patients were positive according to the results of the Whooley questions, which resulted in an acceptable sensitivity of 81.1 % and a specificity of 89.4 %, taking a BDI-II score ≥ 13 as a measure of depression. In the German S3 guideline on unipolar depression, the Whooley questions are recommended as a screening tool while the BDI-II score may be applied to monitor depressive symptoms [23, 26].
the good correlation of these two and the simplicity of the Whooley questions, we support the suggestion that this latter simple tool be implemented to screen for relevant depression in patients with psoriasis in routine daily care.

As expected and consistent with the literature, the BDI-II score depended on disease severity and quality of life in our cohort [12]. When analyzing the relationship between disease severity (PASI), quality of life (DLQI), and risk of depression (BDI-II score), we found a stronger correlation between quality of life and risk of depression than for disease severity and risk of depression. Moreover, we assume that PASI and DLQI do not necessarily have an additive effect on the risk of depression.

| Category                        | Total cohort, n (%) | BDI-II < 13, n (%) | BDI-II ≥ 13, n (%) | p-value (test)a |
|---------------------------------|---------------------|--------------------|--------------------|-----------------|
| Current psychiatric/psychological care provision | 50 (9.9)           | 23 (5.8)           | 27 (21.3)          | < 0.001 (χ²-test) |
| Mental health care provider     |                     |                    |                    |                 |
| Psychiatrist currently          | 32 (5.9)            | 16 (3.9)           | 16 (12.0)          |                 |
| Psychiatrist previously         | 110 (20.6)          | 59 (14.6)          | 51 (39.2)          | < 0.001 (χ²-test) |
| Psychotherapist currently       | 23 (4.3)            | 6 (1.5)            | 17 (12.8)          |                 |
| Psychotherapist previously      | 106 (19.9)          | 354 (12.6)         | 74 (42.6)          | < 0.001 (χ²-test) |
| General practitioner currently   | 19 (7.1)            | 8 (2.0)            | 11 (8.2)           |                 |
| Counseling center currently     | 5 (0.9)             | 4 (1.0)            | 1 (0.8)            |                 |
| Counseling center previously    | 41 (7.7)            | 22 (5.5)           | 19 (14.6)          | < 0.001 (χ²-test) |
| Psychiatric medication          |                     |                    |                    |                 |
| Currently                       | 56 (10.4)           | 32 (7.9)           | 24 (18.1)          | 0.0002 (ANOVA); |
| Previously                      | 69 (12.8)           | 46 (11.4)          | 23 (17.3)          | < 0.0001 currently vs. never (Bonferroni); |
| Never                           | 405 (75.3)          | 322 (79.5)         | 83 (62.4)          | < 0.0001 previously vs. never (Bonferroni) |
| Depression/mental health care provider/psychiatric medication | 129 (24.0) | 78 (19.3) | 51 (38.6) | < 0.001 (χ²-test) |

*Only significant p-values comparing the subgroup with BDI-II scores < 13 with the subgroup with BDI-scores ≥ 13 according to a significance level of p < 0.05 are presented.

Figure 7 Depression, psychiatric medication, and mental health care provision. Patients with a known present or past history of depression are symbolized by the red circle, while patients receiving psychiatric medication or seeing a mental health care provider are represented by the yellow and green circles, respectively. The square (blue) represents the whole cohort of patients with a BDI-II score of < 13 (a) and ≥ 13 (b). In the cohort with BDI-II scores of ≥ 13 (b), the proportion of depression, psychiatric medication, and mental health care is higher (larger circles) than in the cohort with BDI-II score < 13 (a), and there is more overlap of the circles (gray area), i.e. patients with depression who receive psychiatric medication and see a mental healthcare provider.
of depression, as we identified a subgroup with low objective disease severity (PASI ≤ 5), but with highly impaired quality of life (DLQI > 10), in which the risk of depression was elevated disproportionately compared to that in patients with higher objective disease severity. This finding is in line with previous research on chronic inflammatory skin diseases such as psoriasis and hidradenitis suppurativa [37–39]. Patients’ perceptions of illness do not always correlate with objective disease severity [37–39]. Thus, there are patients with minimal disease activity but highly impaired quality of life due to their perception of illness, which may in turn trigger depressive symptoms. However, objective disease scores such as PASI do not reflect all aspects of disease severity either. In particular, psoriatic involvement of locations of special interest (such as visible regions and the genital area) has been described as an independent risk factor for impaired DLQI, but does not necessarily lead to a high PASI score [40–42]. This is reflected in a consensus suggestion to “upgrade” patients with objectively mild psoriasis according to PASI but involvement of visible regions or the genital area as described in an independent risk factor for impaired DLQI, but does not necessarily lead to a high PASI score [40–42]. This is reflected in a consensus suggestion to “upgrade” patients with objectively mild psoriasis according to PASI but involvement of visible regions or the genital area, and a DLQI > 10 to moderate-to-severe psoriasis [43]. We identified a subgroup with high DLQI scores yet low PASI scores, in which the risk of depression was elevated compared to a control group with both low DLQI and low PASI scores. In this subgroup, patients had a numerically higher involvement of location of special interests (such as head, nails, and the genital area) which may have contributed to impaired quality of life and a higher BDI-II score. Although not found with uncorrected analysis, multivariate regression adjusted for age, gender, PASI, PsA, systemic treatment, and medical center revealed higher BDI-II scores in women, which was also described by Dommasch and colleagues [18]. Interestingly, current systemic treatment had a tendency toward lower BDI-II scores in multivariate regression. Similarly, several publications demonstrated an inverse correlation between biological treatment and depression [12, 19]. However, the “anti-depressive” effect of biologicals might also be mediated by their effectiveness on psoriasis symptoms. Psoriatic arthritis was described as a predictor of depression in one report [18] due to functional disability and pain, which we also found in our descriptive and multivariate analysis. Likewise, presence of diabetes was associated with higher BDI-II scores. Semenkovich and colleagues reported an odds ratio of 1.6 for the presence of depression in patients with diabetes (without psoriasis) [44]. One out of ten patients in our cohort received mental health care at the time of data acquisition, most frequently by a psychiatrist or psychotherapist, and 19 patients (7.1%) consulted their general practitioner in that respect. We found that BDI-II ≥ 13 was present in patients despite seeing both a health care provider and anti-depressive drugs, indicating that normalization of depressive symptoms is not always easy. On the other hand, only 38.6% of patients at risk of depression (i.e., BDI-II score ≥ 13) had a mental health care provider, received psychiatric medication or were diagnosed with depression, leaving a gap of 61.4% patients in need of diagnostic investigation and possibly therapy of depressive symptoms.

Several limitations have to be kept in mind when interpreting the results of this study. Firstly, patients were recruited in specialized tertiary care centers, which might introduce a selection bias—for example, for patient preferences or availability of medical care. Secondly, there might have been study participants who are non-native German speakers and could thus have had difficulties in understanding the exact wording of the German questionnaires. Thirdly, although we adjusted for a wide range of patient and treatment characteristics, relevant associated variables might have been neglected (e.g., socioeconomic status). Fourthly, the BDI-II instrument and the Whooley questions serve as screening tools only, and cannot establish diagnosis of depression without other tests. Prospective studies with follow-up of psoriasis patients after initial screening for depression would therefore be desirable.

A major strength of the study is its multicenter design. The relationship between psoriasis and risk of depression assessed with validated screening instruments was investigated in a large patient cohort with extensive subgroup analysis with regard to patient and disease characteristics. In conclusion, dermatologists, patients, and co-treating physicians (e.g., general practitioners) should be aware that depression is a relevant comorbid condition in psoriasis patients. We suggest that the simple Whooley questions for depression screening in psoriasis be implemented in daily routine care to optimize patient management.

Acknowledgment

The authors would like to thank Cecil Juhnke for her assistance in conducting the study.
Open access funding enabled and organized by Projekt DEAL.

Funding source

This work was supported by a research grant from Novartis Pharma. The funding source had no role in the design of this study, its execution, analysis or interpretation of data or decision to submit results.

Conflict of interest

SG has been an advisor and/or received speakers’ honoraria and/or received grants and/or participated in clinical trials conducted by the following companies: Abbott/AbbVie, Almirall-Hermal, Amgen, Anaptys Bio, Bayer Health Care, Biogen Idec, Boehringer Ingelheim, Celgene, Centocor, Dermira, Eli Lilly, Foamix, Forward Pharma, Galderma, Hexal AG, Isotechnika, Janssen-Cilag, Johnson & Johnson, Leo Pharma, Medac, Merck Serono, Mitsubishi Tanabe, MSD, Novartis, Pfizer, Polichem SA, Sandoz Biopharmaceuticals, Sanofi-Aventis, Schering-Plough, Sienna Biopharmaceuticals, Takeda, Teva, UCB Pharma, VBL therapeutics, Wyeth Pharma. DW-T has been an advisor and/or received speakers’ honoraria or travel expense reimbursements and/or received grants and/or participated in clinical trials of the companies AbbVie, Almirall, Amgen, Beiersdorf, Biogen, Boehringer Ingelheim Pharma, Celgene, Forward Pharma, GlaxoSmithKline, Janssen-Cilag, Leo, Lilly, Medac, Merck Sharp & Dohme Corp., Novartis, Pfizer, UCB Pharma, and VBL. CK has been an advisor and/or received speakers’ honoraria or travel expense reimbursements and/or received grants and/or participated in clinical trials of the following companies: Abbott/AbbVie, Allmirall, Biogen IDEC GmbH, Boehringer Ingelheim GmbH, Celgene, Forward Pharma, GlaxoSmithKline, Janssen-Cilag GmbH and Novartis Pharma GmbH. RM has been an advisor and/or received speakers’ honoraria or travel expense reimbursements and/or received grants and/or participated in clinical trials of the following companies: Abbott/AbbVie, Almirall, Amgen, Biogen, Biogen IDEC GmbH, Boehringer Ingelheim GmbH, Celgene, Janssen-Cilag GmbH, Leo Pharma GmbH, Lilly, Merck Serono GmbH, MSD SHARP & DOHME GmbH, Novartis Pharma GmbH, Pfizer GmbH and UCB. DC has no conflicts of interest to declare.

Correspondence to

Prof. Dr. med. Roratun Mössner, MD
Department of Dermatology
Georg-August-University Göttingen
Robert-Koch-Strasse 40
37075 Göttingen, Germany
E-mail: rmoessn@gwdg.de

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