

ORIGINAL RESEARCH

Impact of skin, musculoskeletal and psychosocial aspects on quality of life in psoriatic arthritis patients: A cross-sectional study of outpatient clinic patients in the biologic treatment era

Glenn Haugeberg ¹, Brigitte Michelsen ², Arthur Kavanaugh³

To cite: Haugeberg G, Michelsen B, Kavanaugh A. Impact of skin, musculoskeletal and psychosocial aspects on quality of life in psoriatic arthritis patients: A cross-sectional study of outpatient clinic patients in the biologic treatment era. *RMD Open* 2020;**6**:e001223. doi:10.1136/rmdopen-2020-001223

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/rmdopen-2020-001223>).

Received 6 March 2020
Revised 14 April 2020
Accepted 16 April 2020



© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

¹Division of Rheumatology, Dept. of Medicine, Sorlandet Hospital Kristiansand, Kristiansand, Norway

²Department of Rheumatology, Hospital of Southern Norway Trust Kristiansand, Kristiansand, Norway

³UCSD, San Diego, California, USA

Correspondence to

Glenn Haugeberg;
glenn.haugeberg@sshf.no

ABSTRACT

Background In psoriatic arthritis (PsA), both psoriasis and musculoskeletal manifestations may impair Health-Related Quality of Life (HRQoL). Our objective was to explore the impact of the various disease manifestations and disease consequences, including psychosocial factors, on HRQoL in PsA patients treated in the biologic treatment era.

Methods Data collection in the 131 outpatient clinic PsA patients assessed included demographics, disease activity measures for both skin and musculoskeletal involvement and patient-reported outcome (PRO) measures, treatment and psychosocial burden. The skin dimension of quality of life was assessed by the Dermatology Life Quality Index (DLQI) and the overall HRQoL by the 15-Dimensional (15D) Questionnaire.

Results The mean age was 51.9 years, PsA disease duration 8.6 years, 50.4% were men, 56.9% were employed/working and 47.7% had ≥ 1 comorbidities. Prevalence of monotherapy with conventional synthetic disease-modifying antirheumatic drugs (csDMARDs) was 36.6% and with biologic DMARDs 12.2% and combination of both 22.9%. Mean DLQI was 3.3 and 15D 0.84. In adjusted analysis, not employed/working, higher scores for fatigue, sleep disturbances, anxiety and depression, Modified Health Assessment Questionnaire and presence of comorbidities were independently associated with impaired HRQoL (lower 15D scores), whereas Psoriasis Area Severity Index (PASI) and DLQI were not. Younger age and higher Psoriatic Arthritis Disease Activity Score and PASI scores were independently associated with impaired skin quality of life (higher DLQI score).

Conclusion Our study highlights the negative impact the psychosocial burden, impaired physical function and comorbidities has on reduced HRQoL in PsA outpatients. Thus, to further improve HRQoL in PsA patients, not only physical concerns but also psychological concerns need to be addressed.

BACKGROUND

Psoriatic arthritis (PsA) is a chronic immune-mediated inflammatory disease involving both the skin and the musculoskeletal system.¹

Key messages**What is already known about this subject**

► There has been a growing awareness that psychosocial aspects and not only musculoskeletal and skin involvement contributes to impaired health-related quality of life (HRQoL) in psoriatic arthritis (PsA) patients.

What does this study add

► This study highlights that psychosocial aspects seem to be far more important than musculoskeletal and skin involvement reducing HRQoL in PsA outpatient clinic patients in the biologic treatment era.

How might this impact on clinical practice

► Clinicians treating PsA patients' need to be aware of the psychosocial dimensions when aiming to improve HRQoL in PsA patients.
► Thus, questionnaires addressing psychosocial dimensions should be implemented as part of standard clinical care.

The musculoskeletal presentation in PsA is heterogeneous, and patients may present with peripheral or axial arthritis, dactylitis, enthesitis, and other features. The clinical consequences for the PsA patient may include pain, fatigue, stiffness, loss of physical function and itchy and scaly skin. Psoriasis may also cause psychological distress causing negative body image, poor self-esteem, anxiety, depression and even increased suicidality.² Thus, both the musculoskeletal and the skin manifestation in PsA may have a negative impact on psychological, social and physical aspects of Health-Related Quality of Life (HRQoL).^{3,4}

In active PsA, optimal improvements in HRQoL have also been found to be dependent on successful treatment of both joint and skin symptoms.⁵

Despite the significant improvements achieved by treating PsA patients with new immunomodulatory therapies in the biologic treatment era, there is still a need for improvement.^{6,7} Which role psoriasis and musculoskeletal involvement plays for HRQoL in PsA patients in the biologic treatment era is not fully illuminated and has not been extensively explored.

Thus, the aim of this cross-sectional study was to assess HRQoL in PsA patients exploring associations between HRQoL with demographic variables, measures reflecting skin, musculoskeletal involvement, comorbidities as well as psychosocial factors.

METHODS

PsA patients fulfilling the Classification of Psoriatic Arthritis criteria (CASPAR) were recruited from an outpatient clinic in Southern Norway in the period from January 2013 to May 2014. Patient recruitment and data collection from this cross-sectional study have previously been described in detail.⁷ A broad spectrum of data as listed in [table 1](#) was collected including demographics, measures of musculoskeletal and skin disease activity, patient-reported outcome measures (PROs) and HRQoL measures. In the present HRQoL study, we also report data on exercise, sleep disturbance and anxiety and depression. For exercise, the patients were categorised into (1) those who performed exercise 1–2 times per week or more and 2) those who did less exercise than 1–2 times per week or did no exercise at all.

Patients' sleep disturbance was reported on a Numeric Rating Scale (NRS, 0–10). The anxiety and depression question had three response alternatives: 'I am not anxious or depressed' (score 1), 'I am moderately anxious or depressed' (score 2) and 'I am extremely anxious or depressed' (score 3).

A summed score for comorbidities was calculated based on the presence of cardiovascular disease (CVD), pulmonary disease, neurological disease, urogenital disease, gastrointestinal disorders, endocrine disorders, cancer and mental disorder (range 0–8). Prevalence of patients with ≥ 1 comorbidities was calculated and used in analysis exploring for associates with HRQoL measures.

We also collected data on the current use of prednisolone and current and ever use of conventional synthetic disease-modifying antirheumatic drugs (csDMARDs) and biologic DMARDs (bDMARDs).

HRQoL was assessed using the 15-Dimensional (15D) Questionnaire.⁸ The 15D Questionnaire is a generic, multidimensional, standardised tool for evaluating HRQoL, which is used primarily as a single index measure, but can also be used as a profile utility measure. It describes the patient's health status, assessing 15 different dimensions: mobility, vision, hearing, breathing, sleeping, eating, speech, elimination, usual activities, mental function, discomfort and symptoms, depression, distress, vitality and sexual activity.⁸ Each dimension comprises one question with five response categories. A single utility index score is

obtained by incorporating population-based preference weights to the dimensions.^{9,10} The calculated scores fall between 0.0 (being dead) and 1.0 (no problems on any dimension). The Dermatology Life Quality Index (DLQI) Questionnaire (range 0–30) was used to measure the skin impact of psoriasis on HRQoL.¹¹

Statistical analyses

The Statistical Package for Social Science (SPSS V.25) for Windows was used for statistical analyses. Continuous variables were presented as mean with SD and categorical variables as numbers and proportions (%). Comparisons between two groups were analysed using χ^2 test for categorical variables and independent samples t-test for continuous variables.

Associations between the independent variables and the quality of life measures DLQI and 15D as dependent variables for the whole study population were explored in univariate and multivariate linear regression analyses (enter procedure). The model was adjusted mandatorily for age, gender and body mass index (BMI). For robustness, we also tested the final multivariate models with forward and backward procedures. To be included in the multivariate model, the p value in the univariate analyses for the tested variables listed in [table 1](#) had to be < 0.10 . The composite scores DAPSA and Psoriatic Arthritis Disease Activity Score (PASDAS) were subsequently tested in the models.

The independent variables which were significantly associated with DLQI and 15D in the univariate analyses but were highly correlated in between each other (Pearson correlation coefficient > 0.7) were also tested one by one in the model.

We also performed analyses separately for men and women. Adjusted analyses were performed with the enter procedure, adjusted for age and BMI and subsequently tested with forward procedure to explore for consistency. The level of significance was set at $p < 0.05$.

RESULTS

For the 131 PsA patients with HRQoL data available, the mean age was 51.9 years, disease duration 8.6 years, BMI 28.2 kg/m², 50.4% were men, 16% were current smokers, 79.8% were living together and 56.9% were part-time or full-time employed/working. In [table 1](#), patient characteristics are shown for all PsA patients and for men and women separately. The proportion of patients reporting to be 'not anxious or depressed' was 63.0%, 'moderately anxious or depressed' 31.5% and 'extremely anxious or depressed' 5.5%.

The proportion of patients using prednisolone was 6.9%, using bDMARD monotherapy was 12.2%, using csDMARD monotherapy was 36.6% and using bDMARD/csDMARD combination therapy was 22.9%. The proportion of patients using neither csDMARDs, bDMARDs nor prednisolone was 26.7%. The proportion

Table 1 Characteristics of all psoriasis arthritis patients and for men and women separately

	Total (n=131)	Men (n=66) 50.4%	Women (n=65) 49.6%	P value
Demographics				
Age, years, mean (SD)	51.9 (10.1)	51.4 (10.2)	52.5 (10.2)	0.55
BMI, kg/m ² (n=129), mean (SD)	28.2 (4.4)	28.6 (3.9)	27.9 (4.9)	0.36
Currently smoking, n (%)	21 (16.0%)	9 (13.6%)	12 (18.5%)	0.45
Living together (n=129), number (%)	103 (79.8%)	54 (83.1%)	49 (76.6%)	0.36
Part- time/full time employed/working (n=130), number (%)	74 (56.9%)	44 (67.7%)	30 (46.2%)	0.013
Musculoskeletal disease measures				
PsA disease duration, years, mean (SD)	8.6 (6.6)	8.4 (7.0)	8.8 (6.1)	0.73
CRP, mg/L, mean (SD)	4.8 (8.5)	6.5 (10.8)	3.0 (4.4)	0.017
TJC68 (n=130), mean (SD)	10.4 (11.1)	8.1 (10.3)	12.7 (11.6)	0.018
SJC66 (n=130), mean (SD)	0.6 (1.1)	0.6 (1.1)	0.7 (1.0)	0.49
DAPSA, range 0–164, mean (SD)	18.6 (14.3)	15.3 (13.0)	21.9 (14.8)	0.007
PASDAS, mean (SD)	3.1 (0.4)	3.0 (0.5)	3.2 (0.4)	0.031
MASES, range 0–13, mean (SD)	2.9 (3.1)	1.8 (2.4)	4.1 (3.3)	<0.001
IGA, VAS 0–100 mm, mean (SD)	14.6 (12.5)	14.5 (13.0)	14.8 (12.1)	0.89
PROs				
PGA, VAS 0–100 mm, mean (SD)	36.4 (24.8)	30.8 (22.9)	42.1 (25.5)	0.009
Pain, VAS 0–100 mm, mean (SD)	33.9 (23.3)	29.2 (22.3)	38.7 (23.4)	0.019
Fatigue, VAS 0–100 mm, mean (SD)	45.5 (32.7)	35.6 (30.8)	55.5 (31.7)	<0.001
Morning stiffness, hour, mean (SD)	0.95 (1.24)	0.92 (1.31)	0.97 (1.18)	0.83
Sleep disturbance†, NRS 0–10, mean (SD)	3.34 (2.94)	2.67 (2.70)	4.03 (3.03)	0.007
Anxiety/depression, range 1–3, (n=127) mean (SD)	1.43 (0.60)	1.33 (0.54)	1.52 (0.64)	0.065
MHAQ, range 0–3, mean (SD)	0.42 (0.40)	0.34 (0.33)	0.51 (0.45)	0.012
Exercise ≥1 time per week, number (%)	58 (44.3%)	29 (43.9%)	29 (44.6%)	0.94
Ultrasound				
Power Doppler signal present in any joints, entheses or tendons number (%)	65 (49.6%)	31 (47.0%)	34 (52.3%)	0.54
PD sum score in joints, entheses and tendons (range 0–347), mean (SD)	1.3 (1.9)	1.3 (2.1)	1.2 (1.7)	0.90
Comorbidity				
Comorbidities (n=128), (range 0–8), mean (SD)	0.73 (0.96)	0.48 (0.76)	0.97 (1.08)	0.004
Comorbidities ≥1 (n=128), number (%)	61 (47.7%)	23 (35.9%)	38 (59.4%)	0.008
Skin				
PASI (range 0–72) (n=130), mean (SD)	2.5 (3.7)	3.2 (4.2)	1.8 (2.9)	0.033
PASI score ≥10 (n=130), number (%)	10 (7.7%)	8 (12.1%)	2 (3.1%)	0.054
HRQoL measures				
15D score (range 0–1), mean (SD)	0.84 (0.10)	0.86 (0.16)	0.82 (0.18)	0.008
DLQI, range 0–30 (n=129), mean (SD)	3.3 (3.6)	3.2 (3.5)	3.4 (3.8)	0.72
Treatment				
Current bDMARD, n (%)	46 (35.1%)	29 (43.9%)	17 (26.2%)	0.033
Current csDMARD, n (%)	78 (59.5%)	42 (63.6%)	36 (55.4%)	0.34
Ever bDMARD, n (%)	51 (38.9%)	30 (45.5%)	21 (32.3%)	0.12
Ever csDMARD, n (%)	117 (89.3%)	59 (89.4%)	58 (89.2%)	0.98

Continuous variables are expressed as mean (standard variation); categorical variables are expressed as numbers (proportions). In the group comparisons, the independent sample t-test was used for continuous variables and the χ^2 test for categorical variables. The number of patients in the analyses is 131 if not otherwise indicated.

†The sleep question is phrased as follows: ‘Select the number that best describes the sleep difficulties (ie, resting at night) you felt due to your arthritis during the last week (from 0 (no difficulty) to 10 (extreme difficulty))’.

bDMARDs, biologic disease-modifying anti-rheumatic drugs; BMI, body mass index; CRP, C reactive protein; csDMARDs, conventional synthetic DMARDs; DAPSA, Disease Activity Index for Psoriatic Arthritis; DLQI, Dermatology Life Quality Index; ESR, erythrocyte sedimentation rate; IGA, Investigator Global Assessment; MASES, Maastricht Ankylosing Spondylitis Enthesitis Score; MHAQ, Modified Health Assessment Questionnaire; NRS, Numeric Rating Scale; PASDAS, Psoriatic Arthritis Disease Activity Score; PASI, Psoriasis Area Severity Index; PGA, patient global assessment; PROs, patient-reported outcome measures; PsA, psoriatic arthritis; SJC, swollen joint count; TJC, tender joint count; VAS, Visual Analogue Scale.

of ever users of prednisolone was 10.7%, of csDMARDs was 89.3%, of bDMARDs was 38.9% and of any of these was 92.4%.

The mean value for the 15D HRQoL measure was 0.84. For Psoriasis Area Severity Index (PASI) and DLQI, the mean values were 2.5 and 3.3, respectively. Ten patients had a PASI score >10 and 10 patients had a DLQI >10, indicating a moderate-to-severe psoriasis.¹² Four patients had both a PASI and DLQI score >10.

Associations with the 15D HRQoL measure

In table 2, the variables tested for their univariate association with impaired HRQoL (lower 15D score) are shown.

A strong correlation (Pearson correlation coefficient >0.7) between the following independent variables was found: TJC68 and DAPSA ($r=0.952$) and PGA and pain ($r=0.841$). Thus, TJC28 and PGA were left out of the final adjusted models.

In multivariate analyses, as shown in table 2, not being employed/working, higher scores for fatigue, sleep disturbances, anxiety/depression, Modified Health Assessment Questionnaire (MHAQ) and presence of comorbidities were independently associated with impaired HRQoL. Testing for model robustness with forward and backward procedure in the multivariate regression model did not change the significance of the findings.

The results testing each gender separately is shown in supplementary tables 1a-b. In adjusted analysis, higher scores for fatigue, sleep disturbances and anxiety/depression were independently associated with impaired HRQoL in men and sleep disturbances, anxiety/depression, impaired physical function (MHAQ) and comorbidities in women. The same pattern was seen using forward and backward procedure in the adjusted analysis.

Associations with the dermatology Life Quality Index

In table 3, the variables tested for their univariate association with an impaired skin-related quality of life (higher DLQI score) are shown. In multivariate analyses, as shown in table 3, younger age and higher PASDAS and PASI scores were independently associated with higher DLQI score. Whereas, increased pain was border significantly associated with higher DLQI. When using forward and backward multivariate regression models, testing for model robustness, the variables remained significantly associated with an impaired skin quality of life (increased DLQI).

The results testing each gender separately are shown in the supplementary file. In adjusted analysis (enter procedure) adjusting for age and BMI, younger age and higher scores for PASDAS and PASI were independently associated with impaired skin quality of life in men, and in women only higher PASI score. In adjusted analysis (forward procedure), in men younger age, higher pain, PASDAS, and PASI score and in women higher pain and PASI score were independently associated with impaired skin quality of life (higher DLQI score).

DISCUSSION

The main findings in our cross-sectional study of PsA outpatients were that fatigue, sleep disturbances, anxiety/depression, impaired physical function (MHAQ), not being employed/working and presence of comorbidities were independently associated with impaired HRQoL. For measures of the PsA inflammatory disease process, univariate associations with impaired HRQoL were found for tender joint count (TJC68), enthesitis score (MASES), investigator global score (IGA) and the composite scores DAPSA and PASDAS. However, no association was found with more objective measures of inflammation, neither for skin (PASI) or for musculoskeletal involvement (CRP, SJC66 and ultrasonography). Further, no independent association with HRQoL was found neither for psoriasis skin involvement (PASI score) nor for skin quality of life (DLQI score). Only in univariate analysis, DLQI was found to be associated with impaired HRQoL. However, exploring the skin quality of life dimension separately identified younger age, higher PASDAS and PASI scores to be independently associated with impaired skin quality of life (higher DLQI score).

In the literature, both the psoriasis and the PsA disease are well documented to negatively affect HRQoL.^{413–15}

In PsA patients, more severe skin involvement has been shown to be associated with worse disease burden, and optimal improvement in HRQoL has been shown to be dependent on successful treatment of both skin and joint symptoms.^{5 16 17}

In our PsA cohort, we did not find any independent associations between impaired HRQoL assessed by 15D and psoriasis severity (PASI) nor psoriasis quality of life (DLQI). The lack of association between psoriasis severity and HRQoL in PsA has also been reported by others.^{18 19}

In PsA, as also shown in our study, subjective scores have been reported to be higher in women than in men, whereas for more objective measures of inflammation, more similar results have been found between genders.^{20 21} In our cohort of PsA patients, women had a poorer HRQoL than men. A gender difference was, however, not found in adjusted analysis for HRQoL. In the literature, female PsA patients have been reported to have a poorer HRQoL than men.¹⁸

The psychosocial burden of PsA has been documented to have a major negative impact on HRQoL.²² PsA patients have been reported to suffer from increased sleep disorders, fatigue, low-level stress, depression and mood/behavioural changes, poor body image, and also to have reduced work productivity.²² In our study, sleep disturbance, fatigue, anxiety/depression and not working were also found to be independently associated with impaired HRQoL. Recently, an international patient and physician consensus on a PsA core outcome set for clinical trials to be used in RCT and longitudinal observational studies was published.²³ In this core outcome set, patients rated the importance of, for example, work, independence,

Table 2 Associations with the Health-Related Quality of Life measure 15D in psoriatic arthritis patients tested in univariate and multivariate linear regression models. Only variables with a p value <0.10 in the univariate analysis were tested in the multivariate analysis, which was adjusted for age, gender and BMI independent of their significance in the univariate analyses. Apart from age, gender and BMI, only variables with a p value <0.01 are displayed in the multivariate analysis

	Univariate analyses		Adjusted analyses	
	B (95% CI)	P value	B (95% CI)	P value†
Age, years	-0.001 (-0.003, 0.000)	0.15	-0.001 (-0.002, 0.000)	0.16
Female gender	-0.046 (-0.079, -0.012)	0.008	0.016 (-0.004, 0.035)	0.118
BMI, kg/m ²	-0.004 (-0.008, 0.000)	0.057	0.001 (-0.001, 0.003)	0.47
Current smoking	-0.060 (-0.106, -0.014)	0.011		
Part time/full time employed/working	0.084 (0.052, -0.116)	<0.001	0.021 (0.000, 0.041)	0.045
PsA disease duration, years	-0.001 (-0.004, 0.001)	0.36		
CRP, mg/L	0.000 (-0.002, 0.002)	0.71		
TJC68	-0.003 (-0.005, -0.002)	<0.001*		
SJC66	-0.005 (-0.021, 0.012)	0.58		
DAPSA, range 0-164	-0.004 (-0.005, -0.003)	<0.001		
PASDAS	-0.097 (-0.131, -0.062)	<0.001‡		
MASES, range 0-13	-0.013 (-0.018, -0.008)	<0.001		
IGA, VAS 0-100 mm	-0.002 (-0.004, -0.001)	<0.001		
PGA, VAS 0-100 mm	-0.003 (-0.003, -0.002)	<0.001*		
Pain, VAS 0-100 mm	-0.003 (-0.003, -0.002)	<0.001		
Fatigue, VAS 0-100 mm	-0.002 (-0.003, -0.002)	<0.001	-0.001 (-0.001, -0.000)	<0.001
Morning stiffness, hour	-0.025 (-0.039, -0.012)	<0.001		
Sleep disturbance, NRS 0-10	-0.024 (-0.028, -0.020)	<0.001	-0.008 (-0.013, -0.004)	<0.001
Anxiety/depression, range 1-3	-0.094 (-0.119, -0.070)	<0.001	-0.047 (-0.064, -0.030)	<0.001
MHAQ, range 0-3	-0.172 (-0.204, -0.141)	<0.001	-0.053 (-0.086, -0.020)	0.002
Exercise ≥1 time per week	0.029 (-0.005, 0.064)	0.098		
Power Doppler signal present in any joints, entheses or tendons	-0.006 (-0.040, 0.029)	0.74		
Power Doppler sum score in joints, entheses and tendons (range 0-347)	0.003 (-0.006, 0.012)	0.55		
Comorbidities ≥1	-0.059 (-0.092, -0.025)	0.001	-0.031 (-0.050, -0.012)	0.002
PASI, range 0-72	-0.002 (-0.007, 0.003)	0.36		
PASI score ≥10	-0.055 (-0.120, 0.009)	0.091		
DLQI, range 0-30	-0.007 (-0.012, -0.003)	0.002		
Current use of bDMARD	-0.006 (-0.042, 0.030)	0.75		
Current use of csDMARD	-0.005 (-0.040, 0.030)	0.77		
Ever use of bDMARD	-0.013 (-0.049, 0.022)	0.46		
Ever use of csDMARD	-0.039 (-0.095, 0.016)	0.16		

*Not in the final multivariate model.

†With DAPSA in the model.

‡The independent associations remained overall the same when DAPSA was replaced by PASDAS in the model.

bDMARDs, biologic disease-modifying antirheumatic drugs; BMI, body mass index; CRP, C reactive protein; csDMARDs, conventional synthetic DMARDs; DAPSA, Disease Activity Index for Psoriatic Arthritis; DLQI, Dermatology Life Quality Index; IGA, Investigator’s Global Assessment; MASES, Maastricht Ankylosing Spondylitis Enthesitis Score; MHAQ, Modified Health Assessment Questionnaire; NRS, Numeric Rating Scale; PASDAS, Psoriatic Arthritis Disease Activity Score; PASI, Psoriasis Area Severity Index; PGA, Patient’s Global Assessment; PsA, psoriatic arthritis; SJC, swollen joint count; TJC, tender joint count; VAS, Visual Analogue Scale.

physical function and perception of pain and fatigue to be most important.²³ However, in our study, pain was not found to be independently associated with impaired HRQoL. Sleep disturbances, which in our

study was independently associated with impaired HRQoL, have also by others been reported to be frequent in PsA patients.^{24 25} In a Nordic survey study, as many as 44.5% of the PsA patients reported

Table 3 Associations with the DLQI skin-related quality of life measure in psoriatic arthritis patients tested in univariate and multivariate linear regression models. Only variables with a p value <0.10 in the univariate analyses were tested in the multivariate analysis, which was adjusted for age, gender and BMI independent of their significance in the univariate analyses. Apart from age, gender and BMI, only variables with a p value <0.01 are displayed in the multivariate analysis

	Univariate analyses		Adjusted analyses	
	B (95% CI)	P value	B (95% CI)	P value†
Age, years	-0.066 (-0.128, -0.004)	0.037	-0.074 (-0.128, -0.020)	0.008
Female gender	0.232 (-1.043, 1.506)	0.72	-0.060 (-1.021, 1.140)	0.91
BMI, kg/m ²	0.122 (-0.023, 0.266)	0.01	-0.006 (-0.132, 0.120)	0.93
Currently smoking	0.658 (-1.076, 2.391)	0.45		
Part-time/full-time employed/working	-1.309 (-2.581, -0.037)	0.044		
Disease duration, years	-0.015 (-0.113, 0.082)	0.76		
CRP, mg/L	0.055 (-0.020, 0.130)	0.15		
TJC68	0.015 (-0.042, 0.072)	0.61		
SJC66	-0.118 (-0.727, 0.490)	0.70		
DAPSA, range 0–164‡	0.039 (-0.005, 0.084)	0.080		
PASDAS	2.684 (1.341, 4.026)	<0.001	1.506 (0.240, 2.771)	0.020
MASES, range 0–13	0.152 (-0.050, 0.355)	0.14		
IGA, VAS 0–100 mm	0.047 (-0.004, 0.097)	0.068		
PGA, VAS 0–100 mm	0.052 (0.028, 0.076)	<0.001*		
Pain, VAS 0–100 mm	0.051 (0.025, 0.077)	<0.001	0.034 (-0.001, 0.068)	0.058
Fatigue, VAS 0–100 mm	0.033 (0.015, 0.052)	0.001		
Morning stiffness, hour	0.485 (-0.023, 0.992)	0.061		
Sleep disturbance, NRS 0–10	0.363 (0.155, 0.572)	0.001		
Anxiety/depression, range 1–3	0.766 (-0.309, 1.841)	0.16		
MHAQ, range 0–3	2.642 (1.113, 4.170)	0.001		
Exercise ≥1 time per week	-1.286 (-2.549, -0.023)	0.046		
Power Doppler signal present in any joints, entheses or tendons	-0.315 (-1.589, 0.959)	0.63		
Power Doppler sum score in joints, entheses and tendons (range 0–347)	-0.262 (-0.598, 0.074)	0.13		
Comorbidities ≥1	0.485 (-0.804, 1.773)	0.458		
PASI, range 0–72	0.587 (0.445, 0.728)	<0.001	0.560 (0.420, 0.700)	<0.001
Current bDMARD	-0.382 (-1.716, 0.952)	0.57		
Current csDMARD	-0.898 (-2.187, 0.391)	0.17		
Ever bDMARD	-0.157 (-1.463, 1.150)	0.81		
Ever csDMARD	-0.215 (-2.277, 1.848)	0.84		

*Not in the final multivariate model.

†With PASDAS in the model.

‡With DAPSA instead of PASDAS in the model only age, PASI and comorbidities remained but not DAPSA was statistically significantly associated with DLQI.

bDMARDs, biologic disease-modifying antirheumatic drugs; BMI, body mass index; CRP, C reactive protein; csDMARDs, conventional synthetic DMARDs; DAPSA, Disease Activity Index for Psoriatic Arthritis; DLQI, Dermatology Life Quality Index; IGA, Investigator Global Assessment; MASES, Maastricht Ankylosing Spondylitis Enthesitis Score; MHAQ, Modified Health Assessment Questionnaire; NRS, Numeric Rating Scale; PASDAS, Psoriatic Arthritis Disease Activity Score; PASI, Psoriasis Area Severity Index; PGA, Patient Global Assessment; SJC, swollen joint count; TJC, tender joint count; VAS, Visual Analogue Scale.

sleep disturbances.²⁴ Anxiety was also, in the recent published study by Baviera *et al*, found to be independently associated with impaired HRQoL.²⁶ The impact of depression and anxiety on HRQoL of life is significant as also shown in our PsA patients. Patient's

depression and anxiety status need to be taken into account when aiming for remission. In the NOR-DMARD registry, PsA patients with depression/anxiety at baseline starting on DMARDs were less likely to achieve remission based on composite scores.²⁷ This

was explained by higher PGA and joint pain, and not by the objective measures of inflammation SJC and CRP at follow-up.²⁷ Further, in a recently published study, fibromyalgia, with anxiety and depression being the psychosocial background of fibromyalgia, was found to be the strongest predictor of not achieving minimal disease activity in PsA patients.²⁸

All these psychosocial patient perceptions and pain may end up in a vicious circle of, for example, fatigue, sleep disturbances and depression, and in addition to impaired physical function contribute to reduced work capacity, which is reduced in PsA patients.²⁹ In our study, not being employed/working was independently associated with impaired HRQoL. With the introduction of bDMARDs, work productivity has however increased.³⁰

Presence of comorbidities was in our study independently associated with impaired HRQoL in PsA. In the recently published study, Baviere *et al* suggested that type of comorbidity appeared to have a greater impact than number of comorbidities on HRQoL in PsA. In their study, they identified anxiety to be independently associated with impaired HRQoL, as we also did.²⁶

In PsA, DMARD treatment by reducing psoriasis severity, arthritis and enthesitis activity and achieving minimal disease activity has shown to improve HRQoL.^{4 5 31–35} Despite these significant clinical improvements, there is still an unmet need in the biologic era to improve clinical outcomes and HRQoL in PsA.^{6 7} In our cohort of PsA patients, 36.6% were using csDMARD monotherapy, 12.2% bDMARD monotherapy and 22.9% combination of csDMARD and bDMARD. Apart from one patient using ustekinumab, all patients using bDMARDs were using TNFi. With new biologics beyond TNFi and the newly targeted synthetic DMARDs, further improvement in outcomes may also be expected in future studies.

We should also emphasise that both PASI (2.5) and DLQI (3.3) scores and musculoskeletal disease activity measures were low in our PsA patient cohort compared with what is seen at inclusion in RCTs. In our study, only 7.6% of our PsA cohort had a PASI and DLQI score high enough (>10) to be defined as moderate-to-severe psoriasis.¹² For comparison, in the SPIRIT ixekizumab RCT trials, the mean baseline values for the PsA patients were 8.7 for DLQI and 8.5 for PASI. For measures reflecting PsA inflammatory musculoskeletal involvement, significantly lower values compared with the SPIRIT trial patients were found in our study, for example, for both TJC68 (10.4 vs 22.1 joints), SJC66 (0.6 vs 11.9 joints) and DAPSA (18.6 vs 48.7).⁵ The low PASI score in our study may thus also explain why no association was found with the HRQoL 15D score. Despite no or minor association between measures of skin quality of life (DLQI) and psoriasis severity (PASI) with HRQoL, as seen in our and other studies, the skin impact on HRQoL in PsA patients should not be neglected.^{18 19} In our PsA patients, younger age, higher PASI and PASDAS score

were found to be independently associated with impaired skin quality of life assessed by DLQI. In a review article of the European literature, they found female gender, young age, visibility of skin lesions and skin disease activity and severity to be associated with poorer HRQoL, whereas treatment with bDMARDs had a positive impact on HRQoL in psoriasis patients.¹⁴ Further, in the study by van Mens *et al* studying a real-life PsA cohort, they concluded that the exclusion of a skin domain, as in the DAPSA measures, resulted in negligence of skin disease and a negative impact on the quality of life in some patients.³⁶

Our study has obvious limitations which includes a cross-sectional study design which does not allow for causal interpretation of the results as only associations have been studied. Studies exploring PsA patients prior and after the diagnosis are needed to understand whether it is the disease that leads to the psychosocial burden and if this contributes to reduce HRQoL. Further, the PsA patients had a low disease burden both for musculoskeletal involvement and in particular for psoriasis skin involvement, at least compared with RCTs. This may have reduced the chance to identify potential clinical associations with impaired HRQoL, in particular for variables reflecting the inflammatory disease process itself and not only the consequences of the disease, for example, impaired physical function, reduced work capacity and fatigue.

The general consistency in the results when analyses were performed both with enter and forward procedure in the multivariate analyses, and also when each gender was examined separately, strengthens the results of the findings.

The number of studied patients was rather small; however, we have previously shown that the studied PsA patients were rather representative for the PsA patients visiting the outpatient clinic,⁷ indicating a high internal validity.

Ideally, for measuring HRQoL, we could have used SF-36. Instead, we used the 15D Questionnaire, which has fewer questions and hence is more feasible in an outpatient setting. 15D is less known and less used compared with, for example, SF-36 studying HRQoL. However, the 15D Questionnaire has been validated thoroughly for psychometric properties and been used in several studies exploring HRQoL; however, it has not specifically been validated in PsA.^{8–10} It is to be emphasised that social participation is not well covered in the 15D compared with the SF-36 Questionnaire. The social dimension in patients with psoriasis may be impacted negatively. Therefore, the use of SF-36 instead of 15D in our study may have revealed a stronger association between PASI and DLQI scores and HRQoL in our PsA patients.

Another strength of our study is the use of a broad spectre of variables covering most of the core domains recommended to be assessed in PsA, including, for example, measures of disease activity, PRO, physical function, HRQoL and psychosocial variables.²³

CONCLUSION

In conclusion, our study highlights the significant contribution the psychosocial burden, impaired physical function and comorbidities has on reduced HRQoL in PsA outpatients. Thus, to improve HRQoL in PSA patients in daily clinical care, not only physical concerns but also psychological concerns need to be addressed. This may require that some PsA patients need to be managed by a multidisciplinary team that works in coordination with the patient and their family.

Acknowledgements The authors thank the patients for participating in this study and the local rheumatology staff for data collection.

Contributors GH is the principal investigator of the study and has been involved in all parts including study design, data collection, statistical analyses, interpretation of results and drafting of the manuscript. BM and AK have been involved in the conception of the study and interpretation of the results. All authors have revised the manuscript critically for important intellectual content and have given a final approval of the version to be published.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors. Unrestricted grant from Pfizer Norway ID WS1948310.

Competing interests GH has received fees for speaking and/or consulting from AbbVie, BMS, Celgene, Eli Lilly, Pfizer, UCB, Roche, MSD, AMGEN and Novartis. BM has received fees for consulting from Novartis. AK has conducted clinical research sponsored by and/or consulted for AbbVie, Amgen, Celgene, Eli Lilly, Novartis, Pfizer.

Patient consent for publication Consent obtained directly from patient(s).

Ethical approval The study was approved by the Regional Committee for Medical Research Ethics in South-Eastern Norway (REK number: 2012/101) and was performed in accordance with the Declaration of Helsinki.

Data sharing statement Data are available upon reasonable request.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Glenn Haugeberg <http://orcid.org/0000-0002-9279-5191>

Brigitte Michelsen <http://orcid.org/0000-0003-0103-2840>

REFERENCES

- Ritchlin CT, Colbert RA, Gladman DD. Psoriatic arthritis. *N Engl J Med* 2017;376:957–70.
- Liang SE, Cohen JM, Ho RS. Psoriasis and suicidality: a review of the literature. *Dermatol Ther* 2019;32:e12771.
- Husted JA, Gladman DD, Farewell VT, et al. Health-related quality of life of patients with psoriatic arthritis: a comparison with patients with rheumatoid arthritis. *Arthritis Rheum* 2001;45:151–8.
- Strand V, Sharp V, Koenig AS, et al. Comparison of health-related quality of life in rheumatoid arthritis, psoriatic arthritis and psoriasis and effects of etanercept treatment. *Ann Rheum Dis* 2012;71:1143–50.
- Kavanaugh A, Gottlieb A, Morita A, et al. The contribution of joint and skin improvements to the health-related quality of life of patients with psoriatic arthritis: a post hoc analysis of two randomised controlled studies. *Ann Rheum Dis* 2019;78:1215–19.
- Alten R, Conaghan PG, Strand V, et al. Unmet needs in psoriatic arthritis patients receiving immunomodulatory therapy: results from a large multinational real-world study. *Clin Rheumatol* 2019;38:1615–26.
- Michelsen B, Diamantopoulos AP, Hoiberg HK, et al. Need for improvement in current treatment of psoriatic arthritis: study of an outpatient clinic population. *J Rheumatol* 2017;44:431–6.
- Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Ann Med* 2001;33:328–36.
- Stavem K. Reliability, validity and responsiveness of two multiattribute utility measures in patients with chronic obstructive pulmonary disease. *Qual Life Res* 1999;8:45–54.
- Stavem K, Froland SS, Hellum KB. Comparison of preference-based utilities of the 15D, EQ-5D and SF-6D in patients with HIV/AIDS. *Qual Life Res* 2005;14:971–80.
- Finlay AY, Khan GK. Dermatology life quality index (DLQI): a simple practical measure for routine clinical use. *Clin Exp Dermatol* 1994;19:210–16.
- Mrowietz U, Kragballe K, Reich K, et al. Definition of treatment goals for moderate to severe psoriasis: a European consensus. *Arch Dermatol Res* 2011;303:1–10.
- Michelsen B, Uhlig T, Sexton J, et al. Health-related quality of life in patients with psoriatic and rheumatoid arthritis: data from the prospective multicentre NOR-DMARD study compared with Norwegian general population controls. *Ann Rheum Dis* 2018;77:1290–4.
- Obradors M, Blanch C, Comellas M, et al. Health-related quality of life in patients with psoriasis: a systematic review of the European literature. *Qual Life Res* 2016;25:2739–54.
- Weiss SC, Kimball AB, Liewehr DJ, et al. Quantifying the harmful effect of psoriasis on health-related quality of life. *J Am Acad Dermatol* 2002;47:512–18.
- Mease PJ, Karki C, Palmer JB, et al. Clinical and patient-reported outcomes in patients with psoriatic arthritis (psa) by body surface area affected by psoriasis: results from the corona PsA/Spondyloarthritis Registry. *J Rheumatol* 2017;44:1151–8.
- de Vlam K, Merola JF, Birt JA, et al. Skin involvement in psoriatic arthritis worsens overall disease activity, patient-reported outcomes, and increases healthcare resource utilization: an observational, cross-sectional study. *Rheumatol Ther* 2018;5:423–36.
- Wervens K, Luime JJ, Tchvetverikov I, et al. Influence of disease manifestations on health-related quality of life in early psoriatic arthritis. *J Rheumatol* 2018;45:1526–31.
- Howells L, Chisholm A, Cotterill S, et al. Impact of disease severity, illness beliefs, and coping strategies on outcomes in psoriatic arthritis. *Arthritis Care Res (Hoboken)* 2018;70:295–302.
- Kenar G, Yarkan H, Zengin B, et al. Gender does not make a difference in “composite psoriatic disease activity index (CPDAI)” in patients with psoriatic arthritis. *Rheumatol Int* 2018;38:2069–76.
- Nas K, Capkin E, Dagli AZ, et al. Gender specific differences in patients with psoriatic arthritis. *Mod Rheumatol* 2017;27:345–9.
- Husni ME, Merola JF, Davin S. The psychosocial burden of psoriatic arthritis. *Semin Arthritis Rheum* 2017;47:351–60.
- Orbai AM, de Wit M, Mease P, et al. International patient and physician consensus on a psoriatic arthritis core outcome set for clinical trials. *Ann Rheum Dis* 2017;76:673–80.
- Duvertop A, Ostergaard M, Skov L, et al. Quality of life and contact with healthcare systems among patients with psoriasis and psoriatic arthritis: results from the NORdic patient survey of psoriasis and psoriatic arthritis (NORPAPP). *Arch Dermatol Res* 2019;311:351–60.
- Gezer O, Batmaz I, Sariyildiz MA, et al. Sleep quality in patients with psoriatic arthritis. *Int J Rheum Dis* 2017;20:1212–18.
- Bavière W, Deprez X, Houvenagel E, et al. Association between comorbidities and quality of life in psoriatic arthritis: results from multicentric cross-sectional study (PSAQUAL study). *J Rheumatol* 2020;47:369–76.
- Michelsen B, Kristianslund EK, Sexton J, et al. Do depression and anxiety reduce the likelihood of remission in rheumatoid arthritis and psoriatic arthritis? Data from the prospective multicentre NOR-DMARD study. *Ann Rheum Dis* 2017;76:1906–10.
- Iannone F, Nivuori M, Fornaro M, et al. Comorbid fibromyalgia impairs the effectiveness of biologic drugs in patients with psoriatic arthritis. *Rheumatology (Oxford)* 2019. [Epub ahead of print]
- Kristensen LE, Jorgensen TS, Christensen R, et al. Societal costs and patients' experience of health inequities before and after diagnosis of psoriatic arthritis: a Danish cohort study. *Ann Rheum Dis* 2017;76:1495–501.
- Nakagawa H, Tanaka Y, Sano S, et al. Real-world postmarketing study of the impact of adalimumab treatment on work productivity and activity impairment in patients with psoriatic arthritis. *Adv Ther* 2019;36:691–707.
- Gladman DD, Orbai AM, Klitz U, et al. Ixekizumab and complete resolution of enthesitis and dactylitis: integrated analysis of two phase 3 randomized trials in psoriatic arthritis. *Arthritis Res Ther* 2019;21:38.
- Rahman P, Puig L, Gottlieb AB, et al. Ustekinumab treatment and improvement of physical function and health-related quality of life in

- patients with psoriatic arthritis. *Arthritis Care Res (Hoboken)* 2016;68:1812–22.
- 33 Mourad A, Gniadecki R. Treatment of dactylitis and enthesitis in psoriatic arthritis with biologic agents: asystematic review and metaanalysis. *J Rheumatol* 2020;47:59–65.
 - 34 Coates LC, Orbai AM, Morita A, et al. Achieving minimal disease activity in psoriatic arthritis predicts meaningful improvements in patients' health-related quality of life and productivity. *BMC Rheumatol* 2018;2:24.
 - 35 Strand V, de Vlam K, Covarrubias-Cobos JA, et al. Effect of tofacitinib on patient-reported outcomes in patients with active psoriatic arthritis and an inadequate response to tumour necrosis factor inhibitors in the phase III, randomised controlled trial: OPAL beyond. *RMD Open* 2019;5:e000808.
 - 36 van Mens LJJ, van de Sande MGH, van Kuijk AWR, et al. Ideal target for psoriatic arthritis? Comparison of remission and low disease activity states in a real-life cohort. *Ann Rheum Dis* 2018;77:251–7.