

The Impact of Changes in Psoriasis Area and Severity Index by Body Region on Quality of Life in Patients with Psoriasis

Zorica Sojević Timotijević¹, Predrag Majcan², Goran Trajković³, Milijana Relić¹, Tatjana Novaković⁴, Momčilo Mirković⁴, Sladjana Djurić⁴, Simon Nikolić⁴, Bratislav Lazić⁴, Slavenka Janković⁵

¹Department of Dermatovenerology, School of Medicine, University of Priština, Kosovska Mitrovica, Serbia; ²Department of Dermatology, Clinical Centre Zvezdara, Belgrade, Serbia; ³Institute of Medical Statistics and Informatics, Faculty of Medicine, University of Belgrade, Serbia; ⁴School of Medicine, University of Priština, Kosovska Mitrovica, Serbia; ⁵Institute of Epidemiology, Faculty of Medicine, University of Belgrade, Serbia

Corresponding author:

Professor Slavenka Janković, MD, PhD
Institute of Epidemiology
Faculty of Medicine, University of Belgrade
Višegradska 26
11000 Belgrade
Serbia
slavenkaj@gmail.com

Received: January 19, 2017

Accepted: June 14, 2017

ABSTRACT Psoriasis severity varies by body region, with each affected region having a different impact on patient quality of life (QoL). The aim of this study was to assess the impact of changes in the Psoriasis Area and Severity Index (PASI) scores by body region on QoL in patients with psoriasis after treatment. A total of 100 patients with psoriasis were recruited to the study. All patients completed the generic EuroQoL-5D instrument and two specific QoL measures, Dermatology Life Quality Index (DLQI) and Psoriasis Disability Index (PDI) at the beginning of the study, and 50 patients successfully completed the same questionnaires four weeks after the end of the treatment. Clinical severity was assessed using PASI total score and PASI body region (head, trunk, arms, and legs) scores. QoL improved after treatment, and PASI improvements on visible body regions (head, legs, and arms) showed significant correlation with the most sub-areas of the Visual Analog Scale (EQ VAS), DLQI, and PDI. Multiple linear regression analysis revealed that PASI improvement (particularly on the head), sex, age, and disease duration were predictors of QoL score changes for most domains of the three instruments. Improvement of psoriasis in visible body regions has an appreciable influence on QoL improvement, and may positively affect treatment success in patients with psoriasis.

KEY WORDS: psoriasis, quality of life, psoriasis area and severity index, dermatology life quality index, psoriasis disability index, EuroQoL-5D

INTRODUCTION

Psoriasis is a chronic inflammatory skin disease characterized by redness, infiltrate, and scales. The severity of psoriasis can vary from small plaques localized in one part of the body to the involvement of the entire skin (1). Psoriasis has a negative impact on quality of life (QoL). Previous studies have described

the ways in which psoriasis affects the lives of patients (2-5). Some studies were particularly focused on the relationship between psoriasis severity and QoL (6-8). The improvement of QoL has become the aim of many interventions (9-14). Psoriasis severity and treatment responsiveness vary by body region,

with each affected region having a different impact on patient QoL (9,15).

The aim of this study was to assess the impact of changes in PASI by body region on QoL in patients with psoriasis.

PATIENTS AND METHODS

The study comprised 100 adult patients with plaque psoriasis treated at the Department of Dermatology, Clinical Centre Zvezdara, Belgrade between January and December 2011. Patients younger than 18 years, newly diagnosed patients, and those with mental and other serious diseases (such as cancer, heart disease, or diabetes) were excluded from the study. Only patients who gave their written informed consent were recruited to the study. They were evaluated by experienced dermatologists who collected sociodemographic data (age, sex, education, and marital status) and disease characteristics (age at onset of disease and duration of disease). For the assessment of severity and extent of psoriasis and its response to treatment, the Psoriasis Area and Severity Index (PASI) was used.

Each patient completed a generic QoL instrument (EuroQol-5D) and two specific QoL measures: the Dermatology Life of Quality index (DLQI) and the Psoriasis Disability Index (PDI) at the beginning of the study, and 50 patients completed the same questionnaires successfully four weeks after the end of the treatment. Another 50 patients were lost to follow-up (27 did not attend the second assessment, and for 23 the questionnaires were discarded because they did not answer two and more questions per questionnaire). No significant differences were found between those who answered the questionnaire satisfactorily after treatment and those who did not regarding age, sex, marital status and education (data not shown).

All patients were treated with psoralen plus ultraviolet A (PUVA) photochemotherapy. PUVA therapy was administered according to the following protocol: two hours before the phototherapy, 8-methoxypsoralen was orally administered in a standard dose of 0.6 mg/kg of body weight. The initial dose of UV radiation was usually 0.5 J/cm², and gradually increased by 0.25 J/cm² to 1.5 J/cm². Frequency of UV radiation was 2-4 times per week (typically 4 times per week), depending on the severity of psoriasis.

The study was approved by the Ethics Committee of the School of Medicine, University of Priština, Kosovska Mitrovica, Serbia.

Instruments

PASI is a composite index used to measure the severity and extent of psoriasis. It is aimed at assessing

the overall severity of psoriasis as well as evaluating the severity of psoriasis in four regions of the body (head, trunk, arms and legs) (16,17). The severity of erythema, infiltration, and desquamation were graded for each of four main body areas involved, resulting in ranges of total scores from 0 (the lowest score) to 72 (the highest score), with higher scores indicating greater severity (16). In the present study, a total PASI score and PASI scores by body regions were assessed at baseline and after the end of the treatment.

EuroQol-5D (EQ-5D) is a generic health-related QoL instrument and was chosen to assess improvement in QoL as subjects with psoriasis can suffer from multiple symptoms. The EQ-5D descriptive system consists of five questions – one question for each of the five dimensions that include mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. The respondents are required to rate their health by checking one of three levels of severity “no problems” (coded as 1), “some/moderate problems” (coded as 2), and “severe problems” (coded as 3) in each of the 5 EuroQol dimensions. The EQ-5D questionnaire also includes a Visual Analog Scale (EQVAS), by which respondents can report their perceived health status on the day of administration with a grade ranging from 0 (the worst possible health status) to 100 (the best possible health status) (18).

DLQI is a dermatology-specific 10-item questionnaire related to symptoms and feelings, daily activities, leisure, work and school, personal relationships, and treatment (19,20). It measures how much a skin problem has affected the life of patient over the previous week. The instrument consists of 10 items; DLQI is calculated by summing the score of each item, resulting in a maximum of 30 and a minimum of 0. The higher the score, the more QoL is impaired.

PDI is a psoriasis-specific 15-item questionnaire related to daily activities, work or school, personal relationships, leisure, and treatment effects during the preceding four weeks (21,22). The answers were scored from 0 to 3, producing a range of total PDI score from 0 to 45. The higher the score, the more QoL is impaired.

The validated and cross-culturally adapted Serbian versions of the questionnaires showed good internal reliability across scales (Cronbach's alpha coefficient was 0.89 for DLQI and 0.87 for PDI).

Statistical analysis

Categorical variables were expressed as counts and percentages. Continuous variables were presented as mean ± Standard Deviation (SD). Mann-Whitney U-test was used to analyze changes from the time of

hospital admission to 4 weeks after discharge. To verify how EQ-5D, DLQI and PDI changes in scores correlated with sex, age, disease duration, and changes in disease severity (total PASI score and PASI by body region), we used the Spearman's rho (ρ) correlation coefficient.

Multiple linear regression analyses were carried out to examine the association of demographic (sex and age) and clinical characteristics (duration of disease and severity of disease) with changes in EQ-5D, DLQI, and PDI scores after treatment. A two-tailed probability value of $P < 0.05$ was considered statistically significant. All statistical analyses were performed using SPSS software (Statistical Package for the Social Sciences Inc., Chicago, IL, USA, Version 19.0).

In the present study, EQ-5D, DLQI, and PDI were assessed at baseline and four weeks after the end of the treatment.

RESULTS

The sociodemographic and clinical characteristics of patients who satisfactorily completed all three questionnaires at baseline and four weeks after the end of the treatment ($n = 50$) are presented in Table 1.

There were more women (62%) than men (38%), and most of them were married (66%). Half of all patients had secondary education (50%), and a quarter had an university degree (26%). Mean age at onset of disease was approximately 33 years, and mean age at inclusion in the study was approximately 47 years. Mean duration of the disease was 13.9 ± 9.6 years.

Table 1. Sociodemographic and clinical characteristics of the patients with psoriasis who completed both assessments ($n = 50$)

Characteristic	
Sex, n (%)	
Male	19 (38)
Female	31 (62)
Mean age at inclusion \pm SD (year)	46.7 ± 13.4
Mean age at onset of disease \pm SD (year)	32.8 ± 14.5
Marital status, n (%)	
Married	33 (66)
Non-married	17 (34)
Education, n (%)	
Elementary school	3 (6)
Secondary school	25 (50)
Higher school	9 (18)
University degree	13 (26)
Mean duration of disease \pm SD (year)	13.9 ± 9.6

*SD: Standard Deviation

Table 2 shows mean QoL and PASI scores and their mean percentage changes for 50 patients who completed all questionnaires at both assessments: at baseline and four weeks after the end of the treatment. Significant improvements after treatment were observed in overall PASI score and regional PASI scores (head, trunk, arms, and legs). The mean scores in EQ-5D, DLQI, and PDI in all their domains also showed statistically significant improvements. The mean percentage change from baseline to week 4 after the end of the treatment in EQ VAS, overall DLQI, and overall PDI scores, were 97.6%, -78.6%, and -70.1% respectively.

Table 3 displays the correlations between changes in QoL, sex, age, disease duration, and changes in disease severity measured by Spearman correlation coefficients.

The strongest correlation was found between changes in DLQI domain symptoms and feelings and total PASI score ($\rho = 0.53$), between changes in DLQI symptoms and feelings and PASI on the legs ($\rho = 0.53$), followed by high correlation between changes in total DLQI and total PASI score ($\rho = 0.52$), total DLQI and PASI changes on the legs ($\rho = 0.49$), as well between changes in DLQI symptoms and feelings and PASI changes on the arms ($\rho = 0.48$). Changes in PDI daily activities and in total PDI score also correlated highly with PASI score changes on the head ($\rho = 0.57$ and 0.52 , respectively). In the EQ-5D scale, the strongest correlation was found between changes in EQ VAS and disease severity on the head ($\rho = -0.45$).

Significant, but weak correlation was found between changes in QoL (EQ-5D anxiety/depression and EQ VAS) and sex, QoL (DLQI daily activities and PDI leisure) and age, and QoL (EQ-5D usual activity and pain/discomfort) and disease duration.

Analyzing the results of multiple regression analysis (Table 4) found some evidence that a relationship between disease site and the degree of QoL impairment existed. The correlation coefficients between changes in QoL (for PDI daily activities, EQ VAS, PDI total score, and DLQI leisure) and changes in disease severity over the head were among the highest coefficients found (0.54, -0.45, 0.43, and 0.36, respectively). There was a similar relationship between changes in PDI work or school domain and DLQI symptoms and feelings and changes in disease severity on the legs (0.49 and 0.36, respectively).

Statistically significant, but weak correlations were found between changes in EQ-5D anxiety/depression and sex (0.31) and EQ VAS and sex (-0.31). Improvements were observed for men.

Changes in PDI domain leisure and DLQI domain daily activities positively correlated with age (0.45

Table 2. Mean quality of life (QoL) and Psoriasis Area and Severity Index (PASI) scores at baseline and four weeks after the end of the treatment for patients with both assessments (n = 50)

	Baseline Mean ± SD	After treatment Mean ± SD	% change*
EQ-5D			
Mobility	1.3±0.5	1.1 ±0.3	- 16.9
Self-care	1.2±0.4	1.0±0.1	- 15.0
Usual activities	1.7±0.7	1.1±0.3	- 36.8
Pain/Discomfort	2.0±0.5	1.3±0.5	- 36.3
Anxiety/Depression	2.1±0.6	1.5±0.5	- 29.9
EQ VAS	40.2±24.5	79.5±16.6	97.6
DLQI			
Symptoms and feelings	3.7±1.4	1.0±1.0	- 73.0
Daily activities	3.1±1.4	0.6±1.0	- 82.1
Leisure	2.5±1.8	0.4±0.7	- 83.7
Work or school	1.6±1.3	0.2±0.7	- 84.8
Personal relationships	1.4±1.8	0.3±1.8	- 72.8
Treatment	1.6±1.0	0.4±0.6	- 72.8
Total score	13.9±6.5	3.0±4.0	- 78.6
PDI			
Daily activities	8.1±3.5	2.7±2.3	- 66.1
Work or school	3.2±2.4	0.5±1.1	- 83.8
Personal relationships	1.7±1.8	0.6±1.7	- 63.9
Leisure	2.9±2.3	0.9±1.5	- 68.5
Treatment	1.3±1.0	0.4±0.5	- 71.9
Total score	16.9±8.6	5.1±4.7	- 70.1
PASI			
Head	1.2±1.2	0.2±0.2	- 82.6
Trunk	4.0±3.4	0.7±0.9	- 81.4
Arms	3.2±2.5	0.5±0.5	- 83.5
Legs	7.8±5.2	1.5±1.3	- 80.3
Total	16.2±10.9	3.0±2.4	- 81.3

*All % changes were statistically significant at P<0.05.

SD: Standard Deviation; EQ-5D: EuroQol 5D; DLQI: Dermatology

Life Quality Index; PDI: Psoriasis Disability Index; PASI: Psoriasis Area and Severity Index; EQ VAS: Visual Analog Scale

and 0.33, respectively). A positive correlation was also found between disease duration and EQ-5D pain/discomfort (0.39). Persons with shorter disease duration reported higher improvements in pain/discomfort.

DISCUSSION

The present study assessed the impact of changes in PASI score (total and for body regions) on QoL in patients with psoriasis at baseline and four weeks after the end of the treatment using three validated QoL questionnaires (EQ-5D, DLQI, and PDI) simultaneously.

PASI is the most commonly used tool to assess the severity of psoriasis and treatment effects. However, it has several limitations, including the following: score calculation is complex, the amount of affected body surface area is a subjective estimate, and the amount

of improvement in the score does not always correspond to clinical relevance. Additionally, the scoring does not take into account the impact on patient QoL or the disproportionate psoriasis burden reflected in the more visible (face, neck, hands, feet) or covered (genitalia) body regions (23).

In most studies, data on changes in QoL were analyzed in relation to changes in total PASI scores (11,14), while only a few studies analyzed them in relation to the changes in PASI scores across body regions (9,15). In a recently published study, the importance of the use of PASI score by body region was highlighted and recommended as a novel and important patient-relevant outcome worthy of reporting in future studies (23). This was the reason that we evaluated the impact of changes in PASI body regions on QoL, rather than only changes in total PASI score.

Table 3. Correlation coefficients between changes in quality of life and sex, age, disease duration, and changes in disease severity

Quality of life	Sex†	Age	Disease duration	PASI				
				Head	Arms	Trunk	Legs	Total score
EQ-5D								
Mobility	-0.18	0.09	0.11	0.04	0.01	-0.03	0.20	0.13
Self-care	-0.04	0.22	0.21	-0.04	-0.09	-0.11	-0.05	-0.07
Usual activities	0.12	0.12	0.29*	0.23	0.29*	0.14	0.15	0.19
Pain/Discomfort	0.06	-0.06	0.34*	0.19	0.14	0.16	0.06	0.15
Anxiety/Depression	0.28*	-0.02	-0.03	0.16	0.15	0.17	0.06	0.12
EQ VAS	-0.36*	-0.06	0.10	-0.45*	-0.20	-0.33*	-0.24	-0.36*
DLQI								
Symptoms and feelings	0.24	0.24	0.02	0.39*	0.48*	0.38*	0.53*	0.53*
Daily activities	0.23	0.38*	-0.02	0.47*	0.34*	0.34*	0.30*	0.39*
Leisure	0.27	0.14	-0.09	0.45*	0.28*	0.32*	0.36*	0.38*
Work or school	0.05	0.16	0.22	0.30*	0.44*	0.22	0.44*	0.43*
Personal relationships	0.17	0.12	-0.17	0.26	0.24	0.22	0.36*	0.34*
Treatment	0.10	0.19	0.03	0.13	0.11	0.14	0.19	0.22
Total score	0.25	0.28	0.01	0.47*	0.43*	0.36*	0.49*	0.52*
PDI								
Daily activities	0.18	0.04	-0.04	0.57*	0.33*	0.37*	0.37*	0.45*
Work or school	0.17	0.05	0.12	0.31*	0.32*	0.28*	0.44*	0.42*
Personal relationships	0.20	0.12	0.01	0.32*	0.17	0.18	0.32*	0.31*
Leisure	0.06	0.40*	-0.14	0.21	0.03	0.00	0.13	0.11
Treatment	0.02	-0.17	-0.24	0.22	0.07	0.12	0.08	0.10
Total score	0.19	0.16	-0.05	0.52*	0.29*	0.30*	0.41*	0.43*

*Statistically significant correlation coefficients ($P < 0.05$). †Male is the reference category.

EQ-5D: EuroQol 5D; DLQI: Dermatology Life Quality Index; PDI: Psoriasis Disability Index; PASI: Psoriasis Area and Severity Index; EQ VAS: Visual Analog Scale

Our findings show that the most important predictor of improving the QoL measured by all three instruments after applied therapy and within the four body regions in PASI is the improvement of psoriasis on the head. As in the study by Touw *et al.* (9), we found that the severity of psoriasis not only on the head, but also on the arms and legs have a greater impact on QoL than the severity of the disease on the trunk. This indicates that involvement of visible areas of the body causes greater impairment of QoL than involvement of unseen areas. Our results are in accordance with previous studies showing that social visibility of psoriasis is associated with higher impact on QoL (3,9,15,22,24).

Although the head represents only 10% of the total body surface, the visibility of head and neck psoriasis has a considerable impact on patient QoL. When psoriasis involves the face, it can be much more disabling, inducing important social and emotional distress, and can severely decrease QoL (25). Additionally, the effect of clinical improvement on psychological improve-

ment in patients with localization on the face was weaker than in the other cases (25). However, Richards *et al.* observed that grouping of patients on the basis of head involvement was not an optimal strategy for the assessment of observable, cosmetically disfiguring psoriasis and its effect on psychosocial factors, which were much stronger determinants of disability in patients with psoriasis than disease severity (8).

The improvement of the disease over the arms and legs in our study was a significant predictor of QoL improvement for the DLQI work or school domain, EQ-5D usual activities (arms), DLQI symptoms and feelings, and PDI work or school domain (legs). This may indicate that the treatment of patients with psoriasis is not sufficient to improve the overall burden experienced by them. Such information once again emphasizes the fact that even clearance of psoriasis, although it produces a significant reduction in factors specific to psoriasis, such as disability and stress, does not impact psychological distress, on patient beliefs about psoriasis, or coping (11).

Table 4. Standardized regression coefficients in multiple linear regression models of predictors associated with EuroQol 5D (EQ-5D), Dermatology Life Quality Index (DLQI), and Psoriasis Disability Index (PDI) score changes

Quality of life	Sex†	Age	Disease duration	PASI			
				Head	Arms	Trunk	Legs
EQ-5D							
Mobility	-0.10	0.05	0.07				
Self-care	0.00	0.14	0.16				
Usual activities	0.10	-0.04	0.25		0.28*		
Pain/Discomfort	0.16	-0.16	0.39*				
Anxiety/Depression	0.31*	-0.01	0.10				
EQ VAS	-0.31*	-0.03	0.01	-0.45*		0.07	
DLQI							
Symptoms and feelings	0.09	0.22	-0.02	0.09	0.12	-0.08	0.36*
Daily activities	0.14	0.33*	-0.10	0.22	0.05	0.01	0.04
Leisure	0.14	0.06	-0.08	0.36*	-0.10	-0.02	0.21
Work or school	-0.13	0.01	0.16	0.07	0.33*		0.28
Personal relationships	0.07	0.11	-0.07				0.21
Treatment	0.12	0.19	0.05				
Total score	0.11	0.19	-0.03	0.25	0.08	-0.09	0.30
PDI							
Daily activities	0.09	0.00	-0.05	0.54*	-0.17	0.02	0.07
Work or school	0.04	-0.05	0.18	0.06	0.04	-0.07	0.49*
Personal relationships	0.14	-0.02	0.07	0.34*			0.01
Leisure	0.01	0.45*	-0.21				
Treatment	-0.07	-0.10	-0.18				
Total score	0.11	0.09	-0.01	0.43*	-0.18	-0.16	0.34

*Statistically significant correlation coefficients ($P < 0.05$). †Male is the reference category.

EQ-5D: EuroQol 5D; DLQI: Dermatology Life Quality Index; PDI: Psoriasis Disability Index; PASI: Psoriasis Area and Severity Index; EQ VAS: Visual Analog Scale

PASI body regions (head, trunk, upper and lower extremities) are not the only localizations used for the evaluation of the relationship between changes in psoriasis severity and QoL. The involvement of other areas of the body was used in several studies (e.g. only genital region or face) (12,26). However, the results of these studies did not indicate whether the body regions covered by PASI in comparison with other localizations have advantages or disadvantages in the assessment of disease severity.

The association between symptom severity and QoL was observed in a number of studies (2,7,27,28). However, some studies found no significant association at all (4,5,29). A likely explanation is that symptom severity has a greater impact on the physical than on the mental components of QoL, whereas the effects of stigmatization on QoL are more strongly mental (30).

In our study, disease duration had a negative impact on QoL improvement only for EQ-5D pain/

discomfort. Lee *et al.* found that disease duration of more than 10 years had a negative impact on QoL score changes (31).

Among demographic factors, sex and age proved to be predictors of improvement of QoL in our study. Studies generally show no sex/gender difference in the severity of physical symptoms of psoriasis in men and women. However, women and men have different subjective perceptions of how psoriasis affect their social and emotional life and QoL. Perceived stress was higher in women, and the mental component of their QoL was more altered (32). The men in our study were more likely to report improvement in health status assessed by EQ VAS, and psychological improvement assessed by EQ-5D (anxiety/depression) after clinical improvement measured by PASI. Similarly, Sampogna *et al.* observed that the improvement in clinical severity and symptoms was associated with a decreased frequency of psychiatric disturbance and that men were more likely to improve psychologically in

comparison with women (12). In contrast to our study, in several other studies found no significant association between sex and with QoL (4,31), or QoL was more seriously affected in women than in men (33).

The results of the current study demonstrated that the improvement of QoL (DLQI daily activities and PDI leisure) after clinical improvement was higher in younger than in older patients, which is in accordance with Sampogna *et al.* (34) who found that the impact of psoriasis is more severe for older patients over 65 years of age. In contrast, Young found that the impact of psoriasis seems to be more severe for young adults (35).

The present study also showed that EQ-5D was less sensitive to the changes in severity of psoriasis compared with DLQI and PDI instruments. The explanation may be that EQ-5D captures health-related QoL across diseases, whereas DLQI and PDI are designed to measure skin-specific and psoriasis-specific QoL rather than generic QoL.

Our study is one of the few studies (9,15) in which the relationship between changes in QoL and regional disease severity has been examined. In addition, data on the differences of impairment by dimensions of EQ-5D, DLQI, and PDI offer new insight. However, some limitations of the study have to be considered. The first one refers to the relatively small number of patients who completed all questionnaires after treatment. Second, the QoL instruments applied in the study do not include assessment of stress and specific psychological aspects. Third, we did not consider the potential effect of behavior factors, such as alcohol consumption, cigarette smoking, and use of antidepressants on QoL.

CONCLUSION

The current study has shown that the effect of improving QoL in psoriasis varies between PASI body regions. In particular, the reduction of psoriasis on the head is associated with the highest QoL improvement in overall wellbeing, daily activities, and leisure, while the improvement of psoriasis on the arms and legs is important for the improvement of symptoms and feelings and work or school. Our findings demonstrate that significant clinical improvements in regional psoriasis severity correlated with meaningful improvements in QoL and support the importance of QoL assessment in terms of better understanding of patient response to treatment.

Acknowledgements

We are grateful to Professor Andrew Finlay for the formal permission to translate and use the Psoriasis Disability Index and to use the Dermatology Life

Quality Index questionnaire. We also thank the Euro-QoL Group for the permission to use the EuroQoL-5D questionnaire. The work was supported by the Ministry of Education, Science and Technological Development, Republic of Serbia (project No. 175025).

References:

1. Meier M, Sheth PB. Clinical spectrum and severity of psoriasis. *Curr Probl Dermatol* 2009;38:1-20.
2. Augustin M, Kruger K, Radtke MA, Schwippel I, Reich K. Disease severity, quality of life and health care in plaque-type psoriasis: a multicenter cross-sectional study in Germany. *Dermatology* 2008;216:366-72.
3. Fortune DG, Main CJ, O'Sullivan TM, Griffiths CEM. Quality of life in patients with psoriasis: the contribution of clinical variables and psoriasis-specific stress. *Br J Dermatol* 1997;137:755-60.
4. Jankovic S, Raznatovic M, Marinkovic J, Jankovic J, Kocev N, Tomic-Spiric V, *et al.* Health-related quality of life in patients with psoriasis. *J Cutan Med Surg* 2011;15:29-36.
5. Milčić D, Janković S, Vesić S, Milinković M, Janković J. Assessment of quality of life in patients with psoriasis: a study from Serbia. *Int J Dermatol* 2015;54:523-8.
6. Sojević Timotijević Z, Janković S, Trajković G, Majcan P, Perišić S, Dostanić N, *et al.* Identification of psoriatic patients at risk of high quality of life impairment. *J Dermatol* 2013;40:797-804.
7. Gelfand JM, Feldman SR, Stern RS, Thomas J, Rolstad T, Margolis DJ. Determinants of quality of life in patients with psoriasis: a study from the US population. *J Am Acad Dermatol* 2004;51:704-8.
8. Richards HL, Fortune DG, Griffiths CE, Main CJ. The contribution of perceptions of stigmatisation to disability in patients with psoriasis. *J Psychosom Res* 2001;50:11-15.
9. Touw CR, Hakkaart-Van Roijen L, Verboom P, Paul C, Rutten FF, *et al.* Quality of life and clinical outcome in psoriasis patients using intermittent cyclosporin. *Br J Dermatol* 2001;144:967-72.
10. Wahl AK, Mørk C, Cooper BA, Padilla G. No long-term changes in psoriasis severity and quality of life following climate therapy. *J Am Acad Dermatol* 2005;52:699-701.
11. Fortune DG, Richards HL, Kirby B, McElhone K, Main CJ, Griffiths CE. Successful treatment of psoriasis improves psoriasis-specific but not more general aspects of patients' well-being. *Br J Dermatol* 2004;151:1219-26.

12. Sampogna F, Tabolli S, Abeni D. The impact of changes in clinical severity on psychiatric morbidity in patients with psoriasis: a follow-up study. *Br J Dermatol* 2007;157:508-13.
13. Wahl AK, Langeland E, Larsen MH, Robinson HS, Osborne RH, Krogstad AL. Positive changes in self-management and disease severity following climate therapy in people with psoriasis. *Acta Derm Venereol* 2015;95:317-21.
14. Igarashi A, Kato T, Kato M, Nakagawa H; Japanese Ustekinumab Study Group. Efficacy and safety of ustekinumab in Japanese patients with moderate-to-severe plaque-type psoriasis: long-term results from a phase 2/3 clinical trial. *J Dermatol* 2012;39:242-52.
15. Armstrong AW, Villanueva Quintero DG, Echeverría CM, Gu Y, Karunaratne M, Reyes Servin O. Body region Involvement and quality of life in psoriasis: analysis of a randomized controlled trial of Adalimumab. *Am J Clin Dermatol* 2016;17:691-9.
16. Fredriksson T, Pettersson U. Severe psoriasis - oral therapy with a new retinoid. *Dermatologica* 1978;157:238-44.
17. Puzenat E, Bronsard V, Prey S, Gourraud PA, Aractingi S, Bagot M, *et al.* What are the best outcome measures for assessing plaque psoriasis severity? A systematic review of the literature. *J Eur Acad Dermatol Venereol* 2010;24:10-6.
18. Group EuroQol. EuroQol - a new facility for the measurement of health-related quality of life. *Health Policy* 1990; 16: 199-208.
19. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI) - a simple practical measure for routine clinical use. *Clin Exp Dermatol* 1994;19:210-6.
20. Dermatology Life Quality Index (DLQI) Serbian version (<http://www.dermatology.org.uk/> Accessed 20 October 2016).
21. Finlay AY, Kelly SE. Psoriasis: an index of disability. *Clin Exp Dermatol* 1987; 12: 8-11.
22. Finlay AY, Coles EC. The effect of severe psoriasis on the quality of life of 369 patients. *Br J Dermatol* 1995;132:236-44.
23. Navarini AA, Poulin Y, Menter A, Gu Y, Teixeira HD. Analysis of body regions and components of PASI scores during adalimumab or methotrexate treatment for patients with moderate-to-severe psoriasis. *J Drugs Dermatol* 2014;13:554-62.
24. Herédi E, Rencz F, Balogh O, Gulácsi L, Herszényi K, Holló P, *et al.* Exploring the relationship between EQ-5D, DLQI and PASI, and mapping EQ-5D utilities: a cross-sectional study in psoriasis from Hungary. *Eur J Health Econ* 2014;15 Suppl 1:S111-9.
25. Bucolo S, Torre V, Romano G, Quattrocchi C, Filidoro M, Caldarelli C. Head and Neck Psoriasis. In: Psoriasis. Soung J (ed). In Tech. Rijeka, Croatia 2012;79-106. doi: 10.5772/25594. Available from: <http://www.intechopen.com/books/psoriasis/head-and-neck-psoriasis>
26. Meeuwis KA, de Hullu JA, Int'Hout J, Hendriks IM, Sparreboom EE, Massuger LF, *et al.* Genital psoriasis awareness program: physical and psychological care for patients with genital psoriasis. *Acta Derm Venereol* 2015;95:211-6.
27. Norlin JM, Steen Carlsson K, Persson U, Schmitt-Egenolf M. Analysis of three outcome measures in moderate to severe psoriasis: a registry-based study of 2450 patients. *Br J Dermatol* 2012;166:797-802.
28. Owczarek K, Jaworski M. Quality of life and severity of skin changes in the dynamics of psoriasis. *Postepy Dermatol Alergol* 2016;33:102-8.
29. Perrott SB, Murray AH, Lowe J, Mathieson CM. The psychosocial impact of psoriasis: physical severity, quality of life, and stigmatization. *Physiol Behav* 2000;70:567-71.
30. Böhm D, Stock Gissendanner S, Bangemann K, Snitjer I, Werfel T, Weyergraf A, *et al.* Perceived relationships between severity of psoriasis symptoms, gender, stigmatization and quality of life. *J Eur Acad Dermatol Venereol* 2013;27:220-6.
31. Lee YW, Park EJ, Kwon IH, Kim KH, Kim KJ. Impact of psoriasis on quality of life: relationship between clinical response to therapy and change in health-related quality of life. *Ann Dermatol* 2010;22:389-96.
32. Misery L, Thomas L, Jullien D, Cambazard F, Humbert P, Dubertret L, *et al.* Comparative study of stress and quality of life in outpatients consulting for different dermatoses in 5 academic departments of dermatology. *Eur J Dermatol* 2008;18:412-5.
33. Mabuchi T, Yamaoka H, Kojima T, Ikoma N, Akasaka E, Ozawa A. Psoriasis affects patient's quality of life more seriously in female than in male in Japan. *Tokai J Exp Clin Med* 2012;37:84-8.
34. Sampogna F, Chren MM, Melchi CF, Pasquini P, Tabolli S, Abeni D. Age, gender, quality of life and psychological distress in patients hospitalized with psoriasis. *Br J Dermatol* 2006;154:325-31.
35. Young M. The psychological and social burdens of psoriasis. *Dermatol Nurs* 2005;17:15-9.