Sleep Disturbance in Psoriatic Disease: Prevalence and Associated Factors

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ABSTRACT. ***Objective.*** We aimed to determine the prevalence and quality of sleep in patients with psoriatic arthritis (PsA) and those with psoriasis without PsA (PsC) followed in the same center, to identify factors associated with sleep disturbance, and to compare findings to those of healthy controls (HC).

Methods. The study included 113 PsA [ClASsification for Psoriatic ARthritis (CASPAR) criteria] and 62 PsC (PsA excluded by a rheumatologist) patients and 52 HC. Clinical variables were collected using a standard protocol. The sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI). Other patient-reported outcomes collected included the Health Assessment Questionnaire (HAQ), Dermatology Life Quality Index, EQ-5D, Medical Outcomes Study Short Form-36 survey, patient's global assessment, and the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-fatigue) scale. Statistical analyses included descriptive statistics, Wilcoxon rank-sum test, and linear regression.

Results. The prevalence of poor sleep quality was 84%, 69%, and 50% in PsA, PsC, and HC, respectively. Total PSQI score was higher in both patients with PsA and patients with PsC compared with HC ($p < 0.01$) and higher in patients with PsA compared to patients with PsC ($p < 0.0001$). EQ-5D anxiety component, EQ-5D final, and FACIT-fatigue were independently associated with worse PSQI in patients with PsC and those with PsA ($p < 0.05$). Actively inflamed (tender or swollen) joints are independently associated with worse PSQI in patients with PsA ($p < 0.01$).

Conclusion. Patients with psoriatic disease have poor sleep quality. Poor sleep is associated with fatigue, anxiety, and lower EQ-5D. In patients with PsA, poor sleep is associated with active joint inflammation. (First Release June 15 2017; J Rheumatol 2017;44:1369–74; doi:10.3899/jrheum.161330)

Key Indexing Terms:
PSORIATIC ARTHRITIS PSORIASIS PITTSBURGH SLEEP QUALITY INDEX
DISEASE ACTIVITY FATIGUE

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The Psoriatic Arthritis Program is supported by a grant from the Krembil Foundation. Ian Wong was supported by a Canadian Rheumatology Association–Roche Summer Student Scholarship.

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Accepted for publication May 10, 2017.

Psoriasis is a chronic, immune-mediated, inflammatory skin disorder characterized by scaling, erythematous plaques that often cause pruritus and pain[1]. The prevalence of psoriasis in Europe and North America is about 2–3%, with no sex predilection[2,3]. Psoriasis is associated with extracutaneous comorbidities that include psoriatic arthritis (PsA), inflammatory bowel disease, metabolic syndrome, and cardiovascular disease[1].

PsA is a chronic inflammatory musculoskeletal disease associated with psoriasis, usually seronegative for rheumatoid factor[4]. The prevalence of PsA in the European and North American population is estimated between 0.3% and 1.0%[4]. Among the psoriasis population, the prevalence of PsA is about 30%[4,5]. PsA commonly presents as a constellation of symptoms associated with peripheral arthritis, enthesitis, dactylitis, axial disease, and extraarticular manifestations in addition to skin and nail psoriasis[4].

In psoriatic disease (PsD), which includes the spectrum of disease manifestations associated with psoriasis including PsA, disease burden is not limited to physical symptoms, but also includes major social, emotional, and functional impairment[1,6]. Patients with psoriasis have a higher prevalence of anxiety, depression, smoking, alcohol abuse, and

social inhibition when compared to healthy individuals[7]. Additionally, patients with psoriasis are reported to have higher rates of suicidal ideation compared to those with other dermatologic conditions[8]. Akin to patients with psoriasis, patients with PsA report impaired quality of life as a result of their physical and psychosocial symptoms[6].

In a 2005 National Psoriasis Foundation survey of its members, 49.5% out of 420 patients indicated psoriasis interfered with sleep at least once per month[9]. Specifically, psoriasis symptoms led to 11.3% of survey respondents having sleep impairment for more than half the month[9]. In a subsequent case-control study, Wu, *et al* determined that psoriasis was significantly associated with sleep impairment[10]. Further, Strober, *et al* found that patients' Psoriasis Area and Severity Index (PASI) and measures of inflammation were associated with sleep impairment[11]. Other factors predictive of sleep disturbance in psoriasis include history of PsA, presence of pruritus, pain in psoriatic lesions, and emotional factors[9].

Sleep disturbance in PsA may be attributed to psychological conditions such as anxiety and depression and physical manifestations that include joint pain, cutaneous lesion pain and itch, inflammatory disease activity, sleep apnea, and restless leg syndrome[9]. In comparing 41 patients with PsA to healthy controls (HC), Gezer, *et al* concluded that patients with PsA experienced more frequent sleep impairment, which was associated with quality of life outcomes, bodily pain, anxiety, enthesitis, and inflammatory biomarkers (erythrocyte sedimentation rate and C-reactive protein)[12].

Sleep quality is an important consideration because sleep disturbance is associated with daytime fatigue and risk of depression[13]. Additionally, sleep disturbance has been associated with several comorbidities such as hypertension, diabetes, metabolic syndrome, cardiovascular disease, and obesity[14,15,16,17]. However, small sample populations limit the currently available evidence specifically about sleep quality in PsD[18]. Additionally, there is a paucity of studies comparing the effect of psoriasis and PsA on sleep quality using a validated measure[18,19]. Given the effect of sleep on quality of life, it would be beneficial to further evaluate disease-related factors such as pruritus and pain, and non–disease-related factors commonly associated with sleep disorder such as anxiety, alcohol use, and cigarette smoking. There is impaired sleep quality in patients with PsD, but it is unclear whether it is disease-related or non-disease factors that play a role[9]. Further characterization of sleep disturbance would enhance our understanding of the PsD burden.

The purpose of our study was to determine the prevalence and quality of sleep in patients with PsA and in patients with psoriasis without PsA (PsC) followed in the same center, to identify associated disease-related and demographic factors, and to determine whether there is a difference in prevalence and quality of sleep disturbance in patients with PsA and in patients with PsC. Last, our study aimed to compare sleep quality, fatigue, and overall quality of life measures in patients with PsD to HC.

MATERIALS AND METHODS

Setting and study population. The Psoriatic Disease Program at the Toronto Western Hospital includes the PsA clinic, which provides care for patients with PsA, the majority of whom meet the ClASsification for Psoriatic ARthritis (CASPAR) criteria[20], and the PsC research program, which includes patients with psoriasis who have been confirmed by a rheumatologist not to have inflammatory arthritis[21]. Patients with PsA are reviewed according to a standard protocol that includes a complete history and physical examination, patient-reported outcome (PRO) measures, and laboratory evaluation at 6- to 12-month intervals, while radiographs are performed at 2-year intervals. Patients with PsC are evaluated according to the same protocol at yearly intervals.

Consecutive patients attending the PsA and PsC programs at Toronto Western Hospital over a 3-month period were assessed for poor sleep quality using the Pittsburgh Sleep Quality Index (PSQI)[22]. The control population was recruited by random sampling from a pool of healthy volunteers who had previously consented to the parent International Psoriasis and Arthritis Research Team (IPART) study. The control participants consisted of healthy persons with self-reported absence of rheumatic diseases or connective tissue diseases.

Clinical assessment. Patients with PsA were routinely reviewed and assessed at 6- to 12-month intervals according to a standard protocol[21,23]. At baseline, demographic information and complete medical history were recorded. They were updated at each subsequent clinic visit[21,23]. Alcohol consumption habits, smoking status, and detailed medication history were recorded as well[21,23]. Each visit consisted of a physical examination that recorded the number of actively inflamed joints (stress pain, joint line tenderness, and/or swelling, 0–68 scale) and the number of deformed joints (ankylosis, subluxation, or decreased range of motion of more than 20%, attributable to joint damage rather than inflammation, 0–68 scale)[21,23]. They were also assessed for the presence of fibromyalgia (FM; defined by the presence of 11/18 FM tender points as well as generalized pain and fatigue). The PASI assessed the severity of psoriasis[24]. Radiographic imaging was done at 2-year intervals[21,23].

Patients with PsC were followed at 12-month intervals according to the same protocol. Imaging was done only if clinically indicated.

All patients were recruited for this study from June to August 2015. The University Health Network Research Ethics Board approved the investigation (REB No. 15-9193-AE) as a substudy of the IPART Program (REB No. 08-0640-AE) and all patients gave informed consent to participate in the study.

Patient-reported outcomes. Study participants were administered questionnaires annually in a paper or digital format[25]. These questionnaires included the Health Assessment Questionnaire (HAQ), the Medical Outcomes Study Short Form-36 (SF-36) questionnaire, the Functional Assessment of Chronic Illness Therapy (FACIT)–fatigue scale, the Dermatology Life Quality Index (DLQI), EQ-5D, and the patient's global assessment (PtGA). The HAQ, SF-36, and FACIT-fatigue were validated at the University of Toronto Psoriatic Arthritis Clinic[26,27]. The HAQ questionnaire measures the extent of disability in activities of daily living and assesses the extent of disease-related pain and stiffness[6,28]. The SF-36 questionnaire evaluates an individual's functional health status over 8 domains[29]. The FACIT-fatigue measures the effect of fatigue on an individual's daily life[30]. The DLQI assesses the effect of skin disease on an individual's quality of life[31]. The EQ-5D assesses an individual's health-related quality of life over 5 dimensions[32]. The PtGA provides a self-reported rating of one's overall health regarding the effect of PsC and PsA[31].

PSQI. The PSQI is a 19-item sleep quality and sleep disturbance measurement tool used to assess the patient's self-reported sleep in the preceding 30 days of questionnaire administration[22]. The PSQI assesses 7 modalities of sleep quality including duration of sleep, sleep disturbance, sleep latency, daytime dysfunction, habitual sleep efficiency, use of sleep

medications, and subjective sleep quality[22]. Each modality is scored ranging from 0 to 3[22]. A global PSQI score is then calculated by summing the individual scores from the 7 modalities, producing a score ranging from 0 to 21[22]. A global PSQI score ≤ 5 is associated with good sleep quality and a score > 5 is associated with poor sleep quality[22]. The PSQI is a reliable and valid measure for sleep quality in clinical practice and research, and also has high specificity in distinguishing good and poor sleepers[22].

All collected information, including demographics, medical history, physical examination assessments, PRO, current treatments, and laboratory assessments was entered into the Web-based database. Data obtained within 3 months of the completion of the PSQI questionnaire were used in the analyses.

Statistical analysis. Descriptive statistics were used to characterize the study samples. Wilcoxon rank-sum test was used to compare the prevalence and differences in sleep quality between the PsA, PsC, and HC groups. Linear regression was performed to identify sleep disturbance–associated factors and involved univariate and multivariate analyses performed, with PSQI being the response variable. Multivariate analysis was performed using backward elimination and included variables with significance level of $p < 0.2$ from the respective univariate analyses. A p value < 0.05 was considered statistically significant. Statistical analyses were conducted using SAS version 9.2.

RESULTS

From June to August 2015, data were collected from a total of 113 patients with PsA, 62 patients with PsC, and 52 HC (Table 1). We compared demographic variables among the 3 groups, and disease characteristics and PRO between the 2 patient groups.

The mean age of patients with PsA was similar to those with PsC (57.4 vs 56.9 yrs, respectively; Table 1). However, the mean age of HC was younger (42.2 yrs) compared to the PsD groups. The mean duration of psoriasis was longer in the PsC group compared to PsA (25.9 vs 17.1 yrs, respectively). There were more males in the PsA group compared to the PsC group (54.9% vs 40.3%, respectively). The proportion of men in the HC group was 28.9%. Mean PASI was higher in the PsC group compared to PsA, although the PASI was low in both groups (2.9 vs 1.8, respectively). Among patients with PsA, 5 (4.6%) had concomitant FM, and 2 (3.2%) of the patients with PsC had FM.

Prevalence of sleep disturbance in PsD. The prevalence of sleep disturbance was 84.1% in patients with PsA and 69.4% in patients with PsC, whereas in the HC group the prevalence of sleep disturbance was 50.0% (Table 1).

Sleep quality in PsD. The degree of poor sleep quality was determined by the PSQI score (Table 2 and Table 3). Both the PsA and PsC groups had higher mean PSQI scores compared to HC (9.24 and 7.18 vs 5.67; $p < 0.0001$ and $p = 0.0069$, respectively). Specifically, the PsA group had higher mean PSQI score compared to the PsC group (9.24 vs 7.18, respectively; $p < 0.0001$).

The PsA group had higher mean PSQI sleep disturbance, sleep latency, daytime dysfunction, and subjective sleep quality component scores compared to the PsC group (Table 2 and Table 3). Further, patients with PsA had greater mean PSQI component scores in all 7 assessed components compared to HC (Table 2 and Table 3). The PsC group had higher mean PSQI sleep disturbance and sleep efficiency component scores compared to the HC group (Table 2 and Table 3).

Patient-reported outcomes in PsD. Mean EQ-5D scores in patients with PsD were lower compared to HC (0.81 vs 0.97, respectively; $p < 0.0001$). Also, mean FACIT-fatigue scores in patients with PsD were lower compared to HC (34.8 vs 46.7, respectively; $p < 0.0001$).

Factors associated with sleep disturbance in PsD. Univariate analyses of patients with PsD found these factors to be associated with PSQI score and candidates for multivariate analysis (Table 4): disease group (PsA and PsC), body mass index (BMI), alcohol consumption, HAQ overall score, EQ-5D anxiety component score, EQ-5D overall score, DLQI score, FACIT-fatigue score, SF-36 mental component summary, SF-36 physical component summary, and PtGA. Of the measures of disease activity, PASI was not a significant factor in affecting PSQI scores in univariate analysis. There was a trend for FM to be associated with sleep disturbance. Subsequent multivariate analysis of patients with PsD

Table 1. Demographic clinical characteristics of patients with PsA or PsC, and HC, and prevalence of poor sleep quality.

Characteristic	Frequency (%) or Mean (SD)		
	PsA, n = 113	PsC, n = 62	HC, n = 52
Age, yrs	57.4 (11.58)	56.9 (14.2)	42.2 (13.6)
BMI, kg/m^2	30.2 (6.3)	28.6 (6.2)	N/A
PASI	1.8 (4.7)	2.9 (3.0)	N/A
Duration of PsD, yrs	17.1 (11.6)	25.9 (17.0)	N/A
Sex, male	62 (54.9)	25 (40.3)	15 (28.9)
Obstructive sleep apnea	3 (2.65)	3 (4.8)	N/A
Poor sleep quality*	95 (84.1)	43 (69.4)	26 (50.0)

*Calculated Pittsburgh Sleep Quality Index scores: ≤ 5 is associated with good sleep quality and > 5 is associated with poor sleep quality. PsA: psoriatic arthritis; PsC: psoriasis without arthritis; HC: healthy control; N/A: not applicable or not available; BMI: body mass index; PsD: psoriatic disease; PASI: Psoriasis Area and Severity Index.

Table 2. Comparison of the PSQI scores within each component of sleep quality in patients with PsA or PsC, and HC. Range for each variable is 0–3, except for PSQI, which is 0–21. Data are mean (SD).

Variable	PsA, n = 113	PsC, n = 62	HC, n = 52
Duration of sleep	0.88 (0.97)	0.77 (0.93)	0.54 (0.78)
Sleep disturbance	1.45 (0.55)	1.21 (0.48)	0.92 (0.33)
Sleep latency	1.36 (1.04)	0.71 (0.86)	0.85 (0.80)
Daytime dysfunction due to sleepiness	1.15 (0.91)	0.77 (0.73)	0.58 (0.54)
Sleep efficiency*	2.72 (0.85)	2.60 (1.00)	1.88 (1.44)
Need for sleep medications	0.51 (0.96)	0.32 (0.78)	0.17 (0.47)
Patient perceived sleep quality	1.17 (0.83)	0.79 (0.70)	0.73 (0.49)
PSQI score	9.24 (3.54)	7.18 (2.9)	5.67 (2.12)

*Sleep efficiency was calculated by the following formula and appropriately scored: (total # of hours asleep) / (total # of hours in bed) × 100. PSQI: Pittsburgh Sleep Quality Index; PsA: psoriatic arthritis; PsC: psoriasis without arthritis; HC: healthy controls.

Table 3. Wilcoxon rank-sum test comparing the PSQI scores within each component of sleep quality in patients with PsA or PsC, and HC. Range for each variable is 0–3, except for PSQI, which is 0–21.

Variable	Comparison	p	Comparison	p	Comparison	p
Duration of sleep	PsC vs PsA	0.5351	PsC vs HC	0.1837	PsA > HC	0.0425*
Sleep disturbance	PsC < PsA	0.0056*	PsC > HC	0.0005*	PsA > HC	< 0.0001*
Sleep latency	PsC < PsA	< 0.0001*	PsC vs HC	0.2479	PsA > HC	0.0028*
Daytime dysfunction due to sleepiness	PsC < PsA	0.0091*	PsC vs HC	0.2035	PsA > HC	< 0.0001*
Sleep efficiency**	PsC vs PsA	0.4434	PsC > HC	0.0029*	PsA > HC	< 0.0001*
Need for sleep medications	PsC vs PsA	0.2072	PsC vs HC	0.4646	PsA > HC	0.0474*
Patient-perceived sleep quality	PsC < PsA	0.0034*	PsC vs HC	0.8905	PsA > HC	0.0011*
PSQI score	PsC < PsA	< 0.0001*	PsC > HC	0.0069*	PsA > HC	< 0.0001*

*Statistical significance was defined as $p < 0.05$. ** Sleep efficiency was calculated by the following formula and appropriately scored: (total no. hours asleep)/(total no. hours in bed) × 100. PSQI: Pittsburgh Sleep Quality Index; PsA: psoriatic arthritis; PsC: psoriasis without arthritis; HC: healthy controls.

Table 4. Linear regression of variables associated with PSQI in patients with PsD.

Variable	Measure Estimate	p
Group, 0 = PsC, 1 = PsA	2.061519	0.0001
Sex, 0 = female, 1 = male	–0.80564	0.123
BMI	0.090745	0.029
Age	–0.01098	0.601
PASI	0.032701	0.598
Obstructive sleep apnea	–2.11905	0.137
Diabetes	1.023617	0.223
Hypertension	0.452401	0.410
Alcohol consumption	–0.74446	0.033
Smoking history	–0.00219	0.997
HAQ final	3.054029	< 0.0001
EQ-5D anxiety component	3.252552	< 0.0001
DLQI	0.156001	0.015
EQ-5D final	–10.4221	< 0.0001
FACIT-fatigue	–0.14112	< 0.0001
HAQ pain VAS	0.201758	0.060
HAQ stiffness VAS	0.036352	0.773
SF-36 MCS	–0.1404	< 0.0001
SF-36 PCS	–0.12874	< 0.0001
PtGA	1.442746	< 0.0001

PSQI: Pittsburgh Sleep Quality Index; PsD: psoriatic disease; PsA: psoriatic arthritis; PsC: psoriasis without arthritis; BMI: body mass index; PASI: Psoriasis Area and Severity Index; HAQ: Health Assessment Questionnaire; VAS: visual analog scale; SF-36: Medical Outcomes Study Short Form-36; MCS: mental component summary; PCS: physical component summary; PtGA: patient's global assessment; DLQI: Dermatology Life Quality Index; FACIT: Functional Assessment of Chronic Illness Therapy.

identified disease group and sex as the only demographic variables independently associated with PSQI score (Table 5). FM did not remain in the model. PRO including EQ-5D anxiety component score, EQ-5D final score, and FACIT-fatigue score were independently associated with PSQI score.

Factors associated with sleep disturbance in PsA. Multivariate analysis of patients with PsA identified actively inflamed joint count as associated with PSQI score ($p = 0.003$), controlling for age, sex, and BMI. Notably, the PASI showed only a trend ($p = 0.08$). Again, FM was not associated with sleep disturbance on multivariate analysis.

Table 5. Final reduced model obtained from backward elimination after including variables with $p < 0.2$ from the univariate analysis of variables associated with PSQI in patients with PsD.

Variable	Estimate	p
Group (0 = PsC, 1 = PsA)	1.29642	0.013
Sex (0 = female, 1 = male)	–1.19040	0.009
EQ-5D anxiety component	1.35326	0.019
EQ-5D final	–4.43332	0.020
FACIT-fatigue	–0.05761	0.025

Response variable: PSQI. A higher reported anxiety score reflects worse anxiety. A higher calculated EQ-5D score reflects a better quality of life. A higher calculated FACIT-fatigue score reflects less fatigue. PSQI: Pittsburgh Sleep Quality Index; PsD: psoriatic disease; PsA: psoriatic arthritis; PsC: psoriasis without arthritis; FACIT: Functional Assessment of Chronic Illness Therapy.

Factors associated with sleep disturbance in PsC. Multivariable analysis of patients with PsC did not identify any independently associated disease or non–disease-related factors, after adjusting for age, sex, and BMI.

DISCUSSION

Our study indicates that there is a greater prevalence of poor sleep quality in patients with PsA and PsC compared to HC. Moreover, there is a greater prevalence of poor sleep quality in those with PsA compared to those with PsC, with an average PASI of 1.8 and 2.9, respectively. The prevalence of poor sleep quality in patients with PsA in our study was 84.1%. Our findings are consistent with a study reporting a poor sleep quality prevalence of 85.4% in patients with PsA[12].

On the other hand, there is a lack of studies using the PSQI to define and determine the prevalence of poor sleep quality in patients with PsC. Callis Duffin, *et al* reported 49.5% of those with PsD have affected sleep as a result of their psoriasis; however, sleep quality was not assessed[9]. The prevalence of poor sleep quality in our PsC population was 69.4%. In our study population, the prevalence of poor sleep

quality among HC was higher (50%) than a reported prevalence of 28.9%[12]. Because poor sleep quality is defined by a PSQI score over 5, the higher prevalence may be related to a higher mean PSQI score (5.67 ± 2.12) in our HC group compared to the control group (4.05 ± 1.85) in the study by Gezer, *et al*[12]. This difference may exist partly because our population was on average 4.2 years older and had a higher proportion of women (71.1% vs 65.8%).

When assessing poor sleep quality, as defined by PSQI score, patients with PsA experience worse sleep quality compared to HC in all 7 PSQI components including duration of sleep, sleep disturbance, sleep latency, daytime dysfunction, need for sleep medications, sleep efficiency, and subjective perception of sleep quality. Patients with PsC compared to HC, however, had poor sleep quality specifically in the PSQI components of sleep disturbances and sleep efficiency. We observed an average PSQI score of 9.24 ± 3.54 in the PsA group, which is similar to Gezer, *et al* who found an average score of 9.70 ± 3.90[12]. Our study indicates that our patients with PsA experience worse sleep quality than patients with PsC. When examining the sleep quality in detail, the PSQI components of sleep disturbance, latency, daytime dysfunction, and subjective sleep quality were likely contributory.

Regarding PRO, we found that poor sleep quality in patients with PsD is independently associated with anxiety, EQ-5D, and fatigue when controlling for sex and group. This is consistent with Gezer, *et al* who also reported independent associations with anxiety and quality of life[12]. Further, we found that patients in the PsD group perceived worse quality of life and worse fatigue than HC. Higher levels of anxiety in patients with PsD were associated with worse quality of sleep. Patients with PsD have higher prevalence of fatigue and anxiety, which is associated with debilitating effects on day-to-day activities, including sleep[7,33,34]. Additionally, a diminished perception of quality of life in patients with PsD, measured by EQ-5D, was associated with worse sleep quality. This association has been well documented not only in the PsD population, but also in the general population[33,35,36].

Subgroup analysis of the PsA group revealed poor sleep quality to be independently associated with actively inflamed joint count (a measure of PsA activity) when controlling for age, sex, and BMI. This is also consistent with the literature, where inflammatory arthritis was a predictor of sleep disturbance in patients with psoriasis[9]. The association between poor sleep quality and PASI in patients with PsA did not achieve statistical significance. This suggests that the physical attributes of PsD, in patients with PsA with an average PASI of 1.8, may be less important than the patient's perception and stigmatization, as seen with the independent association of poor sleep quality with anxiety and self-perceived quality of life[34]. Unlike other studies in which disease-related factors such as pruritus and pain were associated with sleep disturbances[37], subgroup analysis of the PsC group did not identify associations between disease or non-disease factors with poor sleep quality when controlling for age, sex, and BMI. However, it should be noted that our patients had mild psoriasis, with an average PASI score of 2.9.

Our study has a number of strengths. We used a validated instrument to measure sleep quality in our patients. We also had demographic and clinical data in both PsD groups to provide a comprehensive breadth of factors that could account for the potential associations with poor sleep quality. Also, our study provides robust data on the prevalence, associated factors, and sleep quality of patients with PsD; literature available in this area of interest is limited by small sample sizes and study designs that lack validated measures of sleep[19].

Our study is limited by its cross-sectional design that does not allow us to discern or provide commentary on causality between the identified disease and non–disease-related factors of the poor sleep quality reported in the PsD study population. Moreover, because the patients with PsA and PsC did not have severe psoriasis (average PASI of 1.8 and 2.9, respectively), they may not be representative of all patients with psoriasis, because higher PASI scores might have demonstrated an association with sleep disturbance and patients might have even higher prevalence of sleep disturbance. FM was not associated with sleep disturbance or the PSQI. This may be because few patients were found to have FM in this cohort, although a higher frequency was detected in another study[38]. To further evaluate the interaction between sleep quality, PsD activity, patient-reported health outcomes, and dysfunction, prospective and longitudinal studies will be valuable. We observed a high rate of poor sleep quality in both the PsA and PsC patient populations that may not be appropriately recognized and managed by primary care physicians, dermatologists, and rheumatologists. Our study increases understanding of the interaction between PsD and sleep quality because it compares patients with PsA, patients with PsC, and HC using a validated, standard questionnaire (PSQI) and a standard clinical protocol. Developing a better understanding of the factors related to poor sleep quality and the components of sleep affected in PsD will be useful in the development of a therapeutic approach toward sleep disturbances in PsD, and the evaluation of both drug and non-drug treatment options. Poor sleep quality is known to affect workplace productivity, mental health, health behaviors, and perceived health[39,40]. Ultimately, PsD is not simply a disease with only physical manifestations, but also a disease with psychosocial consequences. The multifactorial characteristics and extensive deleterious effects of PsD necessitate care from a multidisciplinary team to address all aspects of the disease.

ACKNOWLEDGMENT

The authors acknowledge the contributions to the data collection by Daniel Pereira, Kevin Seetaram, Sutha Shanmugarajah, and Renise Ayearst.

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