Incremental Effects of Comorbidity on Quality of Life in Patients with Psoriatic Arthritis

Janice A. Husted, Arane Thavaneswaran, Vinod Chandran, and Dafna D. Gladman

ABSTRACT. Objective. To assess the added effect of comorbidity on quality of life (QOL) in psoriatic arthritis (PsA).

Methods. Between 2006 and 2012, 631 patients were recruited from the University of Toronto PsA Clinic. Using the clinical database, we ascertained the frequency of 15 comorbidities. The Medical Outcomes Study Short Form-36 (SF-36) physical (PCS) and mental component (MCS) summary scales were used to assess QOL. Linear regression analyses were conducted to estimate the magnitude of the association between number and type of comorbidities and PCS and MCS scores, after adjustment for disease-related and sociodemographic variables.

Results. Prevalence of comorbidity was high, with 42% of patients having 3 or more comorbid conditions. After adjustment for inflammatory disease–related and sociodemographic factors, a history of 3 or more comorbid conditions accounted for only 2% and 1% of the R² value explained in PCS and MCS scores, respectively. In terms of added burden, type of comorbidity condition was more significant than number of comorbidities. After adjustment for disease-related and sociodemographic factors, fibromyalgia (FM), neurological disorders, and obesity jointly accounted for 6% of the R² value explained in PCS scores, while FM and depression/anxiety jointly accounted for about 9% of the R² explained in MCS scores. The point decrease in PCS and MCS scores associated with each of these disorders was clinically significant. The 11 other comorbid conditions failed to achieve statistical significance in the models.

Conclusion. The added effect of comorbidity on patient-reported physical and mental health in PsA was more related to type of comorbidity than number of comorbidities. (First Release June 15 2013; J Rheumatol 2013;40:1349–56; doi:10.3899/jrheum.121500)

Key Indexing Terms:
PSORIATIC ARTHRITIS
PATIENT-REPORTED HEALTH
COMORBIDITY
QUALITY OF LIFE

Psoriatic arthritis (PsA) is a chronic inflammatory arthritis associated with psoriasis, usually seronegative for rheumatoid factor1,2. Its rheumatic manifestations range from enthesitis, dactylitis, and other extraarticular features typical of the seronegative spondyloarthritides, to spinal involvement and the more debilitating arthritis mutilans. It is a progressive disease that may lead to joint destruction,
Understanding the association between comorbidity and QOL may help in effective treatment and management of important patient outcomes in PsA\textsuperscript{30,31}.

The main purpose of our cross-sectional study was to examine the magnitude of the association between comorbidity and QOL in patients with PsA, adjusting for inflammatory joint and skin disease and relevant sociodemographic characteristics.

MATERIALS AND METHODS

Patient population. The study sample originated from the University of Toronto Psoriatic Arthritis Clinic, established in 1978 to follow patients with PsA prospectively. The clinic serves as primary, secondary, and tertiary referral centers, with a broad spectrum of disease activity and duration. Patients are recruited from several sources, including the phototherapy education and research center and community-based and hospital-based dermatologists, rheumatologists, general internists, and general practitioners in the Toronto area. At the initial visit to the PsA clinic, other forms of arthritis are ruled out. More than 98% of patients fulfill the Classification of Psoriatic Arthritis (CASPAR) criteria for PsA\textsuperscript{23,33}. Patients are reevaluated at 6–12 month intervals and each undergoes a complete clinical and laboratory assessment according to a standard protocol; data are entered into a database\textsuperscript{3}.

Each assessment consists of a detailed medical history, physical examination, and laboratory evaluation including items related to PsA as well as current and past medication history, comorbidities, and known risk factors for PsA. In addition, a number of QOL questionnaires, including the Medical Outcomes Study Short Form-36 Survey (SF-36), are completed by patients on an annual basis.

For this study, we used the same inclusion criteria as for our first comorbidity study\textsuperscript{15}, including only patients who had been seen at the clinic since 2006. In addition, we use only cross-sectional data from the first clinic visit since 2006 where patients completed the SF-36\textsuperscript{34}.

Comorbid conditions. At the first clinic visit since 2006, we ascertained the history of 15 comorbid conditions: (1) cardiovascular disease (angina, myocardial infarct, cardiomyopathy, congestive heart failure; cerebrovascular disease); (2) hypertension; (3) hyperlipidemia; (4) type II diabetes; (5) obesity (body mass index ≥ 30); (6) respiratory disease (asthma, chronic obstructive disease, sleep apnea); (7) gastrointestinal disease (ulcer, irritable bowel syndrome); (8) neurological disorder (neuropathy, seizure disorder, multiple sclerosis); (9) liver disease (fatty liver, hepatitis); (10) autoimmune disease (thyroid disease, celiac disease, type I diabetes, Sjögren syndrome, lupus erythematosus); (11) depression/anxiety; (12) cancer; (13) other musculoskeletal conditions, specifically osteoporosis and osteoarthritis; (14) infections; and (15) fibromyalgia (FM). These conditions reflected the current literature on comorbidities in PsA\textsuperscript{21,22,35}.

The clinical database was used to identify the comorbid conditions in patients. Comorbid conditions were recorded in the database as reported by patients at their initial or subsequent clinic visits, by physical examination, and by use of agents to treat comorbid condition (e.g., antidepressants, antihypertensive, and anxiolytic and lipid-lowering drugs). Additional information was also sought from the patient charts, hospital records, pathology, laboratory or radiography reports, and primary care physicians\textsuperscript{23,35}.

Clinical and laboratory measures of disease activity and severity. Factors related to disease activity and severity were disease duration, total number of actively inflamed joints (stress pain, joint line tenderness, and/or swelling; scale 0–68); number of clinically deformed joints (ankylosis, subluxation or decreased range of motion > 20%, attributable to joint damage rather than inflammation; scale 0–68); psoriasis severity [Psoriasis Area and Severity Index (PASI), score 0–72]\textsuperscript{36}; and past and current medications. Laboratory measures included erythrocyte sedimentation rate (ESR) and hemoglobin. Elevated ESR was defined as ESR > 20 mm/h for women and ESR > 15 mm/h for men. Anemia was defined as hemoglobin < 120 g/l for women and < 130 g/l for men.

Sociodemographic variables. A range of variables were assessed including age, ethnicity, education, employment status, sex, daily alcohol use, and current smoking behavior.

Patient-reported physical and mental health. We selected the generic SF-36 questionnaire, developed to assess current physical and mental health functioning across a range of chronic diseases, including arthritis. Specifically, the physical and mental health component scales (PCS and MCS) were used\textsuperscript{37}. Both scales are linear combinations of the eight SF-36 subscales, with the PCS heavily weighting the physical functioning, bodily pain, and role disabilities due to physical limitations subscales; and the MCS heavily weighting the mental health, social functioning, and role disabilities-emotional limitations subscales. The PCS and MCS scores were adjusted by the general US population and SD to produce norm-based scores with a population mean of 50 (SD 10)\textsuperscript{37}. Scores below 50 reflected below-average functioning, with very low PCS scores reflecting severe bodily pain and substantial limitations in self-care, physical activities, and role performance; and very low MCS scores indicating frequent psychological distress and role disability due to emotional problems\textsuperscript{37}. The SF-36 has been shown to be reliable in our clinic population\textsuperscript{38}.

The study was approved by the Research Ethics Board at the University Health Network.

Analyses. Descriptive information was provided on the 631 patients at their first SF-36 assessment since 2006. Initially, univariate linear regression analyses were performed to investigate separately the cross-sectional associations of PCS and MCS scores with number of comorbid conditions, disease activity and severity, and sociodemographic variables. Tests for linearity indicated there was a nonlinear relationship between number of comorbid conditions and MCS and PCS scores. We therefore recoded a number of comorbid conditions to reflect the presence or absence of history of 3 or more comorbid conditions (0 = less than 3 comorbid conditions and 1 = 3 or more comorbid conditions). In the multivariate regression analyses we used a stepwise procedure, with forced entry of age, sex (males vs females), and PsA duration (step 1). The remaining variables with p values below the 0.05 significance level were then considered for both inclusion and retention in the multivariate linear regression analyses. R\textsuperscript{2} values were used to estimate the strength of the association between PCS and MCS scores and comorbid conditions, PsA status, and sociodemographic variables. For the univariate analysis shown in Table 3, R\textsuperscript{2} values denoted the proportion of the total variance in PCS and MCS scores explained or accounted for by the variable in the regression equation. In the multivariate analysis (Tables 4 and 5), multiple R\textsuperscript{2} values indicated the proportion of the total variance in PCS and MCS scores explained by all variables in the final regression equation, while the incremental change in R\textsuperscript{2} value denoted the proportion of the total variance in PCS and MCS scores explained or accounted for by each of the variables in the final regression equation. We also examined interactions of our derived comorbidity index with age, sex, disease activity and severity, as measured by elevated ESR, severe psoriasis (PASI score > 10), number of actively inflamed joints, and severe clinical deformity (damaged joints ≥ 5). Finally, we repeated these analyses jointly, entering the specific comorbid conditions in place of the derived comorbidity index. Statistical analyses were performed using SAS 9.2 software.

RESULTS

Included in the study was a group of 631 patients, predominantly male and white, with PsA (Table 1). The mean age and mean disease duration were 49.6 years (SD 12.9) and 13.0 years (SD 10.8), respectively. The mean number of actively inflamed joints and clinically deformed joints (9.4 and 12.8) reflected moderate to severe disease activity and damage. Thirteen percent of patients had a history of severe
Fewer sociodemographic and disease-related variables were significantly associated with MCS scores. Only number of actively inflamed joints and biological agents ever used were associated with lower MCS scores, whereas number of deformed joints and illness duration were associated with higher scores. A history of 3 or more comorbid conditions was also associated with lower MCS scores. Based on R^2 values, number of actively inflamed joints was the most strongly associated with level of mental functioning (R^2 = 9.0%, 16.0%, and 5.0%, respectively). While data are not shown, the following 9 comorbid conditions were significantly associated (p < 0.05 level) with decreased levels of physical health: cardiovascular disease, hypertension, type II diabetes, obesity, respiratory disease, neurological disease, depression/anxiety, cancer, and FM. Based on the R^2 values, FM and obesity were the most strongly associated with level of physical health (R^2 = 11.0% and 3.0%, respectively).

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Results of multivariate relationships among sociodemographic variables, disease status, number or type of comorbid conditions, and patient-reported physical and mental health. Table 4 shows the added influence of 3 or more comorbidities on both physical and mental health. As shown, the stepwise model for physical and for mental health explained 29% and 9% of the variance in PCS and MCS scores, respectively. Note that the multivariate analyses used a stepwise procedure, with the first step being forced insertion of age, sex, and PsA duration into the models. The p values for all remaining variables in both stepwise models were below the 0.05 significance level. A history of 3 or more comorbid conditions accounted for only 2% and 1% of the R^2 explained in PCS and MCS scores, respectively, after adjustment for disease status and sociodemographic influences. Number of actively inflamed joints played the largest role in accounting for R^2 explained in
PCS scores (16.2%) and in MCS scores (3.0%). The multivariate regression analyses that included interaction terms produced no statistically significant interaction effects, and therefore only main effects of the study variables were included in the multivariate models.

Table 5 shows the results of the multivariate models that jointly entered the specific conditions in place of a history of 3 or more comorbid conditions. As shown, the stepwise model for physical and for mental health now explained 31.5% and 15.5% of the variance in PCS and MCS scores.

Table 2. Relationship between number and type of comorbid conditions and physical and mental health status.

<table>
<thead>
<tr>
<th>No. Comorbid Conditions</th>
<th>Count (%)</th>
<th>PCS Mean (SD)</th>
<th>MCS Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3</td>
<td>365 (57.8)</td>
<td>42.2 (11.2)</td>
<td>48.5 (10.7)</td>
</tr>
<tr>
<td>≥ 3</td>
<td>266 (42.2)</td>
<td>36.8 (12.1)</td>
<td>46.4 (11.3)</td>
</tr>
</tbody>
</table>

Type of comorbidity

- Cardiovascular disease*
  - Hypertension
  - Hyperlipidemia
  - Type II diabetes
  - Obesity
- Respiratory disease*
- Gastrointestinal disease*
- Neurological disease*
- Autoimmune disease*
- Liver disease*
- Depression/anxiety
- Cancer
- Other musculoskeletal conditions*
- Infection
- Fibromyalgia

* Cardiovascular: angina, myocardial infarction, cardiomyopathy, congestive heart failure, and cerebrovascular accident; respiratory disease: asthma, chronic obstructive lung disease, and sleep apnea; gastrointestinal: ulcer and irritable bowel syndrome; neurological disorder: neuropathy, seizure disorder, and multiple sclerosis; autoimmune disease: thyroid disease, celiac disease, type I diabetes, Sjögren syndrome, and lupus erythematosus; liver disease: thyroid disease, celiac disease, type I diabetes, Sjögren syndrome, and lupus erythematosus; other musculoskeletal conditions: osteoporosis, osteoarthritis.

PCS: physical health component scale of SF-36; MCS: mental health component scale of SF-36; SF-36: Medical Outcomes Study Short Form-36.

Table 3. Results for univariate linear regression analysis of physical and mental health on sociodemographic characteristics, disease status, and number of comorbid conditions.

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>R²</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (male vs female)</td>
<td>3.65</td>
<td>0.95</td>
<td>0.0001</td>
<td>0.02</td>
<td>0.83</td>
<td>0.89</td>
<td>0.35</td>
<td>0.006</td>
</tr>
<tr>
<td>Age</td>
<td>-0.06</td>
<td>0.04</td>
<td>0.10</td>
<td>0.004</td>
<td>0.03</td>
<td>0.03</td>
<td>0.31</td>
<td>0.002</td>
</tr>
<tr>
<td>White (yes vs no)</td>
<td>0.008</td>
<td>0.03</td>
<td>0.78</td>
<td>0.0001</td>
<td>0.94</td>
<td>1.37</td>
<td>0.49</td>
<td>0.0008</td>
</tr>
<tr>
<td>College or university education (yes vs no)</td>
<td>3.61</td>
<td>1.10</td>
<td>0.0001</td>
<td>0.02</td>
<td>2.75</td>
<td>1.01</td>
<td>0.007</td>
<td>0.01</td>
</tr>
<tr>
<td>Employed (yes vs no)</td>
<td>7.71</td>
<td>0.9</td>
<td>&lt; 0.0001</td>
<td>0.09</td>
<td>3.18</td>
<td>0.93</td>
<td>0.0007</td>
<td>0.02</td>
</tr>
<tr>
<td>Married (yes vs no)</td>
<td>0.66</td>
<td>1.17</td>
<td>0.58</td>
<td>0.0005</td>
<td>0.40</td>
<td>1.09</td>
<td>0.71</td>
<td>0.0002</td>
</tr>
<tr>
<td>Current smoker (yes vs no)</td>
<td>-1.73</td>
<td>0.56</td>
<td>0.002</td>
<td>0.02</td>
<td>-1.95</td>
<td>0.51</td>
<td>0.0002</td>
<td>0.02</td>
</tr>
<tr>
<td>Current daily drinker (yes vs no)</td>
<td>2.66</td>
<td>0.79</td>
<td>0.0009</td>
<td>0.02</td>
<td>0.57</td>
<td>0.74</td>
<td>0.44</td>
<td>0.001</td>
</tr>
<tr>
<td>Duration of PsA (yrs)</td>
<td>-0.07</td>
<td>0.04</td>
<td>0.12</td>
<td>0.004</td>
<td>0.10</td>
<td>0.04</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Severe psoriasis (PASI &gt; 10)</td>
<td>-2.95</td>
<td>1.47</td>
<td>0.04</td>
<td>0.007</td>
<td>0.005</td>
<td>1.35</td>
<td>0.10</td>
<td>0.000</td>
</tr>
<tr>
<td>No. actively inflamed joints</td>
<td>-0.53</td>
<td>0.05</td>
<td>&lt; 0.0001</td>
<td>0.16</td>
<td>-0.21</td>
<td>0.05</td>
<td>&lt; 0.0001</td>
<td>0.03</td>
</tr>
<tr>
<td>Severe clinical deformity (≥ 5 deformed joints)</td>
<td>-0.80</td>
<td>1.00</td>
<td>0.42</td>
<td>0.001</td>
<td>2.11</td>
<td>0.92</td>
<td>0.02</td>
<td>0.008</td>
</tr>
<tr>
<td>Elevated ESR (yes vs no)</td>
<td>-3.97</td>
<td>1.02</td>
<td>0.0001</td>
<td>0.02</td>
<td>-1.20</td>
<td>0.94</td>
<td>0.20</td>
<td>0.003</td>
</tr>
<tr>
<td>Anemia (yes vs no)</td>
<td>-4.58</td>
<td>1.41</td>
<td>0.001</td>
<td>0.02</td>
<td>0.25</td>
<td>1.30</td>
<td>0.85</td>
<td>0.0001</td>
</tr>
<tr>
<td>NSAID ever used (yes vs no)</td>
<td>-2.77</td>
<td>1.34</td>
<td>0.04</td>
<td>0.007</td>
<td>1.81</td>
<td>1.24</td>
<td>0.15</td>
<td>0.003</td>
</tr>
<tr>
<td>DMARD ever used (yes vs no)</td>
<td>-2.81</td>
<td>1.05</td>
<td>0.008</td>
<td>0.01</td>
<td>0.37</td>
<td>0.98</td>
<td>0.70</td>
<td>0.0002</td>
</tr>
<tr>
<td>Biologic agents ever used (yes vs no)</td>
<td>-3.16</td>
<td>1.08</td>
<td>0.004</td>
<td>0.01</td>
<td>-2.13</td>
<td>1.00</td>
<td>0.03</td>
<td>0.007</td>
</tr>
<tr>
<td>Three or more comorbid conditions (yes vs no)</td>
<td>-5.42</td>
<td>0.94</td>
<td>&lt; 0.0001</td>
<td>0.05</td>
<td>-2.0</td>
<td>0.88</td>
<td>0.008</td>
<td>0.02</td>
</tr>
</tbody>
</table>

See Table 1 for definitions. SE: standard error.
respectively. Again, number of actively inflamed joints played the largest part in accounting for $R^2$ explained in PCS scores (16.0%). However, FM, neurological disorders, and obesity taken together accounted for about 6% of $R^2$ explained in PCS scores. Number of actively inflamed joints accounted for 2% of $R^2$ explained in MCS scores, whereas depression/anxiety and FM combined accounted for about 8% of the $R^2$ explained in MCS scores. Because of relatively small numbers of individual comorbidities, multivariate regression analyses including interaction terms were not conducted.

**DISCUSSION**

To our knowledge this the first study to estimate the added burden of comorbidity on patient-reported health in PsA. As expected, the prevalence of comorbidity was relatively high in our clinic sample of 631 patients, with 42% having 3 or more comorbid conditions. At the univariate level, a history of 3 or more comorbid conditions was significantly associated with physical health, explaining 5% of the explained variance in PCS scores. However, after adjustment for effects of inflammatory disease-related and sociodemographic characteristics, the association between 3 or more comorbid conditions and PCS scores explained only 2% of the explained variance in PCS scores. Number of actively inflamed joints played the largest role in accounting for $R^2$ explained in PCS scores (16.2%). In the univariate and multivariate analyses, 3 or more comorbid conditions explained only 2% and 1% of the explained variance in MCS scores, respectively.

More importantly, our results indicated that not all comorbid conditions were associated with levels of physical and mental health. This suggested that a simple count of conditions (which assumes equal influence of each
condition) may underestimate the effects of specific comorbidities. Indeed, in the multivariate models that jointly entered the individual comorbidities (Table 5), the joint explanatory power of comorbidities increased. Taken together, FM, obesity, and neurological disorders (primarily neuropathies) explained about 6% of the explained variance in PCS scores, and depression/anxiety and FM explained about 9% of the explained variance in MCS scores. With the exception of obesity, the magnitude of the decrease in PCS or MCS scores associated with each of these conditions (as well as anemia) exceeded the MCID.

Our findings show some consistency with studies that have investigated the effects of comorbidity on patient-reported health in other chronic diseases. Rijken, et al investigated the effect of comorbidity on cardiovascular disease, arthritis, cancer, diabetes, chronic respiratory diseases, and thyroid disease, and found that arthritis affected physical function (as measured by the SF-36 PCS) more than all other conditions studied, regardless of the presence of coexisting comorbidity. This is consistent with our observation that the number of actively inflamed joints played the largest role in explaining the variance in physical health in our sample of PsA patients. Similar to our findings, arthritis and the other physical conditions were unrelated or weakly related to mental health (as measured by the SF-36 MCS). Rijken, et al argued that unmeasured disease characteristics, such as illness duration and disease stage, may be more important for mental health than the type and number of chronic physical conditions. However, we found that PsA duration and number of clinically deformed joints were unrelated to mental health status at the multivariate level. Rather, the type and number of coexisting mental conditions (e.g., depression) and other chronic pain disorders (e.g., FM) may be more important.

Table 5. Results for the stepwise multivariate linear regression analyses of physical and mental health on sociodemographic characteristics, disease status, and individual comorbid conditions.

<table>
<thead>
<tr>
<th>PCS Variables</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>Incremental Change in R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>38.94</td>
<td>3.40</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>1.31</td>
<td>0.93</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.007</td>
<td>0.04</td>
<td>0.86</td>
<td>0.03*</td>
</tr>
<tr>
<td>Duration of PsA</td>
<td>0.009</td>
<td>0.05</td>
<td>0.86</td>
<td></td>
</tr>
<tr>
<td>No. actively inflamed joints</td>
<td>-0.41</td>
<td>0.05</td>
<td>&lt; 0.0001</td>
<td>0.16</td>
</tr>
<tr>
<td>Employed</td>
<td>-4.52</td>
<td>1.10</td>
<td>&lt; 0.0001</td>
<td>0.04</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>-6.50</td>
<td>1.62</td>
<td>&lt; 0.0001</td>
<td>0.03</td>
</tr>
<tr>
<td>Neurological disorder</td>
<td>-6.03</td>
<td>1.58</td>
<td>0.0002</td>
<td>0.02</td>
</tr>
<tr>
<td>NSAID ever used</td>
<td>-3.57</td>
<td>1.31</td>
<td>0.007</td>
<td>0.01</td>
</tr>
<tr>
<td>College or university education</td>
<td>-2.31</td>
<td>1.04</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Obesity</td>
<td>-2.43</td>
<td>0.96</td>
<td>0.01</td>
<td>0.007</td>
</tr>
<tr>
<td>Anemia</td>
<td>-3.27</td>
<td>1.31</td>
<td>0.01</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Multiple R² = 0.33
Adjusted R² = 0.31
No. observations deleted due to missing data = 102

<table>
<thead>
<tr>
<th>MCS Variables</th>
<th>B</th>
<th>SE</th>
<th>p</th>
<th>Incremental Change in R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>45.22</td>
<td>3.03</td>
<td>&lt; 0.0001</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-0.95</td>
<td>0.91</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.04</td>
<td>0.04</td>
<td>0.33</td>
<td>0.01*</td>
</tr>
<tr>
<td>Duration of PsA</td>
<td>0.07</td>
<td>0.05</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Depression, anxiety</td>
<td>-7.20</td>
<td>1.11</td>
<td>&lt; 0.0001</td>
<td>0.08</td>
</tr>
<tr>
<td>Current smoker</td>
<td>-1.77</td>
<td>0.52</td>
<td>0.0008</td>
<td>0.02</td>
</tr>
<tr>
<td>No. actively inflamed joints</td>
<td>-0.12</td>
<td>0.05</td>
<td>&lt; 0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>College or university education</td>
<td>2.89</td>
<td>1.01</td>
<td>0.005</td>
<td>0.01</td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td>-4.12</td>
<td>1.58</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Multiple R² = 0.15
Adjusted R² = 0.14
No. observations deleted due to missing data = 60

See Table 1 for definitions. * Incremental change in R² for step 1 of multivariate analyses that forced entry of sex, age, and duration of PsA. SE: standard error.
its effect varied by the outcome studied (physical vs mental) and by type of comorbidity, concluding that a summary count of comorbidity likely masks true effects. Future research should investigate the added influence of comorbidity on the full range of important patient outcomes in PsA, including work disability, hospitalization, and premature mortality. We focused solely on patient-reported physical and mental health. In addition, we did not study the entire range of comorbidities such as chronic pain disorders and visual and hearing impairments shown to be related to both physical and mental health.

There are further methodological issues that warrant consideration. Our study patients may not be representative of all patients with PsA. To address this, we compared sociodemographic characteristics, disease features, and selected comorbidities in our patients with PsA to others reported in the literature and found they were quite similar, although our patients achieved a higher level of education. However, because our patients are routinely seen at the clinic every 6–12 months, the effects of comorbidities may be minimized owing to early detection and effective treatment. In addition, small numbers prevented examination of the effects of particular combinations of comorbid conditions. Further, the different timeframe for assessment of comorbid conditions (past and current) and physical and mental health (current) could have led to an underestimate of the cross-sectional association between specific comorbid conditions and physical and mental health, because some conditions may be successively treated (e.g., cancer, cardiovascular disease), and others (depression or anxiety) may have gone undetected or untreated. Finally, because this was a cross-sectional study, we could not determine whether the individual comorbid conditions most associated with physical or mental health (e.g., obesity, neuropathies, FM) antedated the onset of PsA, or were a consequence of the disorder and its treatment. If the latter, we may have overestimated their influence relative to that of inflammatory joint disease.

There are limited data on the added burden of comorbidity on patient outcomes in PsA. Overall, our results suggested that type of comorbid condition was more important than the total number of conditions. Of the comorbidities studied, FM, neurological disorders, and obesity were most strongly associated with decreased physical health, after adjustment for inflammatory disease-related and sociodemographic characteristics. FM and depression/anxiety disorders were most strongly associated with decreased mental health. Our results suggest that management of PsA likely extends beyond treatment of the inflammatory joint and skin disease. To optimize important patient outcomes, physicians should consider patient education, counseling, or referral to specialists in the areas of weight management, mobility, pain control, and psychological distress.

ACKNOWLEDGMENT
The authors thank the patients for their participation in the study, Renise Ayearst for data management, and Maria Morales for assistance in preparation of the manuscript.

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