



# Predictors of Health-Related Quality of Life in Patients with Ankylosing Spondylitis in Southwest China

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**Purpose:** The purpose of this study was to evaluate health-related quality of life (QoL) and explore its predictors in patients with ankylosing spondylitis (AS) in Southwest China.

**Patients and Methods:** We recruited AS patients from a tertiary hospital in Chengdu, China. Data were collected by self-reported questionnaires, including sociodemographic and disease-related variables, the Medical Outcomes Study 36-Item Short Form (SF-36), Beck Depression Inventory-Second Edition (BDI-II), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath Ankylosing Spondylitis Functional Index (BASFI), and Bath Ankylosing Spondylitis Global score (BAS-G). Stepwise multiple linear regression analysis was used to determine the factors affecting physical component summary (PCS) and mental component summary (MCS) of SF-36.

**Results:** A total of 125 patients with AS were included in the current study. The PCS, MCS scores of SF-36 were  $41.06 \pm 9.12$ ,  $47.82 \pm 9.84$ , respectively. Stepwise multiple linear regression analysis showed that higher educational level ( $\beta = 0.237$ ,  $P < 0.001$ ) and income ( $\beta = 0.141$ ,  $P = 0.017$ ), lower BASDAI ( $\beta = -0.195$ ,  $P = 0.006$ ), BASFI ( $\beta = -0.317$ ,  $P < 0.001$ ) and BAS-G ( $\beta = -0.288$ ,  $P < 0.001$ ) scores were associated with higher PCS scores of SF-36. Higher BDI-II ( $\beta = -0.444$ ,  $P < 0.001$ ) and fatigue ( $\beta = -0.293$ ,  $P < 0.001$ ) scores were associated with worse MCS scores of SF-36.

**Conclusion:** AS patients in Southwest China had impaired health-related QoL. Healthcare providers should take effective strategies to modify the factors affecting health-related QoL, which may prompt disease management and increase QoL.

**Keywords:** ankylosing spondylitis, health-related quality of life, physical function, disease activity, depression, fatigue

## Introduction

Ankylosing spondylitis (AS), as a subtype of spondyloarthritis (SpA), is a common inflammatory rheumatic disease with an unknown etiology.<sup>1-3</sup> The main symptoms of AS patients are inflammatory back pain, morning stiffness, fatigue, enthesitis, extra-arthritis manifestations.<sup>2,4</sup> During the disease process, AS may cause structural and functional limitation, psychological disorders (eg, depression, anxiety), reduced work productivity, and lead to impaired health-related quality of life (QoL) and substantial disease burden.<sup>5-8</sup> The goal of AS management is to maximize long-term health-related QoL through controlling inflammation and improving function.<sup>1,2</sup> Thus, health-related QoL of AS patients should be well studied before health professionals develop target interventions for improving health-related QoL.

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Health-related QoL is a multi-domain concept that reflects the impact of illness and treatment on a person's perception of his/her daily life, including physical and mental well-being.<sup>8–10</sup> Existing evidence suggested that AS patients have poorer health-related QoL than the general population.<sup>7,8</sup> Health-related QoL of AS patients was mainly assessed by the generic instrument- the Medical Outcomes Study 36-Item Short Form (SF-36) and the disease-specific instrument- the Ankylosing Spondylitis Quality of Life (ASQoL).<sup>7,8</sup> Although ASQoL was developed for AS patients use,<sup>11</sup> it may not reflect the multi-domain concept of Health-related QoL well. SF-36 contains 8 domains that can reflect the physical and mental health among different people.<sup>12,13</sup> Thus, SF-36 can be used to assess the level and different aspects of health-related QoL among AS patients.

Although many previous studies have explored health-related QoL in AS patients,<sup>7,8,14–17</sup> health-related QoL among AS patients in Southwest China is not well studied. QoL is a broad concept that can be affected by individual's physical health, psychological state, social relationship, and the relationships with the environment.<sup>8,10</sup> Previous studies indicated that disease activity and functional ability are the main factors affecting health-related QoL.<sup>7,8,18</sup> However, the impacts of psychological disorders (eg, depression), sociodemographic variables (eg, age, educational level, marital status), health behaviors (eg, exercise, smoking status) on health-related QoL have not been well explored.

The aims of this analysis were to (1) assess health-related QoL of AS patients; (2) explore the associations between health-related QoL and sociodemographic variables, health behaviors, depression, and disease-specific variables among patients with AS in Southwest China.

## Materials and Methods

### Study Design and Participants

The data of this study were derived from baseline data of a randomized controlled trial (ChiCTR-IPR-16009293) in Chengdu, China.<sup>19</sup> The patients meeting the following criteria were included in the current study: (1) patients were diagnosed as AS according to the modified New York criteria for the diagnosis of AS; (2) patients were  $\geq 14$  years old; (3) patients can communicate or read in Chinese language; (4) patients were willing to attend this study. Exclusion criteria were: having severe cognitive impairment and other rheumatic diseases.

## Ethical Consideration

This study was conducted in accordance with the Declaration of Helsinki and approved by West China Hospital Medical Ethics Committee in China (ID 20160364). All participants were informed of the content and procedure of this study, and completed written informed consents.

## Measures and Data Collection

All participants independently completed the questionnaires. Research assistants would help participants if they had difficulty in completing the questionnaires. The participants reported their information regarding sociodemographic characteristics (ie age, gender, educational level, marital status, monthly per capita income), disease-related information (peripheral involvement, extra-arthritis manifestation, disease activity, physical function, global well-being), behaviors (ie exercise, smoking status), and health-related QoL.

### Evaluation of Disease Activity

We evaluated disease activity using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI).<sup>20</sup> It is a 6-item scale to measure fatigue, spinal and peripheral joint pain, localized tenderness, the severity and duration of morning stiffness.<sup>20</sup> This scale reported good test-retest reliability.<sup>20</sup> The BASDAI is scored in a range from 0 to 10. Lower scores represents less disease activity.

### Evaluation of Physical Function

AS patients' physical function was evaluated using the Bath Ankylosing Spondylitis Functional Index (BASFI). It is a 10-item scale to measure function in AS and reflect the patient's ability to cope with everyday life.<sup>21</sup> The total score of BASFI is the mean of 10 items with higher scores indicating worse physical function.<sup>21</sup>

### Evaluation of Global Well-Being

We used the Bath Ankylosing Spondylitis Patient Global Score (BAS-G) to reflect the effects of the disease on patients' well-being over the past week/6 month.<sup>22</sup> The final BAS-G is scored from 0 (none) to 10 (very severe). Evidence suggested that this scale had good test-retest reliability, construct validity and predictive validity.<sup>22</sup>

### Evaluation of Health-Related QoL

Health-related QoL was evaluated using the Chinese version of the Medical Outcomes Study Short Form 36-item Health Survey (SF-36).<sup>23,24</sup> This 36-item instrument

contains 8 domains: physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE) and mental health (MH).<sup>24</sup> The first 4 domains can be summarized into the physical component summary (PCS) and the last 4 domains can be summarized into the mental component summary (MCS).<sup>13</sup> The 8 domains and 2 components are scored from 0 to 100 after recoding, and higher scores indicate better health-related QoL.<sup>12,13</sup>

### Evaluation of Depression

Patients' depressive symptoms were evaluated using the Chinese version of Beck Depression Inventory-Second Edition (BDI-II).<sup>25,26</sup> This instrument includes 21 items assessing the severity of depressive symptoms over the past 2 weeks.<sup>27</sup> Total scores of BDI-II range from 0 to 63, with higher scores reflecting more severe depressive symptoms.<sup>27</sup>

### Statistical Analysis

All statistical analyses were conducted using SPSS 22.0 (SPSS Inc., Chicago, IL, USA). We used descriptive statistics (eg, means, standard deviations, frequencies, and percentages) to describe the participants' characteristics. The Spearman rank correlation, independent sample *t*-test and analysis of variance (ANOVA) test were used to explore factors associated with PCS and MCS of SF-36. Finally, stepwise multiple linear regression analyses were performed to explore the predictors of PCS and MCS scores. A *P* value less than 0.05 was considered to be statistically significant.

### Results

We invited 140 patients with AS to participate in this study, and 132 patients were willing to participate in our study. Seven patients who did not meet the inclusion and exclusion criteria were excluded. Finally, 125 patients were included and completed the questionnaire.

### Patients Characteristics

A total of 125 AS patients with a mean age of 29.8 years were enrolled in the current study. The majority of the participants had no extra-arthritis manifestation (103, 82.4%), did not smoke (85, 68.0%), and had no exercise habit (70, 56.0%). Around half of the patients had a high educational level (64, 51.2%) and peripheral involvement (53, 42.4%), and were married (60, 48.0%). Characteristics of the participants are shown in Table 1.

### Clinical Variables and Health-Related QoL

The scores of SF-36 and other clinical variables are shown in Table 2. For the 8 domains of SF-36, the most affected domains were role physical (45.40±43.00), general health (48.94±21.09). The mean (standard deviations, SD) PCS and MCS scores of SF-36 were 41.06±9.12, 47.82±9.84, respectively.

### Factors Associated with Health-Related Quality of Life

Patients with peripheral involvement and exercise habits had higher PCS scores than the others ( $P=0.001$ , 0.011, Table 1). The PCS scores varied by educational level, monthly per capita income ( $P<0.05$ , Table 1). Spearman's test showed that BDI-II, BASFI, BASDAI, BAS-G and fatigue scores were negatively associated with PCS and MCS scores (all  $P<0.05$ , Table 3). However, age was only associated with PCS scores ( $P=0.46$ , Table 3).

The results of stepwise multiple linear regression analyses using PCS and MCS scores as dependent variables are shown in Tables 4 and 5. The results showed that higher educational level ( $\beta=0.237$ ,  $P<0.001$ ) and income ( $\beta=0.141$ ,  $P=0.017$ ), lower BASDAI ( $\beta=-0.195$ ,  $P=0.006$ ), BASFI ( $\beta=-0.317$ ,  $P<0.001$ ) and BAS-G ( $\beta=-0.288$ ,  $P<0.001$ ) predicted higher PCS scores. The whole model could explain 62.9% of the total variance in PCS. For MCS as the dependent variable, BDI-II ( $\beta=-0.444$ ,  $P<0.001$ ) and fatigue ( $\beta=-0.293$ ,  $P<0.001$ ) scores negatively predicted the MCS scores. This model could explain 35.6% of the total variance in MCS.

### Discussion

This study evaluated health-related QoL using the generic instrument SF-36 and explored their predictors among AS patients in Southwest China. We found that the most affected domains of SF-36 were role physical, general health, and bodily pain. Our results were similar to previous studies on AS patients, revealing that role physical and general health were the most affected domain of SF-36.<sup>28,29</sup> Meanwhile, we found that the PCS scores were lower than the MCS scores. Previous studies revealed that physical component of health-related QoL is worse compared to mental component.<sup>9,28–30</sup> AS patients often suffer from pain, morning stiffness, functional limitation, which may negatively affect physical component of health-related

**Table 1** Characteristics of Participants and Relationship Between Sociodemographic, Disease-Related Variables and Health-Related QoL (N=125)

Variable	Mean $\pm$ SD/ n (%)	PCS (Mean $\pm$ SD)	P value	MCS (Mean $\pm$ SD)	P value
Age (years,)	29.8 $\pm$ 8.2				
Gender			0.456 <sup>a</sup>		0.800 <sup>a</sup>
Male	97 (77.6%)	40.73 $\pm$ 9.37		47.94 $\pm$ 9.75	
Female	28 (22.4%)	42.20 $\pm$ 8.24		47.40 $\pm$ 10.33	
Educational level			0.000 <sup>b**</sup>		0.770 <sup>b</sup>
Junior high school or below	33 (26.4%)	35.42 $\pm$ 9.27		48.35 $\pm$ 9.47	
Senior high school	28 (22.4%)	41.30 $\pm$ 9.92		46.65 $\pm$ 10.84	
College or above	64 (51.2%)	43.86 $\pm$ 7.29		48.06 $\pm$ 9.69	
Marital status			0.916 <sup>a</sup>		0.113 <sup>a</sup>
Single/Divorced	65 (52.0%)	41.14 $\pm$ 9.08		46.48 $\pm$ 9.12	
Married	60 (48.0%)	40.97 $\pm$ 9.23		49.27 $\pm$ 10.45	
Monthly per capita income, (¥, yuan)			0.015 <sup>b*</sup>		0.061 <sup>b</sup>
<2200	35 (28%)	37.63 $\pm$ 9.52		46.70 $\pm$ 9.64	
2200~3300	34 (27.2%)	40.63 $\pm$ 9.20		47.26 $\pm$ 10.06	
3300~5500	27 (21.6%)	42.03 $\pm$ 9.90		45.50 $\pm$ 10.23	
>5500	29 (23.2%)	44.81 $\pm$ 6.09		51.99 $\pm$ 8.63	
Peripheral involvement			0.001 <sup>a**</sup>		0.297 <sup>a</sup>
Yes	53 (42.4%)	37.98 $\pm$ 8.46		46.70 $\pm$ 11.25	
No	72 (57.6%)	43.33 $\pm$ 8.97		48.64 $\pm$ 8.65	
Extra-arthritis manifestation			0.333 <sup>a</sup>		0.188 <sup>a</sup>
Yes	22 (17.6%)	39.35 $\pm$ 9.38		45.30 $\pm$ 11.34	
No	103 (82.4%)	41.43 $\pm$ 9.07		48.36 $\pm$ 9.47	
Smoking status			0.826 <sup>a</sup>		0.492 <sup>a</sup>
Yes	40 (32.0%)	40.80 $\pm$ 9.11		46.93 $\pm$ 8.67	
No	85 (68.0%)	41.18 $\pm$ 9.18		48.24 $\pm$ 10.37	
Exercise			0.011 <sup>a*</sup>		0.405 <sup>a</sup>
Yes	55 (44%)	43.38 $\pm$ 8.21		48.65 $\pm$ 9.30	
No	70 (56%)	39.24 $\pm$ 9.43		47.17 $\pm$ 10.27	

Notes: <sup>a</sup>Independent t-test, <sup>b</sup>Analysis of variance; \*\*P<0.01, \*P<0.05.

Abbreviations: SD, standard deviations; PCS, physical component summary; MCS, mental component summary.

QoL.<sup>7</sup> Thus, our findings emphasize that specific and effective intervention should be developed to improve health-related QoL of AS patients, particularly physical component.

AS patients with higher educational level reported higher PCS scores of SF-36. Mielck et al's study among people with chronic disease found that people with low educational level reported more problems compared with the high education group.<sup>31</sup> Lu's cross-sectional study for AS patients revealed that patients with a lower educational level had a poor physical function QoL.<sup>14</sup> Bodur et al<sup>32</sup> also revealed that advanced educational attainment positively affects QoL. More/better

education is associated with better income, occupational choice and disease management, leading to improved health-related QoL.<sup>14,33</sup> Meanwhile, we found that patients with higher income had better PCS scores of health-related QoL, similar to previous study.<sup>31</sup> AS causes a great economic burden for patients, such as medical expense.<sup>6,34</sup> Economic status is an important factor of medication adherence and persistence.<sup>35</sup> AS patients with good economic status may adhere to long-term treatment and management, which may lead to better physical health QoL. Thus, health professionals should pay more attention to patients with low educational level and household income.

**Table 2** Clinical Variables and Health-Related QoL of AS Patients (N=125)

Variables	Mean±SD	Median (IQR)	Range
SF-36 subgroups			
Physical functioning	77.88±18.70	80.00 (70.00–95.00)	5.00–100.00
Role physical	45.40±43.00	50.00 (0.00–100.00)	0–100.00
Bodily pain	51.78±20.35	51.00 (41.00–62.00)	12.00–100.00
General health	48.94±21.09	50.00 (30.00–66.00)	5.00–97.00
Vitality	66.28±18.78	70.00 (50.00–80.00)	15.00–100.00
Social functioning	71.11±22.22	77.78 (55.56–88.89)	0–100.00
Role emotional	63.73±43.59	100.00 (0–100.00)	0–100.00
Mental health	67.07±15.48	68.00 (56.00–80.00)	32.00–100.00
PCS	41.06±9.12	41.83 (34.90–47.35)	9.62–57.47
MCS	47.82±9.84	48.58 (40.00–56.34)	23.08–63.13
BDI-II	7.94±8.38	5.00 (1.50–12.00)	0–51.00
BASDAI	3.25±1.86	2.83 (1.91–4.55)	0–8.10
BASFI	1.41±1.93	0.60 (0.10–1.80)	0–7.30
BAS-G	3.35±2.26	3.00 (1.75–5.00)	0–9.00
Fatigue	3.91±2.36	4.00 (2.00–5.00)	0–10.0

**Abbreviations:** SD, standard deviations; IQR, interquartile range; SF-36, Medical Outcomes Study Short Form 36-item Health Survey; PCS, physical component summary; MCS, mental component summary; BDI-II, Beck Depression Inventory-Second Edition; BASDAI, Bath Ankylosing Disease Activity Index; BASFI, Bath Ankylosing Spondylitis Functional Index; BAS-G, Bath Ankylosing Spondylitis Global Score.

**Table 3** Correlations Between Variables and Health-Related QoL (N=125)

Variables	PCS		MCS	
	r	P value	r	P value
Age	−0.179	0.046*	0.127	0.158
BDI-II	−0.471	0.000**	−0.565	0.000**
BASDAI	−0.521	0.000**	−0.398	0.000**
BASFI	−0.649	0.000**	−0.212	0.018*
BAS-G	−0.598	0.000**	−0.299	0.001**
Fatigue	−0.252	0.005**	−0.372	0.000**

**Notes:** \*\*P<0.01, \*P<0.05.

**Abbreviations:** PCS, physical component summary; MCS, mental component summary; BDI-II, Beck Depression Inventory-Second Edition; BASDAI, Bath Ankylosing Disease Activity Index; BASFI, Bath Ankylosing Spondylitis Functional Index; BAS-G, Bath Ankylosing Spondylitis Global Score.

We found that higher disease activity, worse physical function and global well-being predicted lower PCS scores of health-related QoL. Bodur et al<sup>32</sup> conducted a cross-sectional study enrolling 962 AS patients and found that health-related QoL measured by SF-36 were strongly correlated with BASDAI and BASFI scores. Previous studies and reviews revealed that high disease activity, functional

limitation were the most important determinants of a worse PCS score in AS patients.<sup>7,9,36</sup> Additionally, some previous studies also reported that patients with worse overall wellbeing were correlated with worse PCS scores.<sup>8,18,36</sup> Clinical variables, such as disease activity and symptom severity, influence the progress of the disease, which in turn affects physical component of health-related QoL.<sup>8</sup> Pharmacological treatment, exercise, and self-management interventions are effective to increase AS patients' health outcomes and QoL.<sup>3,37,38</sup> Thus, the combined management is required to modify clinical variables and prompt health-related QoL of AS patients.

In the current study, depression and fatigue were negatively associated with the MCS scores of health-related QoL. Previous studies found that depressive symptoms were associated with impaired QoL.<sup>8,39</sup> Depression leads to enhanced symptom burden, medication non-adherence, disability and negative clinical outcomes, which adversely affects mental health of QoL.<sup>8</sup> Alkan et al<sup>40</sup> found that fatigue was significantly associated with all SF-36 domains. Law et al's study revealed that high level of fatigue was a factor associated with worse MCS scores.<sup>9</sup> Zhou et al<sup>41</sup> found that fatigue significantly reduced physical and mental aspects of QoL in AS patients. Fatigue, as



**Table 4** Multiple Linear Regression Analyses with the PCS Score of SF-36 as Dependent Variable (N=125)

Independent Variables	B	Standardized Coefficient $\beta$	t	P value	R <sup>2</sup> (%)
Overall model					62.4
Educational level	2.541	0.237	4.039	0.000**	
Monthly per capita income	1.141	0.141	2.428	0.017*	
BASDAI	-0.958	-0.195	-2.783	0.006**	
BASFI	-1.498	-0.317	-4.064	0.000**	
BAS-G	-1.166	-0.288	-3.750	0.000**	

Notes: \*\*P<0.01, \*P<0.05.

Abbreviations: SF-36, Medical Outcomes Study Short Form 36-item Health Survey; PCS, physical component summary; BASDAI, Bath Ankylosing Disease Activity Index; BASFI, Bath Ankylosing Spondylitis Functional Index; BAS-G, Bath Ankylosing Spondylitis Global Score.

**Table 5** Multiple Linear Regression Analyses with the MCS Score of SF-36 as Dependent Variable (N=125)

Independent Variables	B	Standardized Coefficient $\beta$	t	P value	R <sup>2</sup> (%)
Overall model					35.6
BDI-II	-0.521	-0.444	-5.835	0.000**	
Fatigue	-1.224	-0.293	-3.851	0.000**	

Note: \*\*P<0.01.

Abbreviations: SF-36, Medical Outcomes Study Short Form 36-item Health Survey; MCS, mental component summary; BDI-II, Beck Depression Inventory-Second Edition.

a common complaint among AS patients, influences patients' social life, relationships and work,<sup>42</sup> which may have a negative impact on the mental component of health-related QoL. We suggest that the management of depression and fatigue may contribute to better mental component of QoL in AS patients.

## Limitations

Several limitations in our study should be taken into account in future studies. The main limitation is that this analysis did not have a control population, such health population, patients with other rheumatic diseases. Secondly, the current study was also limited by a cross-sectional study design and a small sample size. Thirdly, health-related QoL may be different between the newly diagnosed patients and patients in the follow-up period. However, we included both of the patients and no recorded information can be used to compare health-related QoL of the newly diagnosed patients and patients in the follow-up period. This may limit the finding of this study. Finally, we did not have adequate financial support, so we only collected self-reported outcomes.

## Conclusion

This study demonstrated that AS patients in Southwest China had an impaired health-related QoL. The most

affected domains of SF-36 were role physical, general health, and the PCS scores were worse than MCS scores. Educational level, household income, disease activity, functional status, and global well-being were predictors of PCS of health-related QoL. Severe depressive symptom and fatigue predicted lower MCS score. Healthcare providers should take effective strategies to modify the factors affecting health-related QoL, which may prompt disease management and increase QoL.

## Data Sharing Statement

The data used in the current study are available from the corresponding author upon reasonable request.

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## Disclosure

The authors declare no conflicts of interest in this work.

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