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Mediating Roles of Anxiety, Self-Efficacy, and Sleep Quality on the Relationship Between Patient-Reported Physician Empathy and Inflammatory Markers in Ulcerative Colitis Patients

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABEF 1 Xiangfan Chen*
BEF 2 Yin Zhang*
AFG 2 Xianlin Xu
CDE 1 Wei Wang
AEF 1 Hong Yan
AFG 1 Shiyue Li
ABEF 3 Ningxi Yang

1 School of Health Science, Wuhan University, Wuhan, Hubei, P.R. China
2 Department of Gastroenterology, Huiyang Sanhe Hospital, Huizhou, Guangdong, P.R. China
3 College of Humanities and Social Sciences, Harbin Engineering University, Harbin, Heilongjiang, P.R. China

* Xiangfan Chen and Yin Zhang contributed equally to this work

Corresponding Authors: Ningxi Yang, e-mail: yangningxi@bjmu.edu.cn, Shiyue Li, e-mail: lsy_whd@sina.com
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Background: Empathy between doctor and patient has an important bearing on patient health. The purpose of this study was to assess whether anxiety, sleep quality, and self-efficacy of patients have mediating effects in the relationship of patient-reported physician empathy and inflammatory factor in ulcerative colitis (UC) patients.

Material/Methods: This study included 242 patients attended by 45 doctors. Self-reported doctors' empathy ability was measured at patient admission (T1), and patient-reported physician empathy was measured 3 months later (T2). Patient anxiety, general self-efficacy, sleep, and inflammatory factor (IL-6) were measured on T1 and T2. Pearson correlation analysis was used to assess the relationships between self-reported doctor empathy ability and patient indices on T1 and T2. The relationships between anxiety, sleep quality, self-efficacy, IL-6, and patient-reported physician empathy were measured by Pearson correlation analysis and structural equation modeling.

Results: On T1, no significant correlation was reported between self-reported doctors' empathy ability and indices of the patients ($P>0.05$). On T2, self-reported doctors' empathy ability was significantly positively correlated with patient sleep and self-efficacy ($P<0.01$), and significantly negatively correlated with patient anxiety and IL-6 ($P<0.01$). Moreover, on T2, patient-reported physician empathy was negatively correlated with anxiety and IL-6 and was positively correlated with self-efficacy and sleep quality. The effect of patient-reported physician empathy on IL-6 was mediated by anxiety, sleep quality, and self-efficacy.

Conclusions: The anxiety, self-efficacy, and sleep quality of UC patients had mediating effects in the relationship between patient-reported physician empathy and IL-6.

MeSH Keywords: Colitis, Ulcerative • Empathy • Mental Health • Physician-Patient Relations

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Background

Ulcerative colitis (UC) is an inflammatory bowel disease (IBD). Most of the lesions are located in the sigmoid colon and rectum, and can also extend to the descending colon or even the whole colon [1]. Compared with other inflammatory diseases, UC cannot be cured. It has a long course that lasts for a lifetime and often recurs, which brings great physical and psychological trauma to patients. At the same time, the disease itself is a psychosomatic disease, so the outcome of patients is closely related to their psychological factors [2]. Therefore, it is of great importance to pay close attention to the psychological well-being of patients.

It is the responsibility of psychologists to improve the mental health of patients and provide them with emotional support, and this should be practiced in daily communication between medical staff and patients, such as showing full empathy to the patients. Empathy indicates the capacity to understand others' experiences, worries, and opinions, and respond to them accurately and appropriately [3]. In the clinical context, showing empathy to patients refers to understanding the patient's situation, perspective, and feelings, communicating this understanding and examining its correctness, and practicing on the understanding with the patient in a beneficial way [4,5].

Among doctors and patients, empathy is important because patients suffer from various physical misery and their psychological and social adaptation is often affected by the disease to varying degrees, so they need more emotional support. In the process of empathy with patients, doctors and nurses have a better understanding of the patient's disease situation, and then integrate more personalized and humanized elements into the process of diagnosis and treatment, which is of great benefit to both doctors and patients [6]. At the same time, empathy itself is a kind of emotional work, which reflects the humanistic competence of medical staff [7].

Previous studies have focused on the effect of the empathic ability of doctors and nurses on patients' outcome. The positive effect on patients of doctors with high empathy ability has been confirmed by previous research. For example, the founder of the Jefferson scale, Hojat et al., confirmed that for diabetics, patients whose doctors had high empathy scores had lower rates of acute metabolic complications, and their hemoglobin A1c and LDL-C were better controlled [8,9].

The present study explored the relationship between physical and mental health and doctor-patient empathy in patients with ulcerative colitis. Anxiety is a common and serious psychological problem for IBD patients [10]; it is a predictor of disease relapse and may increase health care use and affect patient quality of life [11]. Self-efficacy describes patient confidence in their capacity to manage demands, and it is related to health outcomes in chronic diseases such as IBD [12]. Previous studies have investigated self-efficacy of IBD patients [13,14]. Good sleep is a necessary condition for maintaining good health. Previous studies have found that patients with IBD have a high incidence of sleep disorders [15]. Actually, the effect of anxiety, self-efficacy, and sleep on inflammatory factors has been proven previously [16–18]. However, there has been no research on developing the relationships among doctor-patient empathy, anxiety, self-efficacy, sleep, and inflammatory factors in IBD patients.

Our study concentrated on: (1) comparing physical and psychological indices between patients treated by doctors with different levels of self-reported empathy ability; (2) the influence of patient-reported physician empathy on anxiety, self-efficacy, sleep, and inflammatory factors; and (3) the interaction and mechanism of the above indices. Among the inflammatory factors, we focused on IL-6 because it plays a vital role in the progression of inflammatory bowel disease [19], and published studies proved IL-6 is closely related to patient psychological state [20].

The influence of doctor-patient empathy on patient physical and mental health is based on the social baseline theory, which proposes that healthy human functioning is dependent upon adequate social support and that, at baseline, biological systems are adapted to work interdependently instead of independently [21]. In clinical work, empathy and care from doctors can promote patient social support and have a positive effort on health [22]. On this basis, psychoneuroimmunology can also be involved with the mechanism affecting the immune indicators of patients by affecting their psychology [23]. In the present study, we tested 2 hypotheses: (1) There is a direct relationship between patient-reported physician empathy and inflammatory factor level in patients with ulcerative colitis; and (2) There is a mediating effect of self-efficacy, sleep quality, and anxiety on the relationship between patient-reported physician empathy and inflammatory factor level in patients with ulcerative colitis.

Material and Methods

Participants

All patients with ulcerative colitis who met the inclusion criteria and were hospitalized in one of 8 hospitals in southern China from July 2017 to May 2019 were invited to participate in the study. We chose these hospitals because each of the 8 hospitals has a medical team specializing in IBD. According to previous surveys, the incidence of sleep disorders in IBD patients is 49–82% [12,24]. A review study found that the incidence of

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anxiety was 35.1% [25]. In this study, the lowest 35.1% was chosen to calculate the sample size of this study according to the following sample size formula:

$$n=\frac{\mu_{\alpha}^{2}P(1-p)}{\delta^{2}}.$$

In the formula, p=30.5%, α=0.05, μ_{α}=1.645, and δ=0.15p. In the formula, p indicates prevalence rate. μ indicates overall mean. μ_{α} indicates μ value when the test level is α. δ indicates permissible error.

Therefore, the minimum sample size required was 220 people, and we enrolled 242 patients. Inclusion criteria were: (1) Diagnosed with ulcerative colitis and stayed in hospital for 7 days or more; (2) Knew their diagnosis and provided informed consent for the research; and (3) They were prescribed mesalamine (2.0 g/d). Exclusion criteria were: Patients with cancer, acute infectious diseases, mental disorders, Parkinson's disease and other diseases that significantly affect mood, sleep, and inflammatory factors. In our research, 45 digestive physicians were in charge of the patients' daily treatment and patient education, and were all members of the IBD treatment group in these 8 hospitals. In addition, doctors also paid attention to improving patients' negative moods and answering their questions.

Procedures

At the time of admission (T1), the self-reported doctors' empathy ability score was measured. Secondly, on T1 and 3 months later, when they come to visit their doctors for further consultation (T2), patients' anxiety, self-efficacy, sleep, and inflammatory factor (IL-6) were measured. They were also asked to assess patient-reported physician empathy at T2. This score was given only at T2 because at T1 patients had just been hospitalized, so it was difficult to assess their doctor's empathy toward them. The correlations between self-reported doctors' empathy ability score and patients' anxiety, self-efficacy, sleep, and inflammatory factor (IL-6) were assessed, and the correlations between self-reported doctors' empathy ability score and patient-reported empathy score were measured. Thirdly, we applied Pearson correlation analysis and structural equation modeling to assess the relationships among anxiety, sleep quality, self-efficacy, IL-6, and patient-reported physician empathy scores.

Measures

Patients' demographic sociology information

From medical records, we collected data on patients' sociodemographic information, such as age, gender, marital status, level of education, homeplace, monthly per capita family income, and type of medical insurance.

Anxiety

The Hospital Anxiety and Depression Scale (HADS) was used to test patients' anxiety. The HADS is a self-rating scale of 14 items. The scale consists of 2 parts: 7 items screening for anxiety mood (HADS-a) and 7 items screening for depression mood (HADS-d). The answering to each question is scored from 0 to 3, so each part of the scale scores from 0 to 21, and HADS-a and HADS-d score from 0 to 42. Higher scores indicate more serious anxiety or depression [26]. A single scale score of more than 8 indicates that the screening result is positive [27]. Patients answer the questions based on their actual situation in that month. In this research, only HADS-a was applied to test patients' anxiety. The HADS has been widely used to test anxiety and depression in inpatients and outpatients [28,29], and the scale has good reliability and validity.

Self-efficacy

The General Self-Efficacy Scale (GSES) was used to measure patients' self-efficacy. The table was compiled by Ralf Schwarzer. The reliability and validity of the Chinese version scale is satisfactory. This inventory is a 10-item scale. Examples of items are: "It is easy for me to stick to my aims and accomplish my goals" and "I am confident that I could deal efficiently with unexpected events" [30]. For the 10 items, each item score ranges from 1 to 4, and the aggregate score ranges from 10 to 40. The total score divided by 10 is the final score. Higher scores indicate higher self-efficacy [31].

Sleep quality

Sleep monitoring was performed by polysomnography. Patients were asked to arrive at the sleep monitoring room at 20: 00 and to maintain their typical bedtime. All participants were required to be in bed for 8 hours to ensure that the time in bed was consistent. All patients were monitored by PSG throughout the night (for at least 8 hours). According to the international standard method, surface disc electrodes were used to record the electroencephalogram (EEG) signals of 6 parts synchronously (F3-A2, F4-A1, C3-A2, 01-A2, 02-A1). Two surface electrodes were used to record the electromyogram (EMG) of the chin. An electrode was placed at 1 cm above and below the lateral canthus to record the eye movements of the left and right eyes. Sleep efficiency (SE), i.e., ratio of total sleep time to bedtime, was used to measure sleep quality.

IL-6

All subjects had to fast for more than 10 hours before blood collection, and 3 ml of venous blood was taken in the morning in a vacuum blood collection tube without anticoagulant. The blood samples were kept at room temperature for 10–20 minutes

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and centrifuged in a high-speed desktop centrifuge for 20 minutes at 2000–3000 r/s. The upper 0.5 ml layer of serum was extracted and stored in an Eppendorf tube. The concentrations of IL-6 in serum were determined by ELISA. An SM802 enzyme-labeling instrument (Shanghai Yongchuang Medical Devices Co.) was used. The kit is produced by Wuhan Doctor De Bioengineering Co. and the unit of measurement is pg/mL.

Patient-reported physician empathy

Patient-reported physician empathy scores were tested using the consultation and relational empathy (CARE) scale. The scale was developed by the University of Glasgow and the University of Edinburgh. The scale was used to measure patient-reported physician empathy after treatment. The scale consists of 10 items, with each item scoring from 1 to 5 points. The aggregate score of the questionnaire is 10 to 50 points. For example, the items contain: ...making you feel at ease? (being friendly and warm towards you); and ...being interested in you as a whole person? (asking/knowing relevant details about your life, your situation) [32]. Higher scores indicate the patient perceives more empathy from their doctor [33].

Self-reported doctors' empathy ability

The Chinese version of the Jefferson Scale of Empathy (JSE) was used to assess physicians' empathy ability from the physician's own point of view. In 2001, the questionnaire was first developed by Hojat et al. from Jefferson Medical College [34]. The scale contains 3 dimensions (compassion care, perspective taking, and standing in the patient's shoes) [35]. It is a 7-point Likert scale which contains 20 items. For instance, the items include: "I try to understand what is going on in my patients' minds by paying attention to their nonverbal cues and body language"; and "I try to think like my patients in order to render better care" [36]. Scores for each answer range from 1 to 7 and the total scores is 20 to 140. Higher scores indicate doctors think they have strong empathy abilities. The reliability and validity of the scale is good and is widely applied in many countries [37].

Statistical analyses

EPI 3.1 software was used for data entry. The SAS 9.4 statistical software package was used to analyze the data. All data are represented by mean and standard of error of the mean (SEM). Pearson correlation analysis was used to measure the relationships between self-reported doctors' empathy ability and patients' indices at T1 and T2. The relationships between anxiety, self-efficacy, sleep, inflammatory factors (IL-6), and patient-reported physician empathy were analyzed by Pearson correlation analysis as well as by the structural equation model, using 2-tailed tests with alpha at 0.05 level.

Results

Sample

Three hundred patients received our invitation to participate in the study, and 242 of them chose to participate, producing an effective return ratio of 80.67%. Patients' average age was (39.8±6.8) years. Their average number of hospitalization days was 7.43±1.82 (range, 7–10). Table 1 presents patient demographic sociology information. In this study, all of the 45 physicians who were selected agreed to participate in the study: 25 were male and 20 were female, their average age was 42.26±6.18 years with a range of 25–52 years (4 were ≤30, 18 were 31–40, 18 were 41–50, and 5 were ≥51 years.) They had worked as doctors on average for 18.23±3.11 years (4 worked ≤5 years, 15 worked 5–10 years, 15 worked 10–20 years, and 11 had worked ≥20 years). Eight doctors had previously received training or courses on communication. Each doctor was responsible for the treatment of 3–8 patients, and the average of the number of patients was 5.36±0.66.

Correlations between patient-reported empathy score and self-reported doctors' empathy ability score

The correlations between patient-reported empathy score and self-reported doctors' empathy ability score were analyzed. The results showed that they have a positive correlation ($r=0.422$, $P<0.01$).

The correlations between patients' indexes and self-reported doctors' empathy ability at admission (T1) and 3 months later (T2)

The correlations between patients' indexes and doctors' empathy ability are given in Table 2. At admission, there was no significant correlation between self-reported doctors' empathy ability and patients' indices ($P>0.05$). Three months later, self-reported doctors' empathy ability was significantly positively correlated with patients' sleep and self-efficacy ($P<0.01$), and was significantly negatively correlated with patients' anxiety and IL-6 ($P<0.01$). The results are presented in Table 2.

The correlations of patient-reported physician empathy with patients' anxiety, sleep, self-efficacy, and IL-6

We used Pearson's correlation analysis to test the relationships between patients' anxiety, sleep, self-efficacy, IL-6, and patient-reported physician empathy. The results showed that patient-reported physician empathy scores were negatively correlated with anxiety ($r=-0.467$, $P<0.01$) and IL-6 ($r=-0.393$, $P<0.01$), and positively correlated with self-efficacy ($r=0.429$, $P<0.01$) and sleep ($r=0.418$, $P<0.01$). Moreover, there were significant correlations among self-efficacy, anxiety, sleep and IL-6. Table 3 shows the results.

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Table 1. Patient demographics.

Variable	Number	%
Gender		
Male	110	45.5
Female	132	54.5
Educational background		
Primary school or below	4	1.7
Junior middle school	32	13.2
High school	61	25.2
College or above	145	59.9
Marital status		
Single	51	21.1
Married	176	72.7
Divorced or widowed	15	6.2
Residence		
Countryside	37	15.3
County town	40	16.5
Urban area	165	68.2
Per capita family income monthly		
<5000 yuan	76	31.4
5000–8000 yuan	131	54.1
>8000 yuan	35	14.5
Medical insurance		
Self-paid	58	24
Social medical or business insurance	140	57.9
New rural cooperative medical system	33	13.6
Free medical care	11	4.5

Table 2. The correlation between self-reported doctor empathy ability and patient indices at admission (T1) and 3 months later (T2).

	Self-reported doctor empathy ability	
	rho	P
Aelf-efficacy T1	0.082	0.126
Anxiety T1	–0.044	0.324
Sleep T1	0.034	0.521
IL-6 T1	–0.056	0.329
Self-efficacy T2	0.386	<0.01
Anxiety T2	–0.157	<0.01
Sleep T2	0.453	<0.01
IL-6 T2	–0.813	<0.01

Multiple mediated effects between patient-reported physician empathy and patients' self-efficacy, anxiety, sleep, and IL-6

In order to understand the connections among the factors deeply, the path analysis method was used to build multiple mediation models, and AMOS was applied to prove the early hypotheses. The structural equation model among the indices is fitting well (GFI=0.996, CFI=0.997, TLI=0.973, IFI=0.997, NFI=0.995, AGFI=0.943, RMSEA=0.074, χ^2/df=2.310). The model is presented in Figure 1.

Table 4 shows the normalized path coefficient. Patient-reported physician empathy had a significant negative effect on anxiety (β=–0.467, P<0.05), and had a significant positive effect on self-efficacy (β=0.309, P<0.05). Anxiety significantly negatively affected self-efficacy (β=–0.258, P<0.05), and had a significant negative effect on sleep (β=–0.527, P<0.05). Patient-reported physician empathy had a significant positive effect on sleep (β=0.172, P<0.05). Self-efficacy had a significant negative effect on IL-6 (β=–0.198, P<0.05). Anxiety had a significant

Table 3. The correlations among patient-reported physician empathy and patient self-efficacy, anxiety, sleep quality, and IL-6.

	Mean	Std. Deviation	Empathy	Self-efficacy	Anxiety	Sleep	IL-6
Empathy T2	37.128	4.831	1				
Self-efficacy T2	2.223	0.845	.429**	1			
Anxiety T2	13.256	4.776	–.467**	–.402**	1		
Sleep T2	69.583	10.755	.418**	.352**	–.608**	1	
IL-6 T2	165.802	41.698	–.393**	–.479**	.683**	–.728**	1

* *P*<0.05, ** P<0.01. Empathy – patient-reported physician empathy.

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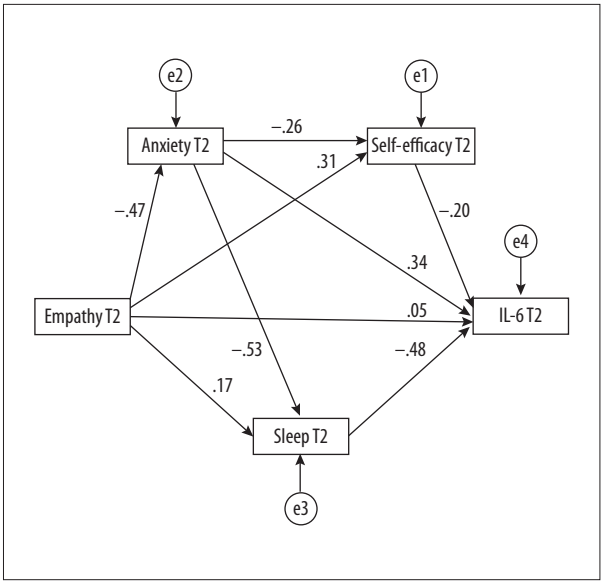

Figure 1. The model of relationships among patient-reported physician empathy and patient's self-efficacy. Anxiety, sleep quality and IL-6. Empathy in the figure refers to patient-reported physician empathy and all the coefficient were standarized.

positive effect on IL-6 (β=0.34, P<0.05). Sleep had a significant negative effect on IL-6 (β=–0.476, P<0.05). Empathy did not have a significant effect on IL-6 (β=0.047, P<0.05). This indicates that our hypothesis 1 is not valid.

This study used AMOS 21.0 to test the mediation effect. IL-6 was taken as the dependent variable; self-efficacy, anxiety, and sleep were intermediate variables; and patient-reported physician empathy were independent variables. Setting the Bootstrap number to 5000, the nonparametric percentile bootstrap method with deviation correction was used to estimate the significance of specific mediation effects. In the AMOS, when evaluating the goodness of fit of the model, 90%CI is usually reported and RMSEA is usually used. In this research, the 90% confidence intervals of the model fit indices in AMOS was Default model: RMSEA=0.074, and the 90%CI was (0.000, 0.204); the Independence model was RMSEA=0.451, and the 90%CI was (0.418, 0.485).

When CI does not cross the value of zero, it means that the effect is significantly different from zero, i.e., a significant effect. In this research, there were 5 mediating paths. Anxiety, sleep, and self-efficacy has mediator roles between patient-reported physician empathy and IL-6, and the effects were –0.159 (95% CI: –1.981, –0.84), –0.082 (95% CI: –1.229, –0.277), and –0.061 (95% CI: –0.918, –0.247). In the path of empathy-anxiety-self-efficacy-IL-6, the confidence interval of the effect was –0.024 (95% CI: –0.39, –0.089) and 0 was not included in the confidence interval. Therefore, anxiety and self-efficacy had a significant chain-mediated effect in the relationship between patient-reported physician empathy and IL-6 (β=–0.024, P<0.05). In the path of empathy-anxiety-sleep-IL-6, the confidence interval of the effect was –0.117 (95% CI: –1.419, –0.689) and 0 was not included in the confidence interval. Therefore, anxiety and sleep had a significant chain-mediating effect in the relationship between patient-reported physician empathy and IL-6 (β=–0.024, P<0.05). Table 5 presented these results.

Discussion

This research confirmed the positive effect of empathy between doctors and patients for physical and psychological health in ulcerative colitis patient samples. The study found that patients

Table 4. Normalized path coefficient.

			Standardization coefficient	Unstandardized coefficients	S.E.	C.R.	P
Anxiety T2	<---	Empathy T2	–0.467	–0.461	0.056	–8.19	***
Self-efficacy T2	<---	Empathy T2	0.309	0.054	0.011	4.852	***
Self-efficacy T2	<---	Anxiety T2	–0.258	–0.046	0.011	–4.051	***
Sleep T2	<---	Anxiety T2	–0.527	–1.187	0.128	–9.289	***
Sleep T2	<---	Empathy T2	0.172	0.383	0.126	3.034	0.002
IL-6 T2	<---	Self-efficacy T2	–0.198	–9.691	2.15	–4.508	***
IL-6 T2	<---	Anxiety T2	0.34	2.952	0.449	6.58	***
IL-6 T2	<---	Sleep T2	–0.476	–1.833	0.189	–9.683	***
IL-6 T2	<---	Empathy T2	0.047	0.401	0.396	1.014	0.311

*** *P*<0.001. Empathy – patient-reported physician empathy.

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Table 5. Result of Bootstrap indirect effects analysis.

Mediation effect path	Standardization coefficient	Unstandardized Coefficients	Standard error	95% CI		P
				Lower	Upper	
Empathy→anxiety→IL-6	–0.159	–1.362	0.29	–1.981	–0.84	0.000
Empathy→sleep→IL-6	–0.082	–0.703	0.24	–1.229	–0.277	0.002
Empathy→self-efficacy→IL-6	–0.061	–0.523	0.17	–0.918	–0.247	0.000
Empathy→anxiety→self-efficacy→IL-6	–0.024	–0.204	0.076	–0.39	–0.089	0.000
Empathy→anxiety→sleep→IL-6	–0.117	–1.004	0.184	–1.419	–0.689	0.000

All the indices were measured on T2. Empathy – patient-reported physician empathy.

whose doctors had stronger self-reported empathy ability and who felt higher patient-reported physician empathy had better mental health and lower proinflammatory factor levels (IL-6). The positive effect of doctor-patient empathy on patients has been confirmed in previous studies. For example, Cánovas et al. found empathy of physicians helped relief pain and increase quality of life in patients with chronic pain [38]. Thompson et al. proved that empathy improved patient-centered care quality and the outcome of heart disease patients [39]. In our previous studies, we also confirmed the function of empathy ability of physicians and nurses on mental health indexes and immunological functioning in breast cancer, prostate cancer, and lung cancer patients [40–42]. These results reveal that medical personnel need to improve their empathy ability.

Empathy is a two-way interaction, and the principle of its influence on patients requires further consideration. Therefore, based on our previous studies, this study not only investigated the relationships between self-reported doctors' empathy ability and patients' outcomes, but also focused on the impact of patient-reported physician empathy on their physical and mental health, and analyzed its mechanism. It is found that patient-reported physician empathy did not directly affect inflammatory factor IL-6, but did affect IL-6 through the mediating effects of anxiety, self-efficacy, and sleep. The mechanism may be based on the following.

Firstly, patient-reported physician empathy affects anxiety, self-efficacy, and sleep. The reasons are: on the one hand, in empathy and narrative, with the company and witness of the medical staff, the patients pour out their sufferings, which helps release negative emotions [43]. As a result, patients' anxiety decreases, self-efficacy improves, and they sleep better. On the other hand, patients' knowledge of disease and treatment is limited. They often have uncertainty and confusion about their illness [44]. Empathizing with patients helps doctors understand patients' situations and thoughts. On this basis, the doctors give the patient proper health education, guidance, and comfort, which help improve the patients' mental health [45].

Secondly, anxiety, self-efficacy, and sleep affect the inflammatory factors of patients. In this study, proinflammatory factor IL-6 was affected by psychological indicators and sleep. Anxiety affects inflammatory factors because the HPA axis stimulates the adrenal gland and secretes cortisol under stress. Cortisol stimulates immune cells to produce more proinflammatory factors [46]. Contrary to anxiety, self-efficacy is a positive psychological factor and it has been demonstrated that positive psychological factors reduce proinflammatory factors [47]. In addition, patients with high self-efficacy have stronger self-disease management ability. This improves the prognosis of the disease, so proinflammatory factors are lower. The effect of sleep on inflammatory factors has been confirmed, and previous studies have shown that sleep deprivation leads to elevated IL-6 levels [48].

Furthermore, anxiety directly affects self-efficacy and sleep. Anxiety can prevent positive behavior and reduce self-efficacy [49]. Anxiety directly reduces sleep quality, because negative emotions can lead to increased cortisol levels, earlier cortisol secretion rhythm, and reduced melatonin synthesis [50,51]. These can make patients have difficulty falling asleep, waking up early, and other sleep disorders. In summary, anxiety, sleep quality, and self-efficacy play a chain-mediated role in the effect of patient-reported physician empathy on IL-6. This shows that medical staff need show solicitude to negative mood such as anxiety of patients, and psychiatrists should be invited to provide psychological intervention for patients if necessary.

The above results give clinical medical staff inspiration that they should attach importance to the establishment of emotional community with patients. In the process of daily diagnosis and treatment, doctors should pay attention to listening and respecting the patients' story, understand the patients by listening, express their concern and love for the patients, and give appropriate response and help. Narrative medicine, a medical model focusing on empathy, reflection, profession, and trust, and emphasizing absorbing, explaining, and responding to patients' stories and other human predicaments, can be

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applied in clinical practice to deepen empathy between medical staff and patients [52].

Several limitations have to be consideration in this study. Firstly, the sample size of this study was small and it was a cross-sectional study. Therefore, some causal relationships such as whether patient-reported empathy affected anxiety or anxiety affected empathy cannot be elucidated. Further cohort studies that contain more samples are needed. Secondly, patients' indices may be affected by many factors, including sports and personal physique. Although we strictly controlled the criteria for enrollment, it was difficult to take all possible factors into account. Thirdly, in our analyses, we did not take into account the physician-level variance. All the analyses were performed at the patient level, so similarities must exist within the same physicians, which may have caused some bias.

Conclusions

This study confirms that empathy between doctors and patients affects psychological indices and inflammatory factor in UC patients. Patients' anxiety, self-efficacy, and sleep quality have mediating effects in the relationship between patient-reported physician empathy and inflammatory factor. Therefore, medical staff should fully empathize with their patients. Anxiety, sleep, and self-efficacy should be taken into consideration in the disease management of UC patients to reduce the level of proinflammatory factor.

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