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ORIGINAL RESEARCH

Current Landscape and Multidimensional Determinants of Spiritual Coping Mechanisms Among Tuberculosis Patients in Zhejiang, China: A Population-Based Cross-Sectional Investigation

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Aim: Investigate the different spiritual coping strategies employed by tuberculosis patients during their illness and determine the multidimensional determinants influencing these adaptive strategies.

Design: Online cross-sectional design.

Methods: Between January and September 2024, 448 tuberculosis (TB) patients in Zhejiang Province, China, were recruited via WeChat-based outreach. Data collection was implemented through a digitally administered, self-report survey platform. Comprehensive statistical analyses were performed, including independent samples *t*-tests, one-way ANOVA for group comparisons, Pearson correlation coefficients for bivariate associations, and hierarchical multiple linear regression modeling to identify predictor clusters. This cross-sectional investigation rigorously adhered to the STROBE guidelines throughout its design, execution, and reporting phases.

Results: Among the 448 patients, 255 were male and 193 were female, with an average age of 47.45 (SD = 18.23) years. The factors influencing the level of Positive Spiritual Coping (PSC) were sex ($t = -2.593$, $p = 0.010$), residence ($t = 2.317$, $p = 0.021$), marital status ($t = -2.485$, $p = 0.013$), and economic indicators ($F = 2.951$, $p = 0.032$). The factors influencing the level of Negative Spiritual Coping (NSC) were age ($F = 3.226$, $p = 0.041$), marital status ($t = 2.635$, $p = 0.009$), alcohol consumption ($t = 2.840$, $p = 0.005$), number of children ($t = 2.022$, $p = 0.044$), and TB diagnosis type ($t = -2.323$, $p = 0.021$). The PSC level was negatively correlated with depression ($p < 0.01$) and positively correlated with the Brief Resilience Scale (BRS), Family APGAR Index (APGAR), and Personal Mastery Scale (PMS) ($p < 0.01$). The NSC level was positively correlated with depression, anxiety, and stress ($p < 0.01$) and negatively correlated with BRS, APGAR, and PMS ($p < 0.01$). Multivariate linear regression analysis indicated that PMS (2.852, P=0.005), APGAR (3.740, P<0.0001), BRS (3.457, P=0.001), and gender (3.343, P=0.001) significantly affected the PSC level in TB patients. Depression (10.112, $P < 0.0001$), APGAR (−4.571, $P < 0.0001$), BRS (−3.084, $P = 0.002$), number of children (−2.315, $P = 0.021$), and type of TB diagnosis (2.217, $P = 0.027$) were factors that independently affected the NSC level of TB patients.

Conclusion: TB patients exhibit better PSC levels in female patients, and higher PMS, BRS, and APGAR levels correlate with higher PSC levels. NSC levels are higher in patients without children and pulmonary TB, while higher BRS and APGAR levels are associated with lower NSC levels. These findings can help healthcare providers tailor person-centered spiritual care strategies for TB patients based on factors influencing spiritual coping, thereby improving their mental health during illness, reducing psychological distress, and facilitating earlier recovery.

Keywords: tuberculosis, positive spiritual coping, negative spiritual coping, influencing factors

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Introduction

The World Health Organization's 2024 Global Tuberculosis Report shows tuberculosis has once again become the world's leading infectious disease killer.[1] It is estimated that in 2023, about 1.25 million people died from tuberculosis worldwide, and there were 10.8 million new tuberculosis patients globally.[1] China is one of the countries with the highest burden of tuberculosis worldwide, with the third-highest number of cases globally.[1] Even though there have been improvements in treating tuberculosis, the serious side effects of the drugs and the long treatment time make patients suffer not just from the disease but also from the harmful effects of the medication. Under this double blow, the body becomes increasingly weak, and the risk of disease recurrence and the heavy sense of shame[2–4] eventually undermine their mental world from the inside out. New research shows a link between TB infection or reactivation and the start of depression, which happens through two main processes: ongoing inflammation in the body and problems with the hypothalamic-pituitary-adrenal (HPA) axis". Almost half of the patients receiving tuberculosis treatment have at least one mental disorder.[5] This is more common during the diagnosis stage and the subsequent treatment stage, including a range of negative outcomes such as substance use disorders, anxiety, and depression, especially in low- and middle-income as well as middle-income countries.[6] A systematic review of TB-related disabilities revealed that the most common type is mental health disorders.[4] The epidemic is further accelerated by mental health disorders, which worsen poor healthcare behaviors and outcomes in the TB treatment cascade (such as care seeking, missed treatment, and loss to follow-up).[3,4,7] The Global Fund to Fight AIDS, TB, and Malaria's groundbreaking five-year strategic framework (2023–2028) has, for the first time in its 23-year history, formally integrated mental health interventions as a cross-cutting priority across all disease portfolios.[8]

Intertwined are the soul, body, and mind.[9] Human history has viewed healing as a spiritual experience.[9] There are always questions about disease that extend beyond the realm of science.[9] We more appropriately refer to these issues as spiritual issues, or spirituality. Although spirituality and religion may overlap, faith is a distinct entity.[10] Consequently, spirituality stands as one of the conceptual markers of health, possessing a multifaceted structure,[10] which could potentially assist in discovering or rediscovering a sense of purpose in life, even in the face of death and disease.[11] Numerous positive health outcomes are closely associated with spirituality and religious beliefs, states of being, public behaviors, and private rituals, according to a growing corpus of solid scientific data.[12] Spiritual coping is the behavior of patients to use internal and external resources to fight against stressful events with cognitive behavioral strategies and help individuals surpass themselves, seek life goals, understand life, and find the value and meaning of life.[13] Research reveals a negative correlation between positive spiritual coping[13–18] and emotional reactions like depression, anxiety, and stress, while also enhancing quality of life,[16,19] tolerating pain,[20] and enhancing self-management.[21] Factors such as age,[22] gender,[15] education level,[15,19] marriage,[22] and religious belief,[14–16,19] among others, can also influence the degree of spiritual coping. In the meantime, spiritual levels are strongly associated with both personal control[19] and social support.[13,15] Consequently, the role of spirituality in health and disease constitutes a complex and emerging field of scientific inquiry, gaining critical momentum within both clinical practice and health professions education frameworks.[23] This paradigm shift reflects growing recognition of spirituality as a biopsychosocial determinant influencing therapeutic outcomes, patient resilience, and clinician well-being.

While the spiritual coping strategies among chronic disease patients have been extensively explored recently, the understanding of such mechanisms in TB patients remains markedly limited. Therefore, there is a need for in-depth and extensive empirical research on the spiritual coping styles of TB patients. To fill the gap in this marginal area, we investigated current levels of spiritual coping styles in TB patients, explored demographic differences, and examined correlations between resilience, family functioning, personal control, emotional reactivity, and spiritual coping. This study aims to holistically map the spiritual coping strategies and associated determinants within the inner worlds of TB patients throughout their illness trajectory. The findings will help us integrate an "evidence-based approach to spiritual care"[12] into a "biological-psycho-socio-spiritual" model of health and illness[24] to provide personalized, human-centered spiritual care for patients.

Methods

Design and Patient

We recruited patients from the tuberculosis ward and tuberculosis clinic of a Category III hospital. Conduct an online cross-sectional study using convenient sampling methods. Inclusion criteria: age ≥18 years old; clinically diagnosed patients, including those with pulmonary TB and extrapulmonary TB, require long-term anti-tuberculosis treatment (for at least 6 months); ability to understand questionnaires correctly and articulate responses. Exclusion criteria: suffering from mental disorders; a major traumatic event (e.g., death of a loved one or divorce) within the last 6 months. Based on the methodology for calculating sample size in multivariate analysis of influencing factors[25]—which mandates a minimum sample size of 5–10 times the number of independent variables—this study accounted for 55 covariates. The researchers calculated the required recruitment target as 330–660 patients, incorporating a 20% anticipated attrition rate (per Cochran's conservative design principles). The final cohort comprised 500 enrolled participants. 52 was excluded due to either insufficient response time (≤200 seconds, indicating non-serious engagement) or withdrawal of consent. The study yielded 448 analyzable responses, achieving an 89.6% valid response rate.

Measurements

We systematically evaluated the general demographic characteristics of the patients, including sex, age, BMI, residence, educational attainment, marital status, occupation type, economic indicators, smoking status, alcohol consumption, number of children, religious affiliation, and payment methods. At the same time, some clinical characteristics were also included: TB diagnosis type, disease duration, and comorbidity burden.

The Chinese version of the Spiritual Coping Questionnaire (SCQ) was administered. Developed by Dr. Charzyńska[26] based on a multidimensional conceptualization of spirituality, this instrument was designed to assess spiritual coping strategies systematically. Tao et al[27] introduced the scale into Chinese and conducted tests on a group of domestic patients with advanced cancer, achieving excellent reliability, validity, and structural stability. The Chinese version of SCQ consisted of two subscales, Positive Spiritual Coping (PSC) and Negative Spiritual Coping (NSC), with a total of 26 items in 7 dimensions. PSC includes four dimensions, namely, individual, social, environmental, and transcendental, with a total of 17 items. NSC includes 3 dimensions—personal, social, and transcendental—with a total of 9 items. Implemented a standardized 5-point Likert scale (1 = very incorrect; 2 = incorrect; 3 = uncertain; 4 = correct; 5 = very true). Rate the responses. The total score ranges from 26 to 130 points. The higher the score, the more inclined one is to use this coping strategy. The Cronbach's α coefficients of the two subscales are 0.88 and 0.91.[27] This scale has been widely used in China.[13,15,19] In this study, the Cronbach's α coefficients and total scales of the SCQ, PSC, and NSC subscales were 0.885, 0.906, and 0.842, respectively.

Use the Chinese version of the "Simplified Depression-Anxiety-Stress Self-Rating Scale" (DASS-21). Compiled by Lovihond et al[28] it contains 21 items and measures negative emotional responses (depression, anxiety, stress) in three dimensions.[28] Gong et al[29] was localized into Chinese. Use the 4-point Likert scale (0= fully applicable; 1= relatively applicable; 2= mostly applicable; 3= fully applicable). The dimension score is calculated by multiplying the sum of the dimension item scores by 2. The scoring range is from 0 to 42 points. The higher the score, the greater the degree of depression, anxiety, or stress response. This scale has been widely used in China.[30] In this study, the Cronbach's α coefficient and the total scale of the depression, anxiety, and stress response subscales were 0.831, 0.765, 0.834, and 0.921, respectively.

The Chinese version of the Short Resilience Scale (BRS)[31] was used and synthesized and verified by Chen et al[32] The scale consists of six items and is used to assess an individual's ability to recover health when coping with stress. Please utilize the five-point Likert scale (1= Strongly disagree; 2= Disagree; 3= Uncertain; 4= Agree; 5= Strongly agree) to rate the responses. This scale has been widely used in China.[30] The Cronbach's α coefficient of BRS in this study was 0.726.

The Family APGAR Index measured family function. APGAR was developed by Smilkstein[33] and translated into Chinese by Lv et al[34] The APGAR scale consists of five items. The scoring method is a three-point Likert scale ranging from 0 (almost never) to 2 (almost always). A higher score indicates better family functioning. This scale has been widely used in China.[35] In this study, the Cronbach α coefficient of the APGAR index was 0.898.

This study also uses the Personal Mastery Scale (PMS) compiled by Pearlin et al[36] The scale consists of a total of 7 items, mainly assessing the patients' perception of control over personal and life events. Use the five-point Likert scale (1= strongly disagree; 2= disagree; 3= uncertain; 4= agree; 5= strongly agree). Score the answers, with 5 items scored in reverse. The higher the score, the higher the level of an individual's sense of control over life.[36] This scale has been widely used in China.[19] The Cronbach's α coefficient of PMS in this study was 0.767.

Data Collection

We collected the data from January to September 2024. We used an electronic questionnaire created through China's online questionnaire software (URL: https://www.wjx.cn). The researchers conducted face-to-face communication with the patients in the tuberculosis ward or tuberculosis clinic, informed them of the purpose and significance of the project, that the survey was anonymous, and that there were no reward measures. Participation was voluntary, and patients could exit the process at any time without affecting their future diagnosis and treatment. Then, the patients scanned the QR code on the system with their mobile phone's WeChat to enter the login interface. After logging in, the home page would display an agreement form, and the patients needed to read the content carefully. If they agreed to participate in the survey, they should check the "Agree" option, and then they could enter the questionnaire page to start answering questions. After answering all the questions, they could submit and complete the online survey. Of course, during this process, patients could also close the page and exit the survey at any time. Or if they chose to check "Disagree" when reading the agreement form, the survey would directly end. Each mobile device can only use its IP address once.

Data Analysis

All analyses were conducted using IBM SPSS Statistics 26.0 (Armonk, NY) with the following rigorous analytical workflow. Patients' demographic and clinical characteristics, along with responses to SCQ, DASS-21, BRS, APGAR, and PMS, were analyzed using descriptive statistics. Categorical variables were expressed as frequencies, while continuous variables were presented as mean ± standard deviation. Group comparisons were performed using independent samples t-tests or one-way analysis of variance (ANOVA). Relationships between PSC/NSC levels and responses to DASS-21, BRS, APGAR, and PMS were examined using Pearson correlation coefficients. Finally, multiple linear stepwise regression analysis was employed to identify factors influencing PSC and NSC levels. A p-value of less than 0.05 was deemed statistically significant.

Ethics

This study was approved by the Ethics Committee of the First Affiliated Hospital, Zhejiang University School of Medicine (Approval No. IIT20230475B).

Results

A total of 448 patients successfully completed the questionnaire survey, comprising 255 males and 193 females, with a mean age of 47.45 years (SD=18.23). The SCQ score of the patients was 71.94 (SD=12.36), of which the PSC score was 56.90 (SD=10.98) and the NSC score was 15.04 (SD=6.73). The DASS-21 score was 12.44 (SD=9.63), with a depression score of 3.81 (SD=3.57), an anxiety score of 3.65 (SD=3.16), and a stress score of 4.98 (SD=3.88). The BRS score was 20.13 (SD=3.64), the APGAR score was 7.29 (SD=2.76), and the PMS score was 25.01 (SD=4.94) (Table 1).

Sex (t=−2.593, p=0.010), residence (t=2.317, p=0.021), marital status (t=−2.485, p=0.013), and economic indicators (F=2.951, p=0.032) were the influencing factors of PSC level. Ages (F=3.226, p=0.041), marital status (t=2.635, p=0.009), alcohol consumption (t=2.840, p=0.005), number of children (t=2.022, p=0.044), and TB diagnosis type (t=−2.323, p=0.044). p=0.021) were the influencing factors of NSC level (p=0.021). The marital status factor was the only demographic factor that showed the same results at the PSC and NSC levels, whereas the other factors showed different results (Table 2).

NSC levels showed significant positive correlations with all three dimensions of the DASS-21 emotional responses (depression, anxiety, and stress) ($p < 0.01$). PSC levels demonstrated a negative correlation with the depression

Table 1 Descriptive Statistics of Psychological Assessment Scales (N=448)

Assessment Tools	Dimensionality	Average		Sum Total	
		Mean	SD	Mean	SD
SCQ	PSC	3.35	0.65	56.90	10.98
	NSC	1.67	0.75	15.04	6.73
	Total	2.77	0.48	71.94	12.36
DASS-21	Depression	0.54	0.51	3.81	3.57
	Anxiety	0.52	0.45	3.65	3.16
	Stress	0.71	0.55	4.98	3.88
	Total	0.59	0.46	12.44	9.63
BRS	/	3.35	0.61	20.13	3.64
APGAR	/	1.46	0.55	7.29	2.76
PMS	/	3.57	0.71	25.01	4.94

Abbreviations: SCQ, Spiritual Coping Questionnaire; PSC, Positive Spiritual Coping; NSC, Negative Spiritual Coping; DASS-21, Depression, Anxiety and Stress Scale; BRS, Brief Resilience Scale; APGAR, Family APGAR Index; PMS, Personal Mastery Scale; SD, Standard Deviation.

Table 2 Demographic and Clinical Characteristics Stratified by Spiritual Coping Strategies (SCQ) (N =448)

Variable	N (%)	PSC			NSC		
		Mean (SD)	t/F	p	Mean (SD)	t/F	p
Sex			−2.593	0.010		−0.414	0.679
Men	255 (56.9)	3.28 (0.63)			1.66 (0.71)		
Females	193 (43.1)	3.44 (0.65)			1.69 (0.79)		
Ages			0.131	0.878		3.226	0.041
≤44	203 (45.3)	3.35 (0.69)			1.77 (0.86)		
45–59	95 (21.2)	3.32 (0.66)			1.55 (0.62)		
≥60	150 (33.5)	3.36 (0.58)			1.62 (0.64)		
BMI			1.395	0.244		0.081	0.970
<18.5	149 (33.3)	3.38(0.62)			1.70(0.85)		
18.5–23.9	213 (47.5)	3.37(0.64)			1.66(0.67)		
24–27.9	65 (14.5)	3.20(0.75)			1.66(0.75)		
≥28	21 (4.7)	3.36(0.45)			1.65(0.77)		
Residence			2.317	0.021		0.005	0.996
City or county town	239 (53.3)	3.41 (0.65)			1.67 (0.77)		
Rural	209 (46.7)	3.27 (0.63)			1.67 (0.73)		
Educational attainment			1.073	0.360		0.239	0.869
Basic Education Stages	263 (58.7)	3.32(0.63)			1.66(0.75)		
Upper Secondary Education	67 (15.0)	3.40(0.65)			1.63(0.68)		
College/Undergraduate	111 (24.8)	3.40(0.68)			1.70(0.79)		
Master degree or above	7 (1.6)	3.04(0.68)			1.83(0.71)		
Marital status			−2.485	0.013		2.635	0.009
(single/divorced/widowed)	136 (30.4)	3.23 (0.67)			1.83 (0.88)		
Married	312 (69.6)	3.40 (0.63)			1.60 (0.67)		

(*Continued*)

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Table 2 (Continued).

Variable	N (%)	PSC			NSC		
		Mean (SD)	t/F	p	Mean (SD)	t/F	p
Occupation type			1.039	0.355		0.940	0.391
Enterprise/Public institution/ retirement	173 (38.6)	3.37(0.63)			1.64(0.71)		
Business/freelance	103 (23.0)	3.39(0.68)			1.75(0.81)		
Farmer/unemployed/student	172 (38.4)	3.29(0.64)			1.66(0.75)		
Economic indicators			2.951	0.032		0.902	0.440
<4000	216 (48.2)	3.31(0.65)			1.70 (0.75)		
4000~	125 (27.9)	3.28(0.59)			1.64 (0.71)		
6000~	51 (11.4)	3.41 (0.62)			1.74 (0.84)		
>8000	56 (12.5)	3.57 (0.74)			1.54 (0.76)		
Smoking status			1.654	0.099		1.496	0.136
No	315 (70.3)	3.38 (0.65)			1.70 (079)		
Yes	133 (29.7)	3.27 (0.64)			1.60 (0.62)		
Alcohol consumption			−0.502	0.616		2.840	0.005
No	334 (74.6)	3.34 (0.66)			1.72 (0.78)		
Yes	114 (25.4)	3.38 (0.60)			1.52 (0.61)		
Number of children			−0.704	0.482		2.022	0.044
No	131 (29.2)	3.31 (0.65)			1.79 (0.85)		
Yes	317 (70.8)	3.36 (0.64)			1.62 (0.70)		
TB diagnosis type			−1.256	0.210		−2.323	0.021
Extrapulmonary tuberculosis	153 (34.2)	3.29 (0.72)			1.56 (0.67)		
Pulmonary tuberculosis	295 (65.8)	3.37 (0.63)			1.73 (0.78)		
Disease duration			0.400	0.753		0.728	0.536
Within six months	328 (73.2)	3.34 (0.66)			1.64 (0.73)		
6 to 12 months	61 (13.6)	3.39 (0.58)			1.78 (0.78)		
1 to 1.5 years	24 (5.4)	3.46 (0.72)			1.64 (0.75)		
More than 1.5 years	35 (7.8)	3.31 (0.62)			1.76 (0.67)		
Comorbidity burden			0.585	0.559		−0.172	0.863
No	268 (59.8)	3.36 (0.67)			1.67 (0.78)		
Yes	180 (40.2)	3.33 (0.61)			1.68 (0.70)		
Religious affiliation			−1.166	0.244		−0.277	0.782
No	387 (86.4)	3.33 (0.66)			1.67 (0.76)		
Yes	61 (13.6)	3.44 (0.51)			1.70 (0,65)		
Payment methods			−0.430	0.667		−1.058	0.294
Have health insurance	397 (88.6)	3.34 (0.64)			1.66 (0.72)		
Without health insurance	51 (11.4)	3.38 (0.67)			1.80 (0.91)		

Abbreviations: SCQ, Spiritual Coping Questionnaire; PSC, Positive Spiritual Coping; NSC, Negative Spiritual Coping; SD,Standard Deviation.

dimension ($p < 0.01$). Furthermore, PSC levels were positively correlated with BRS, APGAR, and PMS factors ($p < 0.01$), whereas NSC levels exhibited negative correlations with these same factors ($p < 0.01$) (Table 3).

While controlling for confounding factors, a hierarchical multivariate stepwise linear regression model was employed to analyze the predictors of PSC and NSC levels. In the PSC model, there was no issue with multicollinearity, as the

Table 3 Correlation Analysis Between Spiritual Coping (SCQ) and Psychosocial Metrics

Questionnaires	Dimensions	SCQ	
		PSC	NSC
DASS-21	Depression	−0.174**	0.549**
	Anxiety	0.028	0.428**
	Stress	−0.024	0.432**
	Total	−0.065	0.518**
BRS	Total	0.281**	−0.396**
APGAR	Total	0.262**	−0.368**
PMS	Total	0.288**	−0.378**

Note: **P<0.01.

Abbreviations: SCQ, Spiritual Coping Questionnaire; PSC, Positive Spiritual Coping; NSC, Negative Spiritual Coping; DASS-21, Depression, Anxiety and Stress Scale; BRS, Brief Resilience Scale; APGAR, Family APGAR Index; PMS, Personal Mastery Scale.

tolerance values were between 0.717 and 0.997 (which is above 0.10), and the variance inflation factor (VIF) values were between 1.007 and 1.396 (which is below 5). In Pattern 1, among the demographic factors (sex, residence, marital status, and economic indicators), only sex, marital status, and economic indicators entered the model. This model explained 3.8% of the variance in PSC levels (F=6.869, p<0.0001). In Pattern 2, adding the BRS factor (related to PSC levels) increased the explanatory power by an additional 7.1%, reaching 10.9% (F=19.233, p<0.0001). BRS emerged as a predictor of PSC levels, while the economic indicators factor was excluded from the model. In Pattern 3, the inclusion of the APGAR factor (associated with PSC levels) further enhanced the explanatory power by 3.1%, resulting in a cumulative 14.0% (F=19.177, p<0.0001). APGAR was identified as a predictor of PSC levels, and residence replaced marital status in the model. For Pattern 4, adding the PMS factor (linked to PSC levels) increased the variance explanation by 0.8%, totaling 14.8% (F=20.409, p<0.0001). PMS became a predictor of PSC levels, and residence was excluded from the model. Finally, in Pattern 5, introducing the depression factor (related to PSC levels) did not alter the model. The final model revealed that PMS, APGAR, BRS, and sex were positively associated with PSC levels (Table 4).

In the NSC model, multicollinearity was not detected, with error ranges from 0.723 to 0.991 (>0.10) and variance inflation factors (VIF) ranging from 1.004 to 1.384 (<5). In Pattern 1: Among factors showing demographic/clinical differences (ages, marital status, alcohol consumption, number of children, TB diagnosis type), only marital status, alcohol consumption, and TB diagnosis type entered the model. This model explained 3.4% of the variance in NSC levels (F=6.169, p<0.0001). In Pattern 2, after adding BRS factors (related to NSC levels), the explanatory power increased by an additional 14.3%, reaching 17.7% (F=33.135, p<0.0001). BRS factors became predictors of NSC levels, while alcohol consumption disappeared from the model. In Pattern 3, with the inclusion of APGAR factors (related to NSC levels), explanatory power further increased by 5.8% to 23.5% (F=46.786, p<0.0001). APGAR factors emerged as NSC predictors, whereas marital status disappeared. In Pattern 4, adding PMS factors (related to NSC levels) increased explanatory power by 3.4% to 26.9% (F=20.409, p<0.0001). PMS factors predicted NSC levels, and alcohol consumption reappeared in the model. In Pattern 5: Incorporating DASS-21 dimensions (related to NSC levels) substantially increased explanatory power by 10.7%, achieving a total of 37.6% (F=54.892, p<0.0001). Only depression (not anxiety/stress) In the model, the factors PMS and alcohol consumption were excluded, while the number of children emerged as a new variable. Factors such as depression and TB diagnosis types showed a positive correlation with NSC levels, whereas APGAR scores, BRS, and the number of children demonstrated a negative correlation with NSC levels (Table 5).

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Table 4 Hierarchical Multivariate Stepwise Linear Regression Analysis of SCQ (PSC) (n=448)

Variant	Patterns 1					95% Confidence Interval	
	Regression Weight	Standard Error	Beta	t-ratio	p-value	Minimum Bound	Maximum Bound
Intercept term	44.157	2.880		15.334	0.000	38.497	49.816
Sex	2.742	1.029	0.124	2.665	0.008	0.720	4.764
Marital status	3.037	1.109	0.127	2.739	0.006	0.858	5.216
Economic indicators	1.274	0.490	0.121	2.602	0.010	0.312	2.237
Variant	**Patterns 2**					**95% Confidence Interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	29.601	3.686		8.030	0.000	22.356	36.846
BRS	0.891	0.136	0.295	6.539	0.000	0.623	1.159
Sex	3.689	0.999	0.167	3.694	0.000	1.726	5.652
Marital status	2.413	1.069	0.101	2.258	0.024	0.312	4.514
Variant	**Patterns 3**					**95% Confidence Interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	34.699	3.730		9.304	0.000	27.369	42.029
BRS	0.702	0.141	0.233	4.987	0.000	0.426	0.979
APGAR	0.815	0.184	0.205	4.435	0.000	0.454	1.175
Sex	3.463	0.985	0.156	3.515	0.000	1.527	5.399
Residence	−1.927	0.976	−0.088	−1.974	0.049	−3.845	−0.008
Variant	**Patterns 4**					**95% Confidence Interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	28.236	3.416		8.266	0.000	21.523	34.950
PMS	0.324	0.114	0.146	2.852	0.005	0.101	0.547
APGAR	0.692	0.185	0.174	3.740	0.000	0.328	1.055
BRS	0.538	0.156	0.178	3.457	0.001	0.232	0.843
Sex	3.290	0.984	0.149	3.343	0.001	1.355	5.224
Variant	**Patterns 5**					**95% Confidence Interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	28.236	3.416		8.266	0.000	21.523	34.950
PMS	0.324	0.114	0.146	2.852	0.005	0.101	0.547
APGAR	0.692	0.185	0.174	3.740	0.000	0.328	1.055
BRS	0.538	0.156	0.178	3.457	0.001	0.232	0.843
Sex	3.290	0.984	0.149	3.343	0.001	1.355	5.224

Note: control variables incorporated into the structural equation model include Sex, Residence, Marital status, and Economic indicators. Patterns 1: R2 = 0.044, adjusted R2 = 0.038, F = 6.869, p <0.0001. Patterns 2: R2 = 0.115, adjusted R2 = 0.109, F = 19.233, p <0.0001. Patterns 3: R2 = 0.148, adjusted R2 = 0.140, F = 19.177, p <0.0001. Patterns 4: R2 = 0.156, adjusted R2 = 0.148, F = 20.409, p <0.0001. Patterns 5: R2 = 0.156, adjusted R2 = 0.148, F = 20.409, p <0.0001.
Abbreviations: SCQ, Spiritual Coping Questionnaire; PSC, Positive Spiritual Coping; BRS, Brief Resilience Scale; APGAR, Family APGAR Index; PMS, Personal Mastery Scale; DASS-21, Depression, Anxiety and Stress Scale.

Table 5 Hierarchical Multivariate Stepwise Linear Regression Analysis of SCQ (NSC) (n=448)

Variant	Patterns 1					95% Confidence Interval	
	Regression Weight	Standard Error	Beta	t-ratio	p-value	Minimum Bound	Maximum Bound
Intercept term	17.400	1.316		13.225	0.000	14.814	19.986
Marital status	−1.697	0.688	−0.116	−2.468	0.014	−3.048	−0.346
Alcohol consumption	−1.688	0.723	−0.109	−2.336	0.020	−3.109	−0.268
TB diagnosis type	1.440	0.663	0.102	2.171	0.030	0.137	2.743
Variant	**Patterns 2**					**95% confidence interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	30.990	1.923		16.119	0.000	27.212	34.769
BRS	−0.731	0.080	−0.395	−9.169	0.000	−0.887	−0.574
TB diagnosis type	1.703	0.612	0.120	2.781	0.006	0.500	2.906
Marital status	−1.394	0.633	−0.095	−2.204	0.028	−2.638	−0.151
Variant	**Patterns 3**					**95% confidence interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	30.675	1.622		18.913	0.000	27.487	33.863
BRS	−0.595	0.080	−0.322	−7.406	0.000	−0.753	−0.437
APGAR	−0.658	0.106	−0.270	−6.220	0.000	−0.866	−0.450
TB diagnosis type	1.727	0.588	0.122	2.938	0.003	0.572	2.882
Variant	**Patterns 4**					**95% confidence interval**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	33.716	1.733		19.450	0.000	30.309	37.123
BRS	−0.408	0.088	−0.220	−4.636	0.000	−0.580	−0.235
APGAR	−0.578	0.105	−0.237	−5.501	0.000	−0.784	−0.371
PMS	−0.284	0.064	−0.208	−4.426	0.000	−0.410	−0.158
TB diagnosis type	1.802	0.575	0.127	3.136	0.002	0.673	2.931
Alcohol consumption	−1.361	0.631	−0.088	−2.157	0.032	−2.602	−0.121
Variant	**Patterns 5**					**95% confidence interval I**	
	Regression Weight	**Standard Error**	**Beta**	**t-ratio**	**p-value**	**Minimum bound**	**Maximum bound**
Intercept term	20.355	1.812		11.233	0.000	16.794	23.917
Depression	0.833	0.082	0.442	10.112	0.000	0.671	0.995
APGAR	−0.457	0.100	−0.187	−4.571	0.000	−0.654	−0.261
BRS	−0.248	0.080	−0.134	−3.084	0.002	−0.405	−0.090
Number of children	−1.345	0.581	−0.091	−2.315	0.021	−2.487	−0.203
TB diagnosis type	1.185	0.535	0.084	2.217	0.027	0.135	2.236

Note: control variables incorporated into the structural equation model include Ages, Marital status, Alcohol consumption, Number of children and TB diagnosis type. Patterns 1: R2 = 0.040, adjusted R2 = 0.034, F = 6.169, p < 0.0001. Patterns 2: R2 = 0.183, adjusted R2 = 0.177, F = 33.135, p < 0.0001. Patterns 3: R2 = 0.240, adjusted R2 = 0.235, F = 46.786, p < 0.0001. Patterns 4: R2 = 0.278, adjusted R2 = 0.269, F = 33.966, p < 0.0001. Patterns 5: R2 = 0.383, adjusted R2 = 0.376, F = 54.892, p < 0.0001.

Abbreviations: SCQ, Spiritual Coping Questionnaire; NSC:, Negative Spiritual Coping; BRS, Brief Resilience Scale; APGAR, Family APGAR Index; PMS, Personal Mastery Scale; DASS-21, Depression, Anxiety and Stress Scale.

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Discussion

Spirituality represents a hidden issue within the population and is recognized as a branch of complementary and alternative medicine (CAM).[37] Spiritual health is a state of well-being that transcends the physical, psychological, and social dimensions and has been recognized by the World Health Organization as the fourth dimension of health.[35] In this study, we utilized the SCQ scale to measure the current levels of PSC and NSC in TB patients and examined their differences across demographic and clinical characteristics. Additionally, we analyzed their correlations with BRS, APGAR, PMS, and DASS-21 responses. To the best of our knowledge, this is the first research to investigate these multidimensional relationships in TB populations. In our study, the PSC levels were lower than those reported by Chen et al [56.90 (SD=10.98) vs 64.68 (SD=4.70)][19] and Tao et al [57.00 (P25=50.00, P75=65.00) vs 65.00 (P25=59.00, P75=71.00)].[15] Conversely, the NSC levels were higher than those found in Chen et al [15.04 (SD=6.73) vs 12.07 (SD=3.03)][19] and Tao et al [13.00 (P25=9.25, P75=18.00) vs 22.67 (P25=17.00, P75=34.00)].[15] The data is sufficient to prove that the level of spiritual coping styles of TB patients is worrisome, and more psychological support and spiritual strength are needed from health care workers.

First, We Discovered That There Were Differences in the Study's Demographics Between PSC and NSC Levels

The factors of sex (female advantage), residence, marital status, and economic indicators are the influencing factors of PSC levels. While the factors of age, marital status, alcohol consumption, number of children, and TB diagnosis type are the influencing factors of NSC levels. It is notable that the marital status factor is the sole common influencing factor for both PSC and NSC levels. Further regression analysis shows that after controlling for other factors, only the sex (female) factor is an independent predictor of PSC levels. This finding contrasts interestingly with the conclusion of Tao et al[15] regarding gender differences—although this study observed that the PSC/NSC levels of females were significantly higher than those of males, the final regression model did not show a significant association between gender and PSC. However, there is also evidence suggesting that the spiritual level of females is higher than that of males, and there is a significant difference.[38] This difference may stem from the particularity of the cultural context: in Chinese society, women traditionally undertake more roles of emotional support (such as family care and social relationship coordination). This makes them more focused on inner activities and able to be aware of the use of their spiritual coping strategies.[39] Thus, in practice, they are more likely to use spiritual coping strategies, including both positive and negative ones.[39]

We were surprised to find that, after adjusting for other NSC model components, the number of children and the type of TB diagnosis were the predictors of NSC level, while age, marital status, and alcohol consumption had no effect on NSC level. Our research contradicts other studies that indicate age and marriage[22] as determinants of NSC level. We found that there may be an internal association between the demographic characteristics of age, marital status, and number of children. For instance, the majority of unmarried persons are young, as are those without children. Furthermore, the traditional habits of the Chinese people emphasize the importance of "descendants", viewing the act of having children and passing on the family line as a significant life event. As a result, some patients, whether unmarried or married but without children, may experience concerns about their prospects for marriage following the recovery of their disease, which may impact their love and fertility. Therefore, the "number of children" factor wins in the final regression model.

Our study also found that a diagnosis of "pulmonary TB" serves as a predictive factor for NSC levels. This phenomenon may be linked to the stigmatization and discrimination associated with pulmonary TB due to cultural norms or beliefs,[2–4,40,41] which consequently lead to social isolation and insufficient social support.[40,41] Such realities of social disconnection create a profound sense of being "abandoned" by society. There is no evidence in the study to support the differences in "education level,[15,19] religious belief[14–16,19] in different spiritual coping styles, which may be related to the differences in nationality, culture, region, customs, and disease studied in the previous study. The fact that only 13.6% of people in this study held religious beliefs could also be a contributing factor. Upon closer inspection, we discovered that the investigation overlooked the "beliefs" of the cohabiting family members. Because people are living together, each other's behavior and communication will subtly affect each other's consciousness. Spirituality, as stated by

Algahtani et al[42] Spirituality does not need to be theorized or operationalized based on "objective" indicators (such as the frequency of religious attendance) but can instead be readily obtained through subjective self-reports.

Second, We Discovered That the Final PSC and NSC Models May Incorporate BRS and APGAR Components

They demonstrated an inverse relationship with NSC levels and a positive relationship with PSC levels. Numerous studies have demonstrated that those who are more resilient also tend to be more spiritual.[36,43,44] Patients with high psychological resilience tend to exhibit milder emotional responses (such as depression, anxiety, and stress reactions) when facing adversity or challenges[30,45] and are able to achieve better sleep quality.[30,46] Consequently, their ability to maintain mental peace and solidify their beliefs enables them to adopt a more optimistic outlook and effectively manage their illness, thereby elevating their spiritual health scores.[44] Therefore, it is essential to integrate resilience-related training programs from the fields of psychology, sociology, and ethics[30] into patients' rehabilitation processes to enhance their psychological resilience.

Based on literature research and data verification by our research team, family system functionality demonstrates a significant positive association with the spiritual health status of TB patients.[35] In simple terms, the family system plays a key role in supporting TB patients in three important ways: first, by providing the necessary resources for their survival; second, by creating ways for emotional communication that help them cope psychologically; and third, by recognizing their values to help them handle stress better. Notably, when family systems fail to fulfill these fundamental functions adequately, this deficiency directly correlates with the emergence of adaptive disorders among family members.[35] From a functionalist perspective, the level of family efficacy essentially reflects the system's responsiveness to members' multidimensional needs. Empirical studies confirm that optimizing family care models can effectively intervene in negative emotional states such as anxiety, depression, and stress.[35] Particularly for TB patients with respiratory infections, the perceived stigma of the disease often causes them to avoid interacting with friends and society during their illness, leading to significant disruptions in their work, studies, and overall life. This sense of isolation, which forces them to disconnect from society, points out the value of family function. Therefore, it is important to disseminate the method of "maintaining good family relations" to patients and their main family members to improve family function. For example, patients should be "grateful" for their meticulous care of family members and avoid individualistic emotional venting; family members need to be aware of the side effects of TB and its medications to understand and cope with the symptoms and emotional reactions of patients. These practices can promote the family atmosphere to form a virtuous circle.

Thirdly, the Final Models of PSC and NSC Revealed an Intriguing Inverse Pattern Between the PMS and Depression Factors

In the final model of PSC, PMS emerged as an independent influencing factor, while the depression factor was no longer significant. Conversely, in the final model of NSC, the depression factor remained an independent influencing factor, whereas the PMS factor disappeared. This evidence indicates that PSC and NSC exhibit distinct psychological resource mobilization patterns. As a positive psychological resource, higher PMS levels are typically associated with sustained accumulation of positive emotional experiences and the formation of beneficial cognitive feedback loops. When facing psychosocial and disease-related stressors, individuals with elevated PMS tend to employ problem-focused coping strategies actively.[19] These findings suggest that for the PSC population, programs should focus on strengthening their positive psychological resources by using mindfulness training and techniques to identify their strengths in order to maintain PMS levels. For the NSC population, the main focus should be on tackling negative thinking patterns related to depression with cognitive-behavioral therapy to break these harmful thought cycles, and then slowly building up their mental strength.

This study employs the DASS-21 scale in conjunction with the psychometric structures of the Spiritual Coping Scale (PSC/NSC), offering unique advantages. Through a cross-validation mechanism for multi-dimensional emotional responses, it enables systematic analysis of the dynamic interaction network among depression, anxiety, and stress.

The emotional response to depression, anxiety, and stress is negatively correlated with PSC levels and positively correlated with NSC levels, as has been confirmed by many studies. Surprisingly, this study found that PSC level does not correlate with anxiety and stress factors, but NSC level does correlate with depression, anxiety, and stress factors. Furthermore, the emotional response to depression is the only common factor that influences both PSC and NSC levels. To support the important role of depression in TB patients, comparisons using standard assessment tools and Chinese norms[47] showed that TB patients in this study had much higher depression scores [3.88 (SD=3.57) vs 2.33 (SD=3.05)]. This unusual mental strain might cause an emotional masking effect—where strong feelings of depression overshadow other emotional responses like anxiety and stress, making them hard to see in statistical analyses. Consequently, these two dimensions failed to reach the statistical significance threshold in the PSC model. Although the final model showed no significant association between depression factors and PSC, a statistically significant correlation with NSC was observed. In Ethiopia, as many as 67.6% of tuberculosis patients suffer from mental distress symptoms,[48] and in South Africa, the figure is 82.0%.[49] Moreover, the literature indicates that depression is commonly co-occurring in tuberculosis patients, and the two conditions often have an interactive outcome.[2,48,49]

In conclusion, through the evaluation of the demography and related factors of TB patients' spiritual coping styles, we found that the influencing factors of PSC and NSC not only have their characteristics but also have mutual internal correlation. As Algahtani et al[16] put it, "the spiritual QoL is neither psychological nor social in nature but a distinctive, important entity in its own right". In the current global field of health research, evidence-based spiritual health intervention models are gradually becoming an important part of medical practice. In the field of Chinese spiritual health research, a significant disciplinary bias exists: existing literature reveals that the majority of clinical spiritual health studies concentrate on patients with malignant tumors, while the investigation of mental adjustment mechanisms in tuberculosis patients has long been overlooked by academics. Therefore, systematically deconstructing the sociopsychological determinants that influence TB patients' choice of spiritual coping strategies can fill this knowledge gap. It can enrich personalized and people-oriented spiritual nursing strategies and help TB patients face reality, accept, and actively cooperate with treatment in a positive state of mind. At the same time, the spiritual nursing skills of "warmth, love, and acceptance" are integrated into the long-term treatment process of patients to promote their stable emotions and firm beliefs and achieve the purpose of constantly surpassing adversity and recovering early. Therefore, it is strongly advocated that emphasis should be placed on theoretical education at the spiritual level and training dedicated to the practice of spiritual care to enhance nurses' ability to meet patients' spiritual needs.[50,51] Additionally, in this study, it was also found that patients exhibit strong depressive emotional responses due to the disease itself and the use of medications, indicating that they have social avoidance behaviors. Therefore, the government, based on the current free anti-tuberculosis drug policy, should focus on cultivating professional tuberculosis counselors with psychological counseling capabilities. Simultaneously, the government should develop a digital health platform specifically for tuberculosis, offering free online consultation functions, follow-up visit appointments, and rehabilitation guidance, among other services. Healthcare personnel need to proactively extend services, regularly contact patients, and understand their psychological confusion and current difficulties.

Limitations

The study also has some limitations. First, anonymous self-assessment and online questionnaires may introduce social desirability bias; a mixed data collection approach (such as biomarker monitoring combined with clinical interviews) could be considered. Second, the cross-sectional study design restricts causal inference. Future studies could employ cohort studies with follow-up periods of at least 3 years to better understand the longitudinal changes in spiritual coping among TB patients. Third, the study sample is limited to a single region in Zhejiang Province, China; future research could conduct multicenter studies in provinces with significant cultural differences, such as Xinjiang, Guangdong, and Heilongjiang. Lastly, the explanatory power of the final model in this study is relatively low (14.8% for PSC and 37.6% for NSC), indicating that many influencing factors remain undiscovered. Future research should include other factors, such as happiness index, sleep quality, social support, and spiritual health, to identify a broader range of influences on spiritual coping and develop more effective improvement strategies.

Conclusions

The present study revealed that the spiritual coping capacity of tuberculosis (TB) patients was generally sub-optimal. Multiple linear stepwise regression analysis demonstrated the following patterns: In the PSC dimension, sex and PMS scores emerged as significant independent predictors. Female patients exhibited superior PSC performance compared to males. PMS scores showed a positive correlation with PSC levels. In the NSC dimension, depression scores, number of children, and TB diagnosis type were identified as significant independent predictors. Depression scores demonstrated a positive correlation with NSC levels. Childless patients and those diagnosed with pulmonary TB manifested higher levels of NSC. Simultaneously, BRS and APGAR factors independently influenced both PSC and NSC levels. Patients with better mental resilience and family function had higher PSC levels and lower NSC levels. These findings can help healthcare personnel to carry out individualized, human-centered spiritual care and nursing for TB patients according to the influencing factors of different spiritual coping styles, improve their mental health during the course of illness, and achieve the purpose of reducing pain and early recovery.

Data Sharing Statement

The corresponding author can provide any information about the data presented in the article upon request.

Ethical Approval and Consent to Participate

This study was approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang University School of Medicine (IIT20230475B). It adhered to the ethical guidelines, protocol, and regulations outlined in the Declaration of Helsinki. Participants provided informed consent online before the survey, which met the study's requirements.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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