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ORIGINAL RESEARCH

Relationship Between Social Support, Symptom Burden, Dyspnea, Perceived Stress, Perceived Stigma, Coping Styles, and Psychological Distress in Patients with Stable COPD: A Structural Equation Model

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Background: Psychological distress is prevalent in patients with stable chronic obstructive pulmonary disease (COPD) and may contribute to disease progression. However, the interplay among its influencing factors remains unclear. This study aimed to explore how social support, symptom burden, dyspnea, perceived stress, perceived stigma, and coping styles impact psychological distress in stable COPD using a structural equation model (SEM).

Methods: A convenience sample of 386 stable COPD patients was recruited from three tertiary hospitals in Chongqing, China. Data were collected using Distress Thermometer, Perceived Social Support Scale, COPD Assessment Test, the Modified Medical Research Council Dyspnea Score, the Perceived Stress Scale 10-item version, the Stigma Scale for Chronic Illness 8-item version, and the Simplified Coping Style Questionnaire were used for data collection. SEM was used for relationships among variables.

Results: The mean psychological distress score was (3.770 ± 1.525). Positive coping style ($\beta = -0.329$, $p < 0.001$) and perceived social support ($\beta = -0.750$, $p < 0.001$) reduced psychological distress directly. In contrast, negative coping style ($\beta = 0.360$, $p < 0.001$), symptom burden ($\beta = 0.317$, $p < 0.001$), dyspnea ($\beta = 0.396$, $p < 0.001$), perceived stress ($\beta = 0.268$, $p < 0.001$), and stigma ($\beta = 0.224$, $p < 0.001$) increased it. Perceived social support exerted extensive indirect effects on psychological distress (total effect = −1.044) by reducing symptom burden ($\beta = -0.681$), dyspnea ($\beta = -0.673$), and negative coping style ($\beta = -0.726$), and by improving positive coping style ($\beta = 0.781$) and perceived stress ($\beta = -0.688$). Similarly, symptom burden indirectly influenced distress via coping styles (indirect effect = 0.290).

Conclusion: Psychological distress in stable COPD patients is influenced by interrelated factors, with perceived social support playing a central role. Healthcare interventions should focus on improving coping strategies, managing symptoms, and strengthening social support to alleviate distress.

Keywords: pulmonary disease, chronic obstructive pulmonary disease, psychological distress, influencing factors, structural equation model

Introduction

Chronic obstructive pulmonary disease (COPD) is a prevalent, preventable, and manageable condition characterized by persistent respiratory symptoms and airflow limitation.[1] It is a leading cause of morbidity and mortality worldwide, with

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its global prevalence expected to rise, potentially affecting 600 million individuals by 2050.[2] COPD is currently the third leading cause of death globally, accounting for 3 million deaths annually.[3] By 2060, the number of COPD-related deaths is projected to exceed 5.4 million annually due to population aging and ongoing exposure to environmental pollutants such as tobacco smoke and air pollution.[4] In China alone, approximately 100 million people are affected by COPD, with a prevalence rate of over 27% among adults aged 60 years and older,[5] underscoring a significant public health concern with extensive economic and social implications.[6,7]

Beyond its physical manifestations, such as breathlessness, cough, and sputum production, COPD also poses profound psychological challenges for patients, with psychological distress being a critical concern.[8] Psychological distress encompasses emotional suffering often associated with chronic illness and includes symptoms of anxiety, depression, and stress.[9] Studies have shown that 42.9% of community-dwelling COPD patients and 64% of those experiencing acute exacerbations suffer from psychological distress.[10] Such distress significantly impairs health-related quality of life (HRQoL), worsens disease self-management, and increases the risk of acute exacerbations, hospitalizations, and mortality.[11,12] Despite its clinical importance, psychological distress remains underrecognized and undertreated in COPD management.[13] Many pulmonologists report a lack of sufficient training and resources to support patients' mental health. Therefore, how to better integrate mental health management, particularly interventions for psychological distress, into routine pulmonary care remains a critical challenge.[14]

To better understand the psychological distress in COPD, the present study integrates "the classical buffering hypothesis of social support",[15] with novel pathways involving dyspnea, perceived stress, and perceived stigma. While Lan et al[16] established coping styles and resilience as mediators, emerging evidence highlights dyspnea as a critical stressor amplifying psychological burden[17] and perceived stigma as a cultural barrier to seeking all kind of supports,[18] particularly in China, where chronic illness is often privately managed due to familial obligations and societal expectations.[19] Our expanded framework posits that social support not only enhances adaptive coping but also alleviates dyspnea-related stress and mitigates perceived stigma, thereby disrupting cycles of psychological distress. This approach addresses gaps in the Lan et al's[16] model by explicitly contextualizing how culturally shaped stigma and understudied physical symptoms (eg, dyspnea) interact with psychosocial factors.

This study investigates these dynamic interactions in Chinese patients with stable COPD using the structural equation modeling approach, addressing three hypotheses: (1) social support directly reduces psychological distress while indirectly mitigating distress through reduced symptom burden and perceived stigma, (2) perceived stress and stigma mediate the relationship between dyspnea and psychological distress, and (3) adaptive coping styles mediate the effects of social support on distress. Unlike prior research focusing solely on the levels of psychological distress,[12,16] our study emphasizes the complex pathways and mediating mechanisms linking these factors. By elucidating these interactions, the present study provides the first culturally nuanced model of COPD-related distress in China, where familial support structures coexist with stigma-driven isolation. This study builds on prior literature by identifying multidimensional pathways through which cultural-specific stressors and multisystem interactions contribute to psychological distress in stable COPD patients, directly informing the design of culturally tailored interventions to address these mechanisms.

Methods

Study Design

This study employed a cross-sectional descriptive survey design and adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Participants

Participants were recruited through convenience sampling between March and June 2024 from the outpatient departments of three tertiary hospitals in Chongqing, China. The inclusion criteria were: (1) age $\geq$ 18 years; (2) confirmed diagnosis of COPD based on the Global Initiative for Chronic Obstructive Lung Diseases (GOLD) guidelines, defined as post-bronchodilator FEV1/FVC < 70%; (3) attendance at a routine outpatient appointment during a stable period; (4) ability to communicate effectively and complete the questionnaire independently or with assistance; and (5) willingness

to provide informed consent for participation. Exclusion criteria were as follows: (1) acute exacerbation or hospitalization within the previous month; (2) presence of severe comorbidities, such as cardiovascular diseases; (3) severe mental disorders or cognitive impairments that could hinder participation; and (4) ongoing involvement in other intervention programs, such as pulmonary rehabilitation.

Sample Size

This study employed structural equation modeling using the maximum likelihood estimation method to examine the relationships among variables. To estimate the required sample size, the N:q rule, with a recommended ratio of 20/1, was applied, where N represents the number of cases required and q denotes the number of parameters requiring statistical estimation.[20] Based on this rule, q was identified as 11, resulting in a minimum required sample size of 260 after accounting for a 20% invalid questionnaire rate.

Measurements

Demographic information was collected using a self-designed questionnaire, and other variables, namely, psychological distress, social support, symptom burden, dyspnea, coping styles, perceived stress, and perceived stigma, were measured using validated instruments, which have been translated into Chinese and published publicly in academic journals.

General Characteristics

Demographic and clinical data, including age, gender, marital status, number of children, residence, educational level, payment method, smoking history, drinking history, monthly household income, body mass index (BMI), exercise frequency, disease duration, GOLD stage, number of acute exacerbations, and comorbidities, were collected using a self-designed standard data collection form.

Psychological Distress

Psychological distress was assessed using the Distress Thermometer (DT),[21] a single-item scale with scores ranging from 0 (no distress) to 10 (extreme distress). The DT is widely recognized in international psycho-oncology research and is recommended as a routine clinical tool in oncology settings for identifying significant levels of distress.[22] Tang et al[23] has confirmed its validity within the Chinese context, and it has also been applied in COPD patients to evaluate psychological distress.[16]

Symptom Burden

The COPD Assessment Test (CAT)[24] evaluated symptom burden. The instrument comprises eight items, each rated on a 6-point scale ranging from 0 to 5, resulting in a total score of 0 to 40. In this scale, higher scores reflect a greater symptom burden. The CAT has been widely validated, demonstrating good reliability, and is endorsed by the GOLD guideline.[12]

Dyspnea

The modified Medical Research Council Dyspnea Score (mMRC), a self-reported scale designed to assess the severity of dyspnea, rates symptoms on a scale from 0 (dyspnea only with strenuous exercise) to 4 (dyspnea at rest).[25] Higher scores indicate greater severity of dyspnea. The mMRC scale is widely utilized in patients with chronic respiratory diseases and is recommended by the Chinese clinical guidelines for evaluating functional dyspnea in patients with COPD.[26]

Knowledge of COPD

The Chronic Obstructive Pulmonary Disease Knowledge Questionnaire (COPD-Q) was used to evaluate patients' knowledge of COPD.[27] The questionnaire consists of 13 items addressing various aspects of the disease, including clinical manifestations, risk factors, medication usage, oxygen therapy, prevention strategies, and outcomes. Participants were asked to respond to each item by selecting "yes", "no", or "don't know". Correct answers, defined as a positive response to "yes" or a reverse answer to "no", were assigned a score of 1 point. Incorrect answers and responses of "don't know" were scored 0 points. Total scores ranged from 0 to 13, with higher scores indicating greater knowledge of COPD. The reliability and validity of the COPD-Q have been validated in China.[12]

Coping Style

The Simplified Coping Style Questionnaire (SCSQ)[28] was employed to evaluate the coping style of participants in this study. This instrument measures two dimensions of coping, including positive and negative coping, through 20 items rated on a 4-point scale (0–3). The positive coping dimension comprises 12 items, with a total score range of 0–36, while the negative coping dimension includes 8 items, with scores ranging from 0–24. Higher scores on each dimension indicate a greater tendency to adopt the corresponding coping style. The Cronbach's α coefficient for the scale is 0.890, demonstrating excellent internal consistency in the Chinese context.[29]

Social Support

The Perceived Social Support Scale (PSSS), originally developed by Blumenthal[30] and subsequently translated and adapted for the Chinese context by Jiang,[31] comprises 12 items measured on a 7-point Likert scale. The scale assesses three dimensions of social support, including family support (items 3, 4, 8, 11), friend support (items 6, 7, 9, 12), and support from others (items 1, 2, 5, 10). The total score ranges from 12 to 84, with higher scores indicating greater levels of perceived social support.

Perceived Stress

The Perceived Stress Scale (PSS-10)[32] assessed perceived stress over the past month through 10 items, with total scores ranging from 0 to 40. Higher scores indicate greater levels of perceived stress. The Chinese version of the PSS-10 has been validated and shown to possess strong reliability and validity.[33]

Perceived Stigma

The Stigma Scale for Chronic Illness 8-item version (SSCI-8) is a concise self-report instrument designed to assess perceived stigma.[34] Each item is rated on a 5-point Likert scale, ranging from 1 (never) to 5 (always), with total scores range from 8 to 40, where higher scores indicate greater perceived stigma. Although SSCI-8 has not been specifically validated in the Chinese COPD population, and we did not conduct comprehensive linguistic validation of the scale in this study, its reliability and validity have been well-established in other Chinese populations with chronic illnesses.[35] Therefore, we use the validated Chinese version of SSCI-8 to ensure the credibility of the collected data.

Ethical Statement

This study was conducted by the principles outlined in the Declaration of Helsinki and was approved by the Ethical Approval Board of Hunan Traditional Chinese Medical College, with the identifier of YXLL202401004. Before data collection, necessary consent and cooperation agreements were obtained from hospital administrators and relevant departments. All participants provided written informed consent before their inclusion in the study.

Data Collection

Patients who expressed willingness to participate and demonstrated the ability to cooperate were surveyed during their outpatient visits using a structured questionnaire. The researcher provided detailed information about the study to the patients and conducted one-to-one surveys after obtaining informed consent. The patients completed the questionnaires on-site and collected them immediately. For patients who were unable to read or fill out the questionnaire independently, assistance was provided by the researchers or family members. A total of 398 eligible patients were initially recruited for the study. After excluding 12 responses due to logical responses, the final sample comprised 386 participants, resulting in a valid response rate of 96.98%.

Quality Control

The researchers underwent standardized training to ensure consistency in data collection procedures, including a clear understanding of the research objectives, questionnaire completion guidelines, and administering assessment scales. Two

researchers conducted data entry independently, with strict quality control measures to exclude datasets with errors or omissions exceeding 20% or questionnaires showing complete duplication.

Data Analysis

The collected data were analyzed using SPSS 22.0 and AMOS 20.0 for descriptive statistics, correlation analysis, and pathway analysis. Categorical variables were summarized as frequencies and percentages, while continuous data were expressed as means and standard deviations (SD) because the data distribution will not significantly influence the reliability of the statistical analyses in a large sample size.[36,37] Pearson's correlation analysis was employed to explore the associations between variables. Structural equation modeling (SEM) was performed using AMOS to investigate the relationship between social support, symptom burden, dyspnea, perceived stress, perceived stigma, coping styles, and psychological distress, employing the robust maximum likelihood method for model estimation. Model fit was evaluated against established cutoff criteria, including chi-square/degree of freedom (χ^2/df) < 3, comparative fit index (CFI > 0.90), Tucker-Lewis Index (TLI > 0.90), and Root Mean Square Error of Approximation (RMSEA < 0.08).[38] The significance of direct and indirect pathways was determined through 95% bias-corrected confidence intervals (CI) obtained from bootstrap sampling.[39] Statistical significance was set at a two-tailed p-value < 0.05.

Results

Sample Characteristics

In this study, as presented in Table 1, 386 patients with stable COPD were included, comprising 298 males (77.2%) and 88 females (22.8%). The average age of patients was (63.728 ± 3.767) years, with the mean disease duration of 13.200 years and mean number of acute exacerbations of 2.520 times. The majority resided in urban areas (79.53%, n = 307), while rural residents accounted for 20.47% (n = 79). Regarding marital status, single, married, divorced, and widowed participants were represented almost equally, with proportions ranging from 21.76% to 26.68%. Most participants had more than two children (67.88%, n = 262), and the most prominent educational group had a primary school education or below (65.28%, n = 252). Self-payment for medical expenses was common (70.47%, n = 272), with the remainder having partial or complete medical insurance. A smoking history was reported by 51.30% (n = 198) of participants, and 47.67% (n = 184) reported a history of drinking. Monthly incomes were almost evenly distributed across three categories: <3,000 RMB (38.86%, n = 150), 3,000–8,000 RMB (30.31%, n = 117), and >8,000 RMB (30.83%, n = 119). BMI was similarly balanced across three categories, with approximately one-third in each group. Most patients exercised occasionally (63.73%, n = 246), and GOLD stage III was the most common disease severity (66.06%, n = 255). More than half of the patients had comorbid conditions (51.81%, n = 200).

Descriptive Statistics and Correlation

The results showed that the mean psychological distress score (DT) was (3.77 ± 1.53). Symptom burden had a mean score of (19.63 ± 7.57), and the average dyspnea score was (1.91 ± 0.76). Positive coping and negative coping had mean scores of (19.28 ± 7.05) and (11.92 ± 5.21), respectively, while perceived social support scored (47.98 ± 13.39). Perceived stress and stigma had mean scores of (18.94 ± 7.99) and (23.49 ± 6.64), respectively. Psychological distress showed strong positive correlations with symptom burden, dyspnea, negative coping, perceived stress, and stigma ($p < 0.01$) but was negatively correlated with positive coping and perceived social support ($p < 0.01$). Detailed descriptive statistics and correlation analysis results are displayed in Table 2.

Structural Equation Model Analysis of the Effects of Social Support, Symptom Burden, Dyspnea, Perceived Stress, Perceived Stigma, and Coping Styles on Psychological Distress

Initial Model Assumptions

Symptom burden, dyspnea, perceived stress, perceived stigma, and coping styles are endogenous variables, social support is exogenous variables, and psychological distress is an explicit variable. Therefore, a theoretical model of the relationship between these variables is therefore constructed.

Table 1 Sociodemographic Characteristics of Patients in This Study (n = 386)

Variables	Mean	Standard Deviation, SD
Age, years	63.728	3.767
Course of disease, years	13.200	4.149
Number of acute exacerbations, n	2.520	1.079
	Frequency, N	**Percentage, %**
Gender, n		
Male	298	77.2
Female	88	22.8
Marital status, n		
Single	103	26.7
Married	100	25.9
Divorced	99	25.6
Widowed	84	21.8
Quantity of children, n		
0	52	13.5
1	41	10.6
2	31	8.0
>2	262	67.9
Residence place, n		
Rural	79	20.5
Urban	307	79.5
Educational level, n		
Primary school or below	252	65.3
Junior high	50	13.0
Senior high	44	11.4
University or above	40	10.3
Payment method, n		
Self-payment	272	70.4
Partial medical insurance	57	14.8
Complete medical insurance	57	14.8
History of smoking, n		
Yes	198	51.3
No	188	48.7
History of drinking, n		
Yes	184	47.7
No	202	52.3
Monthly household income, n		
<3,000 CNY	150	38.9
3,000 to 8,000 CNY	117	30.3
>8,000 CNY	119	30.8
BMI, n		
<18.4 kg/m^2	129	33.4
18.4 to 23.8 kg/m^2	129	33.4
>23.8 kg/m^2	128	33.2
Frequency of exercise, n		
Never	71	18.4
Occasionally	246	63.7
Regularly	69	17.9

(*Continued*)

Table 1 (Continued).

Variables	Mean	Standard Deviation, SD
GOLD classification, n		
I	42	10.9
II	52	13.5
III	255	66.1
IV	37	9.5
Comorbidity, n		
Yes	200	51.8
No	186	47.2

Abbreviations: BMI, body mass index; GOLD, Global Initiative for Chronic Obstructive Lung Disease.

Table 2 Correlation Analysis Between All Targeted Variables

Variable	Mean ± SD	1	2	3	4	5	6	7	8	9
1.DT	3.770 ± 1.525	1								
2.CAT	19.630 ± 7.570	0.922**	1							
3.mMRC	1.910 ± 0.762	0.721**	0.672**	1						
4.COPD-Q	6.350 ± 4.021	−0.116*	−0.064	−0.033	1					
5.SCSQ-P	19.280 ± 7.047	−0.807**	−0.695**	−0.575**	0.052	1				
6.SCSQ-N	11.920 ± 5.205	0.854**	0.770**	0.630**	−0.083	−0.662**	1			
7.PSSS	47.980 ± 13.393	−0.750**	−0.680**	−0.673**	0.022	0.781**	−0.726*	1		
8.PSS-10	18.940 ± 7.988	0.836**	0.745**	0.588**	−0.083	−0.614**	0.704**	−0.688**	1	
9.SSCI-8	23.490 ± 6.639	0.710**	0.616**	0.520**	−0.085	−0.525**	0.590**	−0.704**	0.528**	1

Note: *<0.005, **<0.01.

Abbreviations: COPD, chronic obstructive pulmonary disease; GOLD, global initiative for chronic obstructive lung disease; CAT, COPD Assessment Test; COPD-Q, COPD knowledge questionnaire; SCSQ-P, positive coping subscale of the Simplified Coping Style Questionnaire; SCSQ-N, negative coping subscale of the Simplified Coping Style Questionnaire; PSSS, perceived social support scale; PSS-10, perceived stress scale-10; SSCI-8, stigma scale for chronic illness-8; SD, standard deviation.

Model Modification

The modified structural equation model was obtained using the maximum likelihood method. $\chi^2/df = 3.300$, CFI = 0.999, TLI = 0.982, and RMSEA = 0.077 (90% CI: 0.016, 0.146), all fitting indexes of the model met the standard.

Model Verification and Results

As shown in the model (Figure 1), symptom burden ($\beta = 0.317$, $p < 0.001$), dyspnea ($\beta = 0.396$, $p < 0.001$), negative coping ($\beta = 0.360$, $p < 0.001$), perceived stress ($\beta = 0.268$, $p < 0.001$), and stigma ($\beta = 0.224$, $p < 0.001$) had significant direct positive effects on psychological distress. In contrast, positive coping ($\beta = -0.329$, $p < 0.001$) and perceived social support ($\beta = -0.750$, $p < 0.001$) had significant direct negative effects on psychological distress. Indirect pathways revealed that dyspnea (total effect: $\beta = 0.396$; indirect effect: $\beta = 0.290$, $p < 0.001$) influenced psychological distress through its effects on symptom burden ($\beta = 0.392$, $p < 0.001$), coping styles (positive coping: $\beta = -0.089$, $p = 0.028$; negative coping: $\beta = 0.258$, $p < 0.001$), and perceived stress ($\beta = 0.127$, $p = 0.004$). Perceived social support (total effect: $\beta = -1.044$; direct effect: $\beta = -0.750$, $p < 0.001$) demonstrated extensive indirect effects by reducing symptom burden ($\beta = -0.681$, $p < 0.001$), dyspnea ($\beta = -0.673$, $p < 0.001$), improving positive coping ($\beta = 0.781$, $p < 0.001$), and lowering negative coping ($\beta = -0.726$, $p = 0.002$), perceived stress ($\beta = -0.688$, $p < 0.001$), and stigma ($\beta = -0.704$, $p = 0.002$). Full detailed results for all pathways are presented in Table 3.

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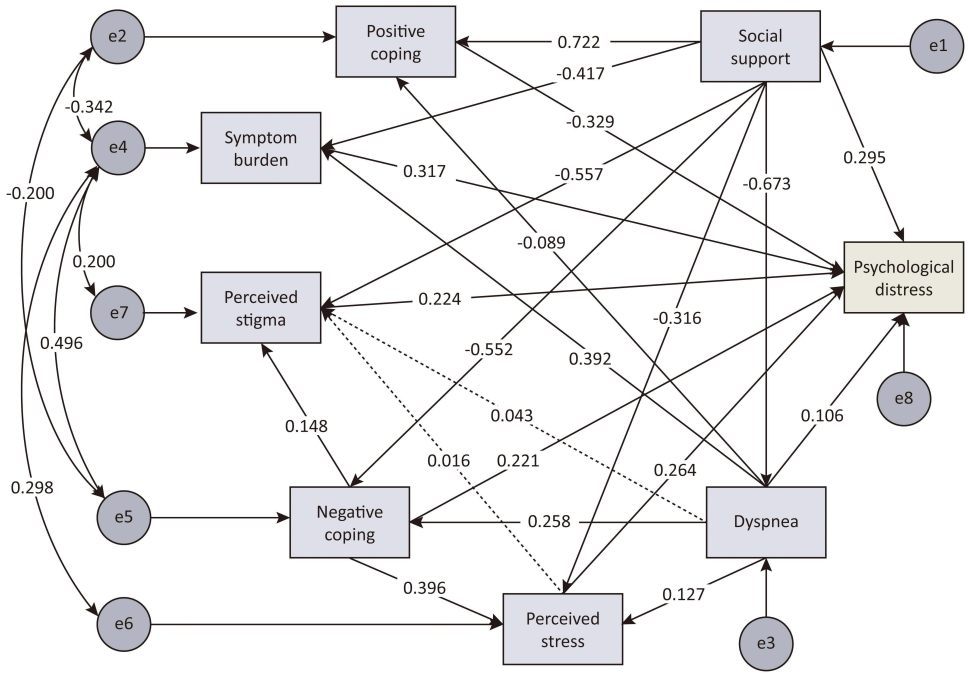

Figure 1 The structural equation model illustrating the relationships among social support, symptom burden, dyspnea, perceived stress, perceived stigma, coping styles, and psychological distress. Arrows originating from a variable indicate its role as an influencing factor, while the direction of the arrows points to the factors being affected. The values displayed on the arrows represent the standardized estimates, reflecting the strength and direction of the relationships. e1–e8 account for the unexplained variance associated with each observed variable.

Discussion

Main Findings

This study aimed to use a structural equation model to investigate the relationships between social support, symptom burden, dyspnea, perceived stress, perceived stigma, coping styles, and psychological distress in patients with stable

Table 3 Standardized Direct, Indirect, and Total Effects of All Pathways

Structural Paths	*β*	95% Confidence Interval		*p*
		Lower	Upper	
Total effects				
CAT → DT	0.317	0.295	0.341	**0.001**
mMRC → DT	0.396	0.342	0.450	**0.001**
SCSQ-P → DT	−0.329	−0.353	−0.303	**0.001**
SCSQ-N → DT	0.360	0.328	0.392	**0.001**
PSSS → DT	−0.750	−0.783	−0.709	**0.002**
PSS-10 → DT	0.268	0.239	0.295	**0.001**
SSCI-8 → DT	0.224	0.203	0.246	**0.001**
mMRC → CAT	0.392	0.325	0.455	**0.001**
mMRC → SCSQ-P	−0.089	−0.149	−0.025	**0.028**
mMRC → SCSQ-N	0.258	0.186	0.328	**0.001**
mMRC → PSS-10	0.228	0.155	0.296	**0.001**
mMRC → SSCI-8	0.084	0.016	0.162	**0.039**
SCSQ-N → PSS-10	0.396	0.317	0.477	**0.001**
SCSQ-N → SSCI-8	0.154	0.069	0.248	**0.004**
PSS-10 → SSCI-8	0.016	−0.076	0.101	**0.778**

(*Continued*)

Table 3 (Continued).

Structural Paths	β	95% Confidence Interval		p
		Lower	Upper	
PSSS → CAT	−0.681	−0.722	−0.632	**0.001**
PSSS → mMRC	−0.673	−0.716	−0.619	**0.001**
PSSS → SCSQ-P	0.781	0.745	0.810	**0.001**
PSSS → SCSQ-N	−0.726	−0.759	−0.685	**0.002**
PSSS → PSS-10	−0.688	−0.731	−0.640	**0.001**
PSSS → SSCI-8	−0.704	−0.741	−0.657	**0.002**
Direct effects				
CAT → DT	0.317	0.295	0.341	**0.001**
mMRC → DT	0.106	0.090	0.122	**0.001**
SCSQ-P → DT	−0.329	−0.353	−0.303	**0.001**
SCSQ-N → DT	0.221	0.201	0.243	**0.001**
PSSS → DT	0.295	0.266	0.327	**0.001**
PSS-10 → DT	0.264	0.244	0.285	**0.001**
SSCI-8 → DT	0.224	0.203	0.246	**0.001**
mMRC → CAT	0.392	0.325	0.455	**0.001**
mMRC → SCSQ-P	−0.089	−0.149	−0.025	**0.028**
mMRC → SCSQ-N	0.258	0.186	0.328	**0.001**
mMRC → PSS-10	0.127	0.054	0.195	**0.004**
mMRC → SSCI-8	0.043	−0.030	0.124	0.311
SCSQ-N → PSS-10	0.396	0.317	0.477	**0.001**
SCSQ-N → SSCI-8	0.148	0.053	0.244	**0.007**
PSS-10 → SSCI-8	0.016	−0.076	0.101	0.778
PSSS → CAT	−0.417	−0.481	−0.349	**0.001**
PSSS → mMRC	−0.673	−0.716	−0.619	**0.001**
PSSS → SCSQ-P	0.722	0.668	0.774	**0.001**
PSSS → SCSQ-N	−0.552	−0.617	−0.487	**0.001**
PSSS → PSS-10	−0.316	−0.401	−0.227	**0.001**
PSSS → SSCI-8	−0.557	−0.644	−0.464	**0.001**
Indirect effects				
mMRC → DT	0.290	0.237	0.343	**0.001**
SCSQ-N → DT	0.139	0.110	0.169	**0.001**
PSS-10 → DT	0.004	−0.017	0.023	0.774
PSSS → DT	−1.044	−1.081	−1.003	**0.001**
mMRC → PSS-10	0.102	0.071	0.141	**0.001**
mMRC → SSCI-8	0.042	0.017	0.071	**0.005**
SCSQ-N → SSCI-8	0.006	−0.031	0.040	0.789
PSSS → CAT	−0.264	−0.315	−0.217	**0.001**
PSSS → SCSQ-P	0.060	0.017	0.102	**0.026**
PSSS → SCSQ-N	−0.173	−0.224	−0.127	**0.001**
PSSS → PSS-10	−0.372	−0.444	−0.307	**0.001**
PSSS → SSCI-8	−0.147	−0.225	−0.074	**0.003**

Note: The bold P-value indicates statistical significance.

Abbreviations: COPD, chronic obstructive pulmonary disease; GOLD, global initiative for chronic obstructive lung disease; CAT, COPD Assessment Test; COPD-Q, COPD knowledge questionnaire; SCSQ-P, positive coping subscale of the Simplified Coping Style Questionnaire; SCSQ-N, negative coping subscale of the Simplified Coping Style Questionnaire; PSSS, perceived social support scale; PSS-10, perceived stress scale-10; SSCI-8, stigma scale for chronic illness-8.

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COPD. The findings revealed that symptom burden, dyspnea, negative coping, perceived stress, and stigma had a significant direct positive impact on psychological distress. In contrast, positive coping and perceived social support had significant negative consequences. Notably, dyspnea had an indirect effect on psychological distress by influencing symptom burden, coping styles, and perceived stress, whereas perceived social support had a wide-ranging indirect effect by alleviating symptom burden and dyspnea, improving positive coping, reducing negative coping, and mitigating perceived stress and stigma. Among these, perceived social support had the greatest overall influence on psychological distress, emphasizing its importance in buffering psychological distress via multiple pathways.

Symptom Burden and Dyspnea

Symptom burden is commonly acknowledged as a major factor to psychological distress in COPD patients.[16] This study found symptom burden not only directly exacerbates psychological distress ($\beta = 0.317$) but also exerts indirect effect through the meditation of coping styles (indirect effect: 0.290). These findings are consistent with the majority of previous studies, further confirming that symptom burden, including physical symptoms and respiratory symptoms, significantly contributes to psychological distress. This aligns with Weldam et al,[40] who reported that higher symptom burden, particularly in the context of chronic diseases such as COPD, is closely associated with poorer mental health outcomes, including increased anxiety and depression. Similarly, Katon et al[41] emphasized that insufficient symptom management in patients with chronic diseases may further exacerbates psychological distress. However, differences in disease stages may significantly influence the relationships between symptoms and psychological outcomes, which may explain discrepancies between our findings and those of prior studies. For example, Lan et al[16] found a negative correlation between symptom burden and psychological distress in patients with acute exacerbations of COPD, likely due to the overwhelming nature of acute symptoms overshadowing chronic burden effects. In contrast, our study focused on patients who were at stable stage, whose chronic symptom burden may manifest as a cumulative stressor that interacts with social support, coping styles, and perceived stigma over time.

Dyspnea, a major component of symptom burden, was identified as a primary factor impacting psychological distress ($\beta = 0.396$) and indirectly influencing it through its effects on symptom burden ($\beta = 0.392$), positive coping ($\beta = -0.089$), negative coping ($\beta = 0.258$), and perceived stress ($\beta = 0.127$). While Ora et al[42] and Parshall et al[17] have highlighted dyspnea as a significant contributor to psychological distress in COPD due to its detrimental impact on daily life and self-efficacy, more recent studies further underscore its critical role. Atlantis et al found that clinically relevant depression or anxiety and COPD exhibit bidirectional associations, with dyspnea being a key factor linking the two.[43] Norweg et al provided evidence that cognitive-behavioral strategies can improve dyspnea and related distress in COPD patients, indicating that the interaction between dyspnea and psychological distress is not static but can be influenced by interventions.[44] Pollok et al noted that psychological therapies can effectively treat depression in COPD patients, and alleviating dyspnea is one of the important pathways through which these therapies reduce psychological distress.[45] Furthermore, advancements in research have deepened the understanding of dyspnea's multidimensional impact. For instance, dyspnea not only affects patient's physical functioning but also interacts intricately with emotions, cognition, and behavior. Patients with COPD may experience anxiety and panic due to catastrophic thoughts about dyspnea, which in turn exacerbates dyspnea and psychological distress, creating a vicious cycle.[46] Additionally, studies have shown that factors such as disease severity, exacerbation frequency, and social support can modulate the relationship between dyspnea and psychological distress.[47] All these findings emphasize the importance of comprehensive symptom management strategies that include physiological interventions and psychosocial support to successfully reduce psychological distress effectively in this population.

Coping Styles

The findings of this study indicate that coping styles significantly impact psychological distress in patients with COPD. Specifically, psychological distress is positively influenced by negative coping strategies ($\beta = 0.360$) and negatively affected by positive coping styles ($\beta = -0.329$). These results align with prior research emphasizing the detrimental effects of maladaptive coping strategies and the positive impacts of adaptive coping strategies on the psychological well-being of individuals living with chronic illnesses. For instance, Brenes[48] found that avoidance-based coping techniques in

COPD patients were linked to increased levels of anxiety and psychological distress, highlighting the need to address these behaviors in clinical practice. Similarly, Hynninen et al[49] identified that emotion-focused coping was associated with higher levels of psychological distress among COPD patients, while problem-focused coping strategies correlated with improved mental health outcomes. This is further supported by Kunik et al,[50] who demonstrated the effectiveness of cognitive-behavioral interventions in enhancing positive coping and reducing distress among COPD patients. Recent studies have further explored the relationship between coping styles and psychological distress. Lan et al[16] examined the effects of symptom burden, psychological resilience, coping styles, and social support on psychological distress in elderly patients with acute exacerbation of COPD, showing that these studies factors directly affected psychological distress, with coping styles having the largest total effect on psychological distress. Hirschmiller et al[51] investigated the interplay of coping styles and optimism/pessimism in shaping depressive and anxiety symptoms, and found that optimism was directly related to depression and anxiety, and the effects of optimism and pessimism were mediated through denial/self-blame. These findings highlight the critical need for tailored interventions aimed at promoting adaptive coping strategies to enhance the psychological resilience and overall well-being of COPD patients.

Perceived Stress

Our study revealed that perceived stress exerted a significant direct positive influence on psychological distress ($\beta = 0.268$) in stable COPD patients. This finding is consistent with prior research suggesting that increased perceived stress may predict psychological distress in various chronic conditions, including COPD. Cohen and Williamson[52] proposed that physiological stress responses, such as inflammation and reduced respiratory function, could contribute to increased psychological distress. Furthermore, the psychological burden of managing a chronic, progressive diseases, which is aggravated by increased stress,[53] may amplify negative emotional stress.[54,55] Similarly, Katon et al[41] observed that psychological stress might exacerbate symptom burden, leading to increased anxiety and depression, while the physical restrictions and emotional obstacles associated with COPD can heighten perceived stress levels.[53] Recent studies have also demonstrated the significant relationship between perceived stress and psychological distress in COPD patients. Offor et al[56] found that psychosocial factors, including perceived stress, are associated with worsened respiratory symptoms in individuals with COPD. Williams et al[57] highlighted the effectiveness of cognitive-behavioral therapy (CBT) for COPD patients, suggesting that CBT can help patients adjust their cognitive and emotional responses to stress, thereby alleviating psychological distress. These findings emphasize the need of stress management interventions tailored to COPD patients, which may reduce psychological distress while improving overall health outcomes.

Perceived Stigma

Perceived stigma significantly contributes to psychological distress in patients with stable COPD, with a positive direct influence ($\beta = 0.224$). This finding is consistent with previous research that highlights the negative effects of stigma on the psychological well-being of individuals with chronic respiratory disorders, such as COPD.[58,59] Experiences related to stigma, including feeling of guilt, blame, and social isolation, can worsen psychological distress, and lead to issues like depression, anxiety, and low self-esteem.[60,61] These results highlight the need to address stigma through targeted interventions, such as psychoeducation and support groups, which can mitigate its psychological effects and enhance the overall well-being of COPD patients.

Social Support

Social support has been established to have a mitigating or protective impact on an individual's psychological and social adjustment.[62] In the present study, we found that perceived social support had a significant overall negative effect on psychological distress ($\beta = -0.750$). However, further analysis revealed that the direct effect of perceived social support on psychological distress was positive ($\beta = 0.295$), while the indirect effect, mediated through symptom burden, dyspnea, coping styles, perceived stress, and perceived stigma was negative ($\beta = -0.750$). This finding highlights the complexity of the pathways through which social support exerts its influence.

Although previous literature has suggested that perceived social support is an important resource for alleviating psychological distress in patients with chronic lung diseases, such as COPD,[58–60] the positive direct effect observed in

this study indicates that high levels of social support may, in certain contexts, be associated with an increased psychological burden. This result may be closely related to the characteristics of collectivist cultures. In such cultures (eg, China), individual needs are often deeply embedded within group relationships.[63] This characteristic may lead to internal conflicts for patients when receiving support: on the one hand, they rely on support to meet their individual needs; on the other hand, they may fear that such needs will be perceived as selfish or conflicting with group goals.[63] Consequently, in this cultural context, social support, while addressing patients' needs, may inadvertently reinforce their "sick role" perception, undermine their autonomy, and increase their dependence on support systems, thereby exacerbating psychological distress.[64]

Nevertheless, our findings also demonstrated that social support significantly alleviated psychological distress through pathways involving improvements in symptoms burden, dyspnea, coping styles, perceived stress, and stigma. This aligns with previous research and further supports the crucial role of social support in enhancing psychological well-being among individuals with chronic lung diseases.[61,65]

Overall, these findings emphasize the complex of social support in psychological distress, where it may both alleviate and exacerbate distress depending on the pathway involved. Future research should further explore the sources (eg, family, friends, or healthcare teams) and quality (eg, emotional vs instrumental support) of social support, as well as the moderating effects of cultural contexts on these pathways.

Limitations

This study had some significant limitations. First, the nature of the cross-sectional design may introduce selection bias, limit the generalizability of research findings, and also limit the capacity to demonstrate causal relationships between the variables. Longitudinal studies are required to better analyze the temporal relationships between the factors studied. Second, the sample was recruited from tertiary hospitals, which may not reflect the general COPD community. Third, the study used self-reported measurements, which might be skewed by biases such as social desirability bias. Moreover, we used the validated Chinese version of SSCI-8 to measure perceived stigma, but we did not conduct language validation of this scale in COPD population, which may have the risk of compromising the credibility of collected data. On the one hand, tools used for data collection should be firstly validated in the target population in future studies. On the other hand, future study could include objective measures, such as physiological tests, to improve the accuracy of the findings. Fourth, while the study accounted for multiple potential confounders, it is still possible that other unmeasured factors influenced the findings. Finally, the research was done within a specific cultural context, which may limit the generalizability of the findings to other populations.

Conclusions

This study provides significant insights into the factors that influence psychological distress among individuals with stable COPD. The findings revealed that symptom burden, dyspnea, negative coping, perceived stress, and stigma all had a significant positive effect on psychological distress, while positive coping and perceived social support exerted negative effects. Indirect pathways illustrated that dyspnea influenced psychological distress through symptom burden, coping styles, and perceived stress. Perceived social support mitigated distress by reducing symptom burden and dyspnea while enhancing positive coping and lowering negative coping and stress. It is important to note that due to the study's population and sampling method, the findings may not be generalizable to rural areas or other healthcare systems with different cultural or structural characteristics. These limitations should be considered when interpreting the results. Nevertheless, these findings underscore the critical role of enhancing social support and promoting positive coping strategies in clinical interventions to alleviate psychological distress in this population. Healthcare professionals should prioritize comprehensive support mechanisms that alleviate symptom burden, empower coping skills, and improve social networks to optimize patient outcomes within the context of the study population.

Implications

Implications for Clinical Practice

The findings of this study highlight actionable strategies to integrate psychosocial and physical care into real-world COPD management. First, we recommend establishing multidisciplinary care teams comprising pulmonologists, nurses,

psychologists, and social workers to systematically address both physical symptoms and psychological distress. For example, clinics could implement routine psychosocial screening during follow-up visits using validated tools to identify high-risk patients needing to targeted support. Second, social support interventions should move beyond generic recommendations to structured programs, such as peer-led support groups, family education workshops, and community partnerships. Third, to foster adaptative coping, clinicians should collaborate with psychologists to deliver evidence-based behavioral interventions, such as cognitive-behavioral therapy modules tailored to COPD-related stress or mindfulness-based stress reduction programs. These could be offered in hybrid formats to improve accessibility. Finally, healthcare systems should invest staff training programs to equip providers with skills to address stigma proactively. For instance, clinicians could adopt stigma-reduction communication techniques and integrate culturally adapted educational materials into patient care plans to reframe COPD as a manageable condition. Digital tools, such as mobile apps tracking symptoms burden and linking users to online support networks, could further reinforce these strategies.

Implications for Future Research

Future research could build upon the findings of this study by further investigating the complex relationships between psychological distress, symptom burden, dyspnea, coping styles, and social support in patients with COPD. While this study identified several direct and indirect pathways influencing psychological distress, longitudinal studies are needed to explore causal relationships and changes over time. Additionally, future studies could examine the role of other potential moderating variables, such as cultural factors or different healthcare settings, in influencing these relationships. The impact of targeted interventions aimed at improving coping strategies and enhancing social support warrants further investigation, particularly in diverse populations and across various stages of COPD. Understanding how these factors evolve with disease progression could lead to more effective psychosocial interventions tailored to specific patient needs, ultimately improving patient outcomes.

Abbreviations

COPD, chronic obstructive pulmonary disease; HRQoL, health-related quality of life; K10, Kessler Psychological Distress Scale; DT, distress thermometer; GOLD, global initiative for chronic obstructive lung diseases; CAT, COPD assessment test; mMRC, the modified medical research council dyspnea score; COPD-Q, COPD knowledge questionnaire; SCSQ, simplified coping style questionnaire; PSSS, perceived social support scale; PSS-10, perceived stress scale; SSCI-8, stigma scale for chronic illness 8-item version; SD, standard deviation.

Data Sharing Statement

The data sets used and analyzed in the present study are available from the corresponding author upon reasonable request.

Study Approval Statement

Ethics approval was not required.

Consent to Participate Statement

Written informed consent was not required.

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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Disclosure

Xu Tian and Lijuan Yi contributed equally to this work as the joint first author. The authors report no conflicts of interest in this work.

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