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Health Literacy and Negative Emotions in Hospitalised COPD Patients:The Serial Mediating Roles of Social Support and Illness Perception

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Abstract

Background

Negative emotions such as anxiety and depression are common among hospitalized patients with chronic obstructive pulmonary disease and are important predictors of poor clinical outcomes and prolonged hospitalization. As a key patient-related capacity, health literacy influences patients' ability to understand health information, engage in self-management, and cope with illness-related stress. However, the heterogeneity of health literacy among hospitalized COPD patients and the mechanisms through which it affects negative emotions remain unclear. Analysis of the associations and pathways linking health literacy and negative emotions may provide essential evidence for targeted nursing interventions. This study aimed to investigate the association between health literacy and negative emotions among hospitalized COPD patients, identify potential subgroup characteristics, and explore the mediating roles of social support and illness perception.

Methods

This study employed a cross-sectional design. From November 2024 to August 2025, COPD patients meeting the inclusion and exclusion criteria were recruited via convenience sampling from the respiratory medicine and geriatrics departments of a Grade A tertiary hospital in Shenzhen. Data were collected using questionnaires covering general information, health literacy, perceived social support, illness perception, and anxiety and depression. Descriptive statistics, latent class analysis, correlation analysis, and mediation analysis were conducted using Mplus 8.3, R 4.4.2, and the PROCESS macro 4.3.

Results

Health literacy among hospitalized COPD patients is heterogeneous in relation to negative emotions, with higher health literacy generally associated with lower levels of negative affect. Moreover, the protective effect of health literacy on negative emotions is partially mediated by improvements in social support and illness perception.

Conclusions

When addressing negative emotions in hospitalized COPD patients, healthcare professionals should prioritize social support and illness perception while enhancing health literacy. Strengthening patients' understanding and coping skills, along with emotional and informational support, may reduce anxiety and depression, improve outcomes, expedite discharge, and enhance quality of life.

Clinical trial number

Not applicable.

1. Introduction

Chronic obstructive pulmonary disease is a major contributor to disability and mortality worldwide. With accelerating global population aging and the continued prevalence of risk factors such as smoking and environmental pollution, the Global Burden of Disease study predicts that COPD related deaths and disability will continue to rise in the coming decades, representing a major global public health challenge [1-3]. China ranks among the countries with the highest COPD burden. Epidemiological surveys report a prevalence of 8.6% among Chinese adults aged ≥20 years, rising to 13.7% in those aged ≥40 years, with this proportion continuing to increase [4-5]. Characterized by recurrent exacerbations and progressive pulmonary dysfunction [6], COPD often necessitates hospital admissions, increasing bed demand and imposing substantial strain on healthcare systems. Comorbid negative emotions, such as anxiety and depression, have been shown to predict poor clinical outcomes in hospitalized COPD patients, potentially delaying discharge and further increasing healthcare resource use [7-9]. Consequently, international scholars emphasize the importance of addressing the mental health of hospitalized patients, which may improve treatment adherence and optimize clinical outcomes [10]. However, most existing research focuses on physiological factors, such as symptom burden, influencing patient emotions [11], with relatively little attention paid to patients' own capacities—particularly the role of health literacy in shaping psychological well-being.

2. Background

Previous studies have demonstrated that health literacy among COPD patients is closely associated with their self-management behaviors and quality of life [12–15]. Patients' psychological state is a key determinant of self-management behaviors and an important indicator of quality of life. This suggests that varying levels of health literacy among hospitalized COPD patients may contribute to differences in their negative emotions. However, current research has yet to provide definitive evidence on this issue. Specifically, there is no clear evidence confirming whether latent group heterogeneity exists between health literacy and negative emotions in this population, nor has the association between these factors and its underlying mechanisms been fully elucidated. Therefore, systematically investigating the heterogeneity, associations, key influencing factors, and underlying mechanisms linking health literacy and negative emotions in hospitalized COPD patients is essential. Such research may help identify potential patient subgroups, improve psychological well-being, optimize clinical outcomes, expedite discharge, and reduce healthcare resource utilization, thereby safeguarding patient health and alleviating the burden on healthcare systems.

Social support is commonly defined as "reliable individuals and the care, regard, and affection they convey" [16], representing interpersonal resources that patients can mobilize when facing life's challenges. It includes not only emotional and material assistance but also the routine exchange of information and knowledge from family, friends, or significant others [17–18]. Previous studies have reported a significant negative correlation between social support and negative emotions, establishing social support as a protective factor against anxiety and depression [19–21]. Patients with greater social support generally exhibit higher well-being and more positive psychological states, thereby mitigating negative perceptions of their illness [22–23]. Moreover, individuals with higher health literacy are better

able to seek information, assistance, and resources, facilitating more effective access to social support. Consequently, social support may influence both health literacy and negative emotions among hospitalized COPD patients, potentially mediating this relationship.

Disease perception refers to an individual's cognition, evaluation, and interpretation of their illness, encompassing perceptions of its severity, chronicity, controllability, and potential threat to personal health [24]. Patients with higher health literacy generally have stronger information acquisition and comprehension skills, enabling them to accurately identify disease-related risks, understand treatment plans, and make scientifically informed self-management decisions [25]. This comprehensive and proactive understanding of their illness helps patients form realistic expectations, mitigates negative perceptions of the disease, and alleviates adverse emotions such as anxiety and depression. Conversely, patients with lower health literacy may have limited comprehension of disease information, overreact to symptoms, or misunderstand treatment plans, thereby increasing the psychological burden of illness. Consequently, disease perception may influence both health literacy and negative emotions among hospitalized COPD patients, potentially serving as a mediating factor between these variables.

In summary, based on the relationships among health literacy, social support, disease perception, and negative emotions, we constructed a theoretical mediation model linking health literacy and negative emotions in hospitalized COPD patients (Fig. 1) and proposed the following hypotheses:

Hypotheses1

(c) Health literacy is negatively associated with negative emotions.

Hypotheses2

Ind 1:(a1b1) Social support mediates the relationship between health literacy and negative emotions.

Hypotheses3

Ind 2:(a2b2) Illness perception mediates the relationship between health literacy and negative emotions.

Hypotheses4

Ind 3:(a1a3b2) Social support and illness perception jointly exert a chain-mediated effect on the relationship between health literacy and negative emotions.

3. The study

3.1 Aims

The objectives of this study were to: (i) identify heterogeneous subgroups of health literacy and negative emotions among hospitalized COPD patients using latent profile analysis, and examine associated influencing factors; and (ii) analyze the pathways through which health literacy affects negative

emotions via mediation analysis, specifically investigating the potential mediating roles of social support and illness perception.

4. Methods

4.1 Design and sample

This study employed convenience sampling and was conducted between November 2024 and August 2025 in the Respiratory Medicine and Geriatrics Departments of a Grade A tertiary hospital in Shenzhen, targeting patients with chronic obstructive pulmonary disease. The inclusion criteria were: (i) meeting the COPD diagnostic criteria outlined in the Global Initiative for Chronic Obstructive Lung Disease guidelines [26]; (ii) age ≥ 18 years; (iii) providing informed consent and voluntarily participating in the study. The exclusion criteria were: (i) being in the acute phase of major systemic illness or critically ill with unstable vital signs requiring continuous monitoring; (ii) inability to cooperate with the investigation due to impaired consciousness, cognitive impairment, or other reasons; (iii) withdrawal from the study for any reason during the study period. Based on Kendall's sample size estimation method [27], which recommends 5–10 times the number of independent variables, this study included 17 independent variables. Accounting for a 20% attrition rate, the planned sample size ranged from 107 to 213. To ensure more stable mediation effects, a total of 400 COPD patients were ultimately enrolled.

4.2 Procedures

Prior to the survey, investigators completed a two-hour standardized training program. They subsequently established rapport with patients through nursing care and communication. After obtaining informed consent from patients and their families, the purpose of the survey and instructions for completing the questionnaire were explained using standardized language. Any questions arising during questionnaire completion were addressed consistently. All questionnaires were collected on-site and checked for missing responses to ensure data integrity.

4.3 Instruments

4.3.1 General Information Questionnaire

General demographic and clinical information was collected using a structured data extraction form based on hospital medical records, including gender, age, medical insurance type, marital status, employment status, place of residence, method of medical expense payment, educational attainment, average monthly household income, smoking status, and the presence of acute exacerbations.

4.3.2 All Aspects of Health Literacy Scale(AAHLS)

This study employed the Chinese version of the AAHLS developed by Wu Qing et al. [28], which is widely used to assess health literacy in clinical patients. The scale comprises three dimensions: ability to use written health information (4 items), ability to communicate with healthcare providers (3 items), and

ability to evaluate and apply health information (4 items), for a total of 11 items. Responses are rated on a three-point Likert scale, yielding a total score range of 11–33 points. The Cronbach's α for the total scale was 0.811 in previous studies and 0.816 in the present study.

4.3.3 Brief Illness Perception Questionnaire(BIPQ)

This study employed the BIPQ, adapted into Chinese by Mei Yaqi et al. [29] in 2015, to assess COPD patients' cognitive understanding and emotional experience of their condition. The questionnaire comprises three dimensions: cognition (5 items), emotion (2 items), and comprehension (1 item), for a total of 8 items. Each item is scored on a 0–10 scale, with items 3, 4, and 8 reverse-scored. Total scores range from 0 to 80, with higher scores indicating greater negative disease perception. The Cronbach's α for this scale in the present study was 0.804.

4.3.4 Perceived Social Support Scale(PSSS)

This study employed the PSSS, developed by Zimet et al. in 1988 and adapted into Chinese by Jiang Qianjin et al. [30–31], to assess social support among elderly patients with COPD. The scale comprises three dimensions—family support, friend support, and other support—with a total of 12 items. Each item is rated on a 1–7 scale, from "Strongly disagree" to "Strongly agree," yielding a total score of 12–84 points. The overall Cronbach's α for the scale is 0.93, indicating good reliability and validity; in the present study, Cronbach's α was 0.888.

4.3.5 Hospital Anxiety and Depression Scale(HADS)

This study employed the Chinese version of the HADS, originally developed by Zigmond et al. [32] and adapted into Chinese by Ye Weifei et al. [33], to assess negative emotional states among hospitalized patients. The scale comprises two subscales: Anxiety (HADS-A) and Depression (HADS-D), each containing seven items, for a total of 14 items. Items are scored from 0 to 3, with higher total scores indicating more severe anxiety and depressive symptoms. The Cronbach's α for the scale in the present study was 0.760.

4.4 Data analysis

In the latent class analysis, we used the three dimension scores of the Comprehensive Health Literacy Scale and the total score of the Hospital Anxiety and Depression Scale as manifest variables. After standardization, Mplus 8.3 was employed to construct latent class models, beginning with a single-class model and progressively increasing the number of classes. The model with the optimal fit indices was selected as the final solution. Model fit was evaluated using: (i) Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and sample-size adjusted BIC (aBIC), with lower values indicating better fit; (ii) the Lo-Mendell-Rubin Likelihood Ratio Test (LMRT) and Bootstrap Likelihood Ratio Test (BLRT), where $P < 0.05$ indicates that a k-class model fits significantly better than a k–1 class model; (iii) entropy, which assesses classification precision, with values closer to 1 indicating higher accuracy. An entropy ≥ 0.8 corresponds to classification accuracy exceeding 90%. Statistical analyses were performed using R software (version 4.4.2). Normally distributed quantitative data were presented as mean ±

standard deviation and compared using t-tests. Categorical data were expressed as counts and percentages, with comparisons conducted using chi-square tests. Multivariate logistic regression was used to examine factors influencing latent profile membership, with a significance level of α = 0.05.

In the mediation analysis, Pearson's correlation was used to examine relationships among health literacy, perceived social support, illness perception, and negative emotions. Multiple mediation effects of perceived social support and illness perception were tested using the PROCESS macro (version 4.3) for R, as described by Hayes (2022) [34]. Mediating effects were considered statistically significant if the bootstrap bias-corrected confidence interval did not include zero.

5. Results

5.1Latent Class Analysis of Health Literacy and Negative Emotions in Hospitalized COPD Patients

Detailed model fit information for different categories of health literacy and negative emotions among hospitalized COPD patients is presented in Tables 1 and 2. As the number of categories increased, AIC, BIC, and aBIC values progressively decreased. Entropy values for the 2-, 3-, and 5-category models were all ≥ 0.8, and BLRT values were statistically significant ($P < 0.05$). Although the three-category model showed optimal entropy, at least one category in the 3 to 5 class models had a probability below 10%, indicating insufficient sample size. Considering all fit indices and practical implications, a two-class latent model was selected for further analysis. Based on the four-dimensional score characteristics within this model, participants were classified as: Class 1 (Lower Health Literacy - High Negative Emotion), comprising 54.8% of the sample ($n = 219$), and Class 2 (Higher Health Literacy - Low Negative Emotion), comprising 45.2% of the sample ($n = 181$). Detailed information is shown in Fig. 2.

Table 1
Fit Indices for Latent Classes of Health Literacy and Negative Emotions in Hospitalized COPD Patients

Model	AIC	BIC	aBIC	Entropy	LMRT *P*	BLRT *P*	Class Proportion
1 Class	4552.60	4584.53	4559.15	—	—	—	100%
2 Class	4171.78	4223.67	4182.42	0.830	< 0.001	< 0.001	54.8% / 45.2%
3 Class	4079.03	4150.88	4093.76	0.876	< 0.001	< 0.001	50.8% / 45.2% / 4.0%
4 Class	4072.99	4164.79	4091.81	0.783	0.585	0.094	9.8% / 50.5% / 35.0% / 4.7%
5 Class	4046.94	4158.70	4069.85	0.815	0.169	< 0.001	41.0% / 10.0% / 19.5% / 25.5% / 4.0%

Table 2
Probability Matrix of Health Literacy Across Two Latent Classes of Negative Emotions

Classification of latent profiles	Probability of belonging to profiles(%)	
	1	2
1	0.952	0.048
2	0.053	0.947

Note: AAHLS 1–3 refer to the following dimensions of health literacy: 1, ability to use written health information; 2, ability to communicate with healthcare providers; and 3, ability to evaluate and apply health information.

Figure 2. **Distribution of Characteristics Across Latent Classes of Hospitalized COPD Patients (N = 400)**

5.2General Characteristics of Hospitalized COPD Patients and Univariate Analysis of Health Literacy Across Latent Classes of Negative Emotions

The results of univariate analyses for general characteristics and latent classes among 400 hospitalized COPD patients are presented in Tables 3 and 4. Significant differences were observed between the two classes in admission pathways, perceived social support scores, and illness perception scores ($P < 0.05$).

Table 3
General Characteristics of Hospitalized COPD Patients and Univariate Analysis of Health Literacy Across Latent Classes of Negative Emotions

Variable	Categories	Class 1 (*n* = 219)	Class 2 (*n* = 181)	Total (*N* = 400)	*P* value
Gender					0.836
	Male	183 (83.1)	149 (82.3)	331 (82.8)	
	Female	37 (16.9)	32 (17.7)	69 (17.2)	
Age					0.439
	<60 years	21 (9.6%)	20 (11.0%)	41 (10.2%)	
	60–69 years	50 (22.8%)	43 (23.8%)	93 (23.2%)	
	70–79 years	88 (40.2%)	81 (44.8%)	169 (42.2%)	
	≥ 80 years	60 (27.4%)	37 (20.4%)	97 (24.2%)	
Medical Insurance					0.647
	Local Insurance	74 (33.8%)	71 (39.2%)	145 (36.2%)	
	Non-local Insurance	48 (21.9%)	38 (21.0%)	86 (21.5%)	
	Cross-province Insurance	91 (41.6%)	69 (38.1%)	160 (40.0%)	
	Self-paid	6 (2.7%)	3 (1.7%)	9 (2.2%)	
Marital Status					0.161
	Married	180 (82.2%)	158 (87.3%)	338 (84.5%)	
	Unmarried/Divorced/Widowed	39 (17.8%)	23 (12.7%)	62 (15.5%)	
Employment Status					0.449
	Retired	108 (49.3%)	99 (54.7%)	207 (51.8%)	

Variable	Categories	Class 1 (*n* = 219)	Class 2 (*n* = 181)	Total (*N* = 400)	*P* value
	Employed	72 (32.9%)	57 (31.5%)	129 (32.2%)	
	Unemployed	39 (17.8%)	25 (13.8%)	64 (16.0%)	
Place of Residence					0.110
	Urban	199 (90.9%)	172 (95.0%)	371 (92.8%)	
	Rural	20 (9.1%)	9 (5.0%)	29 (7.2%)	
Education					0.493
	Primary school or below	74 (33.8%)	55 (30.4%)	129 (32.2%)	
	Junior high school	99 (45.2%)	86 (47.5%)	185 (46.2%)	
	Senior high school / Secondary technical school	10 (4.6%)	14 (7.7%)	24 (6.0%)	
	College degree or above	36 (16.4%)	26 (14.4%)	62 (15.5%)	
Monthly Household Income					0.172
	≤ 3000	74 (33.8%)	47 (26.0%)	121 (30.2%)	
	3001–6000	117 (53.4%)	113 (62.4%)	230 (57.5%)	
	≥ 6001	28 (12.8%)	21 (11.6%)	49 (12.2%)	
Smoking Status					0.099
	Non-smoker	46 (21.0%)	53 (29.3%)	99 (24.8%)	
	Smoker	58 (26.5%)	36 (19.9%)	94 (23.5%)	
	Former smoker	115 (52.5%)	92 (50.8%)	207 (51.8%)	
Admission Pathway					0.020

Variable	Categories	Class 1 (*n* = 219)	Class 2 (*n* = 181)	Total (*N* = 400)	*P* value
	Outpatient admission	110 (50.2%)	112 (61.9%)	222 (55.5%)	
	Emergency admission	109 (49.8%)	69 (38.1%)	178 (44.5%)	
Duration of COPD					0.240
	<5 years	83 (37.9%)	62 (34.3%)	145 (36.2%)	
	5–10 years	54 (24.7%)	56 (30.9%)	110 (27.5%)	
	10–15 years	53 (24.2%)	48 (26.5%)	101 (25.2%)	
	≥ 15 years	29 (13.2%)	15 (8.3%)	44 (11.0%)	
Annual Outpatient Visits					0.712
	≤ 6 times	111 (50.7%)	99 (54.7%)	210 (52.5%)	
	7–12 times	87 (39.7%)	67 (37.0%)	154 (38.5%)	
	≥ 13 times	21 (9.6%)	15 (8.3%)	36 (9.0%)	
Annual Hospitalisations					0.313
	1 times	111 (50.7%)	100 (55.2%)	211 (52.8%)	
	2 times	42 (19.2%)	39 (21.5%)	81 (20.2%)	
	3 times	20 (9.1%)	17 (9.4%)	37 (9.2%)	
	≥ 4 times	46 (21.0%)	25 (13.8%)	71 (17.8%)	
AECOPD					0.654
	Yes	68 (31.1%)	60 (33.1%)	128 (32.0%)	
	No	151 (68.9%)	121 (66.9%)	272 (68.0%)	

Variable	Categories	Class 1 (*n* = 219)	Class 2 (*n* = 181)	Total (*N* = 400)	*P* value
BIPQ					< 0.001
	Mean (SD)	50.67 (8.76)	45.83 (8.51)	48.48 (8.97)	
	Range	34.0 ~ 73.0	29.0 ~ 70.0	29.0 ~ 73.0	
PSSS					< 0.001
	Mean (SD)	50.97 (8.58)	55.74 (9.16)	53.13 (9.14)	
	Range	36.0 ~ 75.0	36.0 ~ 80.0	36.0 ~ 80.0	

Table 4
Scores of Health Literacy, Illness Perception, Social Support, and Negative Emotions in Hospitalized COPD Patients

Variable	Number of Items	Score Range	Total Score (Mean ± SD)	Item Mean Score (Mean ± SD)
AAHLS	11	11 ~ 33	20.33 ± 4.43	1.85 ± 0.40
Ability to use written health information	4	4 ~ 12	8.79 ± 1.99	2.20 ± 0.50
Ability to communicate with healthcare providers	3	3 ~ 9	5.21 ± 1.50	1.74 ± 0.50
Ability to evaluate and apply health information	4	4 ~ 12	6.30 ± 1.76	1.58 ± 0.44
HADS	14	0 ~ 42	11.76 ± 5.46	0.84 ± 0.39
Anxiety	7	0 ~ 21	5.95 ± 3.12	0.85 ± 0.45
Depression	7	0 ~ 21	5.82 ± 3.03	0.83 ± 0.43
PSSS	12	12 ~ 84	53.15 ± 9.12	4.43 ± 0.76
BIPQ	8	0 ~ 80	48.47 ± 8.99	6.06 ± 1.12

5.3Logistic Regression Analysis of Health Literacy Across Latent Classes of Negative Emotions in Hospitalized COPD Patients

Using latent classes of health literacy and negative emotions among hospitalized COPD patients as the dependent variable, Class 1 (lower health literacy–high negative emotions) was designated as the

reference group. Variables showing statistically significant differences in univariate analyses were included as independent variables in a logistic regression model. The analysis indicated that, compared with the lower health literacy–high negative emotions group, patients admitted via outpatient pathways were more likely to be classified into the higher health literacy–low negative emotions group. Patients with higher negative illness perceptions were more likely to be assigned to the lower health literacy–high negative emotions group. Additionally, higher perceived social support scores were associated with increased probability of classification into the higher health literacy–low negative emotions group. Detailed information is shown in Table 5.

Table 5
Logistic Regression Analysis of Health Literacy Across Latent Classes of Negative Emotions

Variable	**Estimate**	**SE**	***OR* (95% *CI*)**	***P* value**
(Intercept)	0.043	1.106	1.044 (0.119 ~ 9.121)	0.969
Admission pathway	-0.432	0.215	0.649 (0.428 ~ 0.985)	0.044
BIPQ	-0.048	0.013	0.954 (0.930 ~ 0.978)	< 0.001
PSSS	0.042	0.013	1.043 (1.017 ~ 1.071)	0.001
Note: In the logistic regression model, Class 1 served as the reference group, and “outpatient admission” was used as the reference category for the admission pathway.				

5.4Correlation Analysis of Health Literacy, Social Support, Illness Perception, and Negative Emotions in Hospitalized COPD Patients

Pearson correlation analysis indicated significant associations among health literacy, perceived social support, illness perception, and negative emotions in hospitalized COPD patients (all $P < 0.001$), as detailed in Fig. 3.

Note: All $P < 0.001$

Figure 3. **Correlation between Health Literacy, Social Support, Illness Perception, and Negative Emotions**

5.5Multiple Mediating Effects Analysis of Social Support and Illness Perception on the Relationship Between Health Literacy and Negative Emotions in Hospitalised COPD Patients

Bootstrap mediation analysis was conducted using the PROCESS macro in R with 5000 iterations. Health literacy was specified as the independent variable, negative emotions as the dependent variable, and social support and illness perception as mediators. Path coefficients for all models are presented in Table 6. Variance inflation factor (VIF) tests indicated no severe multicollinearity, with all values below 2 (AAHLS = 1.149, PSSS = 1.246, BIPQ = 1.280; threshold for concern: VIF > 5).

The overall effect of health literacy on negative emotions was significant, as indicated by a bootstrap 95% confidence interval (CI) that did not include zero, suggesting that higher health literacy alleviates negative emotions among hospitalized COPD patients. The indirect effects of both social support and illness perception were also significant (bootstrap 95% CI excluded zero), indicating multiple mediating pathways. Specifically, higher health literacy reduces negative emotions by enhancing social support and by improving illness perception. The contributions of the three indirect pathways to the total effect were 17.77%, 17.70%, and 7.89%, respectively, with the total indirect effect accounting for 43.36% of the total effect.

Table 6
Analysis of the Multiple Mediating Effects of Social Support and Illness Perception on the Relationship Between Health Literacy and Negative Emotions

Path	Std. Effect	Boot SE	Boot LLCI	Boot ULCI	Effect (%)
Total Effect	−0.283	0.048	−0.374	−0.191	100%
Direct Effect	−0.160	0.048	−0.256	−0.064	56.64%
Indirect Effect					
Total	−0.123	0.025	−0.173	−0.076	43.36%
Ind 1: AAHLS→PSSS→HADS	−0.050	0.021	−0.096	−0.015	17.77%
Ind 2: AAHLS→BIPQ→HADS	−0.050	0.016	−0.083	−0.021	17.70%
Ind 3: AAHLS→PSSS→BIPQ→HADS	−0.022	0.007	−0.038	−0.009	7.89%

6. Discussion

6.1 Current Status of Health Literacy Among Hospitalised COPD Patients and Its Association with Negative Emotions

The overall health literacy of hospitalized COPD patients in this study was moderately low (20.33 ± 4.43), consistent with previous findings [35]. This underscores the challenges faced by this population in understanding, communicating, self-assessing, and accessing and applying health information. Latent class analysis further revealed substantial heterogeneity between health literacy and negative emotions, classifying patients into ‘low health literacy–high negative emotions’ and ‘higher health literacy–low negative emotions’ groups. Correlation analysis indicated a significant negative association between health literacy and negative emotions (r = − 0.25), supporting prior research showing that poor health literacy in COPD patients reduces treatment adherence and quality of life [36]. Negative emotions such as anxiety and depression are key contributors to treatment non-adherence and important indicators for assessing quality of life [37–38]. These findings highlight the importance of enhancing health literacy in hospitalized COPD patients to improve clinical outcomes and facilitate successful discharge. Healthcare

professionals should strengthen targeted health education and improve its quality during hospitalization. Evidence from a randomized controlled trial demonstrated that individualized health literacy follow-up interventions delivered by systematically trained COPD specialist nurses significantly reduced hospital readmissions while improving patients' quality of life and self-care abilities [39]. Moreover, with the rapid advancement of media and digital technologies, self-directed learning via short-video platforms and AI tools may offer an effective approach to enhancing health literacy in this patient population.

6.2 The Association Between Social Support, Perceived Illness, Health Literacy and Negative Emotions

The findings of this study indicate that social support among hospitalized COPD patients is positively associated with health literacy ($r = 0.25$) and negatively associated with negative emotions ($r = -0.27$). Conversely, adverse illness perceptions are negatively correlated with health literacy ($r = -0.32$) and positively correlated with negative emotions ($r = 0.34$). Patients with higher health literacy generally exhibit stronger self-management abilities and self-efficacy, enabling them to access, comprehend, and apply health-related information more effectively, as well as to seek external support through proactive communication and assistance-seeking [40]. Such positive cognitive and behavioral patterns may partially buffer psychological stress arising from negative disease perceptions during hospitalization, thereby alleviating negative emotions. Existing research emphasizes that enhancing health literacy should be a core component of health education, patient management, and health promotion strategies. Achieving this requires coordinated efforts not only within the healthcare system but also across the broader social ecosystem, including families, communities, media, and policy-level initiatives [41]. Through the combined engagement of multiple stakeholders, patient health literacy can be more effectively improved, ultimately benefiting long-term health outcomes.

6.3 The mediating role of social support and illness perception in the relationship between health literacy and negative emotions among hospitalised COPD patients

This study found that social support and illness perception independently mediate the effect of health literacy on negative emotions in hospitalized COPD patients. In addition, social support can exert a chain-mediated effect by influencing illness perception, collectively forming a critical psychological pathway linking health literacy to negative emotions. The Integrated Model of Health Literacy (IMHL) provides a valuable theoretical framework for these findings, suggesting that an individual's health literacy not only directly affects their ability to access and comprehend health information, but may also indirectly influence mental health by shaping the utilization of social resources and illness cognition [42].Hospitalized COPD patients with higher health literacy typically demonstrate greater competence in understanding written health information, communicating with healthcare providers, and self-assessing their health. They are more able to articulate their needs clearly, increasing the likelihood of receiving social support from medical staff, family members, and peers. Such patients also tend to exhibit more positive illness perceptions and lower perceived illness threat, recognising the benefits of disease management and demonstrating greater autonomy and sense of control. Access to social support

further mitigates negative illness perceptions, and the synergistic effects of these mechanisms collectively reduce the likelihood of negative emotions, such as anxiety and depression, during hospitalization and post-discharge.Consequently, social support and illness perception represent critical targets for intervention. Future strategies should focus on strengthening patients' social support networks and implementing measures to mitigate negative illness perceptions, thereby enhancing mental health and quality of life. Healthcare professionals are advised to provide targeted health education and psychological support during hospitalization, while integrating family and community resources to optimise intervention outcomes.

7. Limitations and research recommendations

This study innovatively employed latent class analysis to examine the association between health literacy and negative emotions in hospitalized COPD patients. Mediation analysis was further conducted to elucidate the mechanisms through which health literacy influences negative emotions, identifying multiple mediating pathways involving social support and illness perception.Several limitations should be acknowledged. First, as a cross-sectional study, causal relationships among health literacy, social support, illness perception, and negative emotions cannot be established. Future research employing longitudinal designs could validate and extend these findings. Intervention studies may further explore effective strategies to alleviate negative emotions by enhancing social support and illness perception, providing actionable guidance for healthcare professionals. Second, due to limitations in funding and resources, convenience sampling was employed, which may have affected the representativeness of the sample. Caution is warranted when generalizing these findings to broader COPD populations. Finally, all data were collected via self-reported questionnaires, which may be subject to social desirability bias. Future studies should incorporate multi-source data or qualitative interviews to improve data reliability and strengthen the robustness of conclusions.

8. Conclusion

The primary finding of this study is that health literacy among hospitalized COPD patients exhibits heterogeneity with negative emotions, with higher health literacy generally associated with lower levels of negative emotions. Moreover, the protective effect of health literacy on negative emotions is partially mediated by social support and illness perception, with the indirect effect accounting for over 40% of the total effect. These findings provide both theoretical and empirical support for healthcare professionals to develop and optimize intervention strategies targeting negative emotions in hospitalized COPD patients, with the potential to improve clinical outcomes, expedite discharge, and conserve healthcare resources.

Abbreviations

COPD: **Chronic obstructive pulmonary disease**

Declarations

Data availability

The raw data supporting the conclusions of this article will be made available by the corresponding author upon reasonable request.

Abbreviations

COPD: **Chronic obstructive pulmonary disease**

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Contributions

YP designed the study. YP, SL and SZ collected the data. YY and YL analyzed the data and drafted the manuscript. YP revised the manuscript. All authors read and approved the final manuscript.

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Ethics declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Shenzhen People's Hospital (LL-KY-2025254-01), and all procedures were conducted in accordance with relevant guidelines and regulations. We declare that the research was performed in accordance with relevant regulations and conformed to the provisions of the Declaration of Helsinki.All participants provided written informed consent after being fully informed of the study's purpose and procedures. Participants' rights were fully respected, and they were allowed to withdraw from the study at any time without providing a reason.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Figures

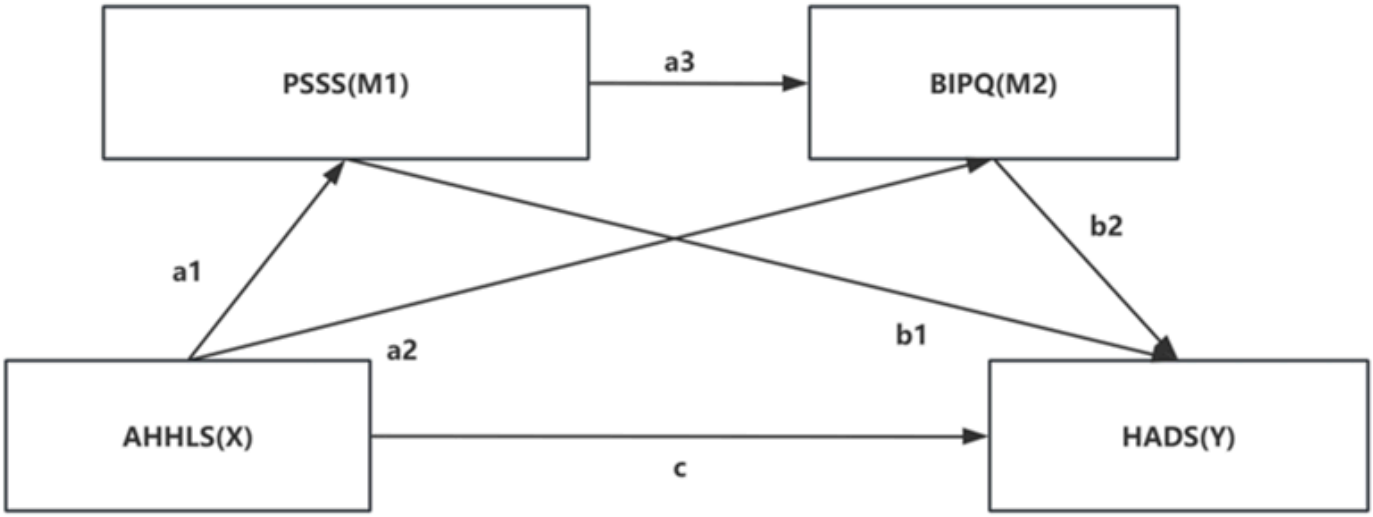


Figure 1

Mediating Effects of Social Support and Illness Perception on the Relationship Between Health Literacy and Negative Emotions in Hospitalized COPD Patients

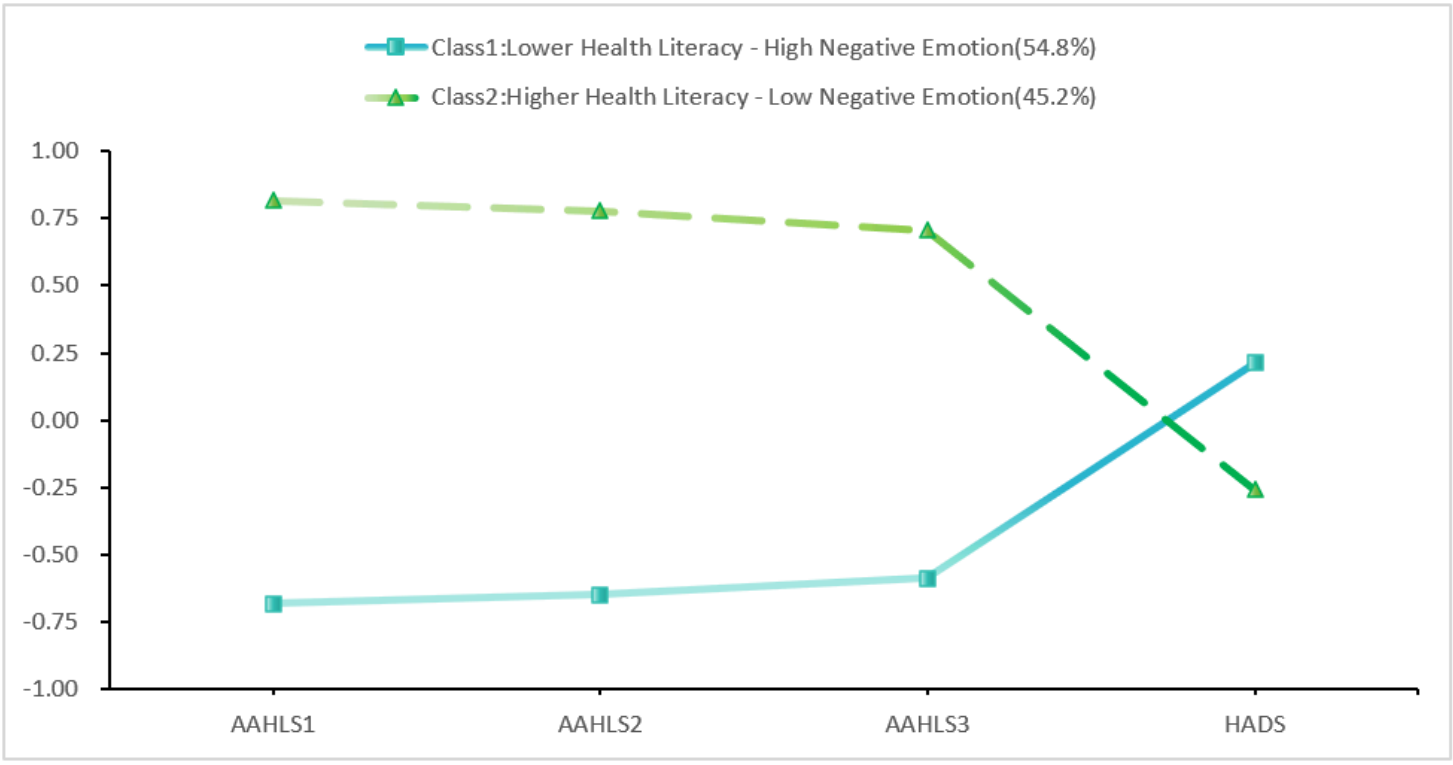


Figure 2

Distribution of Characteristics Across Latent Classes of Hospitalized COPD Patients (*N* = 400)

Note: AAHLS 1–3 refer to the following dimensions of health literacy: 1, ability to use written health information; 2, ability to communicate with healthcare providers; and 3, ability to evaluate and apply

health information.

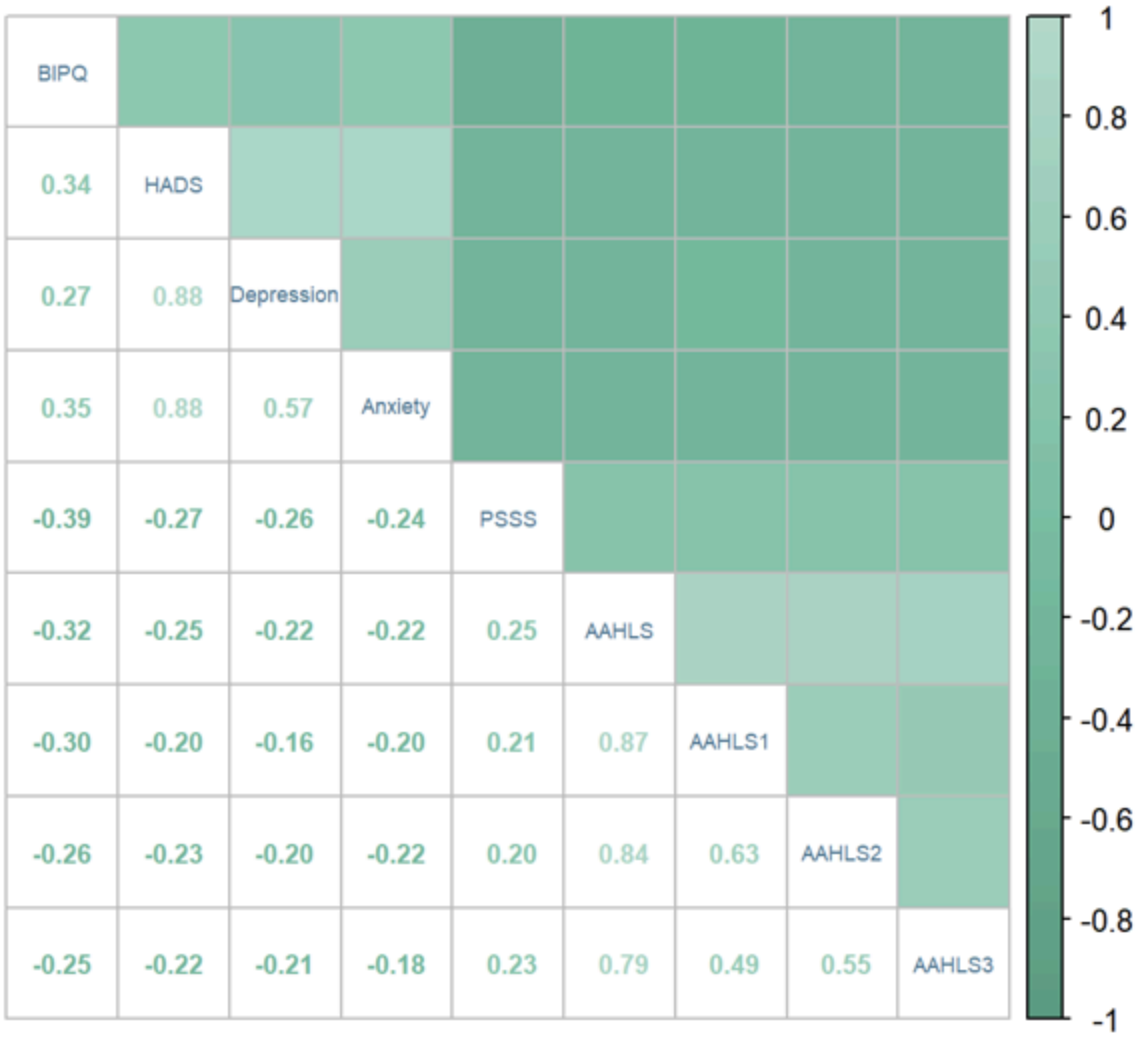


Figure 3

Correlation between Health Literacy, Social Support, Illness Perception, and Negative Emotions

Note: All $P < 0.001$