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Mediating Effect of Perceived Health Competence on the Association Between Mindfulness and Adherence to Health Behaviors in Patients with Acute Coronary Syndrome: A Cross-Sectional Study

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Purpose: Given the importance of adherence to health behaviors in patients with acute coronary syndrome (ACS) and the potential influence of mindfulness, it is important to determine the association between mindfulness and adherence to health behaviors and its potential mechanisms in this population. Perceived health competence is a person's confidence in his/her ability to achieve health goals successfully and may explain how mindfulness influences adherence to health behaviors. This study aimed to examine the association between mindfulness and adherence to health behaviors and whether this association was mediated by perceived health competence.

Methods: A cross-sectional study (N = 555) was conducted at the First Affiliated Hospital of Soochow University from September 2022 to January 2024. Patients' sociodemographic and clinical data, mindfulness (Mindful Attention Awareness Scale [MAAS]), and perceived health competence (Perceived Health Competence Scale [PHCS]) were assessed one-two days before discharge, and adherence to health behaviors (Medical Outcomes Study Specific Adherence Scale [MOSSAS]) was assessed one month after discharge. Good adherence to health behaviors was defined as achieving a cumulative score of ≥ 80%. A mediating effect model was used to analyze data.

Results: The mean score of adherence to health behaviors was 42.58 ± 7.13 and only 27.39% (152/555) of the patients had good adherence. Mindfulness positively predicted adherence to health behaviors ($\beta = 0.13$, $P < 0.01$). Perceived health competence partially mediated the association between mindfulness and adherence to health behaviors, with the mediating effect accounting for 7.00% of the total effect ($P = 0.03$).

Conclusion: The adherence to health behaviors in patients with ACS was very low. Mindfulness positively predicted adherence to health behaviors, and perceived health competence partially mediated the association between mindfulness and adherence to health behaviors. Healthcare providers could intervene patients' mindfulness or perceived health competence to improve adherence to health behaviors.

Keywords: adherence to health behaviors, mindfulness, perceived health competence, mediating effect

Introduction

Globally, approximately more than seven million people are diagnosed with acute coronary syndrome (ACS) each year,[1] nearly one million people die from ACS each year,[2] and the 30-day readmission rate after hospitalization is 15–20%.[3] Modifiable behavioral risk factors precede both initial ACS as well as the increase of risk for major adverse cardiovascular events (MACEs).[4,5] Therefore, after an ACS, patients are instructed to follow health behaviors across multiple domains, including smoking cessation, exercise, adherence to medication, healthy diet, and maintaining mental health,[6]

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which have been proven to be associated with a lower risk of MACEs.[7–10] Unfortunately, most patients' adherence to health behaviors is poor. A systematic review and meta-analysis reported only a 45% pooled rate of smoking cessation in patients with ACS.[11] A cross-sectional study in Korea reported that only 60% of patients with ACS were adherent to five or more among the six health behaviors including low-salt intake, low-fat diet and/or weight-loss diet, regular exercise, stress reduction in daily life, drinking in moderation, and smoking cessation.[12] A multicenter cross-sectional study in Europe showed that 66% of patients with coronary artery disease were physically inactive, being less than 30 min 5 times/week.[13] A scoping review including 58 studies reported moderate to low adherence to medical therapy, and nearly 30% of patients discontinued one or more medications within 90 days after their primary occurrence of ACS, and the non-adherence rate increased to 40% to 50% at one year postdischarge.[14] Therefore, it's important to identify the factors that influence adherence to health behaviors in patients with ACS to develop and implement corresponding intervention measures.

The World Health Organization classifies the influencing factors of adherence to health behaviors into five dimensions, namely patient-related, medication-related, condition-related, healthcare system/healthcare provider-related, and socioeconomic factors, of which the most concerning are patient-related factors, including sociological characteristics and psychological factors.[15] As an important adjustable psychological trait, mindfulness is increasingly attracting people's attention. Mindfulness is a state in which an individual purposefully and consciously focuses on his/her experience or feelings about internal and external stimuli without judgment.[16] Individuals with high levels of mindfulness report more positive psychological profiles, including better life satisfaction, self-esteem and acceptance, self-compassion, and positive affect, which have a powerful impact on health behaviors.[17] Widely known, psychological distress, such as depression and anxiety, is highly prevalent in patients with ACS and is associated with poor health behaviors and poor treatment adherence.[18] Mindfulness-based interventions have been proven to effectively promote psychological health, thereby promoting adherence to health behaviors. For example, the study by Zou et al[19] has shown that mindfulness interventions can improve anxiety, depression, and dietary behavior and physical activity levels in patients with ACS. Therefore, we proposed hypothesis 1: mindfulness is positively associated with adherence to health behaviors in patients with ACS.

In the mindful self-regulation model, mindfulness can lead to a change in health behaviors through self-efficacy,[20] which is an individual's belief in his or her ability to succeed in specific situations or accomplish a task.[21] Studies found that mindfulness was positively correlated with general self-efficacy,[22] and also independently predicted self-efficacy for a specific behavior.[23] Perceived health competence is a patient's belief in his or her ability to achieve health-related goals,[24] which is a specific kind of health-domain self-efficacy. A study found that perceived health competence was associated with positive health behaviors, including more exercise, decreased smoking and alcohol consumption, better medication adherence, more resilient coping, and a healthier diet, and could predict better health-related quality of life after discharge in patients with cardiovascular disease.[25] Increasing the level of mindfulness may improve an individual's perceived health competence, namely self-perceptions of the ability to manage one's health,[22,23] and thereby increase the adherence to health behaviors.[25] Therefore, we proposed the hypothesis 2: perceived health competence could mediate the association between mindfulness and adherence to health behaviors in patients with ACS.

To our knowledge, there have been no studies on the association between adherence to health behaviors, mindfulness, and perceived health competence in patients with ACS. This study filled this knowledge gap. The purpose of this study was to examine the association between mindfulness and adherence to health behaviors and whether this association was mediated by perceived health competence in patients with ACS. This line of inquiry could potentially identify a new intervention target for improving adherence to health behaviors in patients with ACS.

Materials and Methods

Design

This study was a cross-sectional study that complied with the Declaration of Helsinki and was approved by the Ethics Committee of Soochow University (SUDA20220922H02).

Participants

This study was conducted at the First Affiliated Hospital of Soochow University from September 2022 to January 2024. Inpatients with ACS, including acute myocardial infarction (AMI) and unstable angina (UA), aged ≥ 18 years old, with elementary school education or above and basic ability of language communication and comprehension, and who volunteered to participate in this study were recruited. Patients with severe comorbidities (eg, tumors, vital organ failure), dementia, Parkinson's disease, schizophrenia, bipolar affective disorder, alcohol or other substance dependence, or a history of mental illness were excluded.

Data Measurement

Participants' Characteristics

Patients' sociodemographic and clinical data were collected using a self-developed general information questionnaire. Sociodemographic data included gender, age, marital status, education levels, economic pressure, occupational status, living status, medical payment methods, and current smoking and drinking status. Clinical data included types, duration, history, and family history of ACS, history of heart failure and revascularization, comorbidities (diabetes, hypertension, hypercholesterolemia), and number of medications taken. Economic pressure was self-reported by patients on five levels: no, a little large, generally large, relatively large, and very large.

Adherence to Health Behaviors

Medical Outcomes Study Specific Adherence Scale (MOSSAS) was used to assess adherence to 9 health behaviors, including exercise, controlling drinking, smoking cessation, following a low-salt diet, following a low-fat and low-cholesterol diet, carrying medical supplies needed for self-care (eg, nitroglycerine) when out and about, taking medications as prescribed, reducing stress, and participating in social activities. Patients with comorbid diabetes also need to be assessed for adherence to the following 3 health behaviors: monitoring blood sugar levels, checking feet for injuries, and carrying sugary treats when out and about. In a previous study, the Cronbach's α coefficient of MOSSAS was 0.78.[26] The scale was used to assess the frequency of patients' participation in health behaviors in the last month on a 6-point Likert scale (0 "none of the time" to 5 "all of the time"). The clinically based cut point of 80% had a reasonable balance between sensitivity and specificity and had been used to define "good" adherence to medications in medication adherence studies.[27] Therefore, in this study, good adherence was defined as achieving a cumulative score of ≥ 80%, regardless of the score on individual questions. For patients without comorbid diabetes, a MOSSAS score of ≥ 36 (36/45 points derived from 9 questions having answer choices ranging from 0 to 5) was considered to have good adherence to health behaviors. For patients with comorbid diabetes, a MOSSAS score of ≥ 48 (48/60 points derived from 12 questions having answer choices ranging from 0 to 5) was considered to have good adherence to health behaviors.

Perceived Health Competence

Perceived Health Competence Scale (PHCS) was used to assess perceived health competence. PHCS was developed and verified by Smith in 1995[24] and was translated into Chinese version by Liu et al.[28] PHCS includes 8 items on a 5-point Likert scale (1 "strongly disagree" to 5 "strongly agree"). The total score ranged from 8 to 40, with a higher score indicating a higher level of patients' perceived ability to manage their health effectively. The Cronbach's α coefficient of the original scale was 0.82–0.90.[24] The total Cronbach's α coefficient of the Chinese version scale was 0.802.[28]

Mindfulness

Mindful Attention Awareness Scale (MAAS) was used to assess mindfulness. MAAS was developed by Brown and Ryan in 2003.[16] MAAS only includes one dimension, 15 items, scored on a 6-point Likert scale (1 "almost always" to 6 "almost never"). The original scale has good reliability and validity, with a Cronbach's α coefficient of 0.89.[16] MAAS was translated into Chinese version and validated by Chen et al in 2012, with a Cronbach's α coefficient of 0.89.[29] The total score ranges from 15 to 90 and is divided into 3 levels: low mindfulness level (≤ 40), middle mindfulness level (41–65), and high mindfulness level (≥ 66).[29,30]

Disease-Related Knowledge

Coronary Artery Disease Education Questionnaire-Short Version (CADE-Q SV) was used to assess patients' disease-related knowledge. Ghisi et al developed CADE-Q SV in 2016, with Cronbach's α coefficients > 0.7 for each dimension of the original scale, with good reliability and validity.[31] The Chinese version of the CADE-Q SV was translated and validated by Yang,[32] including 5 dimensions: medical condition, risk factors, exercise, nutrition, and psychosocial risk. Each dimension has 4 questions. Patients answer only true/false/I do not know, with one point for correct answers, no points for wrong answers or the response "I do not know". The total score ranges from 0 to 20, with a higher score indicating more knowledge the patient has about the disease. The total Cronbach's α coefficient of CADE-Q SV was 0.856, with the Cronbach's α coefficients of the five dimensions being 0.747–0.817.[32] Disease-related knowledge was used to adjust as a potential confounder of adherence to health behaviors.

Data Collection

One-two days before discharge, patients' sociodemographic and clinical data, and levels of mindfulness, perceived health competence, and disease-related knowledge were collected by researchers, who had undergone unified professional training. The researchers identified hospitalized patients in the healthcare system who met the inclusion criteria. Subsequently, the researchers conducted a brief face-to-face communication with them to explain the purpose of the study and invite them to join the study. If they agree to participate in this study, they would be invited to fill out an informed consent form and complete the general information questionnaire, MAAS, PHCS, and CADE-Q SV. Besides, the researchers would also retain the patients' contact information with their informed consent, such as phone numbers and WeChat. Patients' adherence to health behaviors was assessed by MOSSAS one month after discharge. The researchers contacted patients by phone or WeChat and asked them to recall the frequency of their participation in the above health behaviors over the past month.

Sample Size

The sample size for structural equation modeling should be more than 15 times the number of variables.[33] This study contained 23 variables. Therefore, the required sample size was 345. Given a 20% attrition rate, the required sample size was at least 414.

Data Analysis

Data were analyzed using SPSS 26.0 and AMOS 24.0. Counting variables were presented as numbers and percentages. Continuous variables were presented as mean ± standard deviation if they were distributed normally, or otherwise, as median and inter-quartile range. The univariate analyses of the influencing factors of adherence to health behaviors were conducted using a *t*-test, analysis of variance (ANOVA), or Pearson's correlation analysis. Pearson's correlation analysis was used to test the correlations between adherence to health behaviors and age, number of medications taken, disease-related knowledge, and perceived health competence. *t*-test and ANOVA were used to compare the differences in adherence to health behaviors between participants with other different sociodemographic and clinical characteristics. Spearman rank correlation analysis was used to test the correlations between different mindfulness levels and adherence to health behaviors and perceived health competence. A multiple linear regression model was constructed to determine predictors of adherence to health behaviors, with the statistically significant variables in the above univariate analyses as independent variables. A mediating effect model was constructed to determine the mediating effects of perceived health competence on the association between mindfulness and adherence to health behaviors. Statistical significance was defined as $P < 0.05$. Bootstrap method was used to test the mediating effect and the sample size was set at 1000. To facilitate data analysis, the scores of adherence to health behaviors for patients without comorbid diabetes were converted according to the following formula: X' = X / 45 * 60.

Results

At baseline, a total of 571 patients were collected and 571 questionnaires were distributed, with a 100% return and validity rate of the questionnaires. One month after discharge, 16 patients were lost to follow-up, one of whom passed away, and another 15 were lost to contact. Finally, the 16 participants were excluded. Data from 555 patients were included in the analysis.

The Sociodemographic and Clinical Characteristics, Disease-Related Knowledge, Mindfulness, Perceived Health Competence, and Adherence to Health Behaviors Among Patients with ACS

The sociodemographic and clinical characteristics of the 555 patients with ACS are shown in Table 1. Patients' mean age was 59.71 ± 13.23 years old, with males accounting for 83.2%. Patients' mean MOSSAS score was 42.58 ± 7.13. Only 27.4% (152/555) of the patients had good adherence to health behaviors. There were significant differences in MOSSAS scores between genders, education levels, economic pressure levels, medical payment methods, smoking status, types of ACS, and diabetes status ($P < 0.05$). Disease-related knowledge was positively correlated with

Table 1 Participants' Characteristics, Perceived Health Competence, Mindfulness, Disease Knowledge, and Adherence to Health Behaviors (N = 555)

			MOSSAS score	t/F/r/r_s	*P*
Gender				−2.99	< 0.01
	Male	462 (83.2%)	42.18 ± 7.03		
	Female	93 (16.8%)	44.58 ± 7.34		
Age (year)		59.71 ± 13.23	42.58 ± 7.13	−0.03	0.44
Marital status				1.14	0.32
	Married	505 (91.0%)	42.51 ± 7.24		
	Unmarried	11 (2.0%)	45.79 ± 6.39		
	Other (separated, divorced, widowed)	39 (7.0%)	42.56 ± 5.58		
Education levels				4.15	< 0.01
	Primary school	143 (25.8%)	40.73 ± 6.96		
	Junior high school	197 (35.5%)	42.70 ± 7.19		
	Senior high school/technical secondary school	119 (21.4%)	43.26 ± 6.77		
	Bachelor's degree/ junior college's degree	93 (16.8%)	44.30 ± 7.07		
	Master's degree and above	3 (0.5%)	42.56 ± 12.4		
Economic pressure				2.48	0.04
	No	168 (30.3%)	43.74 ± 7.43		
	A little large	161 (29.0%)	42.38 ± 7.06		
	Generally large	79 (14.2%)	42.19 ± 6.33		
	Relatively large	95 (17.1%)	42.40 ± 6.98		
	Very large	52 (9.4%)	40.38 ± 7.35		
Occupation status				2.43	0.09
	Employed	261 (47.0%)	42.51 ± 7.16		
	Unemployed	16 (2.9%)	38.85 ± 8.27		
	Retired	278 (50.1%)	42.86 ± 7.00		
Living status				1.15	0.25
	Living alone	48 (8.7%)	43.71 ± 6.51		
	Living with others	507 (91.4%)	42.47 ± 7.18		
Medical payment methods				2.23	0.03
	Self-payment	66 (11.9%)	44.41 ± 6.08		
	Medical insurance	489 (88.1%)	42.33 ± 7.23		

(*Continued*)

Table 1 (Continued).

			MOSSAS score	t/F/r/r_s	*P*
Smoking				3.02	< 0.01
	No	269 (48.5%)	43.52 ± 7.27		
	Yes	286 (51.5%)	41.70 ± 6.89		
Drinking				1.50	0.13
	No	344 (62.0%)	42.94 ± 6.87		
	Yes	211 (38.0%)	42.00 ± 7.52		
Type of ACS				7.59	< 0.01
	STEMI	242 (43.6%)	41.79 ± 7.13		
	NSTEMI	217 (39.1%)	42.36 ± 6.93		
	UA	96 (17.3%)	45.06 ± 7.08		
Duration of ACS				0.05	0.95
	≤ 6 months	457 (82.3%)	42.62 ± 6.90		
	6 months - 5 years	57 (10.3%)	42.40 ± 7.85		
	> 5 years	41 (7.4%)	42.34 ± 8.62		
History of ACS				−0.68	0.50
	No	458 (82.5%)	42.48 ± 6.89		
	Yes	97 (17.5%)	43.02 ± 8.17		
Family history of ACS				−1.93	0.05
	No	440 (79.3%)	42.28 ± 6.98		
	Yes	115 (20.7%)	43.72 ± 7.58		
History of heart failure				−0.07	0.95
	No	550 (99.1%)	42.58 ± 7.14		
	Yes	5 (0.9%)	42.80 ± 5.97		
History of revascularization				0.09	0.93
	No	488 (87.9%)	42.59 ± 7.07		
	Yes	67 (12.1%)	42.51 ± 7.59		
Diabetes				43.17	< 0.001
	No	377 (67.9%)	44.37 ± 6.70		
	Yes, but without complications	171 (30.8%)	38.71 ± 6.43		
	Yes, with end-organ damage	7 (1.3%)	40.29 ± 8.58		
Hypertension				0.96	0.34
	No	201 (36.2%)	42.97 ± 6.83		
	Yes	354 (63.8%)	42.36 ± 7.29		
Hypercholesterolemia				0.57	0.57
	No	431 (77.7%)	42.67 ± 7.14		
	Yes	124 (22.3%)	42.26 ± 7.11		
Number of medications taken		2.28 ± 2.35	42.58 ± 7.13	−0.10	0.02
CADE-Q SV score		12.72 ± 4.34	42.58 ± 7.13	0.16	< 0.001
PHCS score		25.33 ± 4.56	42.58 ± 7.13	0.14	< 0.01
MAAS score				0.14	< 0.01
	Middle level	208 (37.5%)	41.32 ± 6.93		
	High level	347 (62.5%)	43.34 ± 7.15		

Notes: Low mindfulness level: Mindful Attention Awareness Scale score ≤ 40; Middle mindfulness level: Mindful Attention Awareness Scale score of 41–65; High mindfulness level: Mindful Attention Awareness Scale score ≥ 66.

Abbreviations: MOSSAS, Medical Outcomes Study Specific Adherence Scale; STEMI, ST elevation myocardial infarction; NSTEMI, Non-ST elevation myocardial infarction; UA, unstable angina; ACS, acute coronary syndrome; CADE-Q, Coronary Artery Disease Education Questionnaire-Short Version; PHCS, Perceived Health Competence Scale; MAAS, Mindful Attention Awareness Scale.

adherence to health behaviors ($P < 0.001$). Number of medications taken was negatively correlated with adherence to health behaviors ($P = 0.02$). Patients' perceived health competence and mindfulness scores were 25.33 ± 4.56 and 68.62 ± 9.09 respectively. 208 (37.5%) patients had a middle level of mindfulness and 347 (62.5%) had a high level.

Correlations Between Adherence to Health Behaviors, Perceived Health Competence, and Mindfulness Among Patients with ACS

Patients' mindfulness was divided into middle and high levels with the scores being 59.05 ± 4.23 and 74.36 ± 5.77, respectively. Perceived health competence (r = 0.14, $P < 0.01$) (Table 1) and mindfulness ($r_s = 0.14$, $P < 0.01$) (Table 1) were positively correlated with adherence to health behaviors. Perceived health competence was positively correlated with mindfulness ($r_s = 0.10$, $P = 0.02$) (Table 2).

The results of the multivariate linear regression showed that perceived health competence (β = 0.12, $P < 0.01$) and mindfulness (β = 0.12, $P < 0.01$) were independent predictors of adherence to health behaviors, with gender, education levels, medical payment methods, type of ACS, diabetes, and disease-related knowledge adjusted as confounding factors (Table 3).

The Mediating Effect of Perceived Health Competence on the Association Between Mindfulness and Adherence to Health Behaviors Among Patients with ACS

As shown in Table 4 and Table 5, mindfulness positively predicted perceived health competence (β = 0.10, $P = 0.02$) and adherence to health behaviors (β = 0.13, $P < 0.01$), and perceived health competence positively predicted adherence to

Table 2 Spearman Rank Correlation Analysis of Perceived Health Competence and Different Mindfulness Levels (N = 555)

		PHCS Score	r_s	*P*
MAAS score			0.10	0.02
Middle level	208 (37.5%)	24.76 ± 4.36		
High level	347 (62.5%)	25.66 ± 4.66		

Notes: Low mindfulness level: Mindful Attention Awareness Scale score ≤ 40; Middle mindfulness level: Mindful Attention Awareness Scale score of 41–65; High mindfulness level: Mindful Attention Awareness Scale score ≥ 66.
Abbreviations: PHCS, Perceived Health Competence Scale; MAAS, Mindful Attention Awareness Scale.

Table 3 Multivariate Linear Regression Analysis of Influencing Factors of Adherence to Health Behaviors (N = 555)

	B	SE	β	t	*P*	95% CI of B	
						Lower	Upper
Gender	1.95	0.81	0.10	2.39	0.02	0.35	3.55
Education levels	1.07	0.28	0.16	3.79	< 0.001	0.52	1.63
Economic pressure	−0.24	0.22	−0.05	−1.13	0.26	−0.66	0.18
Medical payment methods	−2.84	0.84	−0.13	−3.41	< 0.01	−4.48	−1.20
Smoking	−1.06	0.63	−0.07	−1.69	0.09	−2.30	0.17
NSTEMI vs STEMI	0.79	0.60	0.05	1.32	0.19	−0.38	1.97
UA vs STEMI	2.47	0.77	0.13	3.20	< 0.01	0.96	3.98
Diabetes	−5.40	0.59	−0.38	−9.16	< 0.001	−6.56	−4.24
Number of medications taken	0.10	0.13	0.03	0.76	0.45	−0.16	0.36
Disease-related knowledge	0.17	0.07	0.10	2.45	0.02	0.03	0.30
Perceived health competence	0.18	0.06	0.12	2.94	< 0.01	0.06	0.31
Mindfulness	1.83	0.57	0.12	3.22	< 0.01	0.71	2.95

Notes: B, regression coefficient; β, standardized regression coefficient.
Abbreviations: CI, confidence interval; SE, standard error; STEMI, ST-segment elevation myocardial infarction; NSTEMI, Non-ST-segment elevation myocardial infarction; UA, unstable angina.

Table 4 Estimated Parameters Between Mindfulness, Perceived Health Competence, and Adherence to Health Behaviors (N = 555)

	Unstandardized estimate (B)	Standardized estimate (β)	S.E.	C.R.	*P*
Mindfulness → Perceived health competence	0.90	0.10	0.40	2.26	0.02
Mindfulness → Adherence to health behaviors	1.84	0.13	0.62	2.98	< 0.01
Perceived health competence → Adherence to health behaviors	0.20	0.13	0.07	3.10	< 0.01

Abbreviations: S.E, standard error; C.R, critical ratio.

Table 5 The Total, Direct, and Indirect Effects of Perceived Health Competence, Mindfulness, and Adherence to Health Behaviors (N = 555)

	Effect value	Boot CI lower	Boot CI upper	*P*
Indirect effect	0.01	0.02	0.51	0.02
Direct effect	0.13	0.60	3.21	< 0.01
Total effect	0.14	0.75	3.41	< 0.01
r1	0.93	0.67	0.99	< 0.01
r2	0.07	0.01	0.33	0.03

Notes: r1: the ratio of the direct effect to the total effect. r2: the ratio of the indirect effect to the total effect. The bootstrap method estimates the standard error of indirect effects and the lower and upper limits of 95% confidence intervals.
Abbreviation: CI, confidence interval.

health behaviors (β = 0.13, $P < 0.01$). Figure 1 presents the path coefficients for the association between mindfulness and adherence to health behaviors mediated by perceived health competence. Mindfulness could directly predict adherence to health behaviors, as well as indirectly predict adherence to health behaviors through perceived health competence. Perceived health competence played an incomplete mediating role between mindfulness and adherence to health behaviors. The indirect effect (0.01) accounted for 7.0% of the total effect (0.14) ($P = 0.03$).

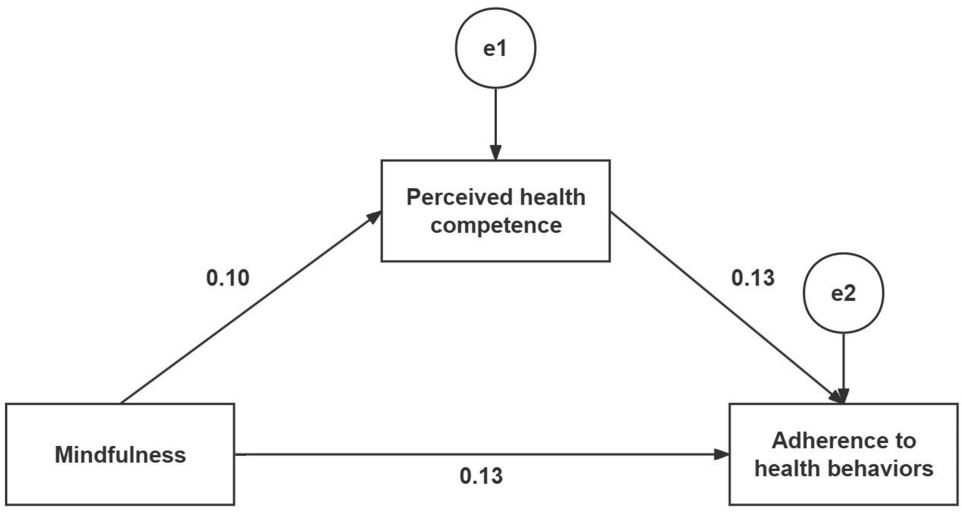

Figure 1 Mediation model of perceived health competence, mindfulness, and adherence to health behaviors.

Discussion

This study was the first to explore the association between adherence to health behaviors and mindfulness and whether this association was mediated by perceived health competence in Chinese patients with ACS. This study revealed that perceived health competence partially mediated the positive association between mindfulness and adherence to health behaviors and adherence to health behaviors was very poor. These findings provided new data for the understanding of the current status of adherence to health behaviors in patients with ACS and the development of intervention programs.

In this study, adherence to health behaviors among patients with ACS was poor, with only 27.4% of patients had good adherence, lower than the results reported by Lu et al in Chinese patients with coronary artery disease.[34] In the study by Lu et al, the adherence to 6 health behaviors while hospitalized was assessed: taking prescribed medications, exercising regularly, cutting down on alcohol intake, stopping or cutting down on smoking, following a low-salt diet, following a low-fat diet, and cutting down on stress. However, in this study, adherence was assessed one month after discharge. For patients without comorbid diabetes, adherence to 9 health behaviors was assessed. In this study, patients with ACS who recuperated at home after discharge were afraid to do too much physical activity and seldom participated in social activities. Except for a few patients with a long disease duration or a high level of disease-related knowledge, the majority of patients did not carry the medical supplies needed for self-care when they went out. Some patients also reported that they could not successfully quit smoking. Additionally, most patients with diabetes did not carry sugary treats to prevent an emergency when they went out, because they thought that their blood sugar was relatively stable and they had never had hypoglycemia before. Some of the patients neglected foot examinations because they thought they would feel uncomfortable when there were wounds on their feet. All of these resulted in overall poor adherence to health behaviors among patients with ACS in this study. Besides, female patients had better adherence, which may be because women generally do not smoke or drink and have healthier diets. Patients with higher education levels, higher disease knowledge levels, without diabetes, or who bore all the medical expenses by themselves had better adherence to health behaviors, similar to the results reported by previous studies.[35–37] Patients diagnosed with UA had better adherence, contrary to the results reported by Rodríguez-Bernal et al.[38] The reason may be that, in this study, patients with a diagnosis of UA were afraid that the degree of vascular blockage would continue to worsen, so they paid more attention to health behaviors. In conclusion, health providers should pay more attention to patients who are male, with lower education levels or lower disease knowledge levels, pay with medical insurance, have comorbid diabetes, or have a diagnosis of AMI, and adopt targeted interventions to improve their adherence to health behaviors.

Mindfulness positively predicted adherence to health behaviors (Hypothesis 1 was valid), which was supported by previous researches.[19,39] Knowing one's body, being aware of whether it is in good condition, consciously relaxing, and being aware of potentially disturbing symptoms are characteristics of people with high levels of mindfulness. According to Vélez-Vélez and Bosch, individuals' awareness and knowledge of their disease, symptoms, consequences, and treatments facilitated medical adherence.[40] Thus, in this study, patients with high levels of mindfulness had good adherence to health behaviors. Mindfulness allows patients to focus on the present moment in a non-judgmental manner, leading to better awareness of deficits and current needs.[16] Therefore, developing mindfulness may help to better understand their current needs and thus improve adherence to health behaviors. Currently, the social media-based mindfulness psycho-behavioral interventions,[19] mental and physical mindfulness exercises, and interventions that apply mindfulness to everyday situations[41] have been shown to improve adherence to health behaviors (eg, healthy diet, physical activity, and medication taking) in patients with cardiovascular disease.

Mindfulness positively predicted perceived health competence. Although there is currently no research reporting the association between mindfulness and perceived health competence, the results of this study are consistent with previous studies that have found an association between mindfulness and self-efficacy.[23] Mindfulness is a kind of nonjudgmental perception that leads to efficient and consistent behaviors in the present. This perception helps individuals to focus on their feelings and experiences, encourages individuals to accept the current situation, and increases their belief in the ability to achieve health-related goals.[42] Therefore, higher mindfulness could help patients with ACS focus their attention on feelings and experiences of disease, and respond to the problems of this period with a higher level of perceived health

competence. Mental and physical mindfulness exercises and interventions that apply mindfulness to everyday situations have also been shown to increase self-efficacy.[41] Besides, negative thinking recognition, cognitive behavioral improvement, and broadening of thinking flexibility can also increase mindfulness levels, thereby improving self-efficacy.[43] Therefore, healthcare providers can improve the perceived health competence in patients with ACS by adopting mindfulness-based interventions.

Perceived health competence partially mediated the association between mindfulness and adherence to health behaviors (Hypothesis 2 was valid). It suggests that improving an individual's belief in coping abilities to address health issues is one possible mechanism by which mindfulness influences adherence to health behaviors. Patients with lower levels of mindfulness have less confidence in their ability to cope with health-related problems, which in turn reduce adherence to health behaviors. Previous studies have reported similar associations between patients' perceived health competence and health behaviors. For example, Bachmann et al reported positive associations between perceived health competence and medication adherence, resilient coping, decreased smoking and alcohol consumption, healthy diet, and exercise in patients hospitalized with ACS and/or congestive heart failure.[25] Thus, perceived health competence may be a useful risk marker for adherence to health behaviors and a target for interventions to improve adherence to health behaviors in patients with low levels of mindfulness. Specific self-efficacy interventions targeting social support, health education and positive feedback, and peer education and support have been proven effective in improving physical activity,[44] vegetable and fruit intake,[45] and medication adherence.[46] Healthcare providers can take targeted interventions to improve the perceived health competence, the specific kind of health-domain self-efficacy, to enhance the health behavior adherence of patients with ACS.

There were several limitations in this study. First, this study was a cross-sectional study, which could not determine the causality of the study variables. Second, self-report instruments were used to collect data, and there might be social desirability bias in participants' responses. Third, perceived health competence accounted for only 7.00% of the total effect in mediating the association between mindfulness and adherence to health behaviors. This suggests that other mediators might be at play but are not explored in the study. Fourth, social support is a very important influencing factor. We have considered some aspects of social support such as economic support (economic pressure), medical care support (medical payment methods) and family support (marital status and living status). But We did not use a structured social support scale to assess the overall level of social support, including emotional support. Finally, as a single-center research, participants were recruited at only one hospital, so this sample may not be representative of the entire population of patients with ACS. Thus, the generalizability of this study was limited. Multi-center studies with large samples in the future are needed to further explore the influencing mechanism of mindfulness on adherence to health behaviors.

Conclusions

The adherence to health behaviors of patients with ACS was poor. Mindfulness positively predicted adherence to health behaviors, and perceived health competence partially mediated the association between mindfulness and adherence to health behaviors. Healthcare providers should implement targeted interventions to improve patients' mindfulness and perceived health competence, thereby increasing their adherence to health behaviors.

Abbreviations

ACS, acute coronary syndrome; MACEs, major adverse cardiovascular events; AMI, acute myocardial infarction; UA, unstable angina; MOSSAS, Medical Outcomes Study Specific Adherence Scale; PHCS, Perceived Health Competence Scale; MAAS, Mindful Attention Awareness Scale; CADE-Q SV, Coronary Artery Disease Education Questionnaire-Short Version.

Data Sharing Statement

Patients were assured of data confidentiality. Therefore, the original data for this study are not publicly available, but will be made available by emailing the corresponding author on reasonable request.

Ethics Approval and Informed Consent

Our research was approved by the Ethics Committee of Soochow University (SUDA20220922H02). All participants provided written informed consent.

Consent for Publication

All the authors have read the manuscript and approved the publication of this manuscript.

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Author Contributions

All listed 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

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