

# Social Support and Self-Efficacy as Mediating Factors Affecting the Association Between Depression and Medication Adherence in Older Patients with Coronary Heart Disease: A Multiple Mediator Model with a Cross-Sectional Study

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**Purpose:** Medication non-adherence is a major public health issue. Recent evidence suggests that depression, inadequate social support, and lower levels of self-efficacy are associated with poor medication adherence. However, the mechanism underlying the association among depression, social support, self-efficacy and medication adherence is unclear. This study aims to examine the mediating role of social support and self-efficacy between depression and medication adherence in older patients with coronary heart disease.

**Patients and Methods:** Data were collected from 238 hospitalized older patients with coronary heart disease. Depression, social support, self-efficacy, and medication adherence were assessed using structured questionnaires. A serial multiple mediation model was tested using the PROCESS macro for SPSS.

**Results:** A total of 238 older patients with CHD with a mean age of 70.5 years were involved in this cross-sectional study. Depression was negatively correlated with medication adherence in older patients with coronary heart disease. Social support and self-efficacy were positively associated with medication adherence, and fully mediated the relationship between depression and medication adherence. Three mediation paths were included in the model: (a) social support, (b) chain combination of social support and self-efficacy, and (c) self-efficacy.

**Conclusion:** Social support and self-efficacy explain the association of depression and medication adherence in older CHD patients and may be the keys target for enhanced intervention to improve medication adherence in older CHD patients with depression.

**Keywords:** coronary heart disease, depression, medication adherence, self-efficacy, social support

## Introduction

Coronary heart disease (CHD) is the main cause of death worldwide, accounting for more than eight million deaths globally each year.<sup>1</sup> It is reported that approximately 85% of people aged 65 or older die as a consequence of CHD.<sup>2</sup> As a common chronic disease, CHD can lead to poor health-related quality of life<sup>3,4</sup> and increase healthcare costs.<sup>5</sup> As a result of lifestyle changing and an aging population, it is estimated that the number of people with CHD will increase from 8.1 to 22.6 million a year by 2030 in China.<sup>6</sup> Evidence-based medication therapy is used as the primary treatment strategy for patients with CHD<sup>4</sup> and the treatment is recommended to continue for the rest of their

life. Medication adherence, defined as taking medication as prescribed over time, is essential for patients with CHD to generate optimal clinical outcomes, eg, low all-cause mortality, low risk of cardiovascular rehospitalization, and high quality of life.<sup>4,7</sup> Nevertheless, medication non-adherence is common and has become a serious public health issue owing to the fact that more than half of older patients with CHD do not take their medication as prescribed.<sup>8,9</sup> Evidence has revealed that medication non-adherence is associated with adverse clinical outcomes and increased healthcare costs.<sup>10,11</sup>

CHD patients with depression are less likely to adhere, at least in some aspects, to treatment regimens such as medication, exercise, and cardiac rehabilitation.<sup>12,13</sup> Evidence suggests that depressive symptoms may contribute to poor medication adherence in CHD patients.<sup>14,15</sup> Depression is prevalent in patients with CHD, with up to 51% of patients affected<sup>16</sup> and over one-third of whom severely affected,<sup>17</sup> thus it is imperative to explore effective measures to improve medication adherence among CHD patients with depression.

Medication adherence can be enhanced through support from family members, community, and friends, as well as other social services.<sup>18</sup> Cohen et al<sup>19</sup> define social support as “the social resources that individuals perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal support groups and informal helping relationships”. Xiao et al<sup>20</sup> propose that individuals’ support utilization should be included in social support. Individuals’ attitude toward support utilization varies, for example, some people might be offered the support, but refuse to take it. With the increase of age, the need of CHD patients for social support increases over time.<sup>21</sup> Findings from recent studies illustrate that social support can promote adherence to health behaviors, which is significantly associated with improved medication adherence.<sup>22–24</sup>

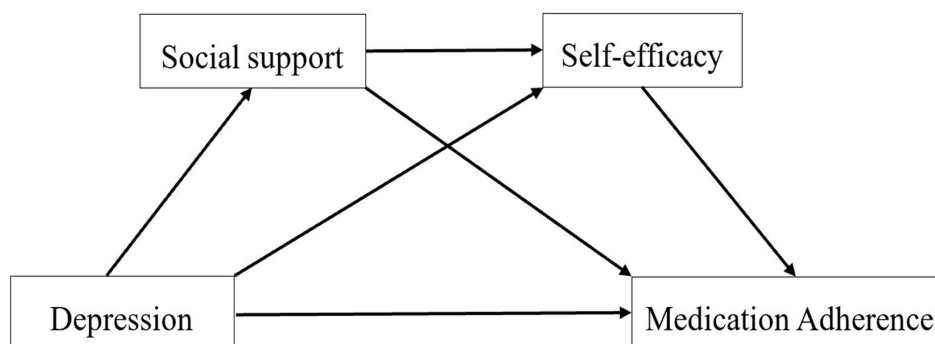
On the other side, evidence shows that self-efficacy may play an important role in adherence to medication.<sup>14,25,26</sup> Medication self-efficacy is generally defined as the belief or confidence in one’s ability to persist with taking medication for desired outcomes, and it has been demonstrated to be a strong predictor of health-promoting behaviors and health-related outcomes in patients with chronic disease.<sup>27</sup> Previous studies found that CHD patients with lower self-efficacy might show a poor medication adherence.<sup>14,28</sup> Polsook et al<sup>29</sup> developed a self-efficacy enhancement program (SEP) based on Bandura’s self-efficacy components and implemented the SEP in patients with acute myocardial infarction, and found that SEP was significantly effective in improving medication adherence.

In summary, existing literature demonstrates that depression, social support, and self-efficacy are significantly associated with medication adherence among patients with CHD.<sup>14,23,28</sup> Self-efficacy partially mediates the relationship between depression and medication adherence,<sup>30,31</sup> and social support also mediates the association between the two.<sup>23</sup> In addition, self-efficacy totally mediates the association of social support with treatment adherence, after adjusted for demographic and medical covariates.<sup>32</sup> However, limited information is available concerning the mechanism underlying the relationships among the three variables and medication adherence in CHD patients. Clarifying this mechanism will contribute to healthcare professionals to develop targeted interventions to improve medication adherence in older patients with CHD. Therefore, this study is aimed to examine the multiple mediating role of social support and self-efficacy between depression and medication adherence in older patients with CHD. The hypothesized mediator model is shown in [Figure 1](#).

## Patients and Methods

### Participants

This is a cross-sectional study. Participants were recruited from 8 cardiovascular units in four tertiary hospitals (each with >500 inpatient beds) in Baoding, a city in northern China. The inclusion criteria were as follows: (1) diagnosis as CHD by a physician, (2) age  $\geq$  60 years old, and (3) having history of cardiovascular medication use. Participants were excluded if they had (1) a cognitive disorder, or (2) cancer, or (3) were classified as having New York Heart Association class IV heart failure. The minimum number of patients was 178 based on a medium effect size of 0.15,  $\alpha$  of 0.05 and a power of 0.90 (using G\*power 3.1 version).<sup>33</sup> Considering 20% missing rate, a sample size of 214 was required in this study. A convenient sample of 238 participants met the sample size requirement for the study.



**Figure 1** The hypothesized serial mediating model of social support and self-efficacy between depression and medication adherence. Independent variable: depression, mediating variables: social support and self-efficacy, dependent variable: medication adherence.

## Instruments

### Socio-Demographic and Clinical Characteristics

The socio-demographic and clinical data include age, gender, marital status, education attained, monthly income, family history of CHD, co-morbidity and duration of CHD. Data were reviewed from hospital medical records by three trained research assistants.

### Depression

The 9-item Patient Health Questionnaire (PHQ-9) was used to assess depression. This scale consists of one dimension and nine items.<sup>34</sup> Each item is scored from 0 (not at all) to 3 (nearly every day). The total scores range from 0 to 27. Higher total scores correlate with more severe depression. Scores are categorized as follows: none (0–4), mild (5–9), moderate (10–14) and severe depression ( $\geq 15$ ).<sup>35</sup> The scale has good validity and reliability (with Cronbach's alpha coefficient of 0.86), and is widely used in China.<sup>36</sup> The Cronbach's alpha coefficient was 0.836 in our study.

### Social Support

Social support was measured using the Social Support Rating Scale (SSRS) developed by Xiao.<sup>20</sup> It consists of ten items that form three subscales: objective support (three items), perceived support (four items), and support utilization (three items). The total scores for SSRS range from 12 to 66. A higher score reflects better social support. Scores are categorized as follows: low social support (12–22), medium social support (23–44), and high social support (45–66). The SSRS has been widely used in China and has demonstrated good reliability and validity.<sup>37</sup> The internal consistency coefficient for this scale was 0.829 in this study.

### Self-Efficacy

Self-efficacy for medication adherence was measured using the Self-Efficacy for Appropriate Medication Use Scale (SEAMS), developed by Risser et al.<sup>38</sup> This scale contains two dimensions (thirteen items): self-efficacy for taking medications under difficult circumstances (eight items), and self-efficacy for continuing to take medications when circumstances surrounding medication-taking are uncertain (five items). Each question is assigned points from 1 to 3 (1=not confident, 2=somewhat confident, and 3=very confident). The sum of the 13 items ranges from 13–39. Higher total scores indicate better self-efficacy for medication adherence. The Chinese version of SEAMS was translated by Dong et al (Cronbach's alpha coefficient of 0.915)<sup>39</sup> and has demonstrated good internal consistency, reliability, and validity in CHD patients.<sup>40</sup> In this study, the Cronbach's alpha coefficient was 0.913.

### Medication Adherence

The medication adherence of CHD patients was measured by the medication adherence questionnaire for coronary heart disease developed by the researchers' team based on *Chinese cardiovascular disease rehabilitation/Secondary prevention guidelines* (2015 Edition).<sup>41,42</sup> The questionnaire includes major elements related to medication adherence, such as

“schedule”, “dosage”, “frequency”, “type”, “regular review” and “medication adjustment”, and contains six items, each measuring a specific medication-related behavior (eg, “How often do you comply with the medication frequency as prescribed?” “How often do you comply with the medication dosage as prescribed?” “How often do you comply with the medication schedule as prescribed?” “How often do you never interruption of taking medication as prescribed?” “How often do you take medication as prescribed without adding or removing medication?” “How often do you review on time and adjust or continue to take medication as prescribed?”). The items are scored on a rating scale from 0 (Never) to 3 (Always). The total scores range from 0 to 18, with higher scores correlating to better medication adherence. The Cronbach alpha coefficient in this study was 0.831, and the test-retest reliability was 0.866. The criterion-related validity of the medication adherence questionnaire was 0.738, with MMAS-8<sup>43</sup> as a comparator criterion.

## Data Collection

The data were collected from September to December 2017. Three research assistants received uniform training before the survey. The training includes the purpose, process, and methods of data collection of the study. To recruit participants from the cardiology ward in hospitals, the research assistants screened for participants who meet the eligibility and criteria and asked eligible patients if they were willing to participate in the survey. Upon expression of interest, the research assistants introduced themselves, explained the study, and obtained informed consent. The survey and the brief interview took about 30 minutes to complete and the research assistants explained content of the items if the participants expressed any questions or confusion. If the patients had no ability to complete the survey by themselves, the face-to-face interview was conducted to collect data.

## Ethical Considerations

This study conformed with the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Hebei University. The researchers explained the aim and procedure of the study to eligible patients, and obtained their informed written consent. The participants were guaranteed that their participation was voluntary, and that all data would be held securely and confidentially, and that it would only be accessed by the research team.

## Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to present the socio-demographic and clinical characteristics, depression, social support, self-efficacy, and medication adherence of the sample. A Pearson correlation coefficient was computed to examine the relationship between the four variables (depression, social support, self-efficacy, and medication adherence). Multivariable linear regression was used to examine the multivariate relationships among depression(X1), social support(X2), self-efficacy (X3) and medication adherence(Y). To control the effects of covariates, all the demographic and clinical variables (such as age, gender, marital status, education, income, family history of CHD, co-morbidity and duration of CHD) were entered into the regression model.

The overall model (Figure 1) was tested using the approach proposed by Preacher and Hayes<sup>44</sup> which allows multiple mediators to be included in the mediation analysis. It is hypothesized that depression (X) would be associated with social support (M1), which, in turn, affects self-efficacy (M2) and influences medication adherence (Y) (Figure 1). A serial mediator model with two mediators of social support and self-efficacy provided three indirect effects that sum to a total indirect effect. The indirect effects in the model were through (a) social support, (b) self-efficacy, and (c) both social support and self-efficacy. We then run the SPSS PROCESS macro for a testing serial mediation model with model 6 and 5000 bootstrap samples. In addition, covariates (age, gender, marital status, education, income, family history of CHD, co-morbidity and duration of CHD) were controlled in the model. 95% confidence interval (CI) was estimated for the mediation effects, with CI not containing zero, indicating the mediation effects being significant. Harman’s single-factor test was used to examine the common method bias (CMB). The variance explained by the first factor was lower than 40%, indicating that no CMB exists in the research data.

**Table 1** Sample Socio-Demographic and Clinical Characteristics (N=238)

	<b>N</b>	<b>%/ Mean±SD</b>
Age(60~87)	238	70.5±6.40
Gender		
Male	134	56.30
Female	104	43.70
Marital status		
Married or with life partner	207	86.97
Single(includes divorced, widowed, separated)	31	13.03
Education attainment		
Primary school or lower	98	41.18
Junior high school	81	34.03
Senior high school or higher	59	24.79
Income monthly per person RMB (USD)		
<3000 (471)	168	70.59
≥3000 (471)	70	29.41
Family history of CHD		
Yes	86	36.13
No	152	63.87
Co-morbidity		
Yes	227	95.38
No	11	4.62
Duration of CHD		
<1 year	21	8.82
1~5 years	79	33.20
5~10 years	67	28.15
≥10 years	71	29.83

**Abbreviations:** SD, standard deviation; CHD, coronary heart disease.

## Results

### Sample Characteristics

The sample consisted of 238 older patients with CHD, 134 males and 104 females, aged between 60 and 87 years old (mean=70.50, SD=6.40). Socio-demographic and clinical characteristics are shown in [Table 1](#).

### Descriptive Statistics and Correlation Among Depression, Social Support, Self-Efficacy, and Medication Adherence

As shown in [Table 2](#), the mean score for medication adherence and depression were  $14.77 \pm 3.08$  and  $3.26 \pm 3.60$ , respectively, and the total prevalence rates of depression was 21.01%, with mild (13.03%), moderate (6.30%) and severe

**Table 2** Descriptive Statistics and Correlations Among the Depression, Social Support, Self-Efficacy and Medication Adherence (N=238)

Variables	Range	Mean±SD	1	2	3	4
			r(P)	r(P)	r(P)	r(P)
1. Depression	0–27	3.26±3.60	1			
2. Social support	12–66	39.47±5.24	–0.146 (0.025)	1		
3. Self-efficacy	13–39	35.71±4.25	–0.212 (0.001)	0.344 (<0.001)	1	
4. Medication adherence	0–18	14.77±3.08	–0.214 (0.001)	0.366 (<0.001)	0.573 (<0.001)	1

(1.68%), respectively. The mean SSRS score was 39.47 (SD=5.24) and the average self-efficacy score was 35.71 (SD=4.25). The depression was negatively related to social support ( $r=-0.146$ ,  $P=0.025$ ), self-efficacy ( $r=-0.212$ ,  $P=0.001$ ), and medication adherence ( $r=-0.214$ ,  $P=0.001$ ), whereas social support and self-efficacy were positively related to medication adherence ( $r=0.366$ ,  $P<0.001$  and  $r=0.573$ ,  $P<0.001$ , respectively). Social support was positively associated with self-efficacy ( $r=0.344$ ,  $P<0.001$ ) (Table 2). Multivariate linear regression analysis showed that depression was not associated with medication adherence when social support and self-efficacy were entered into regression model after adjusting the covariates (Table 3).

## Mediation Effects

The mediated indirect effects of a specific path are shown in Figure 2 and Table 4. Figure 2 displays that the standardized coefficient of depression on medication adherence decreased from  $-0.179$  (95% CI  $(-0.288, -0.070)$ ) to  $-0.073$  (95% CI  $(-0.165, 0.019)$ ), which was not statistically significant, after introducing the mediators of social support and self-efficacy into the model. Thus, both multivariate linear regression (Table 3) and mediation analysis results indicated full mediation, and the relationship between depression and medication adherence was totally mediated by social support and self-efficacy. The effect of the size of the mediational variable was derived from the ratio of the indirect effect over the total

**Table 3** Associations of Demographic, Clinical and Other Variables and Medication Adherence Among Older CHD Patients (N=238)

	Model without Social Support and Self-Efficacy			Model with Social Support and Self-Efficacy		
	Coefficient <sup>a</sup>	SE	p value	Coefficient <sup>a</sup>	SE	p value
Self-efficacy	-	-	-	0.491	0.042	<0.001
Social support	-	-	-	0.191	0.036	0.002
Depression	–0.210	0.055	0.001	–0.085	0.047	0.118
Age	–0.028	0.033	0.685	0.031	0.027	0.590
Gender	–0.044	0.421	0.519	–0.075	0.350	0.183
Marital status	0.035	0.641	0.622	0.033	0.548	0.581
Education attainment	–0.003	0.284	0.972	–0.051	0.234	0.404
Income	0.176	0.481	0.014	0.105	0.403	0.079
Family history of CHD	–0.063	0.419	0.335	0.022	0.348	0.681
Co-morbidity	–0.002	0.940	0.979	–0.057	0.776	0.285
Duration of CHD	0.007	0.209	0.915	–0.013	0.172	0.817

Note: <sup>a</sup>Standardized coefficients.

Abbreviation: SE, standard error.

**Table 4** Mediation Analysis of Depression and Medication Adherence (N=238)

	Effect	SE	95% CI	%*
Direct effect: Depression-medication adherence	-0.073	0.047	(-0.165, 0.019)	40.78%
Total indirect effect	-0.106	0.036	(-0.187, -0.046)	59.22%
Depression-social support-medication adherence	-0.020	0.013	(-0.056, -0.002)	11.17%
Depression-social support-self-efficacy-medication adherence	-0.018	0.012	(-0.050, -0.001)	10.06%
Depression-self-efficacy-medication adherence	-0.068	0.035	(-0.143, -0.002)	37.99%
Total effect	-0.179	0.055	(-0.288, -0.070)	100%

**Note:** \*The percentage of effect/total effect.

**Abbreviations:** CI, confidence interval; SE, standard error.

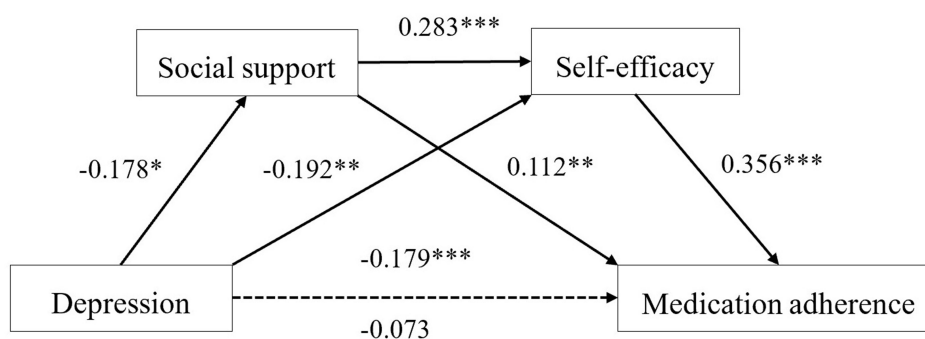
effect of the relationship between depression and medication adherence. The mediation effect of depression on medication adherence through social support was  $-0.020$  (95% CI  $(-0.056, -0.002)$ ), with an effect size of 11.17%. As a result, the serial mediation effect was  $-0.018$  (95% CI  $(-0.050, -0.001)$ ), accounting for 10.06% of the total effect. The serial mediation effect of social support and self-efficacy was thus confirmed in the relationship between depression and medication adherence. The mediation effect of depression on medication adherence through self-efficacy was  $-0.068$  (95% CI  $(-0.143, -0.002)$ ), with an effect size of 37.99% (Table 4).

## Common Method Bias

The Herman single-factor analysis was used to examine Common Method Bias, and 38 items of the four variables, ie, depression, social support, self-efficacy, and medication adherence were examined by non-rotation principal component factor analysis. The first factor resulted in 21.65% of variance lower than 40%, indicating that there was no Common Method Bias in our study.

## Discussion

The current investigation provides a new insight towards understanding of how depression influences medication adherence among older patients with CHD. The results found that depression was indirectly related to medication adherence through three pathways, (a) social support only, (b) self-efficacy only, and (c) combined social support and self-efficacy.



**Figure 2** Result of multiple mediator model. The numbers are standardized coefficients.  $-0.179$ =standardized coefficient before introducing social support and self-efficacy into the model;  $-0.073$ =standardized coefficients after introducing social support and self-efficacy into the model. The mediation model was adjusted for the following covariates: age, gender, marital status, education, income, family history of CHD, co-morbidity, duration of CHD. \* $P<0.05$ , \*\* $P<0.01$ , \*\*\* $P<0.001$ .



## Depression and Medication Adherence

Depression was significantly correlated with medication adherence in older patients with CHD, which matches well with previous findings,<sup>14,30</sup> suggesting that older CHD patients with depression tend to have poor medication adherence. Patients with chronic conditions often require lifelong medication therapy, and are recommended to adhere lifestyles which are synchronous with treatment goals.<sup>45</sup> Expectations of the benefits of treatment recommendations are an essential component of patient adherence.<sup>46</sup> Depressed patients usually have an outlook of hopelessness, and lack energy and motivation, which may contribute to their poor adherence to medication, especially in the long term.<sup>47</sup> The results reported by Son et al,<sup>14</sup> revealed that CHD patients who underwent primary percutaneous coronary intervention with depressive symptoms are more likely to be non-adherent to medication. In addition, our study confirmed that the relationship between depression and medication adherence was fully mediated by social support and self-efficacy. These findings comprise an essential knowledge base for developing interventions to improve medication adherence among older CHD patients with depressive symptoms.

## The Mediation Role of Self-Efficacy Between Depression and Medication Adherence

Our results revealed that older CHD patients with higher self-efficacy had better medication adherence, which is in line with those of prior studies supporting a strong association between self-efficacy and medication adherence among CHD patients.<sup>14,28</sup> Patients with higher self-efficacy may dedicate more effort and have a greater tendency to persist in their attempts to perform a target activity.<sup>29</sup> Also, our study confirmed self-efficacy as a mediator of the association between depression and medication adherence, revealing that older CHD patients with depressive symptoms have a lower confidence in their adherence to medication, ultimately leading to poor medication adherence. Son et al reported that CHD patients with depressive symptoms were more likely to develop low self-efficacy for medication, which was in accordance with our results.<sup>30</sup> Based on Bandura's self-efficacy theory,<sup>27</sup> an individual's self-efficacy for healthy behaviors may partially depend on his psychological or emotional state; positive emotion may enhance healthy behaviors, while negative emotion diminish them. Depressed patients, plagued by pessimism and hopelessness, tend to have reduced confidence in their ability to follow medication regimens persistently.

## The Mediation Role of Social Support Between Depression and Medication Adherence

Social support was positively correlated to medication adherence, which is consistent with reports from previous studies.<sup>18,32</sup> Patients with adequate social support may receive more external objective or subjective support from family members, relatives, or institutions, which promotes patients to likely obtain more health-related information to aid them to cope with diseases and adhere to medication.<sup>18</sup> And this study showed that social support mediated the relationship between depression and medication adherence. Kim et al's study<sup>23</sup> indicated that the social support played a significant mediation role in reducing the negative effect of depression symptoms on medication adherence, which is similar to our view. Depression is more likely to affect the extent to which one may seek social support. Depressed patients with negative interpersonal effect and emotion tend not to make good use of social support network and may obtain less support, subsequently, lower level of social support may be related to poor medication adherence.

## The Chain Mediating Effect of Social Support and Self-Efficacy Between Depression and Medication Adherence

Interestingly, our study also found that the relationship between depression and medication adherence was mediated by the chain combination of social support and self-efficacy. This indicates that older CHD patients with depression may have less social support, and inadequate social support may subsequently reduce their confidence in their ability to adhere to medication, eventually resulting in poor medication adherence. Tavor et al<sup>47</sup> showed that self-efficacy and social support mediated the relationship between depression and adherence and Maeda et al<sup>32</sup> indicated that self-efficacy fully mediated the association of social support with treatment adherence, which support our findings. However, our results are



partially inconsistent with those of Kim et al<sup>23</sup> in their suggestion that social support totally mediated the association of depression with medication adherence in patients. The inconsistency may be due to that only one mediation variable (social support) was tested in Kim et al's study. Older CHD patients with depressive symptoms may have fewer external resources or poor social network utilization, which reduces their level of social support essential for managing their health.<sup>21</sup> Patients with higher level of social support are possibly to have more diverse external resources for them to obtain verbal or behavioral encouragement, normative or informative influence, and take advantages therefrom to overcome their own problems, all of which may promote the level of self-efficacy for medication use.<sup>32</sup> When social support including economical or psychological support is not inadequate, patients may have lesser confidence in taking their medication, relating to poor medication adherence.<sup>32,48</sup>

## Limitations

This study may have the following two limitations. One is that, due to the cross-sectional nature, this study suggested the association among social support, depression, self-efficacy and medication adherence. Therefore, the causal relationship could not be suggested in our analysis. The other is that, because the participants were recruited using a convenience sample process from only one region, it may not be sufficient to represent the population, thus generalizability of the findings is limited. And the number of participants enrolled in this study was small due to the limited time, our findings should be validated in a larger and more diverse CHD patients. Therefore, future studies with employing a larger and randomized sample and stronger statistical parametric analyses may be necessary to confirm the findings here. Additionally, longitudinal study designs with collecting multi-wave data are also recommended to identify the causal relationships among social support, self-efficacy, depression, and medication adherence in the future.

## Clinical Practices

Despite these limitations, our study has some important implications for clinical practice. A considerable, existing body of evidence states that medication non-adherence in patients with CHD is a public health issue, necessitating the development and implementation of effective interventions.<sup>49,50</sup> Based on our finding, healthcare professionals should recognize the effect of depression on older CHD patients, and the mediating role of social support and self-efficacy in the association of depression and medication adherence. Interventions focused on social support and self-efficacy may be beneficial to improve medication adherence in older CHD patients with depression. Thus, healthcare professionals should develop interventions focused on promoting social support and increasing self-efficacy to improve medication adherence in older CHD patients with depression in clinical practice.

## Conclusion

The present study addressed a gap in the literature by exploring the role of self-efficacy and social support in the relationship between depression and self-reported medication adherence among older CHD patients. Social support and self-efficacy help to fully mediate the relationship between depression and medication. Additionally, this study identified that depression could affect medication adherence through the chain mediation of social support and self-efficacy. Thus, social support and self-efficacy are suggested to be given more attention to identify even better strategies for health professionals to improve medication adherence among CHD patients with depression.

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## Disclosure

The authors declare that they have no conflicts of interest in this work.

## References

1. World Health Organisation. The top 10 causes of death. Fact sheet N° 310; 2017. Available from: <http://www.who.int/mediacentre/factsheets/fs310/en/>. Accessed January 17, 2022.
2. Stern S, Behar S, Gottlieb S. Aging and disease of the heart. *Circulation*. 2003;108:e99–e101. doi:10.1161/01.CIR.0000086898.96021.B9
3. Muhammad I, He HG, Kowitlawakul Y, Wang WR. Narrative review of health-related quality of life and its predictors among patients with coronary heart disease. *Int J Nurs Pract*. 2016;22(1):4–14. doi:10.1111/ijn.12356
4. Fihn SD, Gardin JM, Abrams J, et al. ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *J Am Coll Cardiol*. 2012;60(24):e44–e164. doi:10.1016/j.jacc.2012.07.013
5. Liu S, Li Y, Zeng X, et al. Burden of cardiovascular diseases in China, 1990–2016: findings from the 2016 global burden of disease study. *JAMA Cardiol*. 2019;4(4):342–352. doi:10.1001/jamacardio.2019.0295
6. Jiang L, Krumholz HM, Li X, Li J, Hu S. Achieving best outcomes for patients with cardiovascular disease in China by enhancing the quality of medical care and establishing a learning health-care system. *Lancet*. 2015;386(10002):1493–1505. doi:10.1016/S0140-6736(15)00343-8
7. Sabate E. *Adherence to Long-Term Therapies: Evidence for Action*. Geneva: World Health Organization; 2003.
8. Zheng F, Ding S, Lai L, et al. Relationship between medication literacy and medication adherence in patients with coronary heart disease in Changsha, China. *Front Pharmacol*. 2019;10:1537. doi:10.3389/fphar.2019.01537
9. Martins NFF, Abreu DPG, Silva BT, Semedo DS, Pelzer MT, Ienczak FS. Functional health literacy and adherence to the medication in older adults: integrative review. *Rev Bras Enferm*. 2017;70(4):868–874. doi:10.1590/0034-7167-2016-0625
10. Walsh CA, Cahir C, Tecklenborg S, Byrne C, Culbertson C, Bennett KE. The association between medication non-adherence and adverse health outcomes in ageing populations: a systematic review and meta-analysis. *Brit J Clin Pharmacol*. 2019;85(11):2464–2478. doi:10.1111/bcp.14075
11. Du LP, Cheng ZW, Zhang YX, Li Y, Mei D. The impact of medication adherence on clinical outcomes of coronary artery disease: a meta-analysis. *Eur J Prev Cardiol*. 2017;24(9):962–970. doi:10.1177/2047487317695628
12. Sin NL, Kumar AD, Gehi AK, Whooley MA. Direction of association between depressive symptoms and lifestyle behaviors in patients with coronary heart disease: the heart and soul study. *Ann Behav Med*. 2016;50(4):523–532. doi:10.1007/s12160-016-9777-9
13. Ho SY. *The Impact of Depression on Treatment Adherence and Cardiorespiratory Fitness in Cardiac Rehabilitation*. Burlington: The University of Vermont; 2017.
14. Son YJ, Kim SH, Park JH. Role of depressive symptoms and self-efficacy of medication adherence in Korean patients after successful percutaneous coronary intervention. *Int J Nurs Pract*. 2014;20(6):564–572. doi:10.1111/ijn.12203
15. Goldstein CM, Gathright EC, Garcia S. Relationship between depression and medication adherence in cardiovascular disease: the perfect challenge for the integrated care team. *Patient Prefer Adher*. 2017;11:547–559. doi:10.2147/PPA.S127277
16. Ghaemmohamadi MS, Behzadifar M, Ghashghae A, et al. Prevalence of depression in cardiovascular patients in Iran: a systematic review and meta-analysis from 2000 to 2017. *J Affect Disord*. 2018;227:149–155. doi:10.1016/j.jad.2017.10.026
17. Al-Zaru IM, Alhalaiqa F, Dalky HF, Arramadan KA, Batiha AM. Depression in nonhospitalized Jordanian patients with coronary artery disease. *J Nurs Res*. 2020;28(1):1–9. doi:10.1097/jnr.0000000000000341
18. Turan GB, Aksoy M, Çiftçi B. Effect of social support on the treatment adherence of hypertension patients. *J Vas Nurs*. 2019;37(1):46–51. doi:10.1016/j.jvn.2018.10.005
19. Cohen S, Gottlieb B, Underwood L. *Social Relationships and Health: Challenges for Measurement and Intervention*. New York: Oxford University Press; 2000.
20. Xiao SY. The theoretical basis and research application of Social Support Rating Scale. *J Clin Psychiat*. 1994;4(2):98–100. Chinese.
21. Su SF, Chang MY, He CP. Social support, unstable angina, and stroke as predictors of depression in patients with coronary heart disease. *J Cardiovasc Nurs*. 2018;33(2):179–186. doi:10.1097/JCN.0000000000000419
22. Chiou AF, Hsu SP, Hung HF. Predictors of health-promoting behaviors in Taiwanese patients with coronary artery disease. *Appl Nurs Res*. 2016;30:1–6. doi:10.1016/j.apnr.2015.08.008
23. Kim CJ, Schlenk EA, Kim DJ, Kim D, Erlen JA, Kim SE. The role of social support on the relationship of depressive symptoms to medication adherence and self-care activities in adults with type 2 diabetes. *J Adv Nurs*. 2015;71(9):2164–2175. doi:10.1111/jan.12682
24. Spikes T, Higgins M, Quyyumi A, Reolly C, Pemur S, Dunbar S. The relationship among health beliefs, depressive symptoms, medication adherence, and social support in African Americans with hypertension. *J Cardiovasc Nurs*. 2019;34(1):44–51. doi:10.1097/JCN.0000000000000519
25. Huang YM, Shiyabola OO, Smith PD. Association of health literacy and medication self-efficacy with medication adherence and diabetes control. *Patient Prefer Adher*. 2018;12:793–802. doi:10.2147/PPA.S153312
26. Lu M, Xia H, Ma J, et al. Relationship between adherence to secondary prevention and health literacy, self-efficacy and disease knowledge among patients with coronary artery disease in China. *Eur J Cardiovasc Nurs*. 2020;19(3):230–237. doi:10.1177/1474515119880059
27. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs: Prentice-Hall, Inc.; 1986.
28. Al-Ganmi AHA, Alotaibi A, Gholizadeh L, Perry L. Medication adherence and predictive factors in patients with cardiovascular disease: a cross-sectional study. *Nurs Health Sci*. 2020;22(2):454–463. doi:10.1111/nhs.12681
29. Polsook R, Aunguroch Y, Thongvichean T. The effect of self-efficacy enhancement program on medication adherence among post-acute myocardial infarction. *Appl Nurs Res*. 2016;32:67–72. doi:10.1016/j.apnr.2016.05.002
30. Son YJ, Won MH. Depression and medication adherence among older Korean patients with hypertension: mediating role of self-efficacy. *Int J Nurs Pract*. 2017;20:564–572. doi:10.1111/ijn.12525

31. Schoenthaler A, Ogedegbe G, Allegrante JP. Self-efficacy mediates the relationship between depressive symptoms and medication adherence among hypertensive African Americans. *Health Educ Behav.* 2009;36(1):127–137. doi:10.1177/1090198107309459
32. Maeda U, Shen BJ, Schwarz ER, Farrell KA, Mallon S. Self-efficacy mediates the associations of social support and depression with treatment adherence in heart failure patients. *Int J Behav Med.* 2013;20(1):88–96. doi:10.1007/s12529-011-9215-0
33. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G\*Power 3.1: tests for correlation and regression analyses. *Behav Res Methods.* 2009;41(4):1149–1160. doi:10.3758/BRM.41.4.1149
34. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. *JAMA.* 1999;282(18):1737–1744. doi:10.1001/jama.282.18.1737
35. Schutt PE, Kung S, Clark MM, et al. Comparing the Beck Depression Inventory-II (BDI-II) and Patient Health Questionnaire (PHQ-9) depression measures in an outpatient bariatric clinic. *Obes Surg.* 2016;26(6):1274–1278. doi:10.1007/s11695-015-1877-2
36. Yuan J, Ding R, Wang L, Sheng L, Li J, Hu D. Screening for depression in acute coronary syndrome patients: a comparison of patient health questionnaire-9 versus hospital anxiety and depression scale–depression. *J Psychosom Res.* 2019;121:24–28. doi:10.1016/j.jpsychores.2019.03.018
37. Kong LN, Zhu WF, He S, Yao Y, Yang L. Relationships among social support, coping strategy, and depressive symptoms in older adults with diabetes. *J Gerontol Nurs.* 2019;45(4):40–46. doi:10.3928/00989134-20190305-03
38. Risser J, Jacobson TA, Kripalani S. Development and psychometric evaluation of the Self-Efficacy for Appropriate Medication Use Scale (SEAMS) in low-literacy patients with chronic disease. *J Nurs Meas.* 2007;15(3):203–219. doi:10.1891/106137407783095757
39. Dong XF, Liu YJ, Wand AX, Lv PH. Psychometric properties of the Chinese version of the self-efficacy for appropriate medication use scale in patients with stroke. *Patient Prefer Adher.* 2016;10:321–327. doi:10.2147/PPA.S101844
40. Chen B, Chen L. Reliability and validity of Chinese version self-efficacy for appropriate medication use scale in the coronary heart disease patients. *Chin J Modern Nurs.* 2017;23(14):1837–1842. Chinese.
41. Hu DY. *Chinese Cardiovascular Disease Rehabilitation/Secondary Prevention Guidelines (2015 Edition)*. Beijing Science and Technology Press; 2015. Chinese.
42. Zhang WY, Zhou Y, Cui SS, Shi QS, Lou SN, Wang Y. Development and validation of secondary prevention medication compliance questionnaire for patients with coronary heart disease. *Chin Nurs Res.* 2021. In press [<http://www.hlyjzz.com>]. Chinese.
43. Morisky DE, Ang A, Krousel-wood M, Ward HJ. Predictive validity of a medication adherence measure for hypertension control. *J Clin Hypertens.* 2008;10(5):348–354. doi:10.1111/j.1751-7176.2008.07572.x
44. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods.* 2008;40(3):879–891. doi:10.3758/BRM.40.3.879
45. Smith SC, Allen J, Blair SN, et al. AHA/ACC guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by the National Heart, Lung, and Blood Institute. *J Am Coll Cardiol.* 2006;47(10):2130–2139. doi:10.1016/j.jacc.2006.04.026
46. DiMatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med.* 2000;160(14):2101–2107. doi:10.1001/archinte.160.14.2101
47. Tovar E, Rayens MK, Gokun Y, Clark M. Mediators of adherence among adults with comorbid diabetes and depression: the role of self-efficacy and social support. *J Health Psychol.* 2015;20(11):1405–1415. doi:10.1177/1359105313512514
48. Garrett JG. *The Relationship Among Social Support, Self-Efficacy and Medication Adherence in Adults with Hypertension*. San Diego: Northcentral University; 2016.
49. Hussain S, Jamal SZ, Qadir F. Medication adherence in post myocardial infarction patients. *J Ayub Med Coll Abbottabad.* 2018;30(4):552–557.
50. Bansilal S, Castellano JM, Fuster V. Global burden of CVD: focus on secondary prevention of cardiovascular disease. *Int J Cardiol.* 2015;201:S1–S7. doi:10.1016/S0167-5273(15)31026-3

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