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RESEARCH ARTICLE

# Kinesiophobia and self-management behaviour related to physical activity in Chinese patients with coronary heart disease: The mediating role of self-efficacy

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## Abstract

**Aim:** The purpose of this study was to explore the relationship among kinesiophobia, self-efficacy and self-management behaviour related to physical activity (SMBPA) in Chinese patients with coronary heart disease(CHD) and the mediating role of self-efficacy between kinesiophobia and SMBPA in Chinese patients with CHD.

**Design:** A cross-sectional study.

**Methods:** From March to July 2021, 540 Chinese patients with CHD were investigated with three scales using convenient sampling method. The data were analysed with Pearson correlation, univariate analysis, multivariate linear regression and the PROCESS macro.

**Results:** 509 valid questionnaires were collected (effective response rate: 94.2%). Low kinesiophobia and high self-efficacy were related to high-levels of SMBPA (all $p < .01$). Besides, the effect of kinesiophobia on SMBPA was partially mediated by self-efficacy, and the mediation effect accounted for 35.59% of the total effect.

**KEYWORDS**
Kinesiophobia, mediation effect, physical activity, self-efficacy, self-management

## 1 | INTRODUCTION

As the largest fatal disease in the world, coronary heart disease (CHD) not only seriously endangers human life and health, but also causes enormous economic burdens to individuals, health systems and countries around the world (Timmis et al., 2020; Virani et al., 2021). CHD affects 423 million people worldwide and accounts for 31% of deaths from CHD each year (Lum, McCreanor, Luo, & Graves, 2020). According to China's National Center for Cardiovascular Disease, there were about 11.39 million patients with CHD in China in 2020, with an increase of 390,000 cases since 2019 (Hu, 2020; Hu, 2021). The World Heart Association estimates that the total cost of cardiovascular disease worldwide will rise to $1,044 billion by 2030 from $863 billion in 2010 (Virani et al., 2020).

CHD is a behaviour-related disease that could benefit from sufficient physical activity. Physical activity (PA) is defined as any bodily activity caused by skeletal muscle contraction that leads to energy expenditure, including four categories: occupational PA, transportation PA, leisure-time PA and household PA (Caspersen, Powell, & Christenson, 1985). For patients with CHD, regular and moderate PA can significantly reduce coronary risk factors, complications and mortality (Heath, 2019; Virani et al., 2021). This idea was supported

by a systematic evaluation study (Pandey et al., 2016), which included approximately 720,000 patients in nine prospective cohort studies. The results showed that people who sat for more than 12 h a day were at higher risk for CHD than those who sat for 2.5 h a day. In addition, Schnohr et al. followed up with 12,314 participants for 33 years and found that compared with those who did not exercise, mild PA/medium PA/high-intensity PA could reduce CHD mortality by 24%/48%/49%, respectively. The study also proved that the increase in exercise amounts was related reducing of CHD mortality (HR = 0.75) (Schnohr, O'Keefe, Lange, Jensen, & Marott, 2017).

However, many patients with CHD fail to achieve the PA level recommended by the guidelines due to the difficulty in exercise, lack of time and symptom disturbance (e.g. fatigue, shortness of breath and chest tightness) (De Bacquer et al., 2021; Virani et al., 2021). Relevant studies have shown that self-management is a highly effective, strong operability and economic management model for chronic diseases (Kang et al., 2021; Kong, Zuo, & Chen, 2021). Self-management of chronic diseases can help patients effectively control disease symptoms, improve their quality of life and reduce the medical burden on patients (Kang et al., 2021; Kong et al., 2021). Therefore, self-management behaviour related to physical activity (SMBPA) is significant for patients with CHD. Multiple studies have shown that the self-management behaviours of patients with CHD are at a medium and low level in China (Yang, 2020a, 2020b; Zhang & Fu, 2020). In order to improve lifestyle and reduce the risk of CHD for the Chinese patients, a comprehensive understanding of the factors associated with SMBPA is an essential step in designing and implementing effective interventions.

The fear that PA or exercise would damage or re-damage the body is undoubtedly challenging the process of promoting CHD patients to adopt SMBPA. Several studies have examined the related contents of the views on PA among patients with CHD (Campkin, Boyd, & Campbell, 2017; Coull & Pugh, 2021). The results showed that kinesiophobia is a vital part of internal factors, which affects the initiation and continuous participation of patients with heart disease in exercise. Kinesiophobia is the excessive and irrational fear of PA or movement due to the fear of activity or physical exercise causing damage or re-injury to the body (Dabek et al., 2020). According to Health Belief Model (Mercadante & Law, 2021), if individuals have a more subjective understanding of the costs and obstacles that may be paid by taking health-related behaviours, they will be more likely to produce corresponding fear (such as kinesiophobia). Then, the more they hinder the occurrence of health-related behaviours (such as SMBPA).

In order to provide a more direct reference for practical intervention, it is necessary to explore further the intermediary process of kinesiophobia in patients with CHD affecting SMBPA. We noticed that the self-efficacy of patients with CHD may be a crucial intermediary variable between their kinesiophobia and SMBPA. Bandura's Self-Efficacy Theory can support this idea (Cheng et al., 2021). Cheng et al. explained that self-efficacy and individual emotional awakening is an interactive process (Cheng et al., 2021). When individual stress (such as kinesiophobia) decreases, their self-efficacy increases. In addition, high self-efficacy is also essential in achieving self-management (such as SMBPA), changing unhealthy behaviours and coping with kinesiophobia-related stress.

Many empirical studies also provide indirect support for this mediation model. For example, previous studies have shown negative correlation between kinesiophobia and self-efficacy (Liu et al., 2021) and a positive correlation between self-efficacy and self-management behaviour (Yang et al., 2021). Moreover, a lack of self-efficacy can be considered as the main obstacle for patients to change their unhealthy behaviour (De Bacquer et al., 2021). Based on this, self-efficacy is highly possible to be an important "bridge" (i.e. an intermediary variable) between kinesiophobia and SMBPA in patients with CHD. A study on patients after renal transplantation showed that self-efficacy, as an intermediary variable, partially mediated the relationship between kinesiophobia and PA (Zelle et al., 2016). In addition, the previous studies have also shown that the PA level of patients has a significant positive correlation with self-management level (Yang, 2020a). Therefore, it is reasonable to predict the intermediary role of self-efficacy between kinesiophobia and SMBPA in patients with CHD.

## 1.1 | Questions and assumptions

The mediation effect of the self-efficacy in the relationship between kinesiophobia and SMBPA in patients with CHD has not been confirmed. This study aims to clarify the direct/indirect relation and possible causal pathways of these variables by using the mediation model. The theoretical framework of this study was formed by integrating Health Belief Model (Mercadante & Law, 2021) and Self-Efficacy Theory (Cheng et al., 2021). Based on the theoretical framework, the following assumptions were put forward in this study:

**Hypothesis 1** *kinesiophobia is negatively correlated with SMBPA;*

**Hypothesis 2** *kinesiophobia is negatively correlated with self-efficacy;*

**Hypothesis 3** *self-efficacy is positively correlated with SMBPA;*

**Hypothesis 4** *kinesiophobia directly affects SMBPA and it also has an indirect effect on SMBPA through self-efficacy as a mediator.*

The hypothesized model of this study is shown in Figure 1.

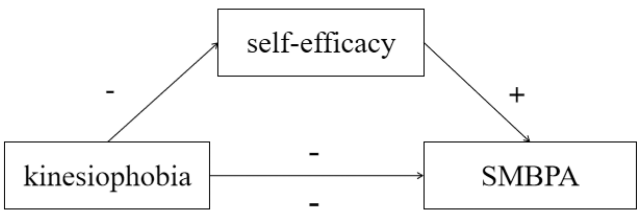


**FIGURE 1** Hypothesized model. SMBPA, self-management behaviour related to physical activity

## 2 | METHODS

### 2.1 | Study design

This study was designed as a cross-sectional study and was guided and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline (von Elm et al., 2014).

### 2.2 | Participants

Using the convenient sampling method, we investigated the patients with CHD in the Department of Cardiovascular Medicine of a tertiary hospital in Tianjin, China, from March to July 2021. Inclusion criteria of participants: (a) patients who were at least 18 years old and have been diagnosed with CHD for more than half a year; (b) be aware and able to communicate in Mandarin; (c) patients who volunteered after the investigator described the purpose of the study. Exclusion criteria: (a) any cognitive impairment or mental illness; (b) the NYHA cardiac function classification was Class IV; (c) contraindications for exercise training: such as uncontrolled unstable angina and severe uncontrolled arrhythmia; (d) patients with activity limitation caused by severe physical diseases (such as poliomyelitis and arthritis) or cerebrovascular diseases. Elimination criteria of questionnaires: (a) responses with the regular answers; (b) the questionnaires that were not completed due to the apparent discomfort of the patient during the questionnaire investigation or the patient's initiative to withdraw from the questionnaire.

PASS 15.0 (PASS) was used to calculate the sample size with a moderate $f^2$ effect of 0.15, alpha of 0.05, a power of 0.9, and 61 predictor variables. After taking into account a 20% elimination rate, 389 samples were estimated. A total of 509 valid questionnaires were received in this study. Due to the large sample size, the reliability and generalization of the research results were increased.

### 2.3 | Data collection

The systematic training of investigators was provided to uniformly collect data. Using the convenient sampling method, participants who satisfied the criteria were met separately in the hospital's inpatient ward. Prior to the start of the study, the informed consent was given to the participants. We introduced the study and its aim and the declaration of anonymity and confidentiality. After the participants agreed to engage the survey and signed informed consent, the questionnaires were provided to participants to conduct this survey. The questionnaire was filled out in an anonymous manner. For participants who have language communication ability but lack the ability to read and write, the investigators introduce each item of the questionnaire one by one and help the participants to complete the questionnaire. There was no time limit for completing the questionnaire. The questionnaire was collected on the spot after completion and the investigators checked the completeness of the questionnaire. For incomplete questionnaires, the investigators ask the respondents on-site and supplement the questionnaires. Questionnaires were double entered and validated with EpiData software (EpiData Version 3.1, EpiData Association).

### 2.4 | Measurements

The demographic and clinical characteristics questionnaire included nine questions: gender, age, height, weight, educational level, occupational status, marital status, complications (i.e. hypertension, diabetes, hyperlipidaemia and others) and whether the patient had received cardiac rehabilitation training.

The Chinese version of the Tampa Scale for Kinesiophobia Heart (TSK-SV Heart) was developed by Lei, Liu, Xiong, Sang, and Jin (2019) based on the scale by Back, Jansson, Cider, Herlitz, and Lundberg (2012). It is used to assess the level of kinesiophobia in patients with heart disease. The scale had 17 items in total. Each item was scored on a 4-point Likert scale, which ranges from 1 (strongly disagree) to 4 (strongly agree), with a total score of 17–68. A higher score indicated a higher level of kinesiophobia in patients. In this study, the Cronbach's α coefficient of the scale was 0.902.

The Chinese version of Cardiac Self-Efficacy Scale (CSES) was developed by Xie (2011) based on the scale by Sullivan, LaCroix, Russo, and Katon (1998). The scale had 16 items in total and was used to assess the self-efficacy of patients with CHD in physiology, role and function. Each item was scored on a 5-point Likert scale, which ranges from 0 (no confidence at all) to 4 (very confident), with a total score of 0–64. The higher the score was, the stronger the self-efficacy was. In this study, the Cronbach's α coefficient of the scale was 0.913.

Liu et al. based on the scale by Tokunaga-Nakawatase et al developed the Chinese version of the Evaluation Scale for Self-management Behaviour related to Physical Activity of Patients with Coronary Heart Disease (ES-SMBPA-CHD) (Tokunaga-Nakawatase, Taru, & Miyawaki, 2012). The scale aims to evaluate the level of Self-management Behaviour related to Physical Activity of Patients with CHD and includes two subscales, namely "what do you do to enhance your daily physical activity?" and "what do you do to maintain the level of daily physical activity?". This scale has 28 items. Each item is scored on a 5-point Likert scale ranging from 0 (never) to 4 (always), with a total score of 0–140. The higher the score, the better the level of SMBPA. In this study, the Cronbach's α coefficient of the scale was 0.921.

### 2.5 | Data analysis

Statistical analysis was performed using the IBM SPSS Statistics 26.0 software (SPSS Inc). Participants' demographic and clinical

characteristics used descriptive statistical methods, including frequencies, percentages, means, standard deviations (SD) and score range of each scale. Value $p < .05$ was statistically significant based on the two-tailed test. To preliminarily verify hypothesis 1–3, Pearson product–moment correlation coefficients were calculated to detect the bivariate correlations of kinesiophobia, self-efficacy and SMBPA. The independent *t* test and one-way ANOVA test (using Bonferroni post-test) were used to identify differences of SMBPA with different demographic and clinical characteristics. To further verify hypothesis 1 and 3, multivariable linear regression was used to assess whether kinesiophobia and self-efficacy significantly affected SMBPA in patients with CHD. SMBPA as the dependent variable, the multiclassification variables were transformed into dummy variables, and the hierarchical regression analysis was used to establish the multiple linear regression model in three steps. Step 1, to control the influence of covariates, the univariate analysis result with significant differences in demographic and clinical characteristics variables were taken as control variables to build model I. Step 2, to further verify hypothesis 1, on the basis of model I, the variable of kinesiophobia was added to build model II. Step 3, to further verify hypothesis 3, the variable of self-efficacy was added into model II to build model III.

The mediation effect test of Hypothesis 4 in this study used model 4 in PROCESS v3.5, a macro program developed by Hayes, with a 95% CI based on 5,000 bootstrapping samples (Hayes, 2012). In this analysis, kinesiophobia was set as the independent variable, self-efficacy of CHD as the mediator, SMBPA as the dependent variable and other variables with statistical significance in the multiple linear regression model as covariates. If the 95% confidence interval contains zero, there is no significant mediating effect at the 5% level of significance.

### 2.6 | Ethical considerations

The ethics committee of hospital approved this study, and the ethical approval number was 2022LW-004. All procedures were conducted according to the ethical standards of the Agency and the National Research Council and the Helsinki Declaration of 2021 (Issue information–Declaration of Helsinki 2021).

## 3 | RESULTS

### 3.1 | Characteristics of the participants

A total of 540 questionnaires were distributed in this study. After the elimination criteria of the questionnaire, 509 valid questionnaires were finally recovered. The effective response rate was 94.2%. In this study, the age of patients with CHD ranged from 27 to 87 years old, and the mean age was 63.39 (SD 9.84). See Table 1.

### 3.2 | Descriptive statistics and correlation analysis of kinesiophobia, self-efficacy and SMBPA in patients with CHD

The results of descriptive statistics and correlation analysis of kinesiophobia, self-efficacy and SMBPA in patients with CHD are shown in Table 2. As shown in Table 2, the mean score for ES-SMBPA-CHD was 87.57 (SD 32.02). According to the standard score = (actual score − theoretical minimum score)/(theoretical maximum score − theoretical minimum score) × 100, the standard score was calculated and divided into three levels, that is, high level (standard score ≥80), medium level (standard score 60–79) and low level (standard score <60). The results showed that the high, medium and low levels of SMBPA in patients with CHD accounted for 35.0%, 21.2% and 43.8%, respectively. In addition, the results of this study showed that kinesiophobia was negatively correlated with SMBPA and negatively correlated with self-efficacy. Moreover, self-efficacy was positively correlated with SMBPA. In general, hypotheses 1–3 in this study had been preliminarily supported.

### 3.3 | Univariate analysis of SMBPA in patients with different characteristics of CHD

The results showed that the differences in the scores of SMBPA of CHD patients from different "gender," "educational level," "occupational status" and "whether the patient had received cardiac rehabilitation training" were statistically significant. See Table 1.

### 3.4 | Multivariate linear regression analysis of SMBPA

Multivariate linear regression analysis was used to further verify hypothesis 1 and 3. "gender," "educational level," "occupational status" and "whether the patient had received cardiac rehabilitation training" were taken as controlled variables. SMBPA as dependent variable. The kinesiophobia and self-efficacy were used as the predictive variables, and the hierarchical regression analysis was used to establish the triple linear regression model. See Table 3 for detailed results.

The results showed that the variance inflation factors of the independent variables of the three models were less than five, indicating that there were no serious multicollinearity problems between the respective variables. In addition, the results of model I ($F = 9.381$, $p < .001$, adjusted $R^2 = .117$) showed that the 11.7% of the variation in SMBPA could be explained by demographic variables. "Educational level," "occupational status" and "whether the patient had received cardiac rehabilitation training" had significant prediction effects on SMBPA. In Model II ($F = 119.964$, $p < .001$, adjusted $R^2 = .678$), kinesiophobia was regarded as an independent variable while demographic variables were controlled. All

**TABLE 1** Demographic and clinical characteristics and the univariate analysis of SMBPA with different characteristics of participants ($n = 509$)

| Variable | Group | *n* (%) | Score (mean ± SD) | *t*/*F* | *p* |
|---|---|---|---|---|---|
| Gender | Male | 309 (60.7) | 90.38 ± 32.31 | 2.502 | .013 |
| | Female | 200 (39.3) | 83.21 ± 31.15 | | |
| Age | ≤39 years old | 17 (3.3) | 85.35 ± 36.41 | 1.932 | .087 |
| | 40–49 years old | 23 (4.5) | 94.78 ± 32.01 | | |
| | 50–59 years old | 119 (23.4) | 91.13 ± 31.67 | | |
| | 60–69 years old | 204 (40.1) | 89.53 ± 29.84 | | |
| | 70–79 years old | 131 (25.7) | 81.01 ± 33.81 | | |
| | ≥80 years old | 15 (2.9) | 81.26 ± 37.47 | | |
| BMI | <18.50 | 6 (1.2) | 91.66 ± 22.33 | 0.285 | .836 |
| | 18.50–23.99 | 145 (28.5) | 86.47 ± 32.47 | | |
| | 24.00–27.99 | 224 (44.0) | 88.91 ± 32.67 | | |
| | ≥28.00 | 134 (26.3) | 86.32 ± 30.99 | | |
| Educational level | Primary school or below | 52 (10.2) | 70.82 ± 29.33 | 12.255 | .000 |
| | Junior middle school | 124 (24.4) | 79.31 ± 31.59 | | |
| | Senior high school and technical secondary school | 146 (28.7) | 86.89 ± 31.68 | | |
| | Junior college | 106 (20.8) | 95.41 ± 30.18 | | |
| | Bachelor degree or above | 81 (15.9) | 101.82 ± 28.91 | | |
| Occupational status | Incumbency | 173 (34.0) | 88.62 ± 32.60 | 16.008 | .000 |
| | Retirement | 255 (50.1) | 92.41 ± 31.12 | | |
| | Unemployed | 81 (15.9) | 70.06 ± 27.62 | | |
| Marital status | Unmarried | 5 (1.0) | 110.60 ± 32.24 | 1.521 | .208 |
| | Married | 463 (90.9) | 87.85 ± 32.01 | | |
| | Widowed | 35 (6.9) | 80.11 ± 32.22 | | |
| | Divorced | 6 (1.2) | 89.83 ± 27.13 | | |
| Number of complications | <1 | 138 (27.1) | 87.59 ± 31.90 | 0.597 | .551 |
| | 1–2 | 303 (59.5) | 88.42 ± 32.22 | | |
| | ≥3 | 68 (13.4) | 83.72 ± 31.54 | | |
| Whether the patient had received cardiac rehabilitation training | Yes | 29 (5.7) | 110.93 ± 23.77 | 4.109 | .000 |
| | No | 480 (94.3) | 86.15 ± 31.93 | | |

Abbreviation: BMI, body mass index.

variables in Model II explained 67.8% of the variation in SMBPA, and kinesiophobia explained 56.1% of the variation in SMBPA. In Model II, "education level," "occupational status" and "kinesiophobia" were important predictors of SMBPA. However, "whether the patient had received cardiac rehabilitation training" was no longer recognized as significant predictor of the SMBPA. In Model III ($F = 171.946$, $p < .001$, adjusted $R^2 = .771$), self-efficacy was included in the regression model, which accounted for the 9.3% variation of the SMBPA. In model III, "education level," "occupational status," "kinesiophobia" and "self-efficacy" were important predictors of SMBPA. Therefore, the accuracy of hypotheses 1 and 3 was verified.

### 3.5 | Mediating effects of self-efficacy on kinesiophobia and SMBPA

The macro program PROCESS developed by Hayes (2012) was used to assess the mediation model of kinesiophobia's indirect effects on SMBPA through self-efficacy. The results are presented in Table 4 and Figure 2. The total effect of kinesiophobia on SMBPA was significant (a = −2.363, 95% CI [−2.517, −2.209]). Kinesiophobia had a significant indirect effect (b × c = − 0.841, 95% CI [−1.004, −0.682]) on SMBPA through self-efficacy, accounting for 35.59% of the total effect of kinesiophobia on SMBPA. Thus, the accuracy of hypothesis 4 was also verified.

**TABLE 2** Descriptive statistics and correlation analysis of variables ($n = 509$)

| Variable | Range of score | Mean | SD | 1 | 2 |
|---|---|---|---|---|---|
| 1. TSK-SV Heart | 17–67 | 39.06 | 10.74 | | |
| 2. CSES | 0–63 | 33.27 | 14.43 | −0.685* | |
| 3. ES-SMBPA-CHD | 10–139 | 87.57 | 32.02 | −0.812* | 0.789* |

Abbreviations: CSES, the cardiac self-efficacy scale; ES-SMBPA-CHD, evaluation scale for self-management behaviour related to physical activity of patients with coronary heart disease; SD, standard deviation; TSK-SV Heart, the Tampa Scale for Kinesiophobia Heart.

*$p < .01$.

## 4 | DISCUSSION

To our knowledge, this is the first study to consider the correlation among kinesiophobia, self-efficacy and SMBPA in patients with CHD. It is also the first study to explore whether self-efficacy mediates the relationship between kinesiophobia and SMBPA. This study confirmed several important findings. First, the mean score for SMBPA was 87.57 (SD = 32.02) and 65.0% of participants were at middle or low level. It showed that the SMBPA of most patients with CHD was at a middle and low level, which was similar to the results of most studies on self-management (Yang, 2020a, 2020b; Zhang & Fu, 2020). This result indicates that the level of SMBPA in patients with CHD needs to be improved. Second, this study confirmed kinesiophobia and self-efficacy were closely related to SMBPA in patients with CHD and affected the production of SMBPA. The result in this study could also provide evidence further to support the Health Belief Model (Mercadante & Law, 2021) and Self-Efficacy Theory (Cheng et al., 2021).

As mentioned above, we discussed the following two aspects: (a) hypothesis 1–3: the correlation between kinesiophobia, self-efficacy and SMBPA; (b) hypothesis 4: the intermediary role of self-efficacy between kinesiophobia and SMBPA.

### 4.1 | Correlation analysis

The results of this study suggested hypothesis 1 was correct. This finding was also found by Baez et al.'s study (Baez, Hoch, & Hoch, 2020). According to the Fear-Avoidance Model (Keessen et al., 2020) and Terror Management Theory (Huang, Du, & Qu, 2021), when patients' fear of PA will cause injury or re-injury increases. In order to protect themselves from the current risk, patients usually use cognitive strategies of active inhibition to resist. For patients, large amounts of exercise avoidance can make it difficult to conduct SMBPA effectively.

This study also has demonstrated hypothesis 2 was correct. The results provide further evidence to support the previous study (Liu et al., 2021). To some extent, individuals' good self-efficacy comes from positive physical and emotional states, while negative physical and emotional states such as anxiety and fear can weaken self-efficacy (Xia, 2019). In addition, since self-efficacy and individual emotional arousal are an interactive process (Wang, Wang, & Xu, 2021). This means that when individuals perceive a threat related to their health, they may experience stressful emotions such as fear and pain. These emotions can further lead to a decrease in the individual's self-efficacy. On the contrary, when individuals are less stressed and emotional, they will have more self-efficacy.

Results of this study also supported hypothesis 3. As for the relationship between self-efficacy and SMBPA, a correlation study is still lacking. However, the correlation between self-efficacy and self-management behaviour has been confirmed (Yang et al., 2021; Zhang & Fu, 2020). Self-efficacy has been used as a predictor of self-management behaviour in patients with CHD (Xie, 2011). When the patients had higher self-efficacy, they were more confident in self-management behaviour and were more likely to develop good self-management behaviour. On the contrary, when individual self-efficacy is insufficient, they lack confidence in completing self-management behaviours, leading to lower self-management level.

### 4.2 | Mediation effect

According to the results of the model I, higher educational background and received cardiac rehabilitation training were the promoting factors of SMBPA, while occupation status of unemployment was the hindering factor of SMBPA in patients with CHD. Patients with higher educational background were more likely to accept knowledge of cardiac motor rehabilitation, which is more beneficial for performing SMBPA. It is not surprising that patients who have received cardiac rehabilitation training have higher levels of SMBPA. A previous study has shown that cardiac exercise rehabilitation training could improve patients' awareness of diseases and provide effective cardiac rehabilitation guidance to ensure patients' sports safety (Yuan & Ding, 2019). This further improved the PA compliance and promoted the level of SMBPA in patients with CHD. In terms of occupational status, in-service and retired patients may have a stable source of income and their work unit also has organized employees to have physical examination, so they pay more attention to the knowledge of PA of CHD, which can arouse their attention to SMBPA.

In Model II and Model III, multiple linear regression analysis indicated that kinesiophobia explained 56.1% of the variation in SMBPA. Self-efficacy accounted for 9.3% variation of the SMBPA. However, "whether the patient had received cardiac rehabilitation training" was no longer used as the predictor of the dependent variable,

**TABLE 3** Multiple linear regression analysis of self-management behaviour related to physical activity ($n = 509$)

| Model | Variable | Standardized coefficients beta | $t$ | $p$ | Collinearity diagnosis | | $F$ | Adjusted $R^2$ |
|---|---|---|---|---|---|---|---|---|
| | | | | | Tolerance | VIF | | |
| Model I | Gender | −0.029 | −0.644 | .520 | 0.840 | 1.191 | 9.381* | .117 |
| | Educational level: Primary school and below | −0.207 | −3.605 | .000 | 0.525 | 1.904 | | |
| | Educational level: Junior high school | −0.242 | −4.023 | .000 | 0.479 | 2.087 | | |
| | Educational level: Senior high schools and technical secondary schools | −0.195 | −3.287 | .001 | 0.492 | 2.031 | | |
| | Educational level: Junior college | −0.083 | −1.451 | .148 | 0.534 | 1.874 | | |
| | Occupational status: Incumbency | 0.135 | 1.896 | .059 | 0.344 | 2.911 | | |
| | Occupational status: Retirement | 0.202 | 2.855 | .004 | 0.346 | 2.890 | | |
| | Whether the patient had received cardiac rehabilitation training | 0.162 | 3.882 | .000 | 0.993 | 1.007 | | |
| Model II | Gender | −0.018 | −0.664 | .507 | 0.840 | 1.191 | 119.964* | .678 |
| | Educational level: Primary school and below | −0.061 | −1.734 | .084 | 0.515 | 1.943 | | |
| | Educational level: Junior high school | −0.072 | −1.953 | .051 | 0.467 | 2.139 | | |
| | Educational level: Senior high schools and technical secondary schools | −0.093 | −2.574 | .010 | 0.488 | 2.050 | | |
| | Educational level: Junior college | 0.005 | 0.150 | .881 | 0.530 | 1.888 | | |
| | Occupational status: Incumbency | −0.012 | −0.276 | .783 | 0.339 | 2.950 | | |
| | Occupational status: Retirement | 0.092 | 2.149 | .032 | 0.343 | 2.912 | | |
| | Whether the patient had received cardiac rehabilitation training | 0.040 | 1.547 | .123 | 0.967 | 1.035 | | |
| | Kinesiophobia | −0.786 | −29.558 | .000 | 0.896 | 1.116 | | |
| Model III | Gender | 0.010 | 0.414 | .679 | 0.834 | 1.199 | 171.946* | .771 |
| | Educational level: Primary school and below | −0.042 | −1.410 | .159 | 0.514 | 1.947 | | |
| | Educational level: Junior high school | −0.051 | −1.629 | .104 | 0.466 | 2.144 | | |
| | Educational level: Senior high schools and technical secondary schools | −0.055 | −1.814 | .070 | 0.484 | 2.065 | | |
| | Educational level: Junior college | 0.014 | 0.481 | .631 | 0.530 | 1.888 | | |
| | Occupational status: Incumbency | −0.011 | −0.312 | .755 | 0.339 | 2.950 | | |
| | Occupational status: Retirement | 0.076 | 2.086 | .037 | 0.343 | 2.915 | | |
| | Whether the patient had received cardiac rehabilitation training | 0.018 | 0.841 | .401 | 0.962 | 1.040 | | |
| | Kinesiophobia | −0.508 | −17.096 | .000 | 0.511 | 1.959 | | |
| | Self-efficacy | 0.421 | 14.245 | .000 | 0.516 | 1.939 | | |

*Note*: "Kinesiophobia" and "Self-efficacy" were input as continuous variables. Gender (1: Male, 2: Female); Educational level (1: Primary school and below, 2: Junior high schools, 3: Senior high schools and technical secondary schools, 4: Junior college, 5: Bachelor degree or above); Occupational status (1: Incumbency, 2: Retirement, 3: Unemployed); Whether the patient had received cardiac rehabilitation training (0: No, 1: Yes).

Abbreviation: VIF, variance inflation factor.

*$p < .001$.

**TABLE 4** Mediating effect of self-efficacy on kinesiophobia and self-management behaviour related to physical activity ($n = 509$)

| Dependent variable | Independent variable | β | SE | *t* | 95% CI | | $R^2$ | *F* |
|---|---|---|---|---|---|---|---|---|
| | | | | | LLCI | ULCI | | |
| SMBPA | Kinesiophobia | −2.363 | 0.078 | −30.194 | −2.517 | −2.209 | 0.682 | 153.597* |
| Self-efficacy | Kinesiophobia | −0.898 | 0.045 | −19.876 | −0.987 | −0.810 | 0.478 | 65.594* |
| SMBPA | Self-efficacy | 0.936 | 0.065 | 14.366 | 0.808 | 1.063 | 0.775 | 215.295* |
| | Kinesiophobia | −1.522 | 0.088 | −17.269 | −1.696 | −1.349 | | |

Abbreviations: CI, confidence interval; LLCI, lower limit confidence interval; SE, standard error; ULCL, upper limit confidence limit interval.
*$p < .001$.

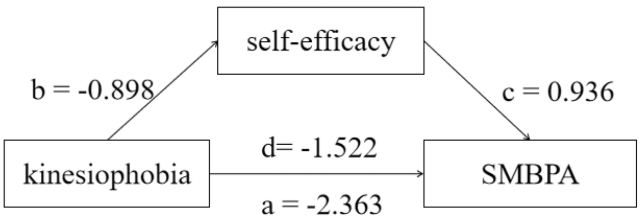


**FIGURE 2** Mediation model shows the direct effect and path coefficients that link kinesiophobia to the SMBPA via self-efficacy ($n = 509$). (a) The total effect between kinesiophobia and SMBPA. (b) The unstandardized regression coefficient between kinesiophobia and self-efficacy. (c) The unstandardized regression coefficient of self-efficacy on SMBPA. (d) The direct effect of kinesiophobia on SMBPA. SMBPA, self-management behaviour related to physical activity

indicating that kinesiophobia and self-efficacy played an important role in affecting SMBPA in patients with CHD.

Results of mediation effect test supported hypothesis 4. The results showed that kinesiophobia not only directly affected the SMBPA in patients with CHD, but also indirectly affected the level of SMBPA through their sense of self-efficacy. Patients' self-management behaviour may be affected by a variety of factors, including kinesiophobia, perceived stress and psychological pain. However, they can all act on self-management behaviour through the intermediary role of self-efficacy. This result was consistent with previous studies on the relationship among stress-related emotions, self-efficacy and self-management behaviours. For example, Guo et al. (2019) reported that self-efficacy plays an intermediary role in the relationship between perceived stress and diabetic self-management behaviour in adolescent patients with type 1 diabetes. Liu et al.'s research on empty older patients with type 2 diabetes has also revealed the same result (Liu et al., 2019).

### 4.3 | Implications for practice

The evidence from this study provides a direction for healthcare professionals to develop targeted interventions to improve the self-efficacy and SMBPA in patients with CHD. First, the evidence in this study suggests that health professionals should provide relevant information to increase the patient's knowledge of cardiac exercise rehabilitation, so that they have an accurate understanding and positive cognition of the safety and effectiveness of PA. Health professionals should also pay more attention to patients with low educational background and unemployed in order to improve the level of SMBPA. Second, targeted psychological intervention seems to be necessary to reduce kinesiophobia, improve self-efficacy in CHD patients and then improve SMBPA. Therefore, further research needs to explore the effectiveness of psycho-educational technology in reducing kinesiophobia and improving self-efficacy of patients with CHD.

### 4.4 | Limitations

The findings in this study are subject to two limitations. First, this study is a cross-sectional study. Even if this study has a theoretical framework, the determination of causality between variables is still limited. Future studies could use experimental design or longitudinal tracking research design to verify the findings of this study and further determine the causality between relevant variables. Second, the investigation and data collection in this study were only conducted in the cardiovascular department of a hospital. The limited representative sample will affect the reliability of the results to some extent.

## 5 | CONCLUSION

CHD is a disease with a long course and severe symptoms, which can cause great psychological and physical stress to the patients. This study demonstrated that kinesiophobia and self-efficacy were significantly associated with SMBPA. Besides, kinesiophobia could indirectly affect SMBPA through self-efficacy. Therefore, in order to improve the patients' SMBPA, reduce the risk factors of CHD and prevent disease recurrence, it seems necessary to reduce kinesiophobia in CHD patients at an early stage through targeted interventions to stimulate self-efficacy.

### AUTHOR CONTRIBUTIONS

SAZ contributed to the work design, data analysis and data interpretation, drafted the article, revised important intellectual content of the article and made the final approval of the version to be

submitted. ZYW contributed to data collection, data acquisition and data analysis, drafted the article and made the final approval of the version to be submitted. XYL and JKB contributed to data collection and data acquisition, drafted the article and made the final approval of the version to be submitted. YWL contributed to data collection and data analysis, drafted the article and made the final approval of the version to be submitted. YYX contributed to data acquisition and data analysis, drafted the article and made the final approval of the version to be submitted. GL contributed to the analysis of the work, drafted the article and made the final approval of the version to be submitted. TEF contributed to the work design and data interpretation, revised important intellectual content of the article and made the final approval of the version to be submitted.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS APPROVAL STATEMENT

This research was approved by the ethics committee of Tianjin Chest Hospital. Ethics Approval Number: 2022LW-004.

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