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Physical Activity and Factors Affecting Its Maintenance Among Patients With Coronary Heart Disease Not Undergoing Cardiac Rehabilitation in China

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Background: The level of physical activity (PA) among patients with coronary heart disease (CHD) living in Chinese communities who do not participate in cardiac rehabilitation programs and the factors contributing to patient maintenance of PA are unclear. **Objective:** This cross-sectional study, guided by the Transtheoretical Model, evaluated (1) the maintenance of PA in Chinese patients with CHD 12 months after hospital discharge and (2) the demographic, clinical, and psychological characteristics associated with maintenance of PA. **Methods:** A total of 1162 patients completed 6 questionnaires at 12 months posthospitalization to assess their maintenance of PA, stage of change, symptoms of depression and anxiety, and health-related quality of life and sleep. **Results:** Only 40% of patients with CHD maintained regular PA 12 months after hospital discharge. Walking was their primary PA. Thirty-seven percent of patients reported no intention of having regular PA. Male sex (odds ratio [OR], 1.69), awareness of PA's cardiac benefit (OR, 4.12), a history of regular PA before the cardiac event (OR, 6.08), history of chronic disease (OR, 1.43), mild depressive symptoms (OR, 1.40), moderate and severe depressive symptoms (OR, 0.41), smoking (OR, 0.54), and years of CHD (OR, 0.96) were related to maintenance of regular PA. Patients with CHD who maintained regular PA had better quality of life and sleep ($P < .001$) and fewer unplanned clinic visits ($P = .001$) and cardiac cause readmissions ($P = .012$) and reported fewer declines in PA capacity ($P < .001$). **Conclusions:** Walking is the most common form of PA 12 months posthospitalization among patients with CHD in China. Patient education and counseling about the cardiac benefits of PA, taking into account stage of change, are important considerations to improve maintenance of PA.

KEY WORDS: coronary heart disease, physical activity, maintenance, risk factors, community health

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Cardiac rehabilitation (CR) can reduce mortality, hospital readmission, and cardiovascular risk factors as well as improve quality of life in patients with coronary heart disease (CHD).[1–3] Physical activity (PA) is a major component of CR programs and is integral to recovery from CHD events. Guidelines for secondary prevention recommend maintaining regular PA to achieve maximum secondary prevention benefit for patients with CHD.[4,5]

Comprehensive CR programs in China cover 5 dimensions, including lifestyle modifications (smoking cessation, diet, PA training, and sleep management), medicine surveillance, stress management or psychological counseling, quality of life improvement, and vocational counseling.[6] The programs include 3 different continuous phases: the first phase is the in-hospital rehabilitation period; the second phase is the outpatient rehabilitation period (usually 1–6 months after being discharged from hospital); and the third phase is a long-term rehabilitation period in the community or family (usually more than 6 months after being discharged from the hospital). The key point of the third phase is maintaining lifestyle modification including PA.

Comprehensive CR programs have expanded during the past 2 decades and alternative models of CR are provided in China, including home- and community-based CR.[7] Unfortunately, participation and adherence to CR programs remain low[8]; it is estimated that only one-third of patients with CHD attend CR.[8] The low participation and adherence rates are attributed to intrapersonal and interpersonal reasons such as clinical factors, provider-level factors, service delivery, health system factors,[9] and symptoms of depression.[10]

In light of the increasing morbidity and mortality of patients with CHD in China,[11] a feasible way to provide secondary prevention is greatly needed. To effectively design and implement CR and secondary prevention programs, 2 important questions must be addressed: (1) Do patients with CHD who do not participate in CR engage in and maintain PA after returning to the community; and (2) If so, what are the factors associated with their maintenance of PA?

To date, most studies on PA in China have focused on the general population. There is little research examining maintenance of PA among patients with CHD in Chinese communities who do not participate in CR. Therefore, the present study guided by the Transtheoretical Model of Behavioral Change (TTM)[12] aimed to (1) assess the status of PA, stage of change, and associated outcomes for patients with CHD not participating in CR; and (2) explore the demographic factors along with clinical, psychological, and PA characteristics associated with the maintenance of PA.

Methods

This descriptive and exploratory study used a cross-sectional survey design. It was performed as a part of the development of a strategy for secondary prevention and home-based CR for patients with CHD in Hebei province, China.

Subjects and Settings

Patients with the diagnosis of CHD were recruited from 3 tertiary hospitals in different districts of Hebei province in northeastern China. Patient surveys were conducted between July and November 2017 in hospitals from 3 cities (Shijiazhuang, Tangshan, and Zhangjiakou). The cities were selected based on their geographical representation and level of economic development. In each of the 3 cities, 1 tertiary hospital was randomly selected. Within each of the 3 hospitals, patients diagnosed with CHD, aged 18 to 80 years were selected. Because of the different population sizes of the 3 cities, to ensure that those at larger sites had the same probability of being selected for the sample as those at smaller sites, and vice versa, probability proportional to the population size of each city was used in this study. Patients were considered eligible if they met 1 of the following inclusion criteria: diagnosis of acute coronary syndrome, coronary revascularization, and/or angina with at least 1 coronary artery stenosis greater than 50%. Patients were excluded if they were beyond the age limit; were involved in any CR program in or out of hospital; had serious dysrhythmia (ventricular fibrillation, ventricular tachycardia, or third-degree atrioventricular block, not including reperfusion arrhythmias), or serious heart failure (New York Heart Association classification type IV) during hospitalization; had a hearing and/or communication disability recorded during hospitalization; or had orthopedic limitations (eg, lower lumbar spinal orthopedic disease limiting PA). Patients included in the study were then classified by the type of CHD treatment strategy, that is, percutaneous coronary intervention (PCI), coronary artery bypass graft, or medical therapy.

The final group included 1162 patients with CHD (Shijiazhuang, 540; Tangshan, 388; Zhangjiakou, 234), who had been discharged from the hospital for 12 months, with data available for all analyzed variables.

The patients were surveyed by telephone interviews in Chinese by trained research assistants. The time to complete the survey ranged from 26 to 54 minutes. All patients provided informed consent before data collection, and the research protocols were approved by the Human Ethics Committee of Tangshan Gongren Hospital.

Data Collection and Measures

Demographic and Clinical Data

Patient demographic and clinical data were collected from the electronic medical record using a data collection form created for this study. Demographic details included age, marital status, sex, and years of education.

Clinical data included medical history of CHD and comorbidities.

Anthropometric Measures

Height and weight were self-reported if the patient could report recent accurate measures. If they could not, or were uncertain, research assistants instructed the patient in the performance of the measures. During measurements, all patients wore light clothing and removed their shoes.

Physical Activity and Stage of Change for Physical Activity

The International Physical Activity Questionnaire, developed by an International Consensus Group, was used in this study. It includes long (31 items) and short (9 items) versions that can be self-administered or completed by interview/telephone to monitor PA habits over the previous 7 days with good reliability and validity.[13,14] The short version was used to estimate the total weekly PA level by classifying reported hours as low, moderate, or high intensity, according to metabolic equivalent of energy (MET) estimates. Walking is an example of low-level PA; moderate PA includes jogging, aerobics, gardening, bicycling, dancing, swimming, or house cleaning; vigorous PA includes running, lifting heavy objects, playing strenuous sports, or strenuous work. Walking was evaluated as 3.3 METs; moderate activity, as 4.0; and high-intensity activity, as 8.0.[15]

The TTM[12] was used to assess patient maintenance of PA. According to the TTM,[12] behavioral change includes 5 stages: precontemplation, contemplation, preparation, action, and maintenance. Patient PA stage was assessed using questionnaire on Stage of Changing.[10] We categorized patients into maintenance and nonmaintenance PA groups (see Figure 1). Maintenance of PA, the main outcome in this study, is the stage in which people have made specific overt modifications in their lifestyle for at least 6 months. Nonmaintenance in this study included the stages of precontemplation (not intending to start PA regularly), contemplation (intending to start PA regularly in the next 6 months), preparation (intending to start PA regularly in the next 30 days), and action stage (those doing PA regularly for less than 6 months or those doing PA irregularly).

Depressive Symptoms

Depressive symptoms were assessed using the Patient Health Questionnaire,[16] a screening instrument with 9 items, developed to measure symptoms of depression. The Patient Health Questionnaire has been used to measure symptoms of depression in CR. For each of the 9 items, patients were asked how much they were bothered by symptoms during the last 2 weeks. Each item had response options ranging from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores ranged from 0 to 27, with higher scores indicating more depressive symptoms. The total score was categorized into 4 severity groups: no (0–4), mild (5–9), moderate (10–14), and severe (≥15) symptoms of depression.[17] The Chinese version of Patient Health Questionnaire[18] is a reliable and efficient instrument to assess symptoms of depression in Chinese outpatients with cardiovascular diseases.[19] In this study, the Patient Health Questionnaire Cronbach's α was 0.74. Moderate depressive symptoms were merged with severe depressive symptoms for analyzing their relationship to PA maintenance.

Anxiety

Symptoms of anxiety were assessed using the Generalized Anxiety Disorder (GAD) 7 Scale. The GAD-7 questionnaire is a 1-dimensional self-administered scale designed to assess the presence of symptoms of generalized anxiety disorder, as listed in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*.[20] Subjects were asked how often during the previous 2 weeks they experienced each of the 7 core symptoms of generalized anxiety disorder. The total GAD-7 score was calculated by simple addition of the answers to each item. Response options were "not at all," "several days," "more than half the days," and "nearly every day," scored as 0, 1, 2, and 3, respectively. The total score ranged from 0 to 21,[20] categorized into 4 severity groups: minimal (0–4), mild (5–9), moderate (10–14), and severe (15–20).[20] The Chinese version of GAD-7[21] is reliable and efficient for screening anxiety disorder in Chinese cardiovascular outpatients.[19] In this study, the GAD-7 Cronbach's α was 0.83. Moderate anxiety symptoms were merged with severe anxiety symptoms for analyzing their relationship with PA maintenance.

Outcomes Associated With Physical Activity Maintenance

Quality of Life

Quality of life was assessed by the Chinese Questionnaire on quality of life in Patients With Cardiovascular Disease (CQQC). The CQQC was developed by the Cardiovascular Committee of the Chinese Society of Rehabilitation Medicine in 1996 and was revised in 2008. It is a self-reported questionnaire with strong reliability (Cronbach α = 0.91).[22] In this study, the CQQC Cronbach's α was 0.85. It includes 6 categories: physical strength, illness, medical treatment, general life, social psychology, and working condition, with a total of 24 items.[22] The questionnaire score ranges from 0 to 154 points; the higher the score, the higher the quality of life.[22]

Sleep Quality

Sleep quality was assessed using the Chinese version of the Pittsburgh Sleep Quality Index.[23] The Pittsburgh Sleep Quality Index has 19 self-rated items related to sleep quality in the past month, of which 7 component scores are summed to obtain a global score. The 7

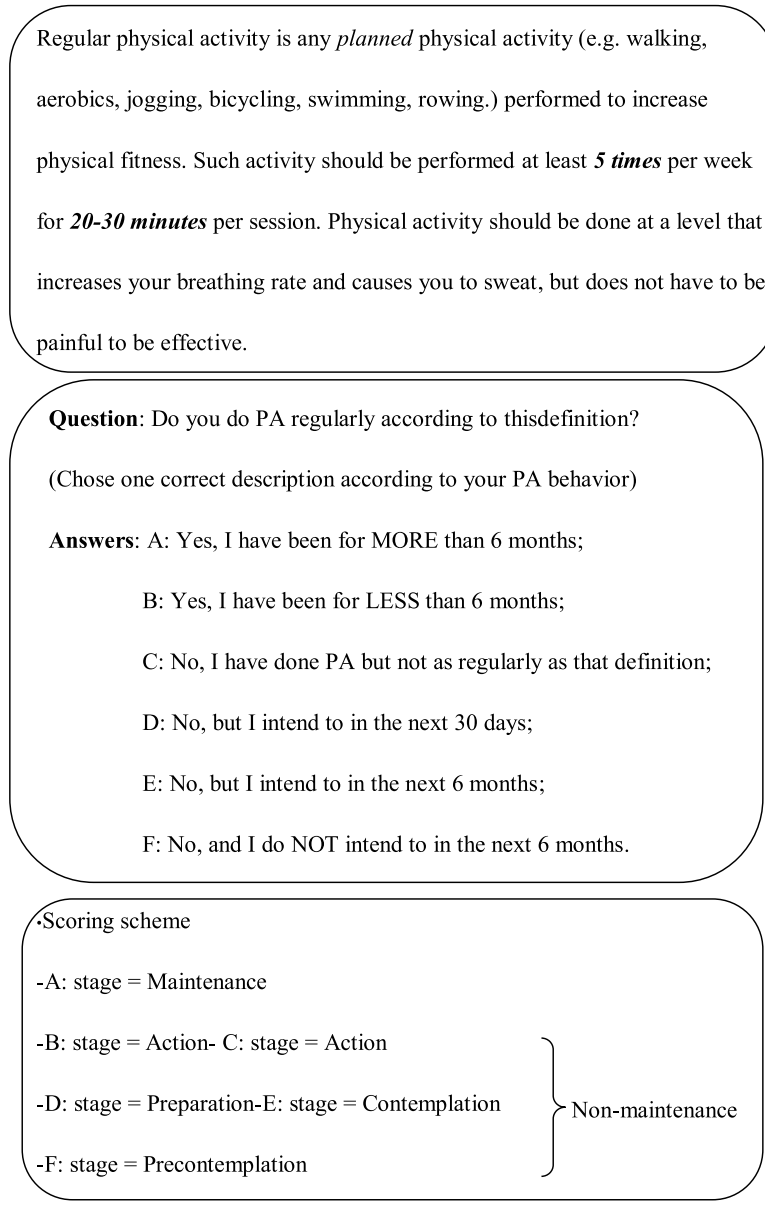

FIGURE 1. *Questionnaire on Stage Of Change.*

components include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component score ranges from 0 to 3, with scores higher than 1 indicating problems in that aspect of sleep quality. The global score of sleep quality ranged from 0 to 21, with a higher score indicating poorer quality of sleep, whereas a cutoff score of 5 or lower indicated good sleep quality.[24] The Pittsburgh Sleep Quality Index has good overall reliability (Cronbach $\alpha = 0.84$).[23] The Pittsburgh Sleep Quality Index Cronbach's α was 0.79 in this study.

The other outcomes were assessed by asking: "How many instances of unplanned clinical visits, emergency visits and hospitalizations for cardiac problems were there?' Unplanned clinical visits included all the cardiac clinic visits, except those for medication refills. Emergency visits included only cardiac-emergency visits. Hospitalization included only the cardiac-causes of hospitalization. The change in PA capacity was assessed by asking "According to your PA capacity during the last month, choose 1 proper word to describe your PA capacity after the cardiac event from the following 3 different words: reduced, similar, or increased."

Covariates

Covariates were sociodemographic and clinical characteristics (age at interview, sex, number of educational years, current smoking status, current alcohol consumption, obesity, chronic disease history, co-morbidity, and treatment strategy). Educational years were categorized as 6 years or less (basic education), 6 to 9 years (secondary

education), and more than 9 years (tertiary education). Smoking status was self-reported. Chronic disease history was collected from the electronic medical record, including history of hypertension, diabetes, and stroke. Obesity was defined as a body mass index greater than 30 kg/m^2. Other information about PA was assessed by asking: "Do you know that you should perform PA when recovering from the index event or procedure (PCI, coronary artery bypass graft surgery, or acute coronary syndrome)?" This was asked to assess patient awareness about the benefit of PA. To assess the patient's history of PA, we also asked, "Did you have a routine for performing regular PA before the diagnosis of CHD" to assess the patients' history of PA.

Data Analysis

Data analyses were performed using the Statistical Package for the Social Sciences (SPSS ver. 22.0; SPSS Inc, Chicago, Illinois). Means and standard deviations, frequencies, and percentages were used to describe sociodemographic, clinical, and PA characteristics. The differences between the maintenance and nonmaintenance groups were compared using Student *t* test for continuous variables and χ^2 test for categorical variables.

Walking was valued as 3.3 METs; moderate activity, as 4.0; and high-intensity activity, as 8.0.[15] The weighted MET-minutes per week (MET·min·wk^{-1}) was calculated as duration × frequency per week × MET intensity. Using the data truncation principle, when a certain intensity of PA lasted more than 3 h/d, it was recalculated as 180 minutes.[15] This principle allows for a maximum of 21 hours for each intensity level of PA (1260 minutes) per week. This process effectively avoids misclassifying some individuals into the "high" groups.[15]

Binary logistic analysis in generalized linear models was used to analyze predictors related to maintenance of PA (dependent variable). All variables were entered into the model, and odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A *P* value <.05 was considered to indicate statistical significance.

Results

Study Population

Between June 1, 2017, and October 31, 2017, among 1682 patients with CHD who were discharged from the 3 hospitals for 12 months, 1442 patients could be reached by telephone. Nineteen patients died before data collection, 20 patients were older than 80 years, and 241 patients refused to participate in the study (Figure 2). Consequently, 1162 patients were included in the analyses. The patients ranged in age from 27 to 80 years (mean, 60.9 ± 9.86 years), 68.8% of patients (n = 800) were male, and 48.3% (n = 561) were obese. The mean number of coronary vascular lesions was 2.42 ± 0.80; 80.3% of the patients had 2 or more vessel diseases, and 19.2% of patients had a more than 5-year history of CHD. Most patients (74.9%) had a history of chronic disease, 54.5% of patients had hypertension, 25.5% had diabetes, and 5.7% had a previous stroke. Most patients (67.1%) received PCI (Table 1).

Physical Activity Level and Stage of Physical Activity Change

The total score of PA in this sample was 4793.70 ± 2556.21 MET·min·wk, in which most of the PA scores were related to walking (2421.96 ± 1341.24), followed by moderate-intensity (2134.04 ± 1495.28) and vigorous-intensity (237.69 ± 1136.47) PA. Most patients (84.9%) in this sample reported awareness of PA's cardiac benefit but less than half of the patients (47.8%) had routine PA before the cardiac event. Overall, 40.4% of the patients were in the maintenance of stage doing PA regularly, whereas 37.3% of patients were in the precontemplation stage, 7.1% were in the contemplation and preparation stage, and 15.2% were in the action phase but did not engage in regular PA (Table 2).

Outcomes and Physical Activity Level Comparing Between the 2 Groups

Patients in the PA maintenance group had fewer unplanned clinic visits and cardiac readmissions, as well as higher quality of sleep and life, than those in the nonmaintenance group. Comparing the PA level between the 2 groups, we found that walking and weekly total METs were significantly different between the 2 groups, being more frequent in the maintenance group ($P < .001$), but there was no difference in moderate- and vigorous-intensity PA ($P > .05$) between the maintenance and nonmaintenance groups. More patients reported increased PA capacity (24.5% vs 15.3%) and fewer patients reported reduced PA capacity (19.8% vs 34.6%) in the maintenance group ($P < .001$) (Table 3).

Factors Affecting Regular Physical Activity Among Patients With Cardiac Disease

Binary logistic analysis in generalized linear models was used to analyze the predictors related to maintenance of PA (dependent variable). All variables were entered into the model as independent variables. The results showed that male sex (OR, 1.69; 95% CI, 1. 21–2.35), chronic disease history (OR, 1.43; 95% CI, 1.03–1.99), awareness of PA's cardiac benefit (OR, 4.12; 95% CI, 2. 40–7.15), history of routine PA before the event (OR, 6.08; 95% CI, 4.54–8.14), a history of chronic disease (OR, 1.64; 95% CI, 1.06–2.55; $P < .05$), and mild depressive symptoms (OR, 1.37; 95% CI, 1.02–1.85; $P < .05$) were associated with significantly higher odds of maintaining regular PA. However, smoking (OR, 0.54; 95% CI, 1 21–2.35), years of CHD (OR, 0.96;

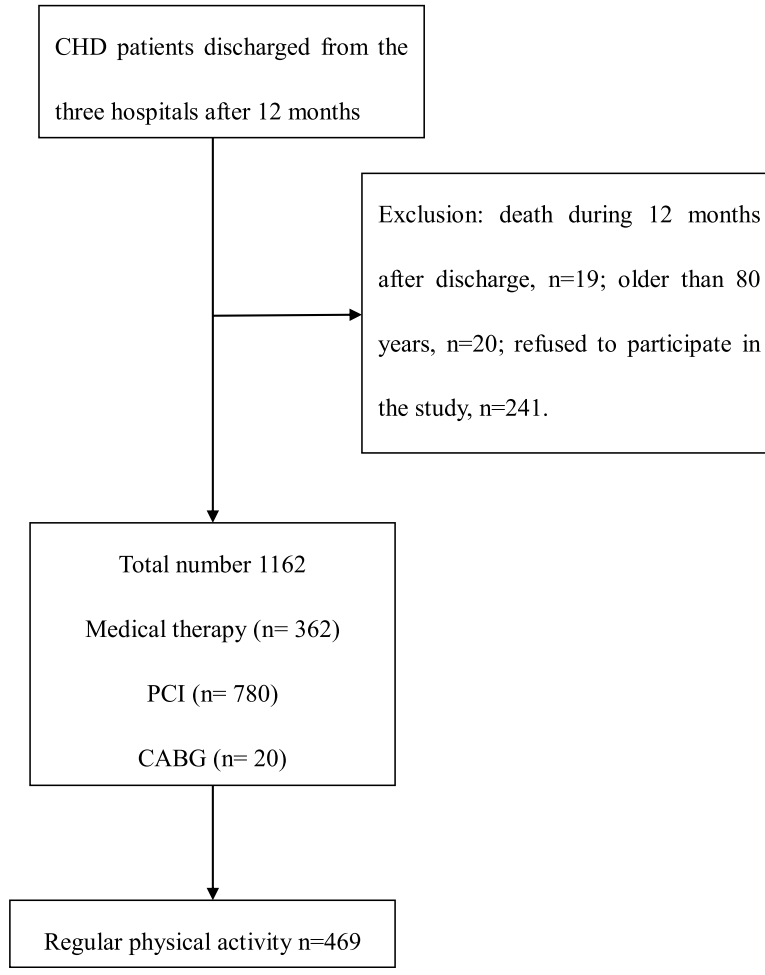

FIGURE 2. *Study overview. Coronary heart disease (CHD) is defined as at least 1 coronary artery stenosis 50% or greater, history of percutaneous coronary intervention, ST-elevated myocardial infarction, non–ST-elevated myocardial infarction, or coronary artery bypass graft.*

95% CI, 0.93–0.99), and moderate or severe depressive symptoms (OR, 0.41; 95% CI, 0.18–0.95) were associated with significantly lower odds of maintaining regular PA (Table 4).

Discussion

In this multicenter study on patients with CHD from China, only 40% (n = 469) of the patients reported maintaining regular PA 12 months after hospital discharge. Importantly, 37% of patients reported no intention of engaging in regular PA.

The patients in the regular PA group reported more energy expenditure by walking ($P < .001$) than by moderate ($P = .969$) and vigorous ($P = .140$) level PA. This suggests that walking might be an easier PA to maintain than moderate or vigorous PA among Chinese patients with CHD, especially for those patients who had no routine PA before their cardiac event.

Meanwhile, better health-related quality of life and exercise capacity, less unplanned clinic visits, and cardiac-caused hospitalization were observed among patients in the regular PA group, compared with the irregular PA group ($P < .05$). Substantial research has shown that walking (mild PA) can improve quality of life[25] and exercise capacity[26] among patients with CHD and decrease mortality compared with those who are inactive, in both the general population[27,28] and patients.[29,30] Wasfy and Baggish,[31] in their review of relevant epidemiologic literature on exercise, also found that the least active patients may benefit most from small increments in PA. Therefore, encouraging patients with CHD to maintain even mild PA can be an extremely important strategy to achieve successful secondary prevention.

This study also showed that the independent factors affecting patient PA maintenance included intrapersonal variables such as sex and smoking; clinical variables, such as chronic disease history and CHD duration; PA characteristics, such as routine PA before the CHD and awareness of PA's cardiac benefits; and moderate and severe depressive symptoms. Generally, research has shown that men are more active than women across the lifespan.[32]

TABLE 1 Characteristics of the Study Participants

Variable	n (%)	Mean (SD)	Range
Age, y		60.91 (9.86)	27–80
Body mass index, kg/m^2		25.10 (3.31)	16.3–37.5
Years with CHD		3.36 (4.17)	1–31
Total number of comorbidities		1.21 (1.00)	0–7
Total number of vascular lesions		2.42 (0.80)	1–3
Total score of PHQ-9		5.58 (3.48)	2–14
Total score of GAD-7		4.56 (2.80)	1–19
Male	800 (68.8)		
Obesity	561 (48.3)		
Married	1092 (94.0)		
Educational level			
Basic education (≤6 years)	340 (29.3)		
Secondary education (6–9 years)	551 (47.4)		
Tertiary education (>9 years)	271 (23.3)		
Employed	358 (30.8)		
Smoking (yes)	118 (10.2)		
Drinking (yes)	184 (15.8)		
Vascular lesions ≥2	933 (80.3)		
Chronic disease history	870 (74.9)		
Diabetes mellitus	296 (25.5)		
Hypertension	632 (54.4)		
Previous stroke	66 (5.7)		
Treatment strategy			
Medical therapy	362 (31.2)		
PCI	780 (67.1)		
CABG	20 (1.7)		

Abbreviations: CABG, coronary bypass graft; CHD, coronary heart disease; GAD-7, Generalized Anxiety Disorder-7; PA, physical activity; PCI, percutaneous coronary intervention; PHQ-9, Patient Health Questionnaire.

Our finding that maintenance of PA was 1.7 times more likely in men than women is similar to the findings from other studies that women are more likely to be inactive after a cardiac event.[33] Tailored interventions addressing the varied independent factors that affected our Chinese patients' participation in PA might be able to improve their maintenance of PA.

Consistent with other studies that have shown that regular PA before a cardiac event is a predictor of PA maintenance,[34] our study found that patients with a history of routine PA before their cardiac event are 6 times more likely to maintain regular PA after their cardiac event. However, less than half patients (47.8%) in this study reported a routine of regular PA before the cardiac event. Several studies of PA in China report low levels of PA. For example, Bennett et al[35] reported a total mean (SD) PA of 21.5 (12.8) MET hours per day (MET-h/d) in a large sample of people in China (n = 487 000). Tian

TABLE 2 Physical Activity Level of the Study Participants

PA Level/Characteristics	n (%)	Mean (SD)	Range
Walking, MET·min·wk		2421.96 (1341.24)	66–4158
Moderate, MET·min·wk		2134.04 (1495.28)	0–5040
Vigorous, MET·min·wk		237.69 (1136.47)	0–7200
Total MET·min weekly		4793.70 (2556.21)	132–19278
Awareness of cardiac benefits of PA	987 (84.9)		
Routine of regular PA before the cardiac event	556 (47.8)		
Stage of PA changing			
Precontemplation	434 (37.3)		
Intend to	83 (7.1)		
Action	176 (15.2)		
Maintenance	469 (40.4)		

Abbreviations: MET·min·wk, metabolic equivalent of energy minutes per week; PA, physical activity.

TABLE 3 Comparison of Physical Activity Stage of Change and Outcomes for the 2 Groups

Variables	Maintenance	Nonmaintenance	*P*	
Outcomes				
Unplanned clinical visits	0.64 ± 0.95	0.91 ± 1.29	.001	
Emergency visits	0.04 ± 0.33	0.04 ± 0.20	.345	
Cardiac-caused hospitalization	0.24 ± 0.64	0.30 ± 0.58	.012	
Total score of PSQI	3.27 ± 3.00	4.55 ± 3.51	<.001	
Total score of CQQC	83.96 ± 10.07	75.49 ± 14.38	<.001	
PA levels				
Walking, MET·min·wk	2904.49 ± 1173.90	2095.40 ± 1349.65	<.001	
Moderate, MET·min·wk	2132.03 ± 1446.17	2135.41 ± 1528.66	.969	
Vigorous, MET·min·wk	299.87 ± 1271.48	195.61 ± 1034.01	.140	
Total MET·min weekly	5336.39 ± 2240.65	4426.43 ± 2689.36	<.001	
Change in PA capacity compared to before the event, n (%)			<.001	<.001
Reduced	93 (19.8)	240 (34.6)		
Similar	261 (55.7)	347 (50.1)		
Increased	115 (24.5)	106 (15.3)		

Abbreviations: CQQC, China Questionnaire of Quality Life in Patients With Cardiovascular Disease; MET·min·wk, metabolic equivalent of energy minutes per week; PA, physical activity; PSQI, Pittsburgh Sleep Quality Index.

et al[36] also reported that, in the general population, only 22.8% individuals engaged in regular PA in China. The participation in PA was much lower than that in the United States (51.6%)[37] and Finland (33% in men and 27% in women).[38] Our study also found that patients who were aware of the cardiac benefit of PA were 4 times more likely to maintain regular PA. Thus, the public health agenda in China should include a strong emphasis on educating patients and the public about the importance and cardiovascular benefits of regular PA. Messaging through enhanced media and broadcasting activities may help to increase awareness and knowledge about the benefits of regular PA for those with CHD as well as the general population in China.

Moderate and severe symptoms of depression were a negative predictor for maintaining regular PA in our patients, lowering the odds of maintaining PA by 60%. This result concurs with findings of the study of Prugger et al[10] wherein severe depressive symptoms had a detrimental effect on maintaining regular PA. Interestingly, the results of our study showed that symptoms of mild depression were associated with a 40% increase in the likelihood of maintaining PA. Further study is needed to confirm this observation and explore the reasons for this relationship.

Patients with a history of chronic disease (hypertension, diabetes, and stroke) were 1.4 times more likely to maintain regular PA in our study, which differs from the findings of Armstrong et al.[39] This may be because individuals in our study with chronic disease history had more frequent visits to healthcare providers and received more education about the benefits of PA. We found that patients who knew the benefits of PA were 4 times more likely to maintain PA. This is similar to results from a previous study, which showed that an awareness of the benefits of PA is helpful in encouraging patients to establish PA.[40] Years of CHD was negatively associated

TABLE 4 Binary Logistic Model for Maintaining Regular Physical Activity Levels Among Patients With Coronary Heart Disease[a]

Variables	*B*	SE	*P*	OR	95% CI for OR
Male sex	0.52	0.17	.002	1.69	1.21–2.35
Smoking	–0.62	0.28	.029	0.54	0.31–0.94
Years of CHD	–0.04	0.02	.020	0.96	0.93–0.99
Chronic disease history	0.36	0.17	.035	1.43	1.03–1.99
Awareness PA's cardiac benefits	1.42	0.28	<.001	4.12	2.40–7.15
PA routine prior CHD	1.81	0.15	<.001	6.08	4.54–8.14
Depression level					
No depression	1				
Mild depression	0.34	0.15	.028	1.40	1.04–1.90
Moderate and serious depression	–0.89	0.43	.038	0.41	0.18–0.95

Abbreviations: CHD, coronary heart disease; CI, confidence interval; OR, odds ratio; PA, physical activity.
[a]This model used the generalized linear model.

What's New and Important

- Only 40% of patients with CHD maintain regular PA 12 months after hospital discharge in China. Walking is the most common form of PA among Chinese patients with CHD.
- Maintenance of regular PA 12 months after hospital discharge for a cardiac event is more likely to occur in patients with a routine of regular PA before the cardiac event, men, patients who are aware of the cardiac benefits of PA, and those with chronic disease history.
- Female sex, smoking, years of CHD, and moderate and severe depressive symptoms are risk factors for lack of regular PA in patients with CHD.
- In patients with CHD who regularly perform PA, even low-intensity PA is likely to be associated with better clinical outcomes.

with maintaining regular PA. An additional year of CHD lowered the odds of maintaining regular PA by 4% (P = .02). This might be explained by a reduction in the capacity for PA associated with progression of CHD.

Limitations

Our findings should be interpreted in light of several limitations. First, this study is cross-sectional and lacks patient baseline data; therefore, it cannot support a causal relationship associated with PA. Second, we used self-reported data including PA routine and PA awareness, which may have introduced a recall bias. However, the measure of PA (International Physical Activity Questionnaire) is reliable, valid, widely used across cultures and populations, and has been correlated with objective measures of PA.[16] Third, we used a convenience sample, which limited the generalizability of findings. Fourth, we only collected the maintenance PA data at 12 months. Data at 6 months or other interim points were not included, and thus, temporal trends were not reported.

Conclusions

To our knowledge, this is the first study to explore maintenance of PA among patients with CHD living in Chinese communities. Our finding that only 40% of patients with CHD maintain regular PA after hospital discharge has important implications for both healthcare providers and researchers. Interventions should focus on enhancing patient awareness of the cardiac benefits of PA and supporting them in establishing an individualized PA routine based on their stage of change. The patient's stage of change for PA should be assessed and their psychological status evaluated and incorporated into a clinical care plan. This would be an important step toward developing a tailored intervention to improve maintenance of PA. Tailored interventions should be developed that take into account those characteristics identified by this study which, when present, suggest that a patient is less likely to maintain PA (eg, women, moderate or severe depression, multiple year history of CHD). Further studies should also examine the dosage effect of such interventions on the maintenance of PA.

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