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Knowledge, Attitudes, and Practices Regarding Cardiac Rehabilitation Among Patients with Chronic Heart Failure and Their Families: A Cross-Sectional Study

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Purpose: Chronic heart failure (CHF) impairs heart function and affects patients' well-being, while cardiac rehabilitation (CR) improves outcomes. In this cross-sectional survey, we assessed knowledge, attitudes, and practices (KAP) related to CR in patients with CHF and their family caregivers.

Patients and Methods: A cross-sectional survey was conducted at Heping Hospital, affiliated with Changzhi Medical College, from July 1 to October 10, 2024. Data were collected using questionnaires that included demographic information and evaluations of KAP scores. A total of 500 questionnaires were distributed to eligible participants.

Results: Of the 500 questionnaires distributed, 492 valid responses were obtained, yielding a response rate of 98.4%. Among the respondents, 277 (56.3%) were patients, with 191 (38.8%) aged 60 or older. The mean knowledge, attitude, and practice scores were 6.90 ± 5.63 (range: 0–30), 33.43 ± 3.31 (range: 9–45), and 28.01 ± 4.46 (range: 8–40), respectively. Multivariate logistic regression analysis identified several factors associated with proactive practice: knowledge score (OR = 1.114, 95% CI: [1.053, 1.179]), college degree (OR = 3.089, 95% CI: [1.054, 9.053]), absence of medical insurance (OR = 6.762, 95% CI: [3.597, 12.713]), no family history of heart issues (OR = 4.414, 95% CI: [2.351, 8.288]), and non-participation in CR (OR = 0.206, 95% CI: [0.087, 0.489]). The SEM results showed that knowledge directly affected attitude ($\beta = 0.321$, $p < 0.001$) and practice ($\beta = 0.285$, $p = 0.004$), and attitude directly affected practice ($\beta = 0.217$, $p < 0.001$). Additionally, knowledge indirectly affected practice through attitude ($\beta = 0.355$, $p < 0.001$).

Conclusion: Patients with CHF and their families showed insufficient knowledge but positive attitudes and proactive practices regarding CR. Targeted educational interventions are recommended to improve knowledge, particularly for younger patients and those without prior CR training, to enhance rehabilitation effectiveness.

Keywords: chronic heart failure, cardiac rehabilitation, KAP, cross-sectional studies, health education

Introduction

Chronic heart failure (CHF) is a complex clinical condition characterized by structural and/or functional abnormalities, leading to impaired ventricular contraction and/or relaxation of the heart.[1] As the final stage of various cardiovascular diseases, CHF severely impacts patients' functional and psychosocial well-being, manifesting through symptoms like breathlessness, reduced endurance, and psychological distress.[2] Patients with CHF often experience frequent recurrences of fatigue, dyspnea, and acute exacerbations, which limit their daily activities.[3]

Cardiac rehabilitation (CR) is a multidisciplinary, guideline-recommended secondary prevention program designed to improve exercise capacity, reduce cardiovascular risks, and enhance the health-related quality of life in patients with

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stable heart failure, regardless of preserved or reduced ejection fraction.[3] Over the past decades, CR's safety and efficacy have been well-established, and it is now widely recommended by international guidelines as a critical component of routine CHF management.[4,5] However, despite the proven benefits, a significant proportion of eligible patients do not participate in CR programs. Globally, around 66.7% of countries have reached the target of providing at least 12 CR sessions on average, with 32.4% offering home-based CR programs as an alternative.[6]

However, data specific to China remain limited, and participation rates may differ substantially from global averages. Previous research has shown that only 16.3% of discharged patients engage in CR.[7] Furthermore, it is unclear whether healthcare providers consistently provide educational interventions related to CR, and if institutional policies or clinical guidelines explicitly address this educational responsibility.[8] Typically, decisions regarding patient education on CR are left to cardiologists, nurses, or pharmacists; however, standardized approaches to track or evaluate these educational efforts are limited.[9]

The KAP model plays a crucial role in influencing health behaviors.[10] The questionnaire is commonly used to assess the KAP of specific populations in healthcare, helping to determine the need for and acceptance of relevant interventions.[11] This model is grounded in the concept that knowledge positively shapes attitudes, which in turn drive practices.[12] Family members are often key contributors to patient care and decision-making, making their involvement in CR critical for ensuring patient adherence and support. Understanding the KAP of both patients and their family members can reveal knowledge gaps or misconceptions that may impede effective participation in CR, thus informing more tailored interventions aimed at improving long-term outcomes in heart failure management.

To our knowledge, no KAP studies regarding CR among CHF patients and their families have been conducted in China. Thus, this study aims to assess the KAP related to CR among patients with CHF and their family members.

Materials and Methods

Study Design, Setting, and Participants

This cross-sectional study was conducted at Heping Hospital, affiliated with Changzhi Medical College, from July 1, 2024, to October 10, 2024. The participants included individuals with CHF and caregivers. Ethical approval for the study was obtained from the Ethics Committee of Heping Hospital, and informed consent was secured from all participants. Inclusion criteria were: 1) patients diagnosed with CHF, with cardiac function grades II–IV, based on the Guidelines for the Diagnosis and Treatment of Chronic Heart Failure (2014). 2) adult family members of such patients. Exclusion criteria were: 1) patients or family members unwilling to participate in the study, and 2) critically ill individuals (defined as those with severe physical or cognitive impairments preventing accurate questionnaire completion).

Questionnaire Development and Validation

A validated, structured questionnaire was used to assess knowledge, attitudes, and practices. The questionnaire was designed based on relevant references.[13–16] After drafting the initial version, a small-scale pilot test was conducted with 30 participants, demonstrating good internal consistency (Cronbach's $\alpha = 0.860$). The final version of the questionnaire, written in Chinese, comprised four dimensions and a total of 52 items (Supplementary Figure 1). The KAP questionnaire was structured into four sections. Demographic data comprised 15 non-scored items. The knowledge dimension included 9 main items, with Item 5 subdivided into 3 sub-items and Item 8 into 5 sub-items, resulting in 15 scorable components. Responses were coded as 2 points for "Very familiar", 1 point for "Have heard of", and 0 points for "Unclear", yielding a total score range of 0–30, categorized as insufficient (0–14), moderate (15–20), or adequate knowledge (21–30). The attitude dimension contained 9 items evaluated on a 5-point Likert scale. Items 1–4 and 7–9 were scored from "very positive" (5) to "very negative" (1), while Item 5 was reverse-scored (1–5). Total scores ranged from 9–45, classified as negative (9–22), neutral (23–31), or positive attitudes (32–45). The practice dimension included 9 items, with Item 9 as a non-scored multiple-choice question (recording participation only). Items 1–8 used a 5-point Likert scale ("always" = 5 to "never" = 1), producing a score range of 8–40, categorized as negative (8–20), moderate (21–28), or positive practice behaviors (29–40). Reverse scoring, and sub-item independence (knowledge Items 5 and 8) were rigorously validated to ensure scoring consistency.

Data Collection and Quality Control

Paper questionnaires were distributed to participants in both the outpatient and inpatient departments of the cardiology unit, as well as through WeChat groups for patients. In total, 500 questionnaires were distributed.

Three professionally trained research assistants were involved in administering the questionnaire. Participants were recruited from both inpatient and outpatient patients with CHF. Before completing the questionnaire, each question was thoroughly explained to the patients or their family members to ensure that responses were as standardized as possible. After the questionnaires were collected, they were preliminarily reviewed, and participants or their family members were re-contacted to complete the questionnaire again if any issues were identified.

Sample Size Calculation

Sample size was calculated using the formula for cross-sectional studies:[17] α=0.05, $n = \left(\frac{Z_{1-\alpha/2}}{\delta}\right)^2 \times p \times (1-p)$ where $Z_{1-\alpha/2} = 1.96$ when α=0.05, the assumed degree of variability of p=0.5 maximizes the required sample size, and δ is admissible error (which was 5% here). The theoretical sample size was 480 which includes an extra 20% to allow for subjects lost during the study.

Statistical Analysis

Stata 17.0 (Stata Corporation, College Station, TX, USA) were used for statistical analysis. Descriptive analysis was conducted on the demographic data, CR status, and KAP (knowledge, attitude, and practice) scores of the respondents. Continuous variables following a normal distribution (KAP scores) are presented as mean ± standard deviation (SD). Categorical data expressed as n (%). Normally distributed data are presented as mean ± SD, and comparisons between two groups were performed using the *t*-test. Pearson correlation analysis was used to assess the correlation between the three dimensions (K, A, P). The Pearson's correlation analysis was performed to explore the correlations among knowledge (K), attitude (A), practice (P). Structural equation modeling (SEM) was utilized to explore the path relationships and mediating effects between K, A, P, and demographic variables. A two-sided P-value of less than 0.05 was considered statistically significant.

Results

Questionnaire Quality

In the formal study, the internal consistency of the overall scale and each subscale was strong. The overall Cronbach's α coefficient was 0.8962, while the values for the knowledge, attitude, and practice sections were 0.9326, 0.7020, and 0.7913, respectively.

Demographic Characteristics

Initially, 500 samples were collected. After excluding 8 samples due to missing or inconsistent data, 492 valid samples remained (98.4% valid rate). Among these, 277 (56.3%) were patients, 191 (38.8%) were aged 60 or older, 281 (57.1%) were male, 177 (36.0%) had been diagnosed with CHF for less than a year, 244 (49.6%) had experienced myocardial infarction or heart failure, and 77 (15.7%) had undergone CR. The mean knowledge, attitude, and practice scores were 6.90 ± 5.63 (possible range: 0–30), 33.43 ± 3.31 (possible range: 9–45), and 28.01 ± 4.46 (possible range: 8–40), respectively (Table S1). As shown in Table S1, the majority of participants scored high in attitude and practice but relatively low in knowledge. Knowledge scores varied significantly with factors such as family status (patient or family member) ($p = 0.026$), age ($p < 0.001$), education level ($p < 0.001$), employment status ($p < 0.001$), monthly income per capita ($p < 0.001$), family history of myocardial infarction or heart failure ($p = 0.002$), CR status ($p < 0.001$), and CR training ($p < 0.001$). Attitude scores also varied based on age ($p = 0.033$), education level ($p = 0.003$), monthly income per capita ($p = 0.044$), drinking habits ($p = 0.024$), medical or commercial insurance ($p < 0.001$), duration of CHF ($p = 0.005$), family history of myocardial infarction or heart failure ($p < 0.001$), and myocardial infarction or heart failure status ($p = 0.001$). Practice scores varied by age ($p = 0.005$), education level ($p = 0.001$), monthly income per capita ($p = 0.010$), medical or commercial insurance ($p < 0.001$), family history of myocardial infarction or heart failure ($p < 0.001$), myocardial infarction or heart failure status ($p = 0.006$), CR status ($p = 0.001$), and CR training ($p = 0.006$) (Table 1).

Table 1 Demographic Characteristics and KAP Scores

Variables (N=492)	N (%)	Knowledge	P	Attitude	P	Practice	P
		Mean (SD)		Mean (± SD)		Mean (± SD)	
Participant Type			0.026		0.102		0.780
The Patient	277(56.3)	6.45 (5.60)		33.29 (3.33)		27.93 (4.39)	
Family members	215(43.7)	7.48 (5.63)		33.61 (3.29)		28.13 (4.56)	
Age, years			<0.001		0.033		0.005
≤40	82(16.7)	9.20 (5.67)		34.12 (3.59)		29.10 (4.38)	
41~50	98(19.9)	7.29 (5.47)		33.16 (2.96)		27.90 (4.25)	
50~60	121(24.6)	7.17 (4.94)		33.54 (3.03)		28.60 (4.10)	
>60	191(38.8)	5.55 (5.77)		33.20 (3.51)		27.24 (4.70)	
Gender			0.674		0.394		0.839
Male	281(57.1)	6.68 (5.43)		33.52 (3.37)		28.05 (4.47)	
Female	211(42.9)	7.19 (5.88)		33.31 (3.24)		27.97 (4.47)	
Education			<0.001		0.003		0.001
Primary school and below	144(29.3)	4.81 (5.66)		32.92 (3.55)		26.91 (5.04)	
Junior high school	150(30.5)	6.87 (4.81)		33.40 (3.17)		28.32 (3.87)	
High school/technical secondary school	122(24.8)	7.66 (5.43)		34.10 (3.31)		28.15 (4.18)	
College/bachelor's degree	76(15.4)	9.72 (5.96)		33.37 (3.00)		29.29 (4.45)	
Working status			<0.001		0.885		0.216
Employment	144(29.3)	9.08 (5.63)		33.27 (2.78)		27.75 (4.23)	
Unemployment	348(70.7)	6.00 (5.38)		33.49 (3.51)		28.12 (4.56)	
Monthly per capita family income			<0.001		0.044		0.010
<2000	74(15.0)	6.41 (6.01)		33.53 (3.72)		28.16 (5.48)	
2000-5000	93(18.9)	7.73 (5.43)		33.71 (3.06)		27.96 (4.14)	
>5000	54(11.0)	10.11 (6.81)		34.35 (3.65)		30.00 (4.53)	
Unwilling to disclose	271(55.1)	6.11 (5.07)		33.12 (3.18)		27.60 (4.16)	
Marital status			0.935		0.089		0.306
Married	443(90.0)	6.85 (5.47)		33.53 (3.34)		28.10 (4.39)	
Divorced/unmarried/widowed	49(10.0)	7.37 (6.95)		32.47 (2.89)		27.24 (5.08)	
Smoking			0.066		0.863		0.589
Yes	201(40.9)	6.27 (5.26)		33.41 (3.36)		27.89 (4.33)	
No	291(59.1)	7.34 (5.84)		33.44 (3.29)		28.10 (4.56)	
Drinking			0.756		0.024		0.259
Yes	135(27.4)	6.93 (5.37)		33.99 (3.54)		28.40 (4.45)	
No	357(72.6)	6.89 (5.73)		33.22 (3.20)		27.87 (4.47)	
Medical insurance or other commercial insurance			0.377		<0.001		<0.001
Yes	327(66.5)	7.00 (6.04)		32.52 (2.39)		26.75 (4.37)	
No.	165(33.5)	6.71 (4.72)		35.23 (4.07)		30.53 (3.49)	
Duration of diagnosed with chronic heart failure:			0.167		0.005		0.079
<1 year	177(36.0)	6.32 (5.70)		33.13 (2.99)		27.54 (4.26)	
>1 year	77(15.7)	6.92 (5.38)		32.77 (3.26)		27.56 (4.65)	
No.	238(48.4)	7.33 (5.64)		33.87 (3.50)		28.51 (4.51)	
Have a family history of myocardial infarction or heart failure			0.002		<0.001		<0.001
Yes	148(30.1)	7.65 (4.95)		33.20 (3.06)		27.56 (3.96)	
No.	164(33.3)	7.41 (5.70)		34.54 (4.06)		30.73 (4.07)	
Unknown	180(36.6)	5.83 (5.94)		32.61 (2.36)		25.91 (3.91)	
Had a myocardial infarction or heart failure			0.220		0.001		0.006
Yes	244(49.6)	6.64 (5.74)		33.05 (3.28)		27.47 (4.43)	
No	248(50.4)	7.16 (5.51)		33.80 (3.31)		28.55 (4.44)	
Have undergone cardiac rehabilitation			<0.001		0.556		0.001
Yes	77(15.7)	10.79 (5.80)		33.44 (3.42)		29.48 (3.87)	
No	415(84.3)	6.18 (5.30)		33.43 (3.30)		27.74 (4.52)	
Have received any training in cardiac rehabilitation			<0.001		0.942		0.006
Yes	89(18.1)	12.29 (4.84)		33.69 (3.55)		29.34 (4.48)	
No	403(81.9)	5.71 (5.07)		33.37 (3.26)		27.72 (4.41)	

Knowledge, Attitude, and Practice

Regarding knowledge, more than 63% of participants were unclear about the three items related to CR staging (K5.1-K5.3). Additionally, over 82.1% were unclear about certified CR centers (K8). Another item with a high rate of "Unclear" responses was "CR evaluation is a very important prerequisite for effective individualized treatment" (K6), with 50.6% of participants indicating uncertainty (Table 2). As shown in Table 2, lack of awareness about CR staging and CR centers was the most common knowledge gap.

In terms of attitudes, 3% strongly agreed and 12.2% agreed that exercise training in CR was too strenuous for CHF patients and could potentially cause harm (A5). Conversely, 46.5% disagreed, and 4.5% strongly disagreed, that they were dissatisfied with the current CR resources and services available to them (A8) (Table 3). Table 3 illustrates that overall, participants maintained a positive attitude toward CR, despite concerns about exercise intensity.

Table 2 Distribution of Knowledge Dimension Responses

Knowledge	Very Familiar	Have Heard of	Unclear
1. Cardiac rehabilitation refers to the synthesis of multiple coordinated, purposeful interventions.	23(4.7%)	335(68.1%)	134(27.2%)
2. Cardiac rehabilitation includes: rehabilitation evaluation, exercise training, diet and behavior, medical compliance, etc.	29(5.9%)	325(66.1%)	138(28%)
3. Cardiac rehabilitation can improve the cardiac function and structure of patients with chronic heart failure, optimize physical and mental health, improve social participation, and prevent cardiovascular events.	25(5.1%)	310(63%)	157(31.9%)
4. The suitable scope of cardiac rehabilitation includes: after myocardial infarction, stable angina pectoris, coronary artery bypass grafting (CABG), percutaneous coronary intervention (PCI), chronic stable heart failure caused by various reasons, heart valve replacement or repair, heart transplantation, atherosclerosis, hypertension.	25(5.1%)	278(56.5%)	189(38.4%)
5. Cr was divided into three phases: 5.1 Phase 1 CR initiated during hospitalization or in-hospital CR;	23(4.7%)	159(32.3%)	310(63%)
5.2 The second phase of CR was a supervised ambulatory outpatient rehabilitation for 3–6 months;	26(5.3%)	134(27.2%)	332(67.5%)
5.3 The third phase of CR included home-based or gym-based exercise;	22(4.5%)	140(28.5%)	330(67.1%)
6. Cardiac rehabilitation evaluation is a very important prerequisite for the effectiveness of individualized treatment.	26(5.3%)	217(44.1%)	249(50.6%)
7. The 6min walk test can be used as a method of cardiopulmonary exercise endurance assessment.	28(5.7%)	282(57.3%)	182(37%)
8. The cardiac rehabilitation centers certified by the Professional Committee of Cardiovascular Disease Prevention and Rehabilitation of Chinese Association of Rehabilitation Medicine are:.	15(3%)	119(24.2%)	358(72.8%)
8.1 Peking University People's Hospital	5(1%)	67(13.6%)	420(85.4%)
8.2 Affiliated Hospital of Changchun University of Traditional Chinese Medicine	7(1.4%)	81(16.5%)	404(82.1%)
8.3 Shanghai Tongji Hospital	7(1.4%)	78(15.9%)	407(82.7%)
8.4 The Third Affiliated Hospital of Sun Yat-sen University	6(1.2%)	28(5.7%)	458(93.1%)
8.5 Other Hospitals	14(2.8%)	286(58.1%)	192(39%)
9. Patients with stable chronic heart failure still need to adhere to cardiac rehabilitation therapy.	23(4.7%)	335(68.1%)	134(27.2%)

Table 3 Distribution of Attitude Dimension Responses

Attitude	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. You believe that cardiac rehabilitation is essential to improve the health status of patients with chronic heart failure. (P)	88(17.9%)	373(75.8%)	29(5.9%)	2(0.4%)	0 (0%)
2. Do you think cardiac rehabilitation can improve the quality of life of patients with chronic heart failure? (P)	88(17.9%)	375(76.2%)	28(5.7%)	1(0.2%)	0 (0%)
3. You believe that persisting in cardiac rehabilitation will reduce the risk of future hospital readmission due to cardiac problems. (P)	90(18.3%)	371(75.4%)	31(6.3%)	0 (0%)	0 (0%)
4. You believe that cardiac rehabilitation is necessary even in the stable stage of chronic heart failure. (P)	92(18.7%)	367(74.6%)	31(6.3%)	2(0.4%)	0 (0%)
5. You think that exercise training in cardiac rehabilitation is too hard for patients with chronic heart failure and may do more harm than good. (N)	15(3%)	60(12.2%)	104(21.1%)	284(57.7%)	29(5.9%)
6. You believe that family support is very important for patients to adhere to the cardiac rehabilitation program. (N)	78(15.9%)	372(75.6%)	33(6.7%)	7(1.4%)	2(0.4%)
7. You believe that cardiac rehabilitation is necessary for patients with chronic heart failure, even if it is partially paid for out of pocket. (P)	76(15.4%)	362(73.6%)	51(10.4%)	2(0.4%)	1(0.2%)
8. You are dissatisfied with the cardiac rehabilitation resources and services currently available to you. (P)	26(5.3%)	75(15.2%)	140(28.5%)	229(46.5%)	22(4.5%)
9. Do you think that the health care personnel have insufficient publicity and education on cardiac rehabilitation? (P)	18(3.7%)	75(15.2%)	142(28.9%)	236(48%)	21(4.3%)

Note: Items labeled with (P) represent positive statements, while items labeled with (N) represent negative statements.

For practices, 45.5% of participants reported that patients were not actively engaging in CR (P1), 36% did not seek out information on CR through various channels (P5), and 15.4% did not regularly communicate with the CR medical team to improve compliance (P6) (Table 4). As summarized in Table 4, active CR practice behaviors remained suboptimal among many participants.

Correlations Between KAP

Correlation analysis revealed significant positive correlations between knowledge and attitude ($r = 0.158$, $p < 0.001$), as well as between knowledge and practice ($r = 0.371$, $p < 0.001$). A significant correlation was also observed between attitude and practice ($r = 0.312$, $p < 0.001$) (Tables S2 and S3). Tables S2 and S3 confirm that all three dimensions (K, A, P) were positively correlated.

Univariate and Multivariate Analysis

The median knowledge, attitude, and practice scores were used as cut-off points, dividing participants into groups. Above-median scores were observed in 51.42% for knowledge, 84.55% for attitude, and 53.25% for practice. Multivariate logistic regression analysis revealed that younger age (≤40 years, OR = 0.379, p = 0.012), higher education level (particularly college or bachelor's degree, OR = 9.715, $p < 0.001$), awareness of family history (OR = 0.507, p = 0.030), participation in CR (OR = 0.371, p = 0.022), and receiving CR training (OR = 0.051, $p < 0.001$) were independently associated with higher knowledge scores. Concurrently, knowledge score (OR = 1.078, 95% CI: [1.016, 1.143], p = 0.013) was independently associated with a positive attitude. Moreover, knowledge score (OR = 1.114, 95% CI: [1.053, 1.179], $p < 0.001$), college or bachelor's degree (OR = 3.089, 95% CI: [1.054, 9.053], p = 0.040), absence of medical or commercial insurance (OR = 6.762, 95% CI: [3.597, 12.713], $p < 0.001$), no family history of myocardial infarction or heart failure (OR = 4.414, 95% CI: [2.351, 8.288], $p < 0.001$), and non-participation in CR (OR = 0.206, 95% CI: [0.087, 0.489], $p < 0.001$) were independently associated with proactive practice (Tables 5 and 6). Tables 5 and 6 highlight the key predictors of higher KAP scores identified in regression analyses.

Table 4 Distribution of Practice Dimension Responses

Practice	Very Consistent	Consistent	General	Inconsistent	Very Inconsistent
1. You (the patient) are currently actively participating in cardiac rehabilitation. (P)	29(5.9%)	166(33.7%)	51(10.4%)	224(45.5%)	22(4.5%)
2. You will participate in physical exercise properly. (P)	46(9.3%)	308(62.6%)	93(18.9%)	45(9.1%)	0 (0%)
3. You will maintain a positive attitude. (P)	55(11.2%)	398(80.9%)	37(7.5%)	2(0.4%)	0 (0%)
4. When confidence and patience are low, you seek help from a health care provider. (P)	50(10.2%)	398(80.9%)	41(8.3%)	3(0.6%)	0 (0%)
5. You will take the initiative to learn about cardiac rehabilitation through various ways. (P)	31(6.3%)	157(31.9%)	118(24%)	177(36%)	9(1.8%)
6. You will communicate with the cardiac rehabilitation medical team regularly to improve the compliance of cardiac rehabilitation. (P)	35(7.1%)	201(40.9%)	176(35.8%)	76(15.4%)	4(0.8%)
7. You will actively participate in cardiac rehabilitation training or lectures organized by medical staff. (P)	35(7.1%)	192(39%)	233(47.4%)	29(5.9%)	3(0.6%)
8. You would recommend cardiac rehabilitation to other patients with chronic heart failure. (P)	36(7.3%)	196(39.8%)	220(44.7%)	37(7.5%)	3(0.6%)
9. What are your biggest barriers to compliance with cardiac rehabilitation (multiple choice):	277(56.3%)	215(43.7%)			
a. Lack of time	209(42.5%)	283(57.5%)			
b. Heavy economic burden	209(42.5%)	283(57.5%)			
c. Lack of motivation or interest	0 (0%)	492(100%)			
d. Insufficient or unclear information	96(19.5%)	396(80.5%)			
e. Physical limitations or discomfort	2(0.4%)	490(99.6%)			

Note: Items labeled with (P) represent positive statements.

Table 5 Cut-off Value and Grouping

Cut-Off Value:Median	N (%)
Knowledge dimension total score	
Ksum≥7	253(51.42%)
Ksum<=6	239(48.58%)
Attitude dimension total score	
Asum≥32	416(84.55%)
Asum<=31	76(15.45%)
Practice dimension total score	
Psum≥28	262(53.25%)
Psum<=27	230(46.75%)

Table 6 Univariate and Multivariate Analysis for Knowledge, Attitude and Practice

Dimension	Variables	Univariate Analysis	P	Multivariate Analysis	P
		OR (95% CI)		OR (95% CI)	
Knowledge					
	Participant Type				
	The Patient				
	Family members	1.368 (0.957,1.958)	0.086	0.905 (0.529,1.547)	0.714
	Age, years				
	≤40				
	41~50	0.468 (0.249,0.863)	0.016	0.379 (0.178,0.806)	0.012
	50~60	0.513 (0.280,0.924)	0.028	0.986 (0.458,2.126)	0.972
	>60	0.274 (0.155,0.472)	<0.001	0.785 (0.317,1.948)	0.602
	Gender				
	Male				
	Female	0.920 (0.644,1.316)	0.648		
	Education				
	Primary school and below				
	Junior high school	2.308 (1.441,3.729)	0.001	2.643 (1.367,5.110)	0.004
	High school/technical secondary school	2.868 (1.745,4.763)	<0.001	3.045 (1.326,6.990)	0.009
	College/bachelor's degree	7.394 (3.959,14.407)	<0.001	9.715 (3.285,28.735)	<0.001
	Working status				
	Employment				
	Unemployment	0.302 (0.197,0.456)	<0.001	0.762 (0.398,1.460)	0.413
	Monthly per capita family income				
	<2000				
	2000-5000	2.386 (1.283,4.499)	0.007	1.050 (0.452,2.435)	0.910
	>5000	2.625 (1.279,5.526)	0.010	0.797 (0.297,2.139)	0.653
	Unwilling to disclose	1.124 (0.671,1.896)	0.659	0.761 (0.381,1.523)	0.441
	Marital status				
	Married				
	Divorced/unmarried/widowed	1.076 (0.595,1.955)	0.809		
	Smoking				
	Yes				
	No	1.239 (0.865,1.777)	0.243		
	Drinking				
	Yes				
	No	1.017 (0.684,1.512)	0.932		

(*Continued*)

Table 6 (Continued).

Dimension	Variables	Univariate Analysis	P	Multivariate Analysis	P
		OR (95% CI)		OR (95% CI)	
	Medical insurance or other commercial insurance				
	Yes				
	No.	0.580 (0.396,0.845)	0.005	0.780 (0.458,1.329)	0.360
	Duration of diagnosed with chronic heart failure:				
	<1 year				
	>1 year	1.359 (0.795,2.334)	0.263		
	No.	1.318 (0.893,1.949)	0.165		
	Have a family history of myocardial infarction or heart failure				
	Yes				
	No.	0.582 (0.370,0.912)	0.019	0.714 (0.393,1.295)	0.267
	Unknown	0.536 (0.343,0.832)	0.006	0.507 (0.274,0.937)	0.030
	Had a myocardial infarction or heart failure				
	Yes				
	No	1.157 (0.812,1.649)	0.420		
	Have undergone cardiac rehabilitation				
	Yes				
	No	0.170 (0.087,0.308)	<0.001	0.371 (0.158,0.868)	0.022
	Have received any training in cardiac rehabilitation				
	Yes				
	No	0.043 (0.015,0.098)	<0.001	0.051 (0.018,0.144)	<0.001
Attitude					
	Knowledge	1.071 (1.016,1.129)	0.011	1.078 (1.016,1.143)	0.013
	Participant Type				
	The Patient				
	Family members	0.882 (0.529,1.475)	0.629		
	Age, years				
	≤40				
	41~50	0.857 (0.362,1.975)	0.719		
	50~60	1.287 (0.537,3.037)	0.564		
	>60	0.832 (0.380,1.708)	0.627		
	Gender				
	Male				
	Female	0.848 (0.509,1.420)	0.528		
	Education				
	Primary school and below				
	Junior high school	1.274 (0.693,2.361)	0.436	1.259 (0.643,2.465)	0.502
	High school/technical secondary school	2.897 (1.351,6.776)	0.009	2.466 (0.984,6.181)	0.054
	College/bachelor's degree	1.523 (0.713,3.485)	0.294	1.127 (0.387,3.282)	0.827
	Working status				
	Employment				
	Unemployment	0.517 (0.263,0.951)	0.043	0.833 (0.344,2.019)	0.686
	Monthly per capita family income				
	<2000				
	2000-5000	2.057 (0.803,5.534)	0.138		
	>5000	1.113 (0.425,3.048)	0.829		
	Unwilling to disclose	1.086 (0.519,2.135)	0.818		

(*Continued*)

Table 6 (Continued).

Dimension	Variables	Univariate Analysis	P	Multivariate Analysis	P
		OR (95% CI)		OR (95% CI)	
	Marital status				
	Married				
	Divorced/unmarried/widowed	0.520 (0.259,1.120)	0.078	0.527 (0.242,1.149)	0.107
	Smoking				
	Yes				
	No	1.134 (0.674,1.891)	0.633		
	Drinking				
	Yes				
	No	0.573 (0.291,1.054)	0.087	0.680 (0.349,1.326)	0.258
	Medical insurance or other commercial insurance				
	Yes				
	No.	1.011 (0.595,1.758)	0.969		
	Duration of diagnosed with chronic heart failure:				
	<1 year				
	>1 year	0.850 (0.407,1.853)	0.671		
	No.	0.975 (0.549,1.710)	0.929		
	Have a family history of myocardial infarction or heart failure				
	Yes				
	No.	0.496 (0.259,0.921)	0.029	0.602 (0.304,1.194)	0.146
	Unknown	1.168 (0.575,2.364)	0.665	1.923 (0.881,4.197)	0.101
	Had a myocardial infarction or heart failure				
	Yes				
	No	1.207 (0.725,2.018)	0.471		
	Have undergone cardiac rehabilitation				
	Yes				
	No	0.901 (0.416,1.779)	0.775		
	Have received any training in cardiac rehabilitation				
	Yes				
	No	0.946 (0.465,1.793)	0.871		
Practice					
	Knowledge	1.123 (1.080,1.167)	<0.001	1.114 (1.053,1.179)	<0.001
	Attitude	1.242 (1.159,1.331)	<0.001	1.074 (0.982,1.174)	0.117
	Participant Type				
	The Patient				
	Family members	0.921 (0.644,1.316)	0.650		
	Age, years				
	≤40				
	41~50	0.808 (0.446,1.457)	0.479		
	50~60	1.214 (0.685,2.151)	0.506		
	>60	0.650 (0.384,1.092)	0.105		
	Gender				
	Male				
	Female	0.924 (0.646,1.322)	0.666		
	Education				
	Primary school and below				
	Junior high school	1.824 (1.151,2.906)	0.011	1.199 (0.594,2.419)	0.613
	High school/technical secondary school	1.335 (0.823,2.170)	0.242	1.444 (0.619,3.370)	0.395
	College/bachelor's degree	1.917 (1.094,3.397)	0.024	3.089 (1.054,9.053)	0.040

(*Continued*)

Table 6 (Continued).

Dimension	Variables	Univariate Analysis	P	Multivariate Analysis	P
		OR (95% CI)		OR (95% CI)	
	Working status				
	Employment				
	Unemployment	1.524 (1.032,2.256)	0.034	1.861 (0.939,3.688)	0.075
	Monthly per capita family income				
	<2000				
	2000-5000	1.102 (0.597,2.034)	0.757	1.448 (0.581,3.608)	0.427
	>5000	2.463 (1.179,5.318)	0.019	1.438 (0.506,4.087)	0.496
	Unwilling to disclose	0.940 (0.561,1.574)	0.815	0.739 (0.348,1.571)	0.432
	Marital status				
	Married				
	Divorced/unmarried/widowed	0.827 (0.456,1.496)	0.528		
	Smoking				
	Yes				
	No	1.108 (0.773,1.589)	0.577		
	Drinking				
	Yes				
	No	0.777 (0.520,1.157)	0.217		
	Medical insurance or other commercial insurance				
	Yes				
	No.	8.867 (5.597,14.509)	<0.001	6.762 (3.597,12.713)	<0.001
	Duration of diagnosed with chronic heart failure:				
	<1 year				
	>1 year	1.062 (0.621,1.816)	0.826		
	No.	1.379 (0.934,2.041)	0.107		
	Have a family history of myocardial infarction or heart failure				
	Yes				
	No.	5.809 (3.478,9.946)	<0.001	4.414 (2.351,8.288)	<0.001
	Unknown	0.517 (0.328,0.811)	0.004	0.757 (0.407,1.408)	0.379
	Had a myocardial infarction or heart failure				
	Yes				
	No	1.479 (1.037,2.113)	0.031	1.255 (0.687,2.292)	0.461
	Have undergone cardiac rehabilitation				
	Yes				
	No	0.493 (0.291,0.816)	0.007	0.206 (0.087,0.489)	<0.001
	Have received any training in cardiac rehabilitation				
	Yes				
	No	0.653 (0.405,1.040)	0.076	1.475 (0.656,3.314)	0.347

Interactions Between KAP

SEM showed acceptable model fit indices (RMSEA = 0.079, SRMR = 0.092, TLI = 0.888, and CFI = 0.899) (Table 7). Mediation analysis demonstrated that knowledge directly influenced attitude ($\beta = 0.321$, $p < 0.001$) and practice ($\beta = 0.285$, $p = 0.004$). Attitude directly influenced practice ($\beta = 0.217$, $p < 0.001$), and knowledge indirectly affected practice through attitude ($\beta = 0.355$, $p < 0.001$) (Table 8). Detailed path coefficients are illustrated in Figure 1. As shown in Table 8 and Figure 1, SEM confirmed both direct and indirect effects among knowledge, attitude, and practice.

Table 7 Index of Fit

Indicators	Reference	Results
RMSEA	<0.08	0.079
SRMR	<0.08	0.092
TLI	>0.80	0.888
CFI	>0.80	0.899

Table 8 Analysis of Mediation

Model Paths	Total Effects		Direct Effect		Indirect Effect	
	β (95% CI)	P	β (95% CI)	P	β (95% CI)	P
Attitude						
Knowledge	0.321 (0.235, 0.407)	<0.001	0.321 (0.235, 0.407)	<0.001		
Practice						
Knowledge	0.070 (0.035, 0.104)	<0.001	0.285 (0.193, 0.337)	<0.001	0.355 (0.269, 0.441)	<0.001
Attitude	0.217 (0.126, 0.309)	<0.001	0.217 (0.126, 0.309)	<0.001		

Discussion

Our findings highlight the persistent gap between CR knowledge and practice in CHF populations. Individuals with CHF and caregivers demonstrated inadequate knowledge, yet exhibited positive attitudes and proactive practices toward CR.

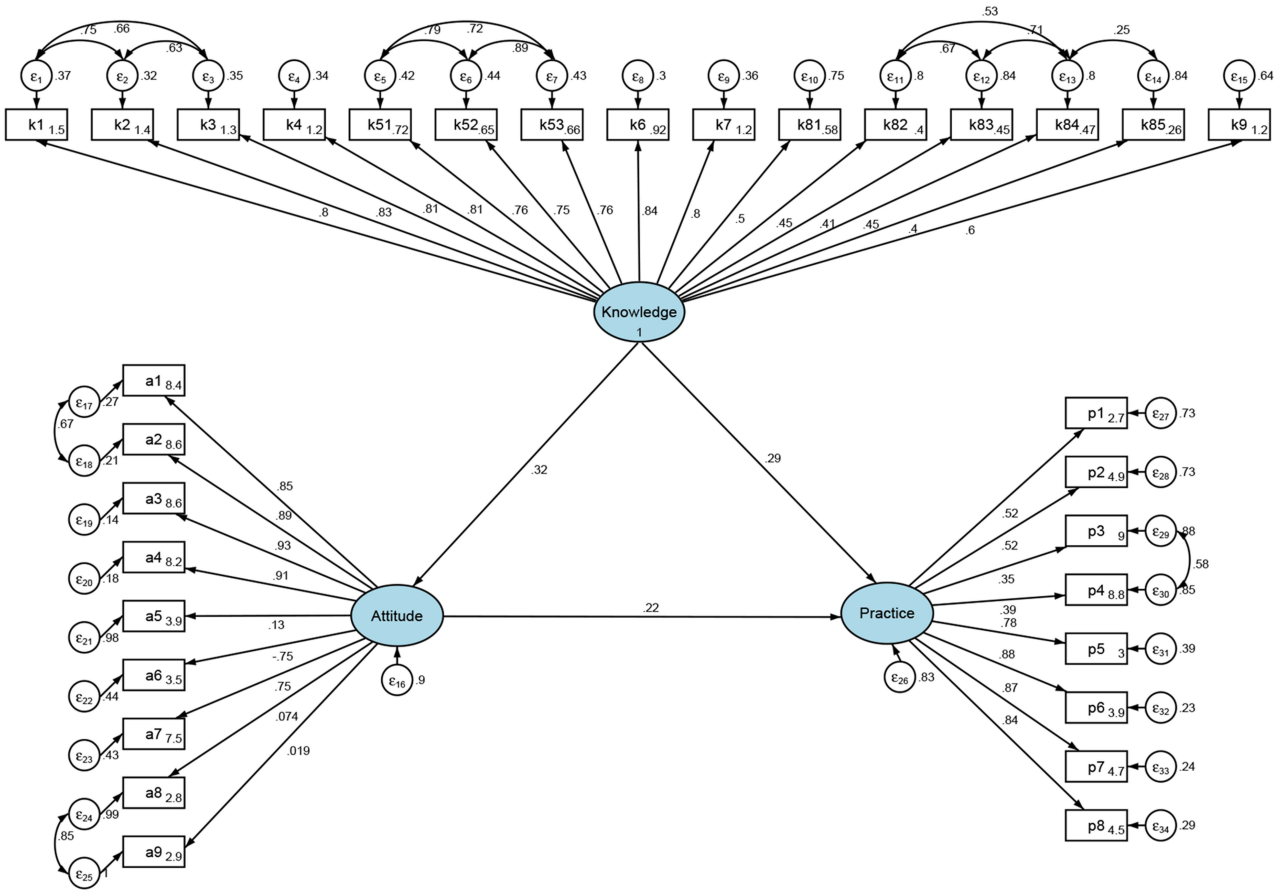

Figure 1 SEM Model.

https://doi.org/10.2147/JMDH.S553152

These findings reveal a notable gap between knowledge and the application of attitudes in practice, underscoring the necessity of targeted educational interventions to address knowledge deficits, thereby potentially enhancing patient engagement in CR programs. This gap is consistent with findings from previous studies. For example, while physiotherapists generally understand CR well, their attitudes and practices in following exercise programs are often influenced by factors related to both clinicians and patients.[18] This suggests that even with knowledge, other obstacles can impact how well rehabilitation is carried out. Practical barriers, such as absence of medical insurance coverage, also play a major role in limiting participation in CR.[19] These logistical issues can further complicate the ability for patients to turn their positive attitudes and intentions into actual participation in rehabilitation programs. Additionally, patients and caregivers tend to share similar levels of understanding and beliefs about CR. Research shows that focusing on both patients and their caregivers early in the rehabilitation process, especially on their specific beliefs and understanding about the disease, can help improve outcomes for patients and caregivers alike.[20]

The interrelationships among KAP dimensions further support the importance of knowledge as the foundation of CR engagement. Regarding the relationships between KAP dimensions, the significant correlations between knowledge, attitude, and practice, supported by both correlation analyses and SEM, align with existing literature. The SEM indicate that knowledge directly influences attitude and practice, with attitude mediating the indirect effect of knowledge on practice. This is consistent with the theory that improved knowledge can shape more positive attitudes, which in turn lead to better health practices.[21,22] These findings emphasize the critical role of knowledge as a foundational element in enhancing attitudes and practices related to CR. Previous studies have similarly found that interventions targeting knowledge improvements can lead to substantial changes in health behaviors and attitudes.[23,24]

Sociodemographic differences significantly shape CR-related KAP. The significant differences in KAP scores across various demographic variables, as identified in both univariate and multivariate analyses, provide further insight. Younger participants and those with higher educational attainment had significantly better knowledge and practice scores, consistent with earlier research indicating higher health literacy among these groups.[25,26] Interestingly, education level was a consistent predictor across all dimensions of KAP, indicating that knowledge, attitude, and practice are heavily influenced by formal education. However, in some cases, such as income, differences were only significant for practice but not for knowledge or attitude, suggesting that financial resources might directly influence the ability to engage in rehabilitation activities but not necessarily affect perceptions or understanding.

Specific knowledge gaps persist in key areas of CR. In terms of knowledge responses, a large proportion of participants were unclear about key aspects of CR, such as its staging and the role of certified centers. This reflects findings from similar studies, which have also reported poor awareness of rehabilitation programs among patients with CHF.[27] Thus, targeted educational initiatives addressing the significance of CR staging, evaluations, and certified centers are recommended. These interventions could be effectively integrated within clinical practices and community-based programs.[28,29]

Attitudes toward CR are generally positive, but misconceptions and dissatisfaction remain. For the attitude dimension, while participants generally expressed positive views towards CR, some misconceptions persisted. For example, a small percentage believed that CR exercises could be harmful, which may reflect fear or misunderstanding about the intensity and benefits of such programs. Healthcare professionals should emphasize individualized rehabilitation planning and clearly communicate exercise safety to alleviate patients' concerns. Additionally, dissatisfaction with available rehabilitation resources and services points to an area for improvement. Expanding access to CR programs, possibly through telehealth options or more local centers, could alleviate this dissatisfaction.[30,31]

Practice behaviors reveal inadequate engagement despite positive attitudes. The practice dimension revealed that while many participants reported consistency in engaging in CR, a notable proportion reported inadequate engagement and communication with the rehabilitation team. Given that these activities are crucial for the success of CR, specific strategies should be developed to increase patient engagement. Implementing structured follow-up procedures, personalized goal-setting, and reducing economic barriers via insurance or financial support are potential strategies for enhancing patient adherence to CR.[32,33]

Limitations

This study has several limitations. First, as a cross-sectional survey, it only captures a snapshot of knowledge, attitudes, and practices at a single point in time, limiting our ability to assess changes over time. Second, single-center data collection may limit the generalizability of the findings. Third, self-reported data on KAP may be subject to response bias.

Conclusions

In conclusion, individuals with CHF and caregivers demonstrated inadequate knowledge, yet generally positive attitudes and proactive practices toward CR. These findings highlight the need for targeted educational interventions to address knowledge deficits and structured support strategies to enhance patient engagement to enhance participation in CR programs.

Data Sharing Statement

All data generated or analysed during this study are included in this published article.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee Heping Hospital Affiliated to Changzhi Medical College (2024) 089. All participants were informed about the study protocol and provided written informed consent to participate in the study. I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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Author Contributions

Xiaohua Gao and Jianzhou Yang carried out the studies, participated in collecting data, and drafted the manuscript. Xiaohua Gao and Jianzhou Yang performed the statistical analysis and participated in its design. Wenjun Cao, Yaoqiang Liu and Tingting Zhao participated in acquisition, analysis, or interpretation of data and draft the manuscript. All authors read and approved the final manuscript. All authors have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

Xiaohua Gao and Jianzhou Yang are co-first authors for this study. The authors declare that they have no competing interests in this work.

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