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Patients' perspective and practices of heart failure recurrence prevention in Yancheng City

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Effective self-management is essential for patients with heart failure, but many struggle with acquiring the necessary skills. Given the complexity of heart failure management and the importance of patient adherence to prescribed regimens, this study aims to investigate the knowledge, attitudes, and practices (KAP) concerning the prevention of heart failure recurrence among patients. A cross-sectional study was conducted at the Third People's Hospital of Yancheng City from September 1, 2023, to December 31, 2023, employing a self-administered KAP questionnaire. The study included 421 heart failure patients, of whom 230 (54.6%) were male. Median scores for knowledge, attitudes, and practices were 12.00 [10.00, 13.00] (possible range: 1–18), 20.00 [19.00, 21.00] (possible range: 5–25), and 16.00 [15.00, 17.00] (possible range: 5–22), respectively. Pearson's correlation analysis indicated a positive correlation between knowledge and attitude scores ($r = 0.183$, $P < 0.001$), as well as between knowledge and practice scores ($r = 0.169$, $P < 0.001$). A higher attitude score was significantly associated with a higher practice score ($r = 0.245$, $P < 0.001$), as supported by structural equation modelling. Multivariate logistic regression revealed that attitude score (OR = 1.238), suburban residence (OR = 2.524), monthly household income exceeding 5000 RMB (OR = 3.539), BMI less than 20 kg/m2 (OR = 2.155, $P = 0.029$), BMI between 20 and 24 kg/m2 (OR = 2.387), and BMI between 25 and 29 kg/m2 (OR = 4.063) were independently linked to proactive practices (all $P < 0.05$). Additionally, Structural Equation Modelling (SEM) elucidated the intricate relationship between sociodemographic factors and KAP dimensions. Despite positive attitudes and proactive prevention efforts, heart failure patients exhibit a knowledge gap. Tailored educational interventions by healthcare providers could effectively bridge this gap, leveraging patients' positive attitudes and proactive behaviours to reinforce preventive measures.

Keywords Heart failure, Patient, Prevention, Heart failure recurrence, Knowledge, Attitude, Practice

Heart failure, which affects over 26 million individuals globally, is a significant health concern characterized by a progressive decline in heart function due to various pathophysiological conditions affecting the heart muscle[1]. The etiologies of heart failure vary, but irrespective of the cause, individuals with heart failure or heart failure-related diseases face high mortality rates and a diminished quality of life[2]. Heart failure affects over 64 million people worldwide, with the highest prevalence found in Central Europe, North Africa, and the Middle East, ranging from 1,133 to 1,196 cases per 100,000 people. In contrast, the prevalence is lower in Eastern Europe and Southeast Asia, with 498 to 595 cases per 100,000 people[3]. In China, heart failure has an estimated prevalence of 0.9%, with approximately 4 million individuals living with chronic heart failure. Alarmingly, this number is on the rise annually[4].

Despite advances that have significantly reduced the mortality rate of heart failure over the past two decades, rehospitalization due to worsening conditions remains a frequent issue, not only in Japan but also globally[5,6]. To counteract this, international guidelines advocate for self-management as a critical component of care for those suffering from chronic heart failure[7,8]. However, it is unfortunate that many patients struggle with or lack the necessary skills to effectively manage their condition in daily life[9]. Self-care education is crucial for preventing rehospitalization in patients with heart failure[10]. Cardiac rehabilitation is globally recommended as a strategy to prevent heart failure recurrence and worsening[11]. Therefore, diet and exercise interventions are recognized as essential treatments for preventing the progression of heart failure.

The Knowledge, Attitude, and Practices (KAP) survey serves as a vital diagnostic tool in health literacy research, providing insights into a group's comprehension, beliefs, and behaviors concerning a specific

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topic. It operates on the principle that improved knowledge positively affects attitudes, subsequently shaping behaviors[12–14]. Despite the wealth of KAP studies focusing on healthcare professionals in the context of heart failure, there is a notable gap concerning heart failure patients themselves. This discrepancy underscores the necessity for this study, which aims to explore the knowledge, attitudes, and practices of heart failure patients in relation to preventing recurrence of the condition. By targeting patients already diagnosed with heart failure, the research intends to identify modifiable factors that contribute to rehospitalization and adverse outcomes. Addressing these factors could significantly influence patient health, potentially diminishing the occurrence of exacerbations and enhancing quality of life. Thus, this study is poised to inform more effective educational interventions and support mechanisms specifically designed for this vulnerable group.

Methods

Study design and participants

This cross-sectional study was conducted at the Third People's Hospital of Yancheng City from September 1, 2023, to December 31, 2023. The study population comprised patients hospitalized for heart failure. Ethical approval was granted by the Medical Ethics Committee of the Third People's Hospital of Yancheng City (Ethics Approval Number: 2023-14), and informed consent was secured from all participants prior to the administration of the questionnaire.

The study included heart failure patients admitted to our hospital from September 1, 2023, to December 31, 2023, due to inadequate treatment effects at our outpatient clinic. Upon admission, all patients underwent comprehensive examinations within the first three days, including biochemical tests, BNP measurements, echocardiography, and chest X-rays, and received hospital orientation. Standard heart failure medications were also administered. The questionnaire was administered between the 4th and 7th day of hospitalization. To ensure the representativeness of the study subjects, we did not restrict the specific types of heart failure but required that all patients be diagnosed by a cardiologist and have BNP levels above normal, meeting the diagnostic criteria for heart failure. Exclusion criteria: Active infectious diseases or malignancies; Cardiac surgery within six months prior to admission; Severe hepatic or renal dysfunction or other uncontrolled comorbidities. Inclusion criteria: Conscious, normal cognitive function, effective communication, and ability to independently complete the questionnaire; Informed consent and voluntary participation. Additionally, patients were excluded if they had difficulty understanding the questionnaire content, limited cooperation, incomplete responses, or were readmitted within three months of their previous discharge." Questionnaires were distributed to the participants in the inpatient ward. To ensure the integrity of the questionnaire process, two research assistants—who had received professional training and were not the attending physicians of the participants—were tasked with collecting the completed forms. The data were then organized and entered by the department's nursing staff.

Questionnaire introduction

The design of the questionnaire was informed by existing guidelines and literature[15–17]. Initially crafted, it underwent revisions based on feedback from three cardiology specialists, resulting in a preliminary version. The questionnaire was then pilot-tested in two phases with approximately 40 and 34 participants respectively. The second pilot test demonstrated good internal consistency, as evidenced by a Cronbach's α coefficient of 0.844. Following these tests, the final version of the questionnaire was established. Detailed information about the questionnaire is available in the appendix, which covers four key areas: demographic data (education, gender, occupation, comorbidities, etc.), and dimensions of knowledge, attitude, and practice. The knowledge dimension assesses participants' understanding of heart failure management, including recognizing symptoms, understanding the importance of diet and physical activity, and awareness of monitoring techniques (e.g., weight and sodium intake). Questions probe common misconceptions and essential knowledge about how heart failure symptoms manifest and what exacerbates the condition. The knowledge dimension includes two aspects: symptom recognition and prevention of heart failure, comprising nine questions. Participants scored two points for correct answers and one point for other responses, with a total possible score ranging from 1 to 18 points. The attitude dimension examines the participants' beliefs and attitudes towards managing heart failure, including their concern about recurrence, willingness to adjust lifestyle and follow medical advice, and their perception of the importance of adherence to prescribed treatment and the impact of healthcare quality on their motivation. The attitudinal dimension includes the perceived severity of the disease and the perceived necessity and willingness to prevent it, totaling five questions. Responses were measured using a five-point Likert scale, ranging from very positive (5 points) to very negative (1 point), with total scores ranging from 5 to 25 points. The practice dimension evaluates the participants' behaviors in managing heart failure, such as their frequency of seeking treatment, adhering to follow-up visits, exercising, taking medication on time, controlling alcohol consumption, and managing fluid intake. The practice dimension features six questions. Questions P1 to P4 are rated on a five-point Likert scale, question P5 offers a binary choice awarding 1 point for "yes" and 2 points for "no", and question P6 is an open-ended question that does not contribute to the point total, yielding a score range of 5 to 22 points. The focus of the practice dimension is on how consistently participants engage in actions that prevent heart failure exacerbation. Scores exceeding 70% of the maximum possible in each section are indicative of adequate knowledge, a positive attitude, and proactive practices[18].

Sample size calculation

The sample size was calculated using the following formula:

$$N = (Z_{(1-\alpha/2)}/\delta)^2 \times p \times (1-p)$$

where N denoted the sample size, p was assumed to be 0.5 to ensure the maximum sample size, α, also known as the type I error, was set to 0.05, $Z_{(1-\alpha/2)} = 1.96$. δ, the standard error, was assumed to be 0.05.

The final target was to collect at least 430 valid questionnaires.

Statistical analysis

Statistical analysis was conducted using R version 4.3.2[19] (with the dplyr for data manipulation, psych for calculating Spearman correlations, tableone for generating descriptive statistics tables, and glm for generalized linear models) and stata 18.0. Continuous variables were expressed as the median (25th percentile, 75th percentile), and between-group comparisons were performed using Wilcoxon-Mann-Whitney test or Kruskal-Wallis analysis of variance. Categorical variables were reported as n (%). Spearman correlation analysis was employed to assess the correlations between knowledge, attitude, and practice scores. Univariate variables with $P < 0.1$ were included in multivariate regression analyses. Structural equation modeling (SEM), incorporating path analysis, was used to examine the relationships among the KAP dimensions and baseline demographic data. Additionally, mediation analysis was conducted to explore the indirect effects within the model. Two-sided p-values < 0.05 were considered statistically significant in this study.

Results

In the formal experiment, a total of 421 valid datasets were collected. The overall Cronbach's α coefficient for the entire scale good internal consistency, with a value of 0.766. The Kaiser-Meyer-Olkin (KMO) measure for the total scale was 0.735, further validating the quality of the questionnaire. Among the 421 patients with heart failure who participated in this study, 230 (54.6%) were male, 165 (39.2%) were aged 70–79 years, 300 (71.3%) had primary school education and below, 230 (54.6%) were retired, 217 (51.5%) had a BMI of 20–24 kg/m2, 265 (62.9%) had suffered from heart failure for more than 18 months, 174 (41.3%) had chronic heart failure, and 236 (56.1%) were classified as NYHA Class 3. The median [interquartile range] scores for knowledge, attitudes, and practices were 12.00 [10.00, 13.00] (possible range: 1–18), 20.00 [19.00, 21.00] (possible range: 5–25), and 16.00 [15.00, 17.00] (possible range: 5–22), respectively. Significant differences in knowledge scores were observed among patients with different age ($P < 0.001$), education ($P = 0.001$), work status ($P = 0.001$), BMI ($P = 0.007$), and current heart failure symptom pattern ($P < 0.001$). Significant differences in attitude scores were also identified among patients with different age ($P = 0.002$), diabetes status ($P = 0.011$), and COPD status ($P = 0.001$). Differences in practice scores were more likely to be found among patients with different age ($P < 0.001$), education ($P = 0.003$), work status ($P < 0.001$), monthly household income ($P < 0.001$), BMI ($P = 0.001$), and COPD status ($P = 0.005$) (as shown in Table 1).

The distribution of knowledge scores indicated that the majority of patients mistakenly believed that physical activity should be avoided (K3), with 68.4%. The question receiving the highest number of "Unsure" responses was "The only dietary restriction for heart failure patients is to avoid adding salt (40.6%)" (K2). Only a small percentage of individuals are aware of the importance of regularly checking their weight, with 20.7% (K6). However, over half correctly identified waking up at night feeling out of breath as a sign of increased heart failure (59.4%), as shown in Table 2.

Responses to the attitude dimension showed that 60.6% strongly agreed that taking medication correctly and avoiding overdosing is necessary to prevent aggravation of heart failure (A5). In terms of preventing heart failure recurrence, 60.3% were willing to adjust their diet (A2). Regarding the impact of medical infrastructure and care quality of the outpatient clinic on their motivation for treatment (A4), 38.2% said it does, 22.8% were neutral, while 23% said it does not (as shown in Table 3).

When it comes to related practices, 54.6% always took their medication on time (P4), 39.7% often sought treatment proactively after sensing heart failure symptoms (P1), and 48.2% agreed to follow up with their doctors regularly after discharge from the hospital (P2). However, 33.7% seldom and 38.2% hardly engaged in appropriate exercise to improve cardiorespiratory fitness to prevent heart failure recurrence (P3). Additionally, only 5.7% consumed more than 2000 mL of water per day (P6) (as shown in Table 4).

Correlation analyses showed significant positive correlations between knowledge and attitude ($r = 0.183$, $P < 0.001$) as well as between knowledge and practice ($r = 0.169$, $P < 0.001$). There was also a correlation between attitude and practice ($r = 0.245$, $P < 0.001$) (as shown in Table 5).

Using 60% of the total practical score as the cut-off value for grouping patients, 253 (60.1%) had a score less than the cut-off value. Multivariate logistic regression showed that attitude score (OR = 1.238, 95% CI: [1.099, 1.396], $P < 0.001$), living in a suburb (OR = 2.524, 95% CI: [1.282, 4.969], $P = 0.007$), having a monthly household income of more than 5000 RMB (OR = 3.539, 95% CI: [1.517, 8.257], $P = 0.003$), having a BMI of less than 20 kg/m2 (OR = 2.155, 95% CI: [1.080, 4.299], $P = 0.029$), having a BMI of 20–24 kg/m2 (OR = 2.387, 95% CI: [1.112, 5.122], $P = 0.026$), and having a BMI of 25–29 kg/m2 (OR = 4.063, 95% CI: [1.359, 12.146], $P = 0.012$) were independently associated with proactive practice (as shown in Table 6).

The fit indices of the SEM model indicated a good model fit (as shown in Fig. 1). Path analysis (as shown in Table S1 and Fig. 1) and analysis of direct and indirect effects (as shown in Table S2) revealed that age (β = -0.146, $P = 0.004$), education (β = 0.134, $P = 0.009$), employment (β = -0.161, $P = 0.001$), and BMI (β = 0.118, $P = 0.014$) directly influenced knowledge. Knowledge (β = 0.192, $P < 0.001$), age (β = -0.124, $P = 0.010$), and COPD (β = -0.120, $P = 0.011$) directly impacted attitude, while age (β = -0.028, $P = 0.019$), education (β = 0.026, $P = 0.029$), employment (β = -0.031, $P = 0.010$), and BMI (β = 0.023, $P = 0.037$) indirectly affected attitude. Attitude (β = 0.218, $P < 0.001$), employment (β = -0.165, $P = 0.003$), BMI (β = 0.093, $P = 0.045$), and income (β = 0.290, $P < 0.001$) directly influenced practice, while knowledge (β = 0.042, $P = 0.002$), age (β = -0.044, $P = 0.003$), and COPD (β = -0.026, $P = 0.025$) indirectly affected practice.

N = 421	N(%)	Knowledge	P	Attitude	P	Practice	P
		Median [25%,75%] or mean (± SD)		Median [25%,75%] or mean (± SD)		Median [25%,75%] or mean (± SD)	
Total	421(100.0)	12.00 [10.00, 13.00]		20.00 [19.00, 21.00]		16.00 [15.00, 17.00]	
1. Age			< 0.001		0.002		< 0.001
Less than 60 years old	38(9.0)	12.00 [11.00, 14.75]		20.50 [19.00, 22.00]		14.00 [13.00, 15.00]	
60–69	83(19.7)	12.00 [11.00, 14.00]		20.00 [19.00, 22.00]		13.00 [12.00, 15.00]	
70–79	165(39.2)	12.00 [11.00, 14.00]		20.00 [19.00, 21.00]		13.00 [11.00, 14.00]	
More than 80 years old	135(32.1)	11.00 [10.00, 12.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
2. Gender			0.978		0.967		0.467
Male	230(54.6)	12.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Female	191(45.4)	11.00 [10.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
3. Education			0.001		0.176		0.003
Primary school and below	300(71.3)	11.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Middle school	72(17.1)	12.00 [11.00, 14.00]		20.00 [19.00, 21.00]		14.00 [13.00, 15.00]	
High school and above	49(11.6)	12.00 [11.00, 15.00]		21.00 [19.00, 22.00]		14.00 [12.00, 15.00]	
4. Work status			0.001		0.328		< 0.001
Unemployed	165(39.2)	12.00 [11.00, 14.00]		20.00 [19.00, 22.00]		13.00 [12.00, 14.00]	
Employed	26(6.2)	12.00 [11.00, 14.00]		20.50 [19.00, 21.00]		15.00 [14.00, 15.00]	
Retired	230(54.6)	11.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
5. Marital status			0.099		0.372		0.395
Married	395(93.8)	12.00 [10.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Other	26(6.2)	11.00 [10.25, 12.75]		20.00 [20.00, 21.00]		13.00 [13.00, 14.00]	
6.Type of permanent residence			0.321		0.249		0.195
Urban	108(25.7)	11.00 [10.00, 14.00]		20.00 [18.75, 21.00]		13.00 [12.00, 14.00]	
Suburb	106(25.2)	12.00 [11.00, 14.00]		20.00 [19.00, 22.00]		13.50 [12.00, 14.00]	
Townships	168(39.9)	11.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Rural	39(9.3)	12.00 [11.00, 12.50]		20.00 [19.00, 22.00]		13.00 [12.00, 14.00]	
7. Monthly household income(RMB)			0.189		0.586		< 0.001
Less than 1000	178(42.3)	12.00 [11.00, 13.00]		20.00 [19.00, 22.00]		13.00 [12.00, 14.00]	
1001–3000	80(19.0)	11.00 [10.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
3001–5000	106(25.2)	11.00 [10.00, 12.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
More than 5000	57(13.5)	12.00 [11.00, 14.00]		20.00 [19.00, 21.00]		14.00 [13.00, 15.00]	
8. Medical insurance status			0.073		0.993		0.096
Having medical insurance other than basic medical insurance	24(5.7)	11.00 [10.00, 12.00]		20.00 [19.00, 22.00]		14.00 [13.00, 15.00]	
Basic medical insurance only	395(93.8)	12.00 [10.00, 13.50]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
No insurance	2(0.5)	13.50 [13.25, 13.75]		20.00 [19.50, 20.50]		11.50 [10.75, 12.25]	
9. Body mass index (BMI)			0.007		0.121		0.001
Less than 20	69(16.4)	12.00 [10.00, 13.00]		20.00 [19.00, 21.00]		12.00 [11.00, 13.00]	
20–24	217(51.5)	11.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
25–29	106(25.2)	12.00 [11.00, 14.00]		21.00 [19.00, 22.00]		13.00 [13.00, 14.00]	
30 and above	29(6.9)	13.00 [11.00, 15.00]		20.00 [19.00, 22.00]		14.00 [13.00, 15.00]	
10. Have you been diagnosed with heart failure for the first time in the last 18 months?			< 0.001		0.913		0.430
No	265(62.9)	12.00 [11.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Yes	156(37.1)	11.00 [10.00, 12.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
11. Are you currently smoking?			0.613		0.461		0.686
No	370(87.9)	12.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Yes	51(12.1)	12.00 [10.00, 13.00]		20.00 [18.00, 22.00]		13.00 [12.00, 14.00]	
12. Do you currently have diabetes?			0.124		0.011		0.392
No	336(79.8)	11.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Yes	85(20.2)	12.00 [11.00, 14.00]		21.00 [19.00, 22.00]		13.00 [12.00, 14.00]	
13. Do you currently have COPD?			0.755		0.001		0.005
No	352(83.6)	11.00 [10.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Yes	69(16.4)	12.00 [10.00, 13.00]		19.00 [18.00, 20.00]		13.00 [12.00, 13.00]	
14. What is your current heart failure symptom pattern?			< 0.001		0.121		0.233
Acute	92(21.9)	11.00 [10.00, 12.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Continued							

N = 421	N(%)	Knowledge	P	Attitude	P	Practice	P
		Median [25%,75%] or mean (± SD)		Median [25%,75%] or mean (± SD)		Median [25%,75%] or mean (± SD)	
Chronic	174(41.3)	12.00 [11.00, 14.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Mixed	155(36.8)	12.00 [11.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
15. Your NYHA classification			0.943		0.803		0.070
Class 1–2	28(6.7)	11.00 [10.00, 14.00]		20.00 [19.00, 21.25]		13.00 [12.00, 14.00]	
Class 3	236(56.1)	11.50 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	
Class 4	157 (37.3)	12.00 [10.00, 13.00]		20.00 [19.00, 21.00]		13.00 [12.00, 14.00]	

Table 1. Basic information of participants and KAP score.

Knowledge	Yes	Unsure	No	正确率
1. Heart failure patients should not drink excessive amounts of water.	164(39%)	128(30.4%)	129(30.6%)	164(39%)
2. The only dietary restriction for heart failure patients is to avoid adding salt.	157(37.3%)	171(40.6%)	93(22.1%)	93(22.1%)
3. Heart failure patients should reduce most of their physical activity.	288(68.4%)	80(19%)	53(12.6%)	53(12.6%)
4. Abdominal bloating is a symptom of worsening heart failure.	116(27.6%)	155(36.8%)	150(35.6%)	116(27.6%)
5. Feeling breathless when waking up at night indicates worsening heart failure.	250(59.4%)	104(24.7%)	67(15.9%)	250(59.4%)
6. Heart failure patients need to monitor their weight in real time to avoid significant weight fluctuations.	87(20.7%)	132(31.4%)	202(48%)	87(20.7%)
7. Heart failure patients need to restrict sodium intake.	194(46.1%)	152(36.1%)	75(17.8%)	194(46.1%)
8. Feeling fatigued, such as weakness in the legs, indicates worsening heart failure.	160(38%)	161(38.2%)	100(23.8%)	160(38%)
9. Heart failure worsens when combined with arrhythmias.	133(31.6%)	121(28.7%)	167(39.7%)	133(31.6%)

Table 2. Knowledge dimension of the participants.

Attitude	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. The extent to which you are concerned about the recurrence of your heart failure.	104(24.7%)	206(48.9%)	26(6.2%)	77(18.3%)	8(1.9%)
2. Are you willing to adjust your diet for the prevention of heart failure recurrence?	133(31.6%)	254(60.3%)	29(6.9%)	5(1.2%)	0 (0%)
3. If your heart failure recurs, you would prioritize following your doctor's treatment advice and cooperate actively.	203(48.2%)	206(48.9%)	12(2.9%)	0 (0%)	0 (0%)
4. The extent to which the outpatient medical facilities and nursing levels affect your enthusiasm for treatment.	33(7.8%)	161(38.2%)	96(22.8%)	97(23%)	34(8.1%)
5. Proper medication adherence and avoiding overdose are essential for preventing exacerbation of heart failure.	255(60.6%)	154(36.6%)	10(2.4%)	2(0.5%)	0 (0%)

Table 3. Attitude dimension of the participants.

Practice					
	Hardly never	Rarely	Sometimes	Often	Always
1. How often do you seek treatment proactively after experiencing symptoms of heart failure?	10(2.4%)	31(7.4%)	115(27.3%)	167(39.7%)	98(23.3%)
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
2. You will have regular outpatient follow up visits as required by your doctor after you are discharged from the hospital.	82(19.5%)	203(48.2%)	101(24%)	35(8.3%)	0 (0%)
	Hardly never	Rarely	Sometimes	Often	Always
3. You will prevent recurrence of heart failure by strengthening your cardiorespiratory fitness with proper exercise.	161(38.2%)	142(33.7%)	81(19.2%)	33(7.8%)	4(1%)
	Hardly never	Rarely	Sometimes	Often	Always
4. How often you take your medication on time?	7(1.7%)	15(3.6%)	22(5.2%)	147(34.9%)	230(54.6%)
	Yes	No			
5. Do you still drink alcohol?	38(9%)	383(91%)			
	Less than 500mL	500-1000mL	1000-2000mL	More than 2000mL	
6.What is your total daily fluid intake?	161(38.2%)	162(38.5%)	74(17.6%)	24(5.7%)	

Table 4. Practice dimension of the participants.

	Knowledge dimension	Attitude	Practice
Knowledge dimension	1.000		
Attitude	0.183($P<0.001$)	1.000	
Practice	0.169($P<0.001$)	0.245($P<0.001$)	1.000

Table 5. Correlation analysis of KAP scores.

Discussion

Heart failure patients exhibit inadequate knowledge but maintain positive attitudes and proactive practices regarding heart failure recurrence prevention. To enhance patient education and improve knowledge, interventions should target those with lower education levels and employment status, and address socioeconomic factors such as income and living environment.

The study on heart failure patients' knowledge, attitudes, and practices (KAP) regarding recurrence prevention revealed a significant disparity: despite limited knowledge, participants exhibited positive attitudes and proactive practices. This discrepancy may originate fromseveral sources. Supportive healthcare interactions or community encouragement can foster positive attitudes, prompting patients to adopt effective health behaviors regardless of their understanding of heart failure[20,21]. Healthcare communications often prioritize practical management aspects like medication adherence and lifestyle changes over comprehensive knowledge, enabling patients to implement these practices effectively. Additionally, social and family support enhances adherence to positive behaviors, like regular medical visits, potentially mitigating the lack of deep knowledge[22,23].

The convergence of statistically significant associations and results from multivariate logistic regression analysis presents an opportunity to delve deeper into the determinants of KAP regarding heart failure recurrence prevention among patients. For instance, age emerged as a significant predictor across multiple dimensions of KAP, with younger patients demonstrating higher levels of knowledge, more positive attitudes, and better adherence to preventive practices. This finding is consistent with previous research suggesting that younger individuals may be more receptive to health education interventions and more motivated to adopt healthy behaviors[24]. Moreover, younger age is often associated with greater access to digital health resources and engagement with technology-driven health promotion initiatives, which may contribute to better health-related knowledge and practices[25].

Education level also emerged as a robust predictor of KAP, with higher education associated with superior knowledge, attitudes, and practices regarding heart failure management. Education serves as a proxy for health literacy, enabling individuals to navigate healthcare information, make informed decisions, and adhere to medical recommendations[26]. Moreover, employment status was another significant predictor of KAP, with working individuals exhibiting higher levels of knowledge and engagement in preventive practices. Employment status may reflect broader socioeconomic factors, including financial stability, access to healthcare resources, and opportunities for health education and workplace wellness programs[27].

Furthermore, BMI emerged as a significant predictor of KAP, with a higher BMI associated with greater knowledge and adherence to preventive practices. This finding may reflect heightened awareness among individuals with obesity regarding the importance of lifestyle modifications in managing chronic health conditions such as heart failure. Having COPD also emerged as a predictor of attitudes toward heart failure management, with COPD patients exhibiting less positive attitudes compared to their counterparts. This finding may be attributed to the presence of overlapping symptoms and comorbidities between COPD and heart failure, leading to greater psychological distress and perceived burden of illness among COPD patients[28].

Moving to the correlation analyses and SEM results, the integration of these findings provides a holistic understanding of the interrelationships between demographic, clinical, and psychosocial factors and their impact on KAP. The positive correlations between knowledge, attitudes, and practices underscore the synergistic nature of these constructs, highlighting the importance of addressing multiple dimensions of KAP in health promotion interventions[29].

In our study, the knowledge dimension among heart failure patients showed varying levels of understanding, particularly regarding dietary restrictions and symptom recognition. While a significant portion recognized the importance of restricting sodium intake, a concerning number were uncertain or disagreed. Similarly, awareness of symptoms like abdominal bloating and nocturnal dyspnea varied substantially. To address these gaps, tailored educational interventions are imperative. These interventions could include interactive workshops, multimedia resources, and regular educational sessions during outpatient clinic visits[30,31]. Providing comprehensive information on dietary management and symptom recognition can enable patients to make informed decisions about their health and adhere to recommended lifestyle modifications effectively[32,33].

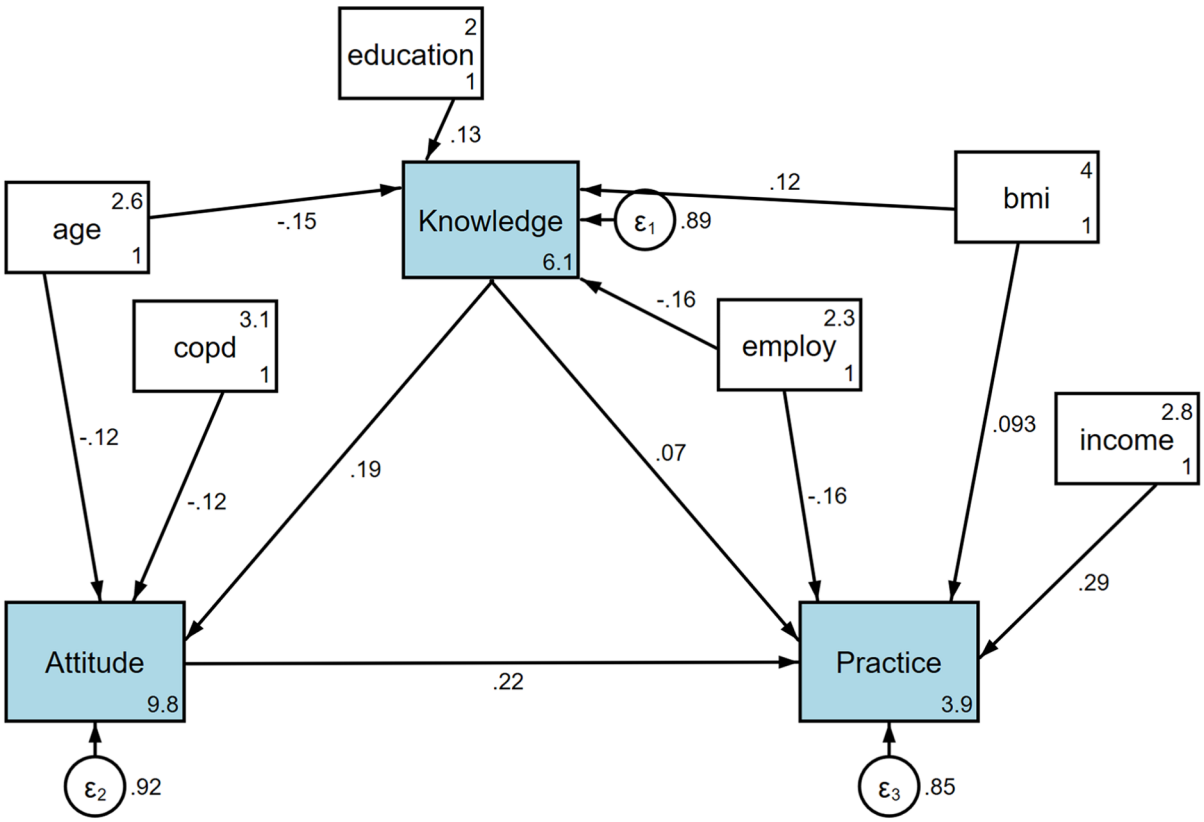
The attitudes of heart failure patients toward management revealed positive inclinations toward treatment adherence and lifestyle modifications. However, attitudes toward outpatient medical facilities and nursing services displayed variations. To improve patient attitudes and enhance treatment engagement, it's crucial to strengthen healthcare infrastructure and promote patient-centered communication approaches. Implementing telehealth services, extending clinic hours, and conducting patient satisfaction surveys can address concerns related to accessibility and quality of care, fostering trust and satisfaction among patients[34,35].

The practice dimension highlighted varying levels of adherence to treatment and self-care behaviors among heart failure patients. While many reported regular medication adherence and proactive symptom management, a notable proportion exhibited suboptimal adherence to dietary and lifestyle recommendations. To bridge this gap, personalized behavior change interventions and digital health technologies are recommended. These

Practice (Cut-off value: 60% of the total practical score, Psum ≥ 4 168(39.9%) Psum ≤ 13253(60.1%))	Univariate analysis		Multivariate analysis	
	OR(95%CI)	*P*	OR(95%CI)	*P*
Knowledge	1.160 (1.050,1.282)	0.003	1.063 (0.945,1.196)	0.312
Attitude	1.253 (1.127,1.393)	< 0.001	1.238 (1.099,1.396)	< 0.001
1. Age				
Less than 60 years old				
60–69	0.508 (0.224,1.112)	0.095	1.316 (0.440,3.939)	0.623
70–79	0.277 (0.128,0.574)	0.001	0.823 (0.284,2.384)	0.719
More than 80 years old	0.263 (0.120,0.554)	0.001	1.015 (0.333,3.099)	0.979
2. Gender				
Male				
Female	0.866 (0.584,1.282)	0.474		
3. Education				
Primary school and below				
Middle School	1.915 (1.139,3.228)	0.014	1.442 (0.780,2.663)	0.243
High school and above	1.887 (1.025,3.481)	0.041	0.831 (0.388,1.779)	0.633
4. Work status				
Unemployed				
Employed	5.778 (2.319,16.525)	< 0.001	3.217 (0.824,12.556)	0.093
Retired	1.082 (0.715,1.641)	0.710	0.974 (0.517,1.837)	0.935
5. Marital status				
Married				
Other	1.102 (0.482,2.449)	0.812		
6. Type of permanent residence				
Urban				
Suburb	1.769 (1.027,3.071)	0.041	2.524 (1.282,4.969)	0.007
Townships	1.082 (0.656,1.795)	0.758	1.414 (0.786,2.543)	0.247
Rural	0.885 (0.400,1.893)	0.756	1.727 (0.674,4.428)	0.255
7. Monthly household income (RMB)				
Less than 1000				
1001–3000	1.010 (0.573,1.759)	0.972	1.589 (0.792,3.186)	0.192
3001–5000	1.641 (1.001,2.694)	0.049	2.023 (0.994,4.117)	0.052
More than 5000	2.932 (1.595,5.477)	0.001	3.539 (1.517,8.257)	0.003
8. Medical insurance status				
Having medical insurance other than basic medical insurance				
Basic medical insurance only	0.547 (0.234,1.252)	0.153		
No insurance				
9. Body mass index (BMI)				
Less than 20	2.320 (1.256,4.502)	0.009	2.155 (1.080,4.299)	0.029
20–24	3.092 (1.579,6.313)	0.001	2.387 (1.112,5.122)	0.026
25–29	5.782 (2.295,15.333)	< 0.001	4.063 (1.359,12.146)	0.012
30 and above				
10. Have you been diagnosed with heart failure for the first time in the last 18 months?				
No	1.064 (0.709,1.591)	0.765		
Yes				
11. Are you currently smoking?				
No	1.052 (0.574,1.900)	0.867		
Yes				
12. Do you currently have diabetes?				
No	0.826 (0.500,1.344)	0.445		
Yes				
13. Do you currently have COPD?				
No	0.431 (0.234,0.760)	0.005	0.612 (0.324,1.156)	0.130
Yes				
14. What is your current heart failure symptom pattern?				
Acute	1.435 (0.854,2.440)	0.177		
Chronic	1.230 (0.721,2.117)	0.450		
Continued				

Practice (Cut-off value: 60% of the total practical score, Psum ≥ 4 168(39.9%) Psum ≤ 13253(60.1%))	Univariate analysis		Multivariate analysis	
	OR(95%CI)	*P*	OR(95%CI)	*P*
Mixed				
15. Your NYHA classification				
Class 1–2	1.597 (0.720,3.733)	0.260		
Class 3	0.793 (0.346,1.903)	0.590		

Table 6. Factors of practice based univariable and multivariable logistic regression.



Indicators	Reference	Results
RMSEA	<0.08 Good	0.000
SRMR	<0.08 Good	0.017
TLI	>0.8 Good	1.046
CFI	>0.8 Good	1.000

Fig. 1. Path analysis model.

interventions can include goal-setting exercises, self-monitoring tools, and real-time feedback mechanisms. Moreover, integrating patient education and self-management support into routine clinical care can reinforce positive behavior changes and facilitate long-term adherence to recommended treatment regimens[36].

Limitations of this study include its reliance on self-reported data, which may introduce recall bias and overestimation of knowledge, attitudes, and practices. Additionally, the cross-sectional design limits causal inference, and the study's single-center setting may affect the generalizability of findings to broader populations. Despite these limitations, this paper contributes valuable insights into the KAP of heart failure patients regarding recurrence prevention. Its comprehensive assessment using structured questionnaires provides a robust foundation for understanding patient perspectives. Moreover, the use of structural equation modeling enhances the depth of analysis, offering insights into the complex interplay between demographic factors and KAP. Overall, this study lays the groundwork for targeted interventions aimed at improving patient education and care strategies for heart failure management.

In conclusion, despite demonstrating positive attitudes and proactive practices, heart failure patients often lack sufficient knowledge regarding the prevention of heart failure recurrence. Improving educational interventions tailored to enhance knowledge among heart failure patients may further reinforce their positive attitudes and proactive practices, thereby reducing the risk of heart failure recurrence.

Data availability

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

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Author contributions

Y.H. and J.X. carried out the studies, participated in collecting data, and drafted the manuscript. X.L. and Z.D. performed the statistical analysis and participated in its design. X.G. and J.X. participated in acquisition, analysis, or interpretation of data and draft the manuscript. All authors read and approved the final manuscript.

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Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Ethical approval was granted by the Medical Ethics Committee of the Third People's Hospital of Yancheng City, and informed consent was secured from all participants prior to the administration of the questionnaire. The study was carried out in accordance with the applicable guidelines and regulations.

Additional information

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