INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Assessment of Nurse-Led Cardiac Rehabilitation Knowledge and Attitudes: A Cross-Sectional Study at Diwaniyah Teaching Hospital

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Abstract: Cardiac rehabilitation (CR) is a critical component of cardiovascular care, yet nurses' knowledge and attitudes towards CR can impact its implementation and success. This study aimed to assess the level of knowledge and attitudes of nurses towards cardiac rehabilitation and identify the factors associated with these outcomes. A cross-sectional study was conducted among 150 nurses at Diwaniyah Teaching Hospital in Iraq during April and May 2025. Data were collected using a structured online questionnaire, comprising demographic and work-related information, knowledge items, and attitude statements rated on a Likert scale. Descriptive analyses, bivariate comparisons (t-tests and ANOVA), Spearman correlation, and multiple linear regression analyses were performed. The mean knowledge score was 10.31 (SD = 4.63) out of 20, indicating a moderate level of knowledge, with 25% of nurses scoring below 6.70 and 75% up to 15.00. Educational level ($p = 0.009$), hospital department ($p = 0.033$), working shift ($p = 0.004$), and previous CR training ($p = 0.042$) were significantly associated with knowledge scores. Nurses with bachelor's degrees, those working in operating rooms (mean = 13.32), and night shift workers (mean = 16.10) had the highest knowledge scores. The mean attitude score was 46.60 (SD = 5.10) out of 75, reflecting moderately positive attitudes. Age ($p = 0.030$) and hospital department ($p = 0.001$) were significantly associated with attitudes. Older nurses (41–50 years, mean = 50.60) and those working in outpatient departments (mean = 50.00) reported the most positive attitudes. Spearman correlation analysis revealed a significant positive correlation between knowledge and attitudes ($r = 0.303$, $p < 0.001$). Multiple linear regression identified knowledge ($B = 0.337$, $p < 0.001$) and age ($B = 1.862$, $p = 0.008$) as independent predictors of attitudes, accounting for the variance in nurses' attitudes towards CR. The study highlighted moderate levels of knowledge and attitudes towards cardiac rehabilitation among nurses, with clear gaps in specific areas and variability across demographic and work-related factors. Efforts to enhance nurses' knowledge, particularly through targeted educational interventions, may play a vital role in fostering more favorable attitudes and ultimately improving the implementation of cardiac rehabilitation services.

Keywords: Cardiac Rehabilitation, Nurses' Knowledge, Nurses' Attitudes, Cardiovascular Nursing, Educational Interventions, Iraq

Introduction

Cardiovascular diseases (CVDs) are a group of disorders affecting the heart and blood vessels, resulting in a poor quality of life, severe health complications, and long-term disability, and are considered a leading cause of morbidity and mortality worldwide [1]. They include a wide range of illnesses including, but not limited to, coronary artery disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolisms, among others [2]. According to various studies conducted throughout the years, several modifiable risk factors play a major role in accounting for the onset of cardiovascular diseases, noting smoking, hypertension, dyslipidemia, diabetes, abdominal obesity, psychosocial factors, increased alcohol intake, and lack of regular physical activity [3], [4], [5].

For instance, the global prevalence of cardiovascular diseases is increasing, which is exacerbating a significant health challenge. For instance, in year 2019, the World Health Organization (WHO) has published in its report an estimated prevalence of around eighteen million individuals who died due to these diseases, which represents around 32% of the global death rate [6]. Of this death rate, 85% was due to myocardial infarction and/or cerebrovascular accidents. On the other hand, ischemic heart disease has accounted for 49.2% of all fatalities, further accentuating the health burden [7]. Moreover, CVDs

were shown to have a more significant impact on low- and middle-income countries (LMICs) compared to high-income countries, with 80% of global CVDs occurring in LMICs [8].

As healthcare systems become overwhelmed with these rates, there is a growing emphasis on primary prevention, including the modification of risk factors, and primordial prevention, including prevention of risk factor emergence, and this to sustain optimal cardiovascular health for an extended duration and alleviate the burden of CVDs [8], [9]. Further complementing these initiatives, cardiac rehabilitation (CR) was shown to be a cost-effective approach advantageous in providing secondary prevention that can further reduce the morbidity and mortality related to patients who already manifested CVDs [10], [11].

For instance, CR, an essential element of clinical practice guidelines, is an inter-professional program that emphasizes on supervised physical exercise, adjustment of cardiovascular risk factors, as well as psychological support for patients recovering from cardiovascular disorders [12]. According to the "American Heart Association" (AHA), the "American Association of Cardiovascular and Pulmonary Rehabilitation", and the "Agency for Health Care Policy and Research", CR should include several components aiming to optimize the CVD risk reduction, reduce disability, promote health lifestyle changes, and support long-term adherence [12], [13], [14], [15].

As part of the inter-professional program, nurses play a significant role in the implementation of cardiac rehabilitation. In order to provide for their patients a high-quality of care, nurses should perform their duties in accordance with adequate knowledge, positive and favorable attitudes, as well as efficient practices for the implementation and management of the core components of cardiac rehabilitation [16]. In this regard, studies have shown that an effective delivery of CR by healthcare professionals, including nurses, is significantly associated with an improved quality of life of patients with CVDs [17], [18]. However, other studies have shown that the lack of knowledge among nurses about rehabilitation of patients with CVDs can negatively affect their attitudes, as well as their practices, and result in a lack of efficient support for these patients, which jeopardizes their quality of life [19], [20].

However, in Iraq, there is a lack of studies highlighting the levels of knowledge and the attitudes of nurses towards cardiac rehabilitation. Hence, the main aim of this study is to evaluate nurses' knowledge and attitudes towards cardiac rehabilitation (CR) and identify factors associated to both knowledge and attitudes.

Methodology

Study Design and setting

A cross-sectional study was conducted among nurses working at Diwaniyah Teaching Hospital, Iraq, during April and May 2025. The study aimed to evaluate nurses' knowledge and attitudes towards cardiac rehabilitation (CR) and identify associated factors.

Study Population and Sampling

The target population comprised all nurses employed at the hospital during the study period. Nurses who consented to participate were included, while those who declined participation were excluded. Given a total nursing workforce of 200, the minimum required sample size was calculated using Slovin's formula with a 95% confidence level and a 5% margin of error, resulting in 133 nurses. Ultimately, 150 nurses participated to enhance representativeness and account for potential non-response.

Data collection and variables

Data collection was performed using a structured online questionnaire developed in Google Forms. The questionnaire included four sections. The first section obtained informed electronic consent. The second section gathered demographic and work-related information, including age, gender, educational level, years of nursing experience, hospital department, and working shift. The third section assessed nurses' knowledge and practices related to cardiac rehabilitation. Knowledge was evaluated through five items rated on a four-point scale ("definitely," "probably," "definitely not," and "don't know"), while practices

were assessed using seven items rated on a four-point frequency scale ("never," "seldom," "often," and "always"). Correct responses for both knowledge and practices were coded as 1, and incorrect responses as 0. The overall knowledge score was calculated by summing correct responses for a maximum raw score of 12, which was then linearly scaled to a 0–20 range to facilitate interpretation. The fourth section explored nurses' attitudes towards cardiac rehabilitation through 15 statements rated on a five-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree"). Negatively worded items were reverse coded to ensure consistency, with the total attitude score ranging from 15 to 75.

The questionnaire was adapted from validated instruments in previous studies and pilot-tested with a subset of nurses to ensure clarity and contextual relevance [16], [21]. Reliability analysis confirmed high internal consistency for both scales, with a Cronbach's alpha of 0.909 for the attitude scale (15 items) and 0.823 for the knowledge scale (12 items). Construct validity was also assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. For the attitude scale, the KMO measure was 0.826 and Bartlett's test was significant ($\chi^2 = 1267.048$, df = 105, $p < 0.001$). For the knowledge scale, the KMO measure was 0.772 and Bartlett's test was significant ($\chi^2 = 767.855$, df = 66, $p < 0.001$), confirming the appropriateness of factor analysis.

Ethical consideration

Participation in the study was voluntary and anonymous. No personal identifiers such as names, email addresses, or IP addresses were collected. Participants could withdraw at any time without consequences. The study protocol adhered to the ethical principles of the Declaration of Helsinki and received approval from the institutional review board at Diwaniyah Teaching Hospital.

Data Analysis

Data analysis was performed using SPSS version 27.0. Descriptive statistics, including frequencies, percentages, means, standard deviations, medians, and interquartile ranges, were used to describe demographic data, knowledge, and attitude scores. The normality of continuous variables was assessed visually through histograms and numerically by examining skewness and kurtosis values. Bivariate analyses were conducted using Mann Whitney test and Kruskal Wallis test for continuous variables, with Levene's test to assess homogeneity of variance. Significant ANOVA results were further explored using Bonferroni post hoc tests. Spearman's correlation analysis was conducted to assess the relationship between knowledge and attitude scores. Finally, multiple linear regression analysis was performed to identify independent predictors of nurses' attitudes towards cardiac rehabilitation. Model assumptions, including normality of residuals, linearity, homoscedasticity, and multicollinearity, were carefully examined and met. A p-value of less than 0.05 was considered statistically significant.

Results

Demographics and work-related conditions

Table 1 shows the distribution of sociodemographic and work-related characteristics of the nurses participating in the study. The sample comprised predominantly young nurses, with 82.7% aged between 20 and 30 years, followed by 10.7% aged 31 to 40 years, and 6.7% aged 41 to 50 years. In terms of gender, the majority were female (65.3%), while 34.7% were male. Regarding educational attainment, nearly half of the nurses (48.0%) held a bachelor's degree in nursing, 30.7% had a diploma in nursing, and 21.3% held a master's degree or PhD.

The distribution of nursing experience revealed that 32.0% had less than one year of experience, 42.7% had 1 to 5 years of experience, 18.7% had 6 to 10 years, and 6.7% had more than 10 years of experience. The departmental distribution of the nurses was diverse: 18.7% worked in the emergency department, 13.3% in the intensive care unit, 2.7% in medical or surgical wards, 12.0% in operating rooms, 6.7% in outpatient departments, and 46.7% in other departments. With respect to work shifts, the majority of nurses (85.3%) worked morning shifts, while evening and night shifts were each reported by 4.0% of nurses. Additionally, 6.7% worked in rotational shifts.

Table 1. Sociodemographic and work-related characteristics of the nurses (n=150).

		Frequency	Percent
Age (in years)	20-30 years	124	82.7
	31-40 years	16	10.7
	41-50 years	10	6.7
Gender	Male	52	34.7
	Female	98	65.3
Educational Level	Diploma in Nursing	46	30.7
	Bachelor's Degree in Nursing	72	48.0
	Master's Degree / PhD	32	21.3
Years of Nursing Experience	< 1 year	48	32.0
	1-5 years	64	42.7
	6-10 years	28	18.7
	>10 years	10	6.7
Hospital Department (Unit)	Emergency Department	28	18.7
	Intensive Care Unit (ICU)	20	13.3
	Medical/Surgical Wards	4	2.7
	Operating Room	18	12.0
	Outpatient Department	10	6.7
	Other	70	46.7
Working Shift	Morning	128	85.3
	Evening	6	4.0
	Night	6	4.0
	Rotational	10	6.7

Table 2 presents the distribution of previous training and perceptions of cardiac rehabilitation among the nurses. Regarding previous training, 56.0% of the participants reported having received cardiac rehabilitation training or attended relevant conferences, while 44.0% indicated no prior training in this area.

When asked about their self-assessed knowledge of cardiac rehabilitation, 10.7% rated their knowledge as very poor, 20.0% as poor, 37.3% as average, 28.0% as good, and 4.0% as excellent. Additionally, 61.3% of nurses reported having directly participated in managing a cardiac rehabilitation case, whereas 38.7% had not been involved in such care.

Table 2. Nurses' previous training, perceived knowledge, and experience in managing cardiac rehabilitation.

		Frequency	Percent
Have you previously received Cardiac Rehabilitation training or attended Cardiac Rehabilitation conferences?	No	66	44.0
	Yes	84	56.0
How do you perceive your overall knowledge about Cardiac Rehabilitation?	Very Poor	16	10.7
	Poor	30	20.0
	Average	56	37.3
	Good	42	28.0
	Excellent	6	4.0
Have you ever participated directly in managing a Cardiac Rehabilitation case?	No	58	38.7
	Yes	92	61.3

Knowledge about Cardiac Rehabilitation

Table 3 shows the distribution of nurses' responses to questions assessing knowledge and practice-related activities regarding cardiac rehabilitation. In response to the statement that cardiac rehabilitation is designed only for patients who had heart valve surgery, 28.0% correctly disagreed (definitely not), while 26.7% selected "definitely," 40.0% chose "probably," and 5.3% were unsure. Regarding the

initiation of Phase 1 of cardiac rehabilitation, 14.7% correctly identified that it does not begin after hospital discharge, while the majority incorrectly selected "definitely" (32.0%) or "probably" (45.3%). For the statement about the use of warfarin post-cardiac surgery in patients with bioprostheses or mitral repair, 26.7% responded "definitely" and 38.7% "probably," reflecting some awareness of the recommendation, although 12.0% incorrectly chose "definitely not," and 22.7% reported not knowing. In contrast, 49.3% correctly recognized that aerobic and resistance exercise are recommended forms of cardiac rehabilitation, with another 34.7% responding "probably."

Regarding the safety of activities like walking, swimming, and stair climbing six weeks after heart surgery, 25.3% chose "definitely," and 41.3% "probably," indicating generally positive perceptions of gradual reconditioning, while 26.7% believed these activities were unsafe.

Practice-related questions about rehabilitation activities before discharge also revealed a range of responses. For early detection of complications, 36.0% of nurses reported "often" and 33.3% "always," consistent with best practices. Sexual activities counselling was reported "often" by 34.7% and "always" by 24.0% of nurses. Advising caregivers regarding support and care was more frequently practiced, with 38.7% of nurses reporting "always" and 30.7% "often."

Preparing a work-up schedule for post-discharge activities was reported as "often" by 34.7% and "always" by 17.3%. Counselling patients to cope with surgery, stress, and anxiety was more evenly split between "often" (32.0%) and "always" (33.3%). Similarly, counselling caregivers to cope with stress and anxiety was reported "often" by 30.7% and "always" by 32.0% of nurses. Encouraging caregivers to participate in the patient's physical activities was reported "often" by 26.7% and "always" by 29.3%. These findings collectively highlight both knowledge gaps and variations in the reported practices of cardiac rehabilitation activities among nurses.

Table 3. Knowledge and practice-related responses on cardiac rehabilitation among Nurses.

		Frequency	Percent
Knowledge about Cardiac Rehabilitation			
Cardiac rehabilitation is designed only for those patients who had heart valve surgery.	Definitely	40	26.7
	Probably	60	40.0
	Definitely not *	42	28.0
	Don't know	8	5.3
Phase 1 of the cardiac rehabilitation program begins as soon as the patient is discharged from the hospital.	Definitely	48	32.0
	Probably	68	45.3
	Definitely not *	22	14.7
	Don't know	12	8.0
Patients with bio-prostheses or mitral repair should receive warfarin for 1 month after cardiac surgery.	Definitely	40	26.7
	Probably	58	38.7
	Definitely not	18	12.0
	Don't know	34	22.7
Aerobic and resistance exercise training are two types of exercise recommended for cardiac rehabilitation.	Definitely *	74	49.3
	Probably	52	34.7
	Definitely not	14	9.3
	Don't know	10	6.7
Walking, swimming, jogging, stair climbing and lightweight at 6 weeks after heart surgery is safe for patients who underwent cardiac event and heart surgery.	Definitely *	38	25.3
	Probably *	62	41.3
	Definitely not	40	26.7
	Don't know	10	6.7
Which of the following rehabilitation activities you provide to patients before discharge from the hospital?			
Early detection of complications	Never	18	12.0
	Seldom	28	18.7

		Frequency	Percent
Sexual activities counselling	Often *	54	36.0
	Always *	50	33.3
	Never	14	9.3
	Seldom	48	32.0
	Often *	52	34.7
	Always *	36	24.0
Advice caregivers regarding support and care of their family members.	Never	14	9.3
	Seldom	32	21.3
	Often *	46	30.7
	Always *	58	38.7
Preparing a work-up schedule for the activities of the patients regarding cycling, rowing, swimming, bicycling, jogging, and rest.	Never	20	13.3
	Seldom	52	34.7
	Often *	52	34.7
	Always *	26	17.3
Counselling of the patients in helping them to cope with heart valve surgery, stress and anxiety	Never	20	13.3
	Seldom	32	21.3
	Often *	48	32.0
	Always *	50	33.3
Counselling of the caregivers to help them to cope with stress and anxiety in caring for their family member after heart valve surgery.	Never	22	14.7
	Seldom	34	22.7
	Often *	46	30.7
	Always *	48	32.0
Encouraging and counselling the caregivers to get involved in the physical activities of their family member.	Never	30	20.0
	Seldom	36	24.0
	Often *	40	26.7
	Always *	44	29.3

* *Correct answer coded 1 in the methodology score*

Table 4 summarizes the descriptive statistics of the knowledge scores related to cardiac rehabilitation among nurses. The mean knowledge score was 10.31 (SD = 4.63) over 20, with scores ranging from 1.70 to 18.30. The median score was 11.70, suggesting a distribution slightly skewed towards higher knowledge levels. The interquartile range further revealed that 25% of nurses scored below 6.70, while 75% of nurses scored up to 15.00. These findings indicate a mild to moderate level of knowledge overall, with substantial variation among participants.

Table 4. Nurses knowledge scores related to cardiac rehabilitation among nurses.

		Knowledge about Cardiac Rehabilitation
N		150
Mean		10.31
Median		11.70
Std. Deviation		4.63
Minimum		1.70
Maximum		18.30
Percentiles	25	6.70
	50	11.70
	75	15.00

Attitude towards Cardiac Rehabilitation

Table 5 shows the distribution of nurses' attitudes towards cardiac rehabilitation as assessed by a series of Likert-scale items. The item "I believe rehabilitation should begin as soon as the patient is discharged from hospital" demonstrated a varied response pattern, with 40.0% of nurses agreeing, 32.0% neutral, and 13.3% each disagreeing or strongly disagreeing. Similarly, the statement "I believe it is the duty and responsibility of the cardiologists to give information to patients regarding rehabilitation after cardiac surgery" had 42.7% of nurses agreeing, while 17.3% strongly agreed and 18.7% were neutral.

Regarding the sufficiency of information given to patients at discharge on medications, wound care, infection control, and psychological stress, 30.7% agreed and 38.7% remained neutral. The adequacy of the Warfarin information booklet was met with neutral responses from 41.3% of nurses, while 20.0% agreed and 18.7% strongly disagreed.

For the item "I feel uncomfortable to talk to patients and their caregivers about sexual life experiences," which was reverse scored, 21.3% of nurses strongly disagreed and 25.3% disagreed, reflecting a generally open attitude to discussing this topic, although 33.3% remained neutral.

When asked whether the support and care given by caregivers at home was sufficient for patient recovery, only 14.7% agreed, while 33.3% were neutral and 30.7% disagreed. Similarly, the item "I do not think caregivers usually experience any difficulty in support and care of their loved ones who had heart valve surgery," which was reverse scored, revealed that 28.0% of nurses disagreed, 28.0% were neutral, and 24.0% agreed.

The statement "I think I am skilled enough and interested to give health information to patients regarding cardiac rehabilitation program after heart surgery" had 26.7% agreeing and 38.7% neutral, suggesting moderate confidence among nurses. Likewise, 38.7% of nurses agreed that patients and caregivers should be responsible for their own health behavior changes and post-hospitalization care, while 25.3% remained neutral and 16.0% disagreed.

A similar pattern was noted in the duplicate item "I believe rehabilitation should begin as soon as the patient is discharged from hospital," where 26.7% agreed and 30.7% remained neutral. The statement regarding information given at discharge, repeated in the survey, saw 46.7% neutral responses, while 18.7% disagreed and 16.0% agreed.

For the statement "I am skeptical about the benefits of cardiac rehabilitation," which was reverse scored, 36.0% disagreed and 21.3% strongly disagreed, indicating general confidence in its benefits. Another item addressing perceived caregiver challenges also showed that 16.0% of nurses disagreed, 46.7% were neutral, and 13.3% agreed. Finally, 29.3% of nurses disagreed with the statement "I do not see cardiac rehabilitation as part of my responsibilities," which was reverse scored, while 34.7% were neutral and 10.7% agreed.

Overall, these findings reflect a moderate level of positive attitudes towards cardiac rehabilitation, though substantial proportions of neutral responses suggest areas where further training and support may be beneficial to fully engage nurses in cardiac rehabilitation efforts.

Table 5. Nurses' Attitudes Towards Cardiac Rehabilitation (n=150).

		Frequency	Percent
I believe rehabilitation should begin as soon as the patient is discharged from hospital	Strongly disagree	20	13.3
	Disagree	20	13.3
	Neutral	48	32.0
	Agree	60	40.0
	Strongly agree	2	1.3
I believe it is the duty and responsibility of the cardiologists to give information to patients regarding rehabilitation after cardiac surgery.	Strongly disagree	12	8.0
	Disagree	20	13.3
	Neutral	28	18.7
	Agree	64	42.7
	Strongly agree	26	17.3
I think the information given to patients on discharge	Strongly disagree	18	12.0

		Frequency	Percent
regarding medications, wound care, infection control, and psychological stress is sufficient for their recovery process.	Disagree	22	14.7
	Neutral	58	38.7
	Agree	46	30.7
	Strongly agree	6	4.0
	Strongly disagree	28	18.7
I think the Warfarin information booklet given to patients after discharge is sufficient in providing information about diet/nutrition counselling services.	Disagree	26	17.3
	Neutral	62	41.3
	Agree	30	20.0
	Strongly agree	4	2.7
	Strongly disagree	32	21.3
I feel uncomfortable to talk to patients and their caregivers about sexual life experiences *	Disagree	38	25.3
	Neutral	50	33.3
	Agree	24	16.0
	Strongly agree	6	4.0
	Strongly disagree	28	18.7
I feel the support and care given to patients by caregivers at home is sufficient for patient recovery and return to normal activities.	Disagree	46	30.7
	Neutral	50	33.3
	Agree	22	14.7
	Strongly agree	4	2.7
	Strongly disagree	18	12.0
I do not think caregivers usually experience any difficulty in support and care of their loved ones who had heart valve surgery. *	Disagree	42	28.0
	Neutral	42	28.0
	Agree	36	24.0
	Strongly agree	12	8.0
	Strongly disagree	22	14.7
I think I am skilled enough and interested to give health information to patients regarding cardiac rehabilitation program after heart surgery.	Disagree	26	17.3
	Neutral	58	38.7
	Agree	40	26.7
	Strongly agree	4	2.7
	Strongly disagree	18	12.0
I think patients and caregivers should be responsible for their own health behavior changes, risk reduction, self-management and post-hospitalization.	Disagree	24	16.0
	Neutral	38	25.3
	Agree	58	38.7
	Strongly agree	12	8.0
	Strongly disagree	16	10.7
I do not think caregivers usually experience any difficulty in support and care of their loved ones who had heart valve surgery. *	Disagree	28	18.7
	Neutral	62	41.3
	Agree	38	25.3
	Strongly agree	6	4.0
	Strongly disagree	24	16.0
I believe rehabilitation should begin as soon as the patient is discharged from hospital.	Disagree	24	16.0
	Neutral	46	30.7
	Agree	40	26.7
	Strongly agree	16	10.7
	Strongly disagree	18	12.0
I think the information given to patients on discharge regarding medications, wound care, infection control and psychological stress is sufficient for their recovery process	Disagree	28	18.7
	Neutral	70	46.7
	Agree	24	16.0
	Strongly agree	10	6.7

		Frequency	Percent
I am skeptical about the benefits of cardiac rehabilitation. *	Strongly disagree	32	21.3
	Disagree	54	36.0
	Neutral	48	32.0
	Agree	12	8.0
	Strongly agree	4	2.7
I do not think caregivers rarely encounter any problems in providing care and support to their family members after heart valve surgery *	Strongly disagree	22	14.7
	Disagree	24	16.0
	Neutral	70	46.7
	Agree	20	13.3
	Strongly agree	14	9.3
I do not see cardiac rehabilitation as part of my responsibilities. *	Strongly disagree	34	22.7
	Disagree	44	29.3
	Neutral	52	34.7
	Agree	16	10.7
	Strongly agree	4	2.7

** Reverse coding*

Table 6 summarizes the descriptive statistics of the attitude scores towards cardiac rehabilitation among the nurses. The mean attitude score was 46.60 (SD = 5.10) over 75, with individual scores ranging from 35.00 to 60.00. The median score was 47.00, indicating a distribution centered slightly above the mean. The interquartile range showed that 25% of nurses scored below 42.00, while 75% achieved scores up to 50.00. These findings suggest an overall moderately positive attitude towards cardiac rehabilitation among nurses, with relatively narrow variability compared to the knowledge scores.

Table 6. Nurses' Attitudes Score Towards Cardiac Rehabilitation (n=150).

		Attitudes towards Cardiac Rehabilitation
N		150
Mean		46.60
Median		47.00
Std. Deviation		5.10
Minimum		35.00
Maximum		60.00
Percentiles	25	42.00
	50	47.00
	75	50.00

Correlation between Knowledge and Attitudes

Table 7 presents the results of the Spearman correlation analysis between nurses' knowledge and attitudes towards cardiac rehabilitation. The analysis revealed a significant positive correlation ($r = 0.303$, $p < 0.001$), indicating that nurses with higher knowledge scores tended to exhibit more positive attitudes towards cardiac rehabilitation. This significant association suggests that improving knowledge among nurses may be an important factor in fostering more favorable attitudes towards the delivery and promotion of cardiac rehabilitation services.

Table 7. Spearman Correlation Between Knowledge and Attitudes Towards Cardiac Rehabilitation (n=150).

		Knowledge about Cardiac Rehabilitation	Attitudes towards Cardiac Rehabilitation
Knowledge about Cardiac Rehabilitation	Spearman Correlation Coefficient	1	.322**
	P.value		**<0.001**
	N	150	150
Attitudes towards Cardiac Rehabilitation	Spearman Correlation Coefficient	.322**	1
	P.value	<0.001	
	N	150	150

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 1 displays the scatter plot illustrating the relationship between nurses' knowledge scores and their attitudes towards cardiac rehabilitation. The plot demonstrates a positive trend, as indicated by the linear regression line with the equation y=43.16+0.33x and an $R2$ value of 0.092. This suggests that knowledge about cardiac rehabilitation modestly contributes to the variance in nurses' attitudes. Although the relationship is not strong, the trend line and the spread of data points support the notion that improved knowledge is associated with more positive attitudes towards cardiac rehabilitation.

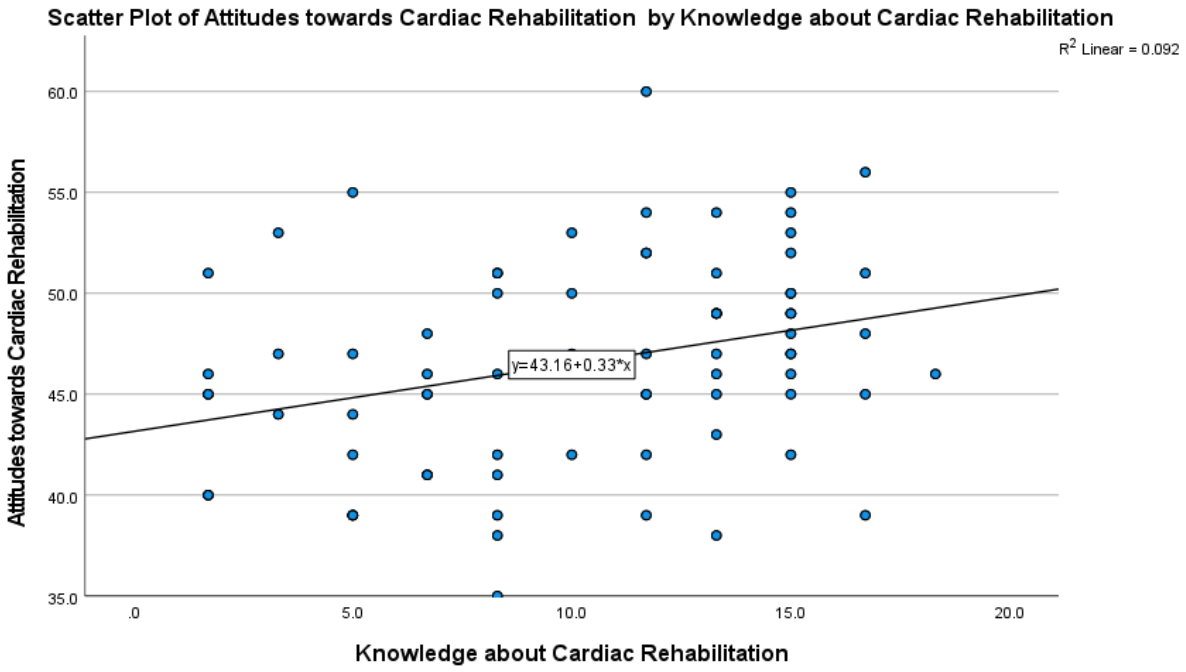

Figure 1. Scatter Plot of Attitudes towards Cardiac Rehabilitation by Knowledge about Cardiac Rehabilitation.

Factors affecting knowledge and Attitudes

Table 8 presents the associations between various sociodemographic and work-related factors and the knowledge scores as well as attitudes regarding cardiac rehabilitation among nurses.

Educational level was significantly associated with knowledge scores (p = 0.009). Nurses with a bachelor's degree had the highest mean score (11.21), followed by those with a diploma (10.37), while nurses with a master's or PhD degree had the lowest mean score (8.23). moreover, the hospital department showed a significant difference (p = 0.033). Nurses in the operating room had the highest mean knowledge score (13.32), followed by those in outpatient departments (11.66). Conversely, those

in emergency departments had the lowest mean score (8.94). However, when departments were grouped (ED/ICU/OR vs. others), no significant difference was found (p = 0.411).

Working shifts were significantly associated with knowledge scores (p = 0.004). Nurses working night shifts had the highest mean score (16.10), while those working morning shifts had a lower mean score (9.98). When comparing morning shifts to all other shifts combined, a significant difference was also observed (p = 0.031), with higher mean knowledge scores among nurses in non-morning shifts (12.27 vs. 9.98).

Regarding previous training or attendance at conferences related to cardiac rehabilitation, nurses who had not received such training (n = 66) had a mean knowledge score of 9.45 (SD = 4.84), significantly lower than those who had received training (n = 84; mean = 10.99, SD = 4.36; p = 0.041). Similarly, attitudes towards cardiac rehabilitation were significantly more positive among nurses who had received training (mean = 47.24, SD = 4.26) compared to those without training (mean = 45.79, SD = 5.94; p = 0.038).

With respect to direct participation in managing cardiac rehabilitation cases, nurses who had not been directly involved in case management (n = 58) had a slightly lower mean knowledge score (9.48, SD = 4.90) compared to those who had such experience (n = 92; mean = 10.83, SD = 4.39), although this difference was not statistically significant (p = 0.084). Attitude scores were also comparable between those with and without direct experience (46.60 vs. 46.45; p = 0.588).

On the other hand, age was significantly associated with attitude scores (p = 0.030). Nurses aged 41–50 years had the highest mean attitude score (50.60), while those aged 20–30 years had a lower mean score (46.23). Gender did not significantly affect attitudes (p = 0.193), although male nurses had a slightly higher mean attitude score (47.35) compared to female nurses (46.20).

A significant difference was observed based on hospital department (p = 0.001). Nurses in the outpatient department had the highest mean attitude score (50.00), followed by those in the ICU (49.20), while nurses in medical/surgical wards reported the lowest scores (39.50). However, grouping departments into ED/ICU/OR versus other units did not yield a significant difference (p = 0.738).

Table 8. Factors Associated with Knowledge and Attitude scores on Cardiac Rehabilitation Among Nurses.

Study variables		N	Knowledge about Cardiac Rehabilitation			Attitudes towards Cardiac Rehabilitation		
			Mean	SD	P.value	Mean	SD	P.value
Age (in years)	20-30 years	124	10.30	4.72	0.817	46.23	5.18	**0.030**
	31-40 years	16	10.83	4.79		47.00	4.20	
	41-50 years	10	9.64	3.40		50.60	3.81	
Gender	Male	52	10.32	4.82	0.983	47.35	4.96	0.193
	Female	98	10.31	4.55		46.20	5.15	
Educational Level	Diploma in Nursing	46	10.37	4.58	**0.009**	46.61	5.63	0.536
	Bachelor's degree in nursing	72	11.21	4.51		46.22	5.11	
	Master's Degree / PhD	32	8.23	4.42		47.44	4.25	
Years of Nursing Experience	< 1 year	48	9.94	4.82	0.316	45.92	5.14	0.506
	1-5 years	64	11.09	4.51		46.56	4.92	
	6-10 years	28	9.64	4.72		47.29	5.11	
	>10 years	10	8.98	3.93		48.20	6.16	
Hospital Department (Unit)	Emergency Department	28	8.94	5.60	**0.033**	45.86	4.84	**0.001**
	Intensive Care Unit (ICU)	20	10.68	4.84		49.20	4.40	
	Medical/Surgical Wards	4	10.00	3.81		39.50	1.73	

Hospital Department (Unit)	Operating Room	18	13.32	2.93	0.411	45.44	5.04	0.738
	Outpatient Department	10	11.66	3.36		50.00	2.58	
	Other	70	9.81	4.43		46.37	5.21	
	ED/ICU/OR	66	10.66	5.04		46.76	4.97	
	Med/Chir/Outpatient/Other	84	10.04	4.29		46.48	5.22	
Working Shift	Morning	128	9.98	4.54	**0.004**	46.53	4.89	0.542
	Evening	6	13.33	3.97		47.67	9.97	
	Night	6	16.10	1.70		49.00	3.90	
	Rotational	10	9.34	4.68		45.40	4.74	
Working Shift	Morning	128	9.975	4.54	**0.031**	46.531	4.89	0.692
	Other	22	12.27	4.74		47.000	6.28	
Have you previously received training or attended conferences?	No	66	9.45	4.84	**0.041**	45.79	5.94	**0.038**
	Yes	84	10.99	4.36		47.24	4.26	
Have you ever participated directly in managing a case?	No	58	9.48	4.90	0.084	46.45	5.53	0.588
	Yes	92	10.83	4.39		46.60	4.83	

SD: Standard Deviation – Tests done using Mann-Whitney and Kruskal Wallis test. Significance level set at 5%

Table 9 presents the results of the multiple linear regression analysis examining factors associated with nurses' attitudes towards cardiac rehabilitation. In the initial model including all predictors (age, previous cardiac rehabilitation training or conference attendance, direct participation in cardiac rehabilitation management, and knowledge scores), two variables emerged as significant predictors: age and knowledge about cardiac rehabilitation.

Age was positively associated with attitudes ($B = 1.863$, $p = 0.008$), indicating that older nurses tended to have more positive attitudes towards cardiac rehabilitation. Knowledge about cardiac rehabilitation was also a significant positive predictor ($B = 0.325$, $p < 0.001$), suggesting that higher knowledge scores were associated with more favorable attitudes. Previous cardiac rehabilitation training ($p = 0.158$) and direct participation in managing cardiac rehabilitation cases ($p = 0.435$) were not significantly associated with attitudes in this model.

In the final stepwise regression model, only age and knowledge remained significant. Age ($B = 1.862$, $p = 0.008$) and knowledge ($B = 0.337$, $p < 0.001$) maintained their significant positive relationships with attitudes, reinforcing the finding that nurses with greater age and higher knowledge levels are more likely to have positive attitudes towards cardiac rehabilitation.

These results highlight the importance of enhancing nurses' knowledge about cardiac rehabilitation and recognizing the role of age-related experience in shaping more positive attitudes towards these essential services.

Table 9. Multiple Linear Regression of Factors Associated with Nurses' Attitudes Towards Cardiac Rehabilitation.

Model		Unstandardized Coefficients		Standardized Coefficients	P.value	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta		Lower Bound	Upper Bound	Tolerance	VIF
				Enter Model					
1	(Constant)	40.670	1.356		0.000	37.990	43.349		
	Age (in years)	1.863	0.694	0.206	0.008	0.492	3.234	1.000	1.000
	Have you previously received Cardiac Rehabilitation training or attended Cardiac Rehabilitation conferences?	1.224	0.863	0.120	0.158	-0.482	2.929	0.828	1.207
	Have you ever participated directly in managing a Cardiac Rehabilitation case?	-0.687	0.876	-0.066	0.435	-2.418	1.045	0.835	1.198
	Knowledge about Cardiac Rehabilitation	0.325	0.086	0.295	0.000	0.155	0.495	0.965	1.036
				Stepwise Model					
2	(Constant)	40.816	1.293		.000	38.261	43.372		
	Knowledge about Cardiac Rehabilitation	.337	.085	.306	.000	.170	.504	1.000	1.000
	Age (in years)	1.862	.694	.206	.008	.490	3.233	1.000	1.000

a. Dependent Variable: Attitudes towards Cardiac Rehabilitation

Discussion

The main purpose of the present study was to evaluate the levels of knowledge and attitudes of Iraqi nurses in Diwaniyah Teaching Hospital regarding cardiac rehabilitation. Another objective was to examine the factors affecting nurses' knowledge and attitudes towards CR.

The study surveyed 150 nurses at Diwaniyah Teaching Hospital, predominantly young (82.7% aged 20–30 years) and female (65.3%), with most holding a bachelor's degree (48.0%) and working morning shifts (85.3%). A significant proportion had less than five years of experience (74.7%), and all nurses worked in various departments. These characteristics emphasizes the heterogeneity of the study sample, further showing that nurses participating to this study are from different backgrounds.

Regarding previous cardiac rehabilitation exposure, 56.0% reported having received related training or attended conferences, and 61.3% had participated directly in managing a cardiac rehabilitation case. Self-perceived knowledge varied, with 37.3% rating their knowledge as average, 28.0% as good, and smaller proportions indicating very poor or poor levels. For instance, these findings highlight a notable

gap in the exposure of nurses to information related to cardiac rehabilitation. This might be due to the fact that formal training on CR among nurses can often be theoretical or fragmented, which shows a lack of structured follow-up or effective practical reinforcement to strengthen the skills of nurses [22]. For instance, Isam et al. explained that CR training is becoming more and more recognized and incorporated into nursing education programs in Iraq, yet, this implementation is still not unified on the national level [23]. Moreover, Kumudah et al. noted that even among nurses who had undergone formal CR training, many still lack the competences to apply the guidelines in an effective way, even though they perceive their knowledge as good [21].

The knowledge assessment revealed that nurses in the chosen hospital possess a moderate level of knowledge regarding CR, with a mean score of 10.31 out of 20 (SD = 4.63). While almost half of nurses correctly identified recommended exercise regimens, there were notable misconceptions about the timing of cardiac rehabilitation initiation and the role of warfarin post-surgery. These results indicate the existence of a gap in the foundational understanding of CR, which can be attributed to a limited inclusion of structured CR training and education in the Iraqi nursing curriculum and a lack of professional development programs in this area. Therefore, the results of the present study seem to be concordant with those found by Masule et al. who highlighted that nurses in Namibian hospitals had a low to moderate level of knowledge of CR, with only a small percentage (26.1%) having a good knowledge [16]. Similarly, Alsultan & Jalal found that 63.8% of nurses in Saudi Arabia had an average knowledge on CR, and 20.8% had a poor knowledge [24], which mirrors the results of our study. On the other hand, the results of our study seem to be divergent from the ones found in China by Zhu et al. who reported a mean knowledge score of 58.23 over 74, corresponding to 78.7% of nurses having good knowledge on CR [25]. Hence, the differences in knowledge scores among nurses in different contexts can be attributed to the variations in healthcare infrastructures, educational opportunities, and availability of CR training programs.

Similarly, practice-related questions showed varied responses, with nurses demonstrating a good adherence to clinical monitoring and emotional support as main components of CR. Yet, these practices were less consistent with pre-discharge planning, caregiver-involved physical activity promotion, and sexual health counseling. These results seem to be concordant with those mentioned by Masule et al. who stated that the practices of nurses in what it concerns CR focuses mainly on early complication detection and psychosocial support and lacks the integration of other important components [16]. Therefore, these practices are consistent with theoretical approached that positions the CR nurse as a central coordinator of care in patients recovering from CVDs [26]. Hence, this shows that nurses responsible for CR needs to focus not only on emotional support but also on clinical tasks while also utilizing their broader rehabilitative role [27].

Attitude scores were generally positive, with a mean of 46.60 out of 75 (SD = 5.10). However, while generally encouraging, this score indicates that nurses still have neutrality in some areas, uncertainties and hesitation. This neutrality can be attributed to the lack of clarity in the nurses' roles and responsibilities in CR, as well as it can reflect their limited confidence in delivering structured education or address sensitive topics like sexual health and caregiver burden. These results are aligned with other published studies in the literature, showing that there exists an ambiguity in nurses' role perception [16], [21], which suggests that there is a need for a more defined role and more targeted training in this area. Moreover, the tendency of nurses to view cardiac rehabilitation as a main responsibility for cardiologists mirrors the results found in the study of Farah et al. who indicated that interdisciplinary role delineation in CR remains unclear in different healthcare systems up until today [28].

A significant positive correlation was found between knowledge and attitudes ($r = 0.303$, $p < 0.001$), suggesting that higher knowledge levels are associated with more favorable attitudes towards cardiac rehabilitation. These results seem to be aligned with other studies in the literature. For instance, Zhu et al. found that nurses who have higher scores of knowledge have significantly more positive attitudes [25]. Similarly, Almoghairi et al. also found that moderate knowledge level among healthcare professionals and cardiologists was directly correlated with more positive attitudes and willingness to

handle secondary prevention programs for patients suffering from CVDs [29]. Furthermore, Farah et al. conducting a study among specialists in cardiology and cardiac surgeons in Lebanon, showed that physicians who acknowledged CR as a secondary prevention approach had more positive attitudes towards prescribing it for their patients [28], which echoes the association between knowledge and attitudes among nurses.

Analysis of factors influencing knowledge revealed significant differences based on educational level ($p = 0.009$), hospital department ($p = 0.033$), working shift ($p = 0.004$), and previous training ($p = 0.042$). Nurses with higher educational attainment had better knowledge scores, which mirrors the results revealed by Zhu et al. showing that better knowledge is acquired through education, including qualifications and formal training, as well as through departmental exposure and specialization [25]. Moreover, these results are concordant with those highlighted by Masule et al. (2024) who showed that a structured education and the exposure in the work contexts are factors that shape a better knowledge among nurses in what it concerns CR [16].

Multiple linear regression to examine the predictors of attitudes towards CR further confirmed that both age ($B = 1.862$, $p = 0.008$) and knowledge ($B = 0.337$, $p < 0.001$) were independent predictors of attitudes towards cardiac rehabilitation. These results indicate that nurses who have more experience, those who have more educational attainments and those who consequently have more clinical exposure towards cardiac rehabilitation are more prone to have more favorable attitudes towards CR. These results seem to be aligned with those of Alsultan & Jalal who found similar associations, further showing that individuals with higher knowledge levels exhibit more positive attitudes, with knowledge, age, and experience significantly shaping these attitudes [24]. Similarly, Almoghairi et al. showed that knowledge is the strongest predictor of positive attitudes, which is reinforced by educational and clinical exposure [29].

Limitations

Despite the several advantages presented by this study, there exist limitations that are worth discussing. First, the study was conducted in a single hospital in Iraq and didn't include different hospitals in this country, which limits the ability to generalize the results to all the nurses practicing in Iraq or even in other healthcare settings. Second, the study used a cross-sectional approach, which might have limited our ability to draw causal relationships between knowledge, attitudes, and practices. Third, data was collected using a self-reported questionnaire which might introduce social desirability bias, where nurses might have responded by answers they find socially accepted rather than presenting accurate results showing their real knowledge and attitudes towards cardiac rehabilitation.

Conclusion

As cardiovascular diseases remain a leading cause for mortality worldwide, preventive measures including cardiac rehabilitation became an important area of practice to improve the quality of life of patients suffering from these illnesses. Hence, as nurses play an important role in addressing cardiac rehabilitation, this study assessed the knowledge and attitudes of Iraqi nurses to further evaluate the factors affecting both knowledge and attitudes. The results of this study highlighted a moderate level of knowledge and positive attitudes towards cardiac rehabilitation, with higher knowledge and older age – hence higher exposure, as main predictors of favorable attitudes towards CR.

Based on these results, this study calls for an update of the national nursing education curricula in Iraq to include structured modules on cardiac rehabilitation. On the other hand, hospitals should work on expanding the professional development of their staff through tailoring educational programs that focus on interdisciplinary work to deliver a high quality of CR for patients recovering from CVDs. Moreover, healthcare institutions should clarify in their policies and protocols the roles of nurses in CR and this to improve the confidence and consistency of nurses' practices. Furthermore, future studies should focus on multi-centered designs to be able to generalize the results to the broader population of nurses, as well as on longitudinal studies to track how the levels of knowledge and attitudes of nurses improve after educational interventions.

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