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Determinants of Practice: Exploring Healthcare Providers' Beliefs and Recommendations for Cardiac Rehabilitation in China

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Abstract

Cardiac rehabilitation (CR) has been shown to improve outcomes for individuals with cardiovascular conditions significantly. The encouragement and referrals provided by healthcare professionals are crucial for engaging patients in CR programs. This study aimed to investigate the perceptions of Chinese healthcare providers regarding CR, assess the frequency with which they recommend it to patients, and examine the factors influencing their recommendation practices. A nationwide cross-sectional survey targeted cardiovascular physicians, nurses, rehabilitation therapists, and general practitioners across various healthcare settings. A total of 1,120 valid responses were analyzed. The questionnaire collected demographic data, used the Chinese adaptation of the Recommending Cardiac Rehabilitation (ReCaRe) scale to evaluate beliefs about CR, and collected information on CR knowledge, available resources, and recommendation behaviors. Binary logistic regression was used to examine factors associated with the likelihood of recommending CR. The mean ± SD total score on the ReCaRe scale was 60.80 ± 7.36. The mean ± SD subscales included perceived severity and susceptibility (3.98 ± 0.60), service accessibility (2.72 ± 0.96), and perceived benefits and barriers (4.13 ± 0.56). Overall, 56.5% of respondents reported recommending CR to patients, but only 34.6% were well-acquainted with specific CR protocols. In addition, 86.0% expressed a need for greater resources and training regarding CR. Factors independently associated with recommending CR included familiarity with CR content and core components, professional title, availability of CR services, hospital type, clinical role, department affiliation, and age. There is an urgent need to enhance healthcare providers' knowledge and access to resources concerning CR. Targeted training and improvements in service availability could help strengthen CR referral practices and increase patient participation rates.

Keywords: Cardiac rehabilitation, Healthcare professionals, Referral practices, Determinants, Beliefs, Secondary prevention

Introduction

Cardiac rehabilitation (CR) represents a multidisciplinary, evidence-driven secondary prevention approach for patients with cardiovascular disease. It involves collaboration among healthcare professionals, including physicians, nurses, exercise specialists, and dietitians, who work together to develop tailored rehabilitation plans aligned with individual patient needs and goals [1]. CR is generally structured into three phases: in-hospital care, early outpatient rehabilitation, and late outpatient follow-up [2]. The second phase, which is the most commonly discussed and regarded as the core of CR, encompasses 36 sessions conducted throughout 12 to 18 weeks [2-4]. Key elements of this phase include exercise interventions such as aerobic training, resistance exercises, flexibility routines, and balance training, complemented by nutritional counseling, psychological support, management of cardiovascular risk factors, and medication optimization [5, 6]. Notably, Professor Hu Dayi, a prominent cardiovascular specialist in China, has encapsulated CR into the concept of the "five prescriptions," comprising

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exercise, pharmacotherapy, nutrition, psychological and sleep care, and risk factor control, including smoking cessation [7].

Extensive evidence demonstrates that CR enhances patients' physical functioning [8], supports mental health [9], improves adherence to treatment plans [10], helps manage cardiovascular risk factors [11], facilitates return to employment [12], lowers recurrence, mortality, and hospital readmission rates associated with cardiovascular disease [13], and contributes to better health-related quality of life [13]. Despite these established benefits, CR participation rates globally remain low, with studies estimating that only about 16–24% of eligible patients enroll in CR programs [14, 15], and nearly half of those who start do not complete the regimen [16]. In developing nations such as China, participation is even lower due to insufficient availability of CR services [17, 18].

One of the primary factors influencing patient engagement in CR is the recommendation from healthcare professionals, whose guidance plays a critical role in shaping patient decisions about CR participation [19]. Research indicates that encouragement from medical staff can significantly boost patient enrollment in CR [20], whereas a lack of physician support constitutes a significant barrier [20]. However, disparities exist in healthcare providers' knowledge and understanding of CR. Some studies report satisfactory levels of CR knowledge among providers [21]. In contrast, others highlight that although healthcare professionals recognize CR's advantages, they often lack adequate knowledge to explain specific program details such as eligibility criteria or referral pathways [22–24], which contributes to limited patient awareness and reduced referral rates [25].

In China, disparities in regional medical resource allocation contribute to significant differences in access to CR services. Data from the National Health Commission of the People's Republic of China [26] indicate that by the end of 2022, there were 1,016,744 hospitals and primary healthcare facilities nationwide; however, only 611 CR centers existed [27], accounting for a mere 0.06% of all healthcare institutions. This result highlights that the vast majority of healthcare facilities still cannot offer CR services. Moreover, CR resources are unevenly distributed, with economically developed regions, such as East and South China, hosting 42.2% of all CR centers. In contrast, less developed areas, like Northwest China, account for only 8.8% [27]. Among these centers, 79.1% (483 centers) are located within tertiary hospitals, while only 20.9% (128 centers) operate in primary or secondary hospitals [27]. Such pronounced imbalances mean that many rural areas and lower-level hospitals lack adequate CR services, severely limiting patient access to comprehensive rehabilitation care [28-30].

Thus, gaining insights into healthcare professionals' beliefs about CR, their perceptions of resource availability, and understanding how existing resources are distributed—as well as identifying training gaps—is essential for improving patient participation rates in CR programs.

Although healthcare providers' recommendations are pivotal for promoting CR participation, there remains a scarcity of research examining their knowledge, attitudes, and referral practices in China. This study investigates the beliefs, knowledge levels, current practices of recommending CR, and the factors influencing such behaviors among Chinese healthcare professionals. The findings aim to generate empirical evidence to support efforts aimed at increasing CR referrals and provide updated, comprehensive data for this important field.

Materials and Methods

A nationwide cross-sectional survey was conducted among cardiovascular physicians, nurses, rehabilitation therapists, and general practitioners across various healthcare settings. A total of 1,120 valid responses were analyzed. The questionnaire collected demographic data, utilized the Chinese adaptation of the Recommending Cardiac Rehabilitation (ReCaRe) scale to evaluate beliefs about CR, and gathered information on CR knowledge, available resources, and recommendation behaviors. Binary logistic regression was used to investigate factors associated with the likelihood of recommending CR.

Data analysis

All statistical analyses were performed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized using frequencies and percentages, while continuous data, such as scores from the ReCaRe scale, were described using means and standard deviations (SD). Chi-square tests were employed to examine associations between variables, and binary logistic regression was conducted to identify factors predicting healthcare providers'

likelihood of recommending CR. The strength of associations was reported using odds ratios (ORs) and 95% confidence intervals (CIs). All statistical tests were two-sided, with significance defined as $P < 0.05$.

Ethical considerations

The study protocol was reviewed and approved by the Ethics Committee of Shanghai Sixth People's Hospital affiliated with Shanghai Jiao Tong University School of Medicine. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants before the commencement of data collection. Participants were assured of the confidentiality and anonymity of their responses and informed that they could withdraw from the study at any point without any adverse consequences.

Results and Discussion

Participant demographics

A total of 1,120 healthcare professionals participated in the study. Women made up 77.4% of the sample. Most respondents were either under 30 years of age (37.6%) or between 31 and 40 years old (39.3%). Regarding educational background, 59.1% held a bachelor's degree, while 19.0% had obtained a master's degree. In terms of regional distribution, the majority were from eastern China (61.1%), followed by 31.1% from the western region and 7.9% from the central area. Additional demographic details are provided in **Table 1**.

Table 1. Participant demographics

Characteristic	Category	Number (%)
Gender	Male	253 (22.6%)
	Female	867 (77.4%)
Age group	30 years or younger	421 (37.6%)
	31 to 40 years	440 (39.3%)
	41 to 50 years	197 (17.6%)
	51 years or older	62 (5.5%)
Education level	Junior college or below	143 (12.8%)
	Bachelor's degree	662 (59.1%)
	Master's degree	213 (19.0%)
	PhD degree	102 (9.1%)
Region	Eastern China	684 (61.1%)
	Central China	88 (7.9%)
	Western China	348 (31.1%)
Type of hospital	General hospital	875 (78.1%)
	Specialized hospital	101 (9.0%)
	Community hospital	144 (12.9%)
Hospital ownership	Public	1061 (94.7%)
	Private	59 (5.3%)
Hospital level	Tertiary	848 (75.7%)
	Secondary	109 (9.7%)
	Primary	163 (14.6%)
Department	Cardiology	771 (68.8%)
	Cardiac surgery	181 (16.2%)
	Rehabilitation	15 (1.3%)
	General practice	153 (13.7%)
Position	Nurse	624 (55.7%)
	Physician	477 (42.6%)
	Rehabilitation therapist	19 (1.7%)
Professional title	Junior	548 (48.9%)
	Intermediate	395 (35.3%)
	Associate senior	129 (11.5%)
	Senior	48 (4.3%)
Years of experience	≤ 3 years	237 (21.2%)
	> 3 to 5 years	117 (10.4%)
	> 5 to 10 years	252 (22.5%)
	> 10 to 20 years	318 (28.4%)
	> 20 to 30 years	149 (13.3%)
	> 30 years	47 (4.2%)

CR belief

The overall mean score on the ReCaRe scale was 60.80 ± 7.36. Among its dimensions, the perceived benefits and barriers of CR received the highest score at 4.13 ± 0.56, followed by perceived severity and susceptibility, which averaged 3.98 ± 0.60. Perceived service accessibility scored the lowest, with a mean of 2.72 ± 0.96 **(Table 2)**. Detailed scores for each item are presented in **Table 3**. These findings suggest that healthcare professionals place the most significant weight on the advantages and potential obstacles associated with CR when deciding whether to recommend it.

Table 2. Participants' beliefs in CR recommendation (n = 1120)

Dimension	Number of items	Score range	Total score (Mean ± SD)	Mean item score (Mean ± SD)
Perceived severity and susceptibility	7	7–35	27.85 ± 4.23	3.98 ± 0.60
Perceived accessibility of services	3	3–15	8.15 ± 2.88	2.72 ± 0.96

Perceived benefits and barriers	6	6–30	24.79 ± 3.36	4.13 ± 0.56
Overall ReCaRe scale score	16	16–80	60.80 ± 7.36	3.80 ± 0.46

Note: ReCaRe refers to the Recommending Cardiac Rehabilitation scale.

Table 3. ReCaRe item scores (n = 1120)

Item no.	ReCaRe scale item (paraphrased)	Score (Mean ± SD)
1	I believe all patients with ACS should undergo cardiac rehabilitation to help manage their disease	3.89 ± 0.90
2	I think cardiac rehabilitation is necessary for cardiac patients who also have other health conditions	4.08 ± 0.76
3	I consider acute coronary syndrome to be a serious medical issue	4.29 ± 0.73
4	I believe my ACS patients would fare worse without participating in cardiac rehabilitation	3.79 ± 0.87
5	I believe that recommending cardiac rehabilitation helps prevent disease progression in most of my patients	4.04 ± 0.72
6	I feel that the way I currently recommend cardiac rehabilitation is appropriate	3.86 ± 0.74
7	I think all patients who have undergone angioplasty or CABG should be referred to cardiac rehabilitation	3.90 ± 0.81
8	I do not refer patients to cardiac rehabilitation because no local services are available	2.96 ± 1.09
9	I avoid referring patients to cardiac rehabilitation because local programs are poorly managed	2.69 ± 1.05
10	I refrain from referring patients to cardiac rehabilitation because I do not trust the local program's team	2.50 ± 1.07
11	I believe cardiac rehabilitation can enhance heart disease management	4.17 ± 0.69
12	I think high-quality cardiac rehabilitation benefits my patients with ACS	4.21 ± 0.65
13	I believe referring more patients to cardiac rehabilitation would be beneficial	4.19 ± 0.67
14	I feel that changing my current referral practices for cardiac rehabilitation requires too many systemic changes	4.19 ± 0.66
15	I find it challenging to follow the referral guidelines for cardiac rehabilitation	3.97 ± 0.70
16	I believe cardiac rehabilitation is effective in preventing future cardiac events for most of my patients	4.05 ± 0.72

Abbreviation: ReCaRe = Recommending Cardiac Rehabilitation Scale

CR resources, knowledge, and recommendations

Among respondents, 72.7% reported that cardiac rehabilitation services were available at their healthcare institutions, although 62.9% felt that these resources were inadequate. A large proportion (86.0%) indicated a need for additional resources and further training related to CR. Regarding knowledge of cardiac rehabilitation, 38.2% were aware of the specific aspects of CR but lacked sufficient knowledge to implement it in practice. Another 34.6% were well-acquainted with the details of CR. Meanwhile, 23.6% had only heard of CR without understanding its specifics, and 3.7% were largely unfamiliar with the concept.

When asked about knowledge of exercise prescriptions for CR, 43.5% described themselves as "somewhat familiar," whereas 22.5% reported being "unfamiliar." Concerning the five core CR prescriptions, 38% admitted to having only a limited understanding.

In terms of recommendation practices, 56.5% of healthcare professionals reported recommending CR to patients. Patient participation levels varied considerably. Reported barriers to patient engagement in CR included long travel distances or transportation difficulties (61.8%), lack of awareness about CR benefits (58.3%), time constraints (44.7%), high costs (34.9%), and a general lack of interest (31.0%) **(Table 4)**.

Table 4. CR resources, knowledge, and recommendations of participants

Item	Number (n)	Percentage (%)
Availability of CR services at the workplace		
Yes	814	72.7

No	306	27.3
Adequacy of resources and support for CR		
Yes	415	37.1
No	705	62.9
Need for more CR resources and training		
Yes	963	86.0
No	157	14.0
Familiarity with CR content		
Thoroughly familiar with specific details	387	34.6
Know details but unsure about implementation	428	38.2
Heard of CR but lack detailed knowledge	264	23.6
Mostly unfamiliar with CR	41	3.7
Familiarity with CR exercise prescription		
Very familiar	79	7.1
Familiar	249	22.2
Somewhat familiar	487	43.5
Unfamiliar	252	22.5
Very unfamiliar	53	4.7
Familiarity with the five CR prescriptions		
Very familiar	110	9.8
Familiar	222	19.8
Somewhat familiar	426	38.0
Unfamiliar	296	26.4
Very unfamiliar	66	5.9
Have recommended CR to patients		
Yes	633	56.5
No	487	43.5
Patient participation rate after recommendation (n = 633)		
No participation	13	2.1
10% participation	19	3.0
20% participation	41	6.5
30% participation	75	11.8
40% participation	51	8.1
50% participation	127	20.1
60% participation	77	12.2
70% participation	74	11.7
80% participation	73	11.5
90% participation	21	3.3
Full participation	62	9.8
Barriers to patient participation (multiple responses, n = 571)		
Limited time	255	44.7
Lack of interest	177	31.0
High cost	199	34.9
Long distance or poor transportation	353	61.8
Unawareness of CR benefits	333	58.3
Other factors	36	6.3

Abbreviation: CR = Cardiac Rehabilitation

Note: Patient participation barriers were assessed through a multiple-choice question.

Factors influencing recommendation behavior

Chi-square analysis identified several variables significantly linked to the likelihood of recommending cardiac rehabilitation. These included demographic factors such as gender, age, and education level; regional location; characteristics of the healthcare institution,

including hospital type, ownership, and level of care; as well as professional factors like department, job position, professional rank, and years of experience. Additionally, familiarity with CR content and availability of CR resources were also associated with recommendation behavior **(Table 5)**. Specifically, healthcare providers who were male, older, more highly educated, working in central regions, employed at general or private hospitals, tertiary-level facilities, or rehabilitation departments, holding senior professional titles, possessing more work experience, having greater access to CR resources, and exhibiting better knowledge of CR were more inclined to refer patients to cardiac rehabilitation.

Table 5. Chi-square test of CR recommendation behavior (n = 1120)

Variable	Recommended CR, n (%)	Not recommended CR, n (%)	χ^2	P-value
Gender			24.032	< 0.001
Male	177 (70.0%)	76 (30.0%)		
Female	456 (52.6%)	411 (47.4%)		
Age group			53.919	< 0.001
≤ 30 years	185 (43.9%)	236 (56.1%)		
31–40 years	262 (59.5%)	178 (40.5%)		
41–50 years	139 (70.6%)	58 (29.4%)		
≥ 51 years	47 (75.8%)	15 (24.2%)		
Education level			36.907	< 0.001
Junior college or below	60 (42.0%)	83 (58.0%)		
Bachelor's degree	361 (54.5%)	301 (45.5%)		
Master's degree	132 (62.0%)	81 (38.0%)		
PhD degree	80 (78.4%)	22 (21.6%)		
Region			28.642	< 0.001
Eastern	362 (52.9%)	322 (47.1%)		
Central	73 (83.0%)	15 (17.0%)		
Western	198 (56.9%)	150 (43.1%)		
Hospital type			36.739	< 0.001
General	533 (60.9%)	342 (39.1%)		
Specialized	50 (49.5%)	51 (50.5%)		
Community	50 (34.7%)	94 (65.3%)		
Hospital ownership			8.265	0.004
Public	589 (55.5%)	472 (44.5%)		
Private	44 (74.6%)	15 (25.4%)		
Hospital level			28.497	< 0.001
Tertiary	509 (60.0%)	339 (40.0%)		
Secondary	63 (57.8%)	46 (42.2%)		
Primary	61 (37.4%)	102 (62.6%)		
Department			61.620	< 0.001
Cardiology	487 (63.2%)	284 (36.8%)		
Cardiac surgery	88 (48.6%)	93 (51.4%)		
Rehabilitation	11 (73.3%)	4 (26.7%)		
General medicine	47 (30.7%)	106 (69.3%)		
Position			37.452	< 0.001
Nurse	304 (48.7%)	320 (51.3%)		
Doctor	313 (65.6%)	164 (34.4%)		
Rehabilitation therapist	16 (84.2%)	3 (15.8%)		

Professional title			81.650	< 0.001
Junior	242 (44.2%)	306 (55.8%)		
Intermediate	251 (63.5%)	144 (36.5%)		
Associate senior	97 (75.2%)	32 (24.8%)		
Senior	43 (89.6%)	5 (10.4%)		
Years of work experience			33.971	< 0.001
≤ 3 years	106 (44.7%)	131 (55.3%)		
> 3 to ≤ 5 years	58 (49.6%)	59 (50.4%)		
> 5 to ≤ 10 years	137 (54.4%)	115 (45.6%)		
> 10 to ≤ 20 years	195 (61.3%)	123 (38.7%)		
> 20 to ≤ 30 years	102 (68.5%)	47 (31.5%)		
> 30 years	35 (74.5%)	12 (25.5%)		
CR services availability at the workplace			116.94	< 0.001
Yes	540 (65.3%)	274 (33.7%)		
No	93 (30.4%)	213 (69.6%)		
Sufficient resources/support for CR			103.32	< 0.001
Yes	316 (76.1%)	99 (23.9%)		
No	317 (45.0%)	388 (55.0%)		
Need for additional CR resources/training			47.59	< 0.001
Yes	584 (60.6%)	379 (39.4%)		
No	49 (31.2%)	108 (68.8%)		
Familiarity with CR content			328.30	< 0.001
Familiar with details	329 (85.0%)	58 (15.0%)		
Know details but unsure how to implement	253 (59.1%)	175 (40.9%)		
Heard of CR but lack specifics	49 (18.6%)	215 (81.4%)		
Mostly unfamiliar	2 (4.9%)	39 (95.1%)		
Familiarity with CR exercise prescription			256.97	< 0.001
Very familiar	74 (93.7%)	5 (6.3%)		
Familiar	220 (88.4%)	29 (11.6%)		
Somewhat familiar	256 (52.6%)	231 (47.4%)		
Unfamiliar	67 (26.6%)	185 (73.4%)		
Very unfamiliar	16 (30.2%)	37 (69.8%)		
Familiarity with the five CR prescriptions			290.97	< 0.001
Very familiar	104 (94.5%)	6 (5.5%)		
Familiar	193 (86.9%)	29 (13.1%)		
Somewhat familiar	244 (57.3%)	182 (42.7%)		
Unfamiliar	76 (25.7%)	220 (74.3%)		
Very unfamiliar	16 (24.2%)	50 (75.8%)		

Abbreviation: CR = cardiac rehabilitation

Determinants of recommendation behavior

Chi-square tests revealed that a range of factors were associated with whether healthcare providers recommended cardiac rehabilitation. These included demographic characteristics such as gender and age, educational background, and geographic region, as well as workplace-related aspects like hospital type, ownership, and level of care. Professional factors, such as department, job role, title, years of experience, as well as familiarity with CR knowledge and available resources, also showed significant associations **(Table 6)**. In particular, male providers, older staff, those with advanced education, individuals working in central regions, and those in private or general hospitals, as well as tertiary care centers, were more inclined to recommend CR. Moreover, professionals based in rehabilitation units or serving as rehabilitation therapists, those with senior titles, longer tenure, greater access to

CR resources, and more substantial knowledge of CR content demonstrated higher recommendation rates.

Table 6. Binary logistic regression of CR recommendation behavior (n = 1120)

Factor	Odds ratio (OR)	95% confidence interval (CI)	P-value
Familiarity with CR content			
Well-acquainted with specific details	20.79	[3.79, 114.11]	< 0.001 *
Know details but unsure how to apply	9.89	[1.84, 53.09]	0.008 *
Heard of CR but lack detailed knowledge	2.26	[0.42, 12.17]	0.343
Relatively unfamiliar (reference)	1	—	—
Familiarity with the five CR prescriptions			
Very familiar	9.64	[3.06, 30.43]	< 0.001 *
Familiar	4.93	[2.14, 11.38]	< 0.001 *
Somewhat familiar	1.87	[0.89, 3.92]	0.099
Unfamiliar	0.82	[0.38, 1.73]	0.596
Very unfamiliar (reference)	1	—	—
Professional title			
Junior (reference)	1	—	—
Intermediate	2.65	[1.64, 4.28]	< 0.001 *
Associate senior	2.19	[1.04, 4.59]	0.038 *
Senior	3.35	[0.88, 12.73]	0.076
Availability of CR services at the institution			
Yes	2.59	[1.71, 3.91]	< 0.001 *
No (reference)	1	—	—
Hospital type			
General (reference)	1	—	—
Specialized	0.39	[0.22, 0.69]	0.001 *
Community	6.31	[0.80, 49.69]	0.080
Position			
Nurse (reference)	1	—	—
Doctor	2.02	[1.36, 3.01]	< 0.001 *
Rehabilitation therapist	1.17	[0.23, 5.99]	0.850
Department			
Cardiology	18.86	[2.44, 146.03]	0.005 *
Cardiac surgery	17.15	[2.15, 136.55]	0.007 *
Rehabilitation	22.77	[2.41, 214.80]	0.006 *
General practitioner (reference)	1	—	—
Age group			
≤ 30 years (reference)	1	—	—
31–40 years	1.21	[0.77, 1.88]	0.413
41–50 years	2.02	[1.06, 3.85]	0.032 *
≥ 51 years	3.65	[1.37, 9.75]	

Notes: OR = odds ratio; CI = confidence interval; and P-value = significance value; * indicates statistical significance at P < 0.05; reference categories are shown for comparison.

The results of this study align with previous findings, indicating that although healthcare professionals generally recognize the benefits of cardiac rehabilitation (CR), their detailed understanding—such as knowledge of exercise prescriptions and the core "five prescriptions" of CR—is often limited [22]. This limited familiarity is closely linked to their likelihood of recommending CR to patients [23]. A majority of participants (62.9%)

perceived the existing CR resources as inadequate, and an overwhelming 86.0% expressed a desire for increased training and resource availability, emphasizing the urgent need to strengthen healthcare workers' expertise in CR.

In agreement with Zhu *et al.* [21], our analysis showed that older professionals and those with higher professional ranks are more prone to suggest CR. The previous study also highlighted that doctors, especially those with senior titles and more experience, tend to hold more positive attitudes towards CR compared to nurses, a trend that we also observed. Physicians, likely due to their role in treatment decision-making and patient referrals, recommended CR more frequently than nursing staff, who have less authority to initiate such referrals [3, 31].

Additionally, general practitioners were less likely to advocate for CR than specialists in cardiology, cardiac surgery, and rehabilitation. This could be attributed to the GPs' relatively limited specialized training in CR and less familiarity with its advantages [32]. Earlier research has noted the shortage of formal CR education among primary care physicians, which correlates with lower referral rates [33]. We also found that staff working in specialized hospitals were less likely to recommend CR than those in general hospitals, underscoring the importance of improving access to and awareness of CR in specialized care settings.

Although nearly three-quarters (72.7%) of the participating institutions offered CR services, respondents' answers on item 14 of the ReCaRe scale suggest that systemic and organizational barriers persist even where resources exist. Effective CR programs require coordinated, multidisciplinary involvement; for example, exercise prescriptions must be tailored by rehabilitation professionals, a role that cardiologists alone may not be equipped to fulfill [3]. Communication gaps and the lack of streamlined referral pathways between departments make recommending CR a cumbersome process, discouraging healthcare providers from making referrals and thereby limiting patient participation [34]. Similarly, Supervia *et al*. [20] identified logistical and structural challenges as significant obstacles to CR referral, especially for female cardiac patients. Simplifying referral processes through automation or standardized discharge protocols has been shown to improve the uptake of CR [33, 35]. Moreover, expanding patient access to home-based or technology-supported CR programs offers a promising approach, with evidence supporting comparable outcomes to traditional center-based rehabilitation [36].

This investigation's strengths include a large, diverse sample of 1,120 healthcare professionals representing a wide range of hospital types, geographic regions, and clinical roles across China. Unlike much of the existing literature, which predominantly originates from Western countries, this study contributes novel insights specific to the Chinese healthcare system, thereby filling a significant gap and informing future interventions to increase CR utilization.

Limitations

Several limitations should be acknowledged in this study. Firstly, the sampling approach may have introduced selection bias, as participants were mainly recruited from hospitals that provide cardiac rehabilitation services. This might have resulted in an overrepresentation of healthcare professionals already familiar with CR, potentially underestimating the challenges faced by those working in facilities lacking such programs. Secondly, the use of self-administered questionnaires carries the risk of social desirability bias, where respondents may exaggerate their knowledge or favorable attitudes toward CR. Thirdly, the cross-sectional design restricts the ability to infer causal relationships between the examined factors and CR recommendation practices. Finally, although the study included participants from multiple regions across China, some areas with limited healthcare infrastructure may be underrepresented, which could potentially affect the generalizability of the findings.

Conclusion

This research sheds light on healthcare professionals' perceptions of cardiac rehabilitation and the factors influencing their recommendation behaviors in China. While there is strong recognition of CR's benefits among healthcare providers, their level of familiarity with CR content plays a key role in whether they recommend it. Additional determinants, including resource availability, hospital classification, department, role, professional rank, and age, also significantly affect recommendation practices. Furthermore, the study highlights the critical need to address systemic and organizational barriers that hinder the utilization of CR. Enhancing access to CR services and strengthening healthcare professionals' training are vital steps toward increasing CR referral rates, ultimately improving cardiovascular patient

outcomes across China. Future initiatives should focus on expanding CR resources, bolstering education and training, and fostering an enabling environment that encourages healthcare professionals to incorporate CR recommendations into routine patient management actively.

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Conflict of Interest: None

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Ethics Statement: This study was approved by the institutional review board of the Shanghai Sixth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine and conducted following the Declaration of Helsinki. Informed consent was obtained from all participants prior to their participation in the study.

References

1. Thomas RJ. Cardiac rehabilitation - challenges, advances, and the road ahead. N Engl J Med. 2024;390(9):830–41. doi:10.1056/NEJMra2302291
2. Baman JR, Sekhon S, Maganti K. Cardiac rehabilitation. JAMA. 2021;326(4):366. doi:10.1001/jama.2021.5952
3. Bozkurt B, Fonarow GC, Goldberg LR, Guglin M, Josephson RA, Forman DE, et al. Cardiac rehabilitationtion for patients with heart failure: JACC expert panel. J Am Coll Cardiol. 2021;77(11):1454–69. doi:10.1016/j.jacc.2021.01.030
4. Chinese Medical Association, House CMJP, Chinese Society of General Practice, Prevention Committee of Chinese Society of Cardiology, Cardiac Rehabilitation Committee of Chinese Society of Cardiology, Editorial Board of Chinese Journal of General Practitioners of Chinese Medical Association, Expert Group of Guidelines for Primary Care of Cardiovascular Disease, Dayi H, Dayi H. Guideline for primary care of cardiac rehabilitation of coronary artery disease (2020). Chinese J General Practitioners. 2021;20(2):150-65. doi:10.3760/cma.j.cn114798-20201124-01187
5. Balady GJ, Williams MA, Ades PA, Bittner V, Comoss P, Foody JM, et al. Core components of cardiac rehabilitation/secondary prevention programs: 2007 update: a scientific statement from the American heart association exercise, cardiac rehabilitation, and prevention committee, the Council on clinical cardiology; the councils on cardiovascular nursing, epidemiology and prevention, and nutrition, physical activity, and metabolism; and the American association of cardiovascular and pulmonary rehabilitation. Circulation. 2007;115(20):2675–82. doi:10.1161/CIRCULATIONAHA.106.180945
6. Ennis S, Lobley G, Worrall S, Evans B, Kimani PK, Khan A, et al. Effectiveness and safety of early initiation of poststernotomy cardiac rehabilitation exercise training: the SCAR randomized clinical trial. JAMA Cardiol. 2022;7(8):817–24. doi:10.1001/jamacardio.2022.1651
7. Dayi H. Current status and development of rehabilitation of heart in China. Chin J Practical Intern Med. 2017;37(07):581–2. doi:10.19538/j.nk2017070101
8. Prabhu NV, Maiya AG, Prabhu NS. Impact of cardiac rehabilitation on functional capacity and physical activity after coronary revascularization: a scientific review. Cardiol Res Pract. 2020;2020:1236968. doi:10.115 5/2020/1236968
9. Blumenthal JA, Sherwood A, Smith PJ, Watkins L, Mabe S, Kraus WE, et al. Enhancing cardiac rehabilitation with stress management training: a randomized, clinical efficacy trial. Circulation. 2016;133(14):1341–50. doi:10.1161/CIRCULATIONAHA.115.018926
10. Soldati S, Di Martino M, Rosa AC, Fusco D, Davoli M, Mureddu GF. The impact of in-hospital cardiac rehabilitation program on medication adherence and clinical outcomes in patients with acute myocardial infarction in the Lazio region of Italy. BMC Cardiovasc Disord. 2021;21(1):466. doi:10.118 6/s12872-021-02261-6

11. Ogmundsdottir Michelsen H, Nilsson M, Schersten F, Sjolin I, Schiopu A, Leos-dottir M. Tailored nurse-led cardiac rehabilitation after myocardial infarction results in better risk factor control at one year compared to traditional care: a retrospective observational study. BMC Cardiovasc Disord. 2018;18(1):167. doi:10.1186/s12872-018-0907-0
12. Hegewald J, Wegewitz UE, Euler U, van Dijk JL, Adams J, Fishta A, et al. Interventions to support return to work for people with coronary heart disease. Cochrane Database Syst Rev. 2019;3(3):CD010748. doi:10.1002/14651858.CD010748.pub2
13. Dibben GO, Faulkner J, Oldridge N, Rees K, Thompson DR, Zwisler AD, et al. Exercise-based cardiac rehabilitation for coronary heart disease: a meta-analysis. Eur Heart J. 2023;44(6):452–69. doi:10.1093/eurheartj/ehac747
14. Beatty AL, Truong M, Schopfer DW, Shen H, Bachmann JM, Whooley MA. Geographic variation in cardiac rehabilitation participation in Medicare and Veterans Affairs populations: opportunity for improvement. Circulation. 2018;137(18):1899–908. doi:10.1161/CIRCULATIONAHA.117.029471
15. Ritchey MD, Maresh S, McNeely J, Shaffer T, Jackson SL, Keteyian SJ, et al. Tracking cardiac rehabilitation participation and completion among medicare beneficiaries to inform the efforts of a National initiative. Circ Cardiovasc Qual Outcomes. 2020;13(1):e005902. doi:10.1161/CIRCOUTCOMES.119.005902
16. Martin BJ, Hauer T, Arena R, Austford LD, Galbraith PD, Lewin AM, et al. Cardiac rehabilitation attendance and outcomes in coronary artery disease patients. Circulation. 2012;126(6):677–87. doi:10.1161/CIRCULATIONAHA.111.066738
17. Jin H, Wei Q, Chen L, Sun Q, Zhang Y, Wu J, et al. Obstacles and alternative options for cardiac rehabilitation in Nanjing, China: an exploratory study. BMC Cardiovasc Disord. 2014;14:20. doi:10.1186/1471-2261-14-20
18. Ragupathi L, Stribling J, Yakunina Y, Fuster V, McLaughlin MA, Vedanthan R. Availability, use, and barriers to cardiac rehabilitation in LMIC. Glob Heart. 2017;12(4):323–34. doi:10.1016/j.gheart.2016.09.004. e10
19. Ski CF, Jones M, Astley C, Neubeck L, Thompson DR, Gallagher R, et al. Development, piloting and validation of the recommending cardiac rehabilitation (ReCaRe) instrument. Heart Lung. 2019;48(5):405–13. doi:10.1016/j.hrtlng.2019.04.008
20. Supervia M, Medina-Inojosa JR, Yeung C, Lopez-Jimenez F, Squires RW, Perez-Terzic CM, et al. Cardiac rehabilitation for women: a systematic review of barriers and solutions. Mayo Clin Proc. 2017. doi:10.1016/j.mayocp.2017.01.002
21. Zhu H, Ye Z, Ning L, Han X, Wu Y. Knowledge and attitude of the medical staff concerning cardiac rehabilitation in Zhejiang province, China: a cross-sectional study. Patient Prefer Adherence. 2020;14:1771–7. doi:10. 2147/PPA.S270503
22. Kellar G, Hickey GW, Goss F, Fertman C, Forman DE. Cardiac rehabilitation knowledge and attitudes of cardiology fellows. J Cardiopulm Rehabil Prev. 2021;41(1):30–4. doi:10.1097/HCR.0000000000000532
23. Iyngkaran P, Appuhamilage PY, Patabandige G, Sarathchandra Peru Kandage PS, Usmani W, Hanna F. Barriers to cardiac rehabilitation among patients diagnosed with cardiovascular diseases-A scoping review. Int J Environ Res Public Health. 2024;21(3). doi:10.3390/ijerph21030339
24. Xie X, Chen Q, Liu H. Barriers to hospital-based phase 2 cardiac rehabilitation among patients with coronary heart disease in China: a mixed-methods study. BMC Nurs. 2022;21(1):333. doi:10.1186/s12912-022-01115-6
25. Alhotye M, Evans R, Ng A, Singh SJ. Healthcare professionals' views about delivering a rehabilitation programme for individuals living with atrial fibrillation: a cross-sectional survey. BMC Sports Sci Med Rehabil. 2024;16(1):227. doi:10.1186/s13102-024-01000-6
26. 2022 Statistical Bulletin on the Development of Health and Healthcare in China [http://www.nhc.gov.cn/guihuaxxs/s3585u/202309/6707c48f2a2b420f bfb739c393fcca92.shtml]
27. Tao S, Chuan R, Zhi S, Kexin W, Shunlin X, Wei Z, et al. Current situation of cardiac rehabilitation and exercise evaluation under the background of the construction of chest pain center. Chin J Interventional Cardiol. 2023;31(7):509–13. doi:10.3969/j.issn.1004-8812.2023.07.003
28. Zhang S, Ding R, Chen S, Meng X, Jianchao L, Wang DW, et al. Availability and trend of dissemination of cardiac rehabilitation in china:

report from the multicenter National registration platform between 2012 and 2021. Front Cardiovasc Med. 2023;10:1210068. doi:10.3389/fcvm.2023.1210068

29. Chen Q, Zhou J, Li N, Liu L, Li Y, Long W, et al. Factors influencing changes in the quality of life of the Hainan migratory population with hypertension: a survey of the Chengmai Mangrove Bay community. BMC Public Health. 2025;25(1):49. doi:10.1186/s12889-025-21281-x
30. Ning Q, Shuangjiao S, Shuhua Z, Yinglong D, Xiao L, Zhuqing Z. The Chinese version of the recommending cardiac rehabilitation scale and its reliability and validity test. Chin J Nurs. 2022;57(06):762–8. doi:10.16821/j.cnki.hsjx.2024.09.001
31. King M, Bittner V, Josephson R, Lui K, Thomas RJ, Williams MA. Medical director responsibilities for outpatient cardiac rehabilitation/secondary prevention programs: 2012 update: a statement for health care professionals from the American Association of Cardiovascular and Pulmonary Rehabilitation and the American Heart Association. Circulation. 2012;126(21):2535–43. doi:10.1161/CIR.0b013e318277728c
32. Gallagher R, Neubeck L, Du H, Astley C, Berry NM, Hill MN, et al. Facilitating or getting in the way? The effect of clinicians' knowledge, values and beliefs on referral and participation. Eur J Prev Cardiol. 2016;23(11):1141–50. doi:10.1177/2047487316630085
33. Elsakr C, Bulger DA, Roman S, Kirolos I, Khouzam RN. Barriers physicians face when referring patients to cardiac rehabilitation: a narrative review. Ann Transl Med. 2019;7(17):414. doi:10.21037/atm.2019.07.61
34. Sugiharto F, Nuraeni A, Trisyani Y, Melati Putri A, Aghnia Armansyah N. Barriers to participation in cardiac rehabilitation among patients with coronary heart disease after reperfusion therapy: a scoping review. Vasc Health Risk Manag. 2023;19:557–70. doi:10.2147/VHRM.S425505
35. Ades PA, Khadanga S, Savage PD, Gaalema DE. Enhancing participation in cardiac rehabilitation: focus on underserved populations. Prog Cardiovasc Dis. 2022;70:102–10. doi:10.1016/j.pcad.2022.01.003
36. McDonagh ST, Dalal H, Moore S, Clark CE, Dean SG, Jolly K, et al. Home-based versus centre-based cardiac rehabilitation. Cochrane Database Syst Rev. 2023;10(10):CD007130. doi:10.1002/14651858.CD007130.pub5