

Availability and characteristics of cardiac rehabilitation programmes in China

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ABSTRACT

Objective Cardiac rehabilitation (CR) improves patient outcomes in cardiovascular disease (CVD), but little is known about its current practice in China. Since China has a high CVD burden, the potential impact of CR is large. We surveyed large hospitals in China to assess the prevalence and characteristics of CR.

Methods We carried out a cross-sectional survey of 454 large medical centres in China to ascertain the prevalence of CR, perceived barriers to CR and various other characteristics of centres with and without CR programmes.

Results Responses were received from 124 (27%) of the 454 centres surveyed. Of these, only 30 (24%) reported having an operating CR programme. This was true, despite the near universal availability of advanced imaging, coronary stenting and other technologies. Overall, the estimated availability of CR programmes was about 2 programmes per 100 million inhabitants.

Centres with CR were more likely than centres without CR to be university or government hospitals, have more inpatient cardiovascular beds and provide secondary CVD prevention services. Perceived barriers to CR included a lack of awareness, training and experience in CR, as well as limited resources for a CR programme. Respondents suggested that educational and training activities could help promote greater implementation of CR in China.

Conclusions The availability of CR is low (24%) in the large medical centres in China we surveyed, highlighting the importance of efforts to raise awareness of the benefits of CR, to provide CR training to healthcare professionals and to improve CR availability throughout China.

METHODS

We carried out an email-based survey of 454 (51%) of the 899 largest (level IIIA) hospitals in China, identified from a list of hospitals through the Ministry of Health of the People's Republic of China (now called the National Health and Family Planning Commission of the People's Republic of China). We contacted the chief of cardiology at each hospital and asked him/her to participate in the survey. Email addresses of the chiefs of cardiology were obtained from the communication directories of Chinese national cardiovascular conferences and from the list of corresponding author email addresses in major Chinese and international medical journals. If we had not received a response to the email survey after 2 weeks, we re-sent the request. If we still had not received a response after 2 additional weeks, an alternative physician leader was identified at that same hospital and was sent the survey request. If the alternative physician did not respond after two requests, we considered that hospital to be a 'non-respondent'. Consent was obtained from each respondent and the project was approved by the Mayo Clinic Institutional Review Board. We provided to each respondent a brief DVD on CR produced by the Mayo Clinic, as a small token of appreciation and as an incentive to participate in the survey.

The survey included three components: (1) a 36-item survey of basic hospital and staff characteristics, (2) respondents who reported having an active CR programme were asked to complete a second survey about how they had developed, implemented and maintained their CR programme and (3) respondents from centres without CR programmes were sent a second survey about potential barriers to the development, implementation and maintenance of a CR programme.

Finally, an abbreviated version of the original survey was sent to non-respondents that included 6 of the original 36 survey items that helped ascertain whether or not the hospital had an operating CR programme.

Content and face validity of the survey items were assessed by the coauthors, who have experience in both survey research and CR. All survey questions were translated into Chinese by one of the investigators (ZZ). That translation was reviewed and approved by the Mayo Clinic Language Services Department.

Prevalence of CR programmes was estimated from responses to the surveys. Using the initial 36-item survey, we performed univariate analysis to find those factors that differed significantly between the hospitals with CR and those without CR.

INTRODUCTION

There is growing evidence that cardiac rehabilitation (CR) is a cost-effective and highly beneficial method of delivering secondary prevention services, resulting in decreased cardiovascular morbidity and mortality in patients with cardiovascular disease (CVD).¹⁻⁴ Unfortunately, CR usage is sub-optimal and has significant geographical variability in the USA, with close correlation between CR participation and local availability of CR programmes.⁵ Usage of CR in parts of Europe, Canada, Australia and Latin America is also sub-optimal and variable,⁶⁻¹⁰ but little is known about the availability and use of CR in China, the most populous country in the world.

The aim of our study was to carry out a national survey of the largest hospitals in China in order to identify the availability, predictors and characteristics of operational CR programmes.



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Significant univariate factors were then assessed using multivariate logistic regression to identify which if any characteristics were independently associated with the presence of CR. Statistical analysis was performed with SPSS V.13.0 (SPSS, Chicago, IL, USA). Due to the limited sample size, frequencies were compared with non-parametric Mann–Whitney U test. A two-sided p value of <0.05 was considered to be statistically significant.

RESULTS

We received completed surveys from 124 (27%) of the 454 hospitals surveyed. Sixty per cent of respondents were cardiology department chairs or vice-chairs. The full 36-item survey was returned by 74 (60%) respondents, while 50 (40%) additional respondents who had failed to return the full survey completed the shorter 6-item survey. Thirty (24%) of the 124 participating hospitals reported having an active CR programme. Twenty-nine per cent (18/62) of the participating government hospitals, 22% (12/54) of the university-based hospitals and 0% (0/8) of the military hospitals reported an active CR programme. Of the 13 hospitals that finished the complete 36-item survey and reported having a CR programme, 3 (23%) offered only inpatient CR, 3 (23%) offered only outpatient CR and 7 (54%) offered both inpatient and outpatient CR services. **Table 1** shows the CR programme density by region (see online supplementary figures S1–S3 for additional details). The number and density of CR programmes were greatest in regions 2 (North), 3 (East) and 5 (South), and were lowest in regions 1 (Northeast), 4 (Central), 6 (Southwest) and 7 (Northwest), with region 7 reporting no CR programmes. Overall, the estimated density of CR programmes in China is approximately 2 CR programmes for every 100 million inhabitants.

Table 2 shows various characteristics of the responding hospitals with and without CR programmes. Hospitals with CR had a higher ratio of cardiology beds to total inpatient beds, and were more likely than non-CR hospitals to have special prevention-related clinics, such as weight loss clinics. A very high percentage of hospitals, with or without CR, reported performing common cardiovascular procedures, including percutaneous coronary intervention (PCI), coronary artery bypass graft surgery (CABG) and heart valve surgery. However, more hospitals without CR reported performing heart transplantation than hospitals with

Table 1 Distribution of hospitals with CR programmes, population and CR density by region in China

Region	Number of hospitals with CR	Population (in millions)	Density of CR programmes per 100 million inhabitants
1	1	108	0.9
2	9	155	5.8
3	13	382	3.4
4	2	240	0.8
5	4	147	2.7
6	1	213	0.5
7	0	99	0
Total	30	1344	2.2

Regions in China include the following: (1) Northeast China (Heilongjiang, Jilin and Liaoning), (2) North China (Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia), (3) East China (Shanghai, Shandong, Jiangsu, Anhui, Jiangxi, Zhejiang, Fujian), (4) Central China (Hubei, Hunan, Henan), (5) South China (Guangdong, Guangxi, Hainan), (6) Southwest China (Chongqing, Sichuan, Guizhou, Yunnan, Tibet) and (7) Northwest China (Shaanxi, Gansu, Ningxia, Xinjiang, Qinghai). CR, cardiac rehabilitation.

Table 2 Characteristics of hospitals with and without CR programmes

Item	Hospitals with CR (n=13) (%)	Hospitals without CR (n=61) (%)	p Value
Ratio of number of beds (CV department/total)			
≤5%	0	20 (32.8)	0.016
5%–10%	10 (76.9)	33 (54.1)	0.133
≥10%	3 (23.1)	8 (13.1)	0.363
Tests and services provided			
MRI	13 (100)	58 (95.1)	0.417
CTA	13 (100)	59 (96.7)	0.511
NCIT	9 (69.2)	45 (73.8)	0.740
Echocardiography	13 (100)	61 (100)	1.000
ABPM	12 (92.3)	59 (96.7)	0.467
Special clinic for hypertension	10 (76.9)	48 (78.7)	0.889
Special clinic for lipid disorders	9 (69.2)	27 (44.3)	0.104
Special clinic for tobacco cessation	8 (61.5)	25 (41.0)	0.179
Special clinic for weight loss	8 (61.5)	16 (26.2)	0.014
Special clinic for diabetes	11 (84.6)	54 (88.5)	0.697
Special clinic for sleep disorders	9 (69.2)	29 (47.5)	0.158
Psychiatry/psychology clinic	10 (76.9)	39 (63.9)	0.372
Physical rehabilitation clinic	11 (84.6)	37 (60.7)	0.103
Special clinic for nutrition counselling	6 (46.2)	23 (37.7)	0.574
Types of cardiology procedures performed			
Coronary angiography	13 (100)	61 (100)	0.417
PCI	13 (100)	61 (100)	0.511
CABG	12 (92.3)	58 (95.1)	0.740
Placement of ICD	12 (92.3)	50 (82.0)	1.000
Placement of CRT and CRTD	10 (76.9)	52 (85.2)	0.467
RF ablation therapy	13 (100)	56 (91.8)	0.889
Heart valve surgery	12 (92.3)	51 (83.6)	0.104
CHD surgery	11 (84.6)	50 (82.0)	0.179
Heart transplantation	3 (23.1)	18 (29.5)	0.014
Number of PCI procedures performed (in 2011)			
100–300	3 (23.1)	13 (21.3)	0.889
301–500	1 (7.7)	13 (21.3)	0.258
501–1000	5 (38.5)	11 (18.0)	0.107
1001–3000	4 (30.8)	22 (36.1)	0.718
≥3001	0	2 (3.3)	0.551
Number of CABG procedures performed (in 2011)			
0	2 (15.4)	13 (21.3)	0.632
1–50	5 (38.5)	21 (34.4)	0.783
51–200	4 (30.8)	17 (27.9)	0.834
201–500	1 (7.7)	10 (16.4)	0.426
≥501	1 (7.7)	0	0.030

Bold denotes statistical significance at (p<0.05).

ABPM, Ambulance Blood Pressure Monitoring; CABG, coronary artery bypass graft surgery; CHD, congenital heart disease; CR, cardiac rehabilitation; CRT, cardiac resynchronisation treatment; CRTD, cardiac resynchronisation treatment and defibrillation; CTA, computer tomography angiography; CV, cardiovascular; ICD, implantable cardiac defibrillator; NCIT, nuclear cardiology imaging tests; PCI, percutaneous coronary intervention; RF, radiofrequency.

CR (29.5% vs 23.1%, p=0.014). Of note, all hospitals with CR and more than 95% of hospitals without CR reported the availability of services involving advanced technologies, including MRI and computed tomographic angiography. Likewise, a high

percentage of all hospitals reported the availability of advanced cardiology technologies and treatments, including PCI, CABG, defibrillator placement, cardiac resynchronisation treatment and radiofrequency ablation therapy. Long-term follow-up of 1 year or longer was significantly more common in hospitals with CR compared with those without CR programmes (79% vs 33%, $p=0.02$).

All CR programmes reported offering a clinical assessment of patients at programme entry, periodic blood tests to assess cardiovascular risk factors and counselling for physical activity, exercise training, nutrition, smoking cessation and adherence to preventive medications. Weight management services and blood pressure monitoring and treatment were offered by 92% of CR programmes, while 85% of CR programmes offered lipid management, 69% offered psychological counselling and management, 46% offered sleep apnoea screening and management and 39% offered depression screening and management. Most CR programmes reported that they had been in operation for a relatively short time period, with 52% of programmes reported being in operation for 2 years or less, and 41% reporting that they had been in operation for 2–5 years. Less than 7% had been in operation for more than 10 years.

All CR programmes reported using physicians to help with the operations of their programme, 85% reported using nurses as well, 46% reported using dietitians and <20% reported using exercise specialists and other types of healthcare professionals (see online supplementary table S3). All programmes reported caring for post-PCI and heart failure patients, 92% reported caring for patients following myocardial infarction or pacemaker implantation, 69% reported caring for patients following CABG or heart valve surgery and 62% reported caring for patients with stable congenital heart disease, including patients with stable angina. Of the three hospitals with CR that reported performing heart transplantation surgery, only one reported caring for post-transplantation patients in their CR programme.

Perceived barriers to implement CR programme were reported by respondents from 92 hospitals without CR. The most common barrier to CR implementation was the lack of staff members with interest, experience and training in CR. Additional barriers that were reported include financial limitations, space limitations and lack of patient awareness of CR (see online supplementary table S4). Potential solutions to CR implementation in China were suggested by respondents from 13 hospitals with CR, including the provision of education and training to hospital staff members who, in turn, could provide CR services in their hospital. Other potential solutions included raising awareness of the benefits of CR among patients, physicians and healthcare leaders, and increasing collaboration and cooperation within specific hospitals and regions to establish systematic approaches to CR referral for eligible patients. Efforts to promote governmental policy and financial support for CR were also mentioned as potential solutions to CR implementation (see online supplementary table S5). Among hospitals without CR programmes, 12% reported that they were likely to implement a CR programme in their hospital in the coming year.

DISCUSSION

From this national survey of large hospitals in China, we found that 24% have operational CR programmes, resulting in a low density of CR programmes throughout China—approximately 2 programmes for every 100 million inhabitants, significantly lower than most countries (eg, 10 CR programmes per 100

million inhabitants in the USA and 500 programmes per 100 million inhabitants in Brazil).¹¹ Components of the CR programmes in China are similar to those reported in other countries, including in the USA,¹² Canada,¹³ the Middle East¹³ and South America.¹⁰ Hospitals with CR programmes had more hospital beds devoted to cardiovascular care (more than 5% of the total hospital beds), and were more likely to have long-term CVD patient follow-up programmes than hospitals without CR. Nearly all CR programmes (90%) reported using only physicians and nurses for their CR staffing needs, but relatively few used other healthcare professionals who are potentially more cost-effective in the CR setting, such as exercise physiologists, dietitians or physical therapists. This suggests the need to provide more cost-effective staffing models through training and delivery model redesign.

While many countries in the world report a gap in the referral of eligible patients to existing CR programmes,^{14–15} our results suggest an even greater ‘upstream’ challenge in China—a lack of available CR programmes throughout China to which eligible patients could potentially be referred. This gap in China is similar to but larger than the gap in CR programme availability reported previously in Latin America.⁷ One study of Latin American and Caribbean hospitals found that only 56% of hospitals that were surveyed reported having operational CR programmes, compared with the 24% of hospitals we found in China that reported having operating CR programmes.

Although CR programme availability was low in the hospitals we surveyed, a high percentage of respondents reported that their hospitals provided advanced, complex medical and/or surgical procedures and technologies, including PCI, defibrillator implantation, radio frequency catheter ablation and MRI. This paradoxical finding—that resources appear to be available for ‘higher tech’ services, but not for ‘lower tech’ services like CR, is important, is similar to reports from other parts of the world,^{7–10} and is a call to policy makers to re-evaluate healthcare funding priorities. At the same time, this paper is a call to CR healthcare professionals in China and throughout the world to develop, validate and implement models of CR delivery that would be feasible and cost-effective. Clearly, the relative cost of CR delivery models in high-income countries is not feasible in low-income and middle-income countries.¹⁶

Our study has several limitations, including the small sample size due to a relatively low response rate in our survey cohort. The low response rate for our survey may reflect a low level of familiarity and/or interest in CR in China, or a possible limitation of the effectiveness of our email survey strategy. Given the limitation in survey responses, it is possible that our estimates of CR availability (prevalence) in China are skewed and inaccurate. Furthermore, we selectively sampled only larger hospitals in China, assuming that they would be more likely to have CR programmes than smaller hospitals. However, this assumption may be incorrect, and may have led to inaccurate estimates of CR prevalence in China. Finally, since it is possible that non-respondents were less likely than respondents to have CR programmes in their hospitals, it is possible that our assessment overestimates the true prevalence of CR programmes in China.

In conclusion, 24% of major hospitals in China report that they have an operating CR programme. Barriers and potential solutions appear to revolve around the provision of appropriate training of CR professionals who can carry out CR in their hospitals. In addition, there is a need to provide education to raise awareness of the benefits of CR to patients and health providers throughout China. Through these efforts, there is a hope that

CR can be implemented more widely throughout China and thereby provide the benefits of CR services to the growing number of eligible patients in China who have CVD.

Key messages

What is already known about this subject?

No previous studies have been published on this topic—the prevalence and predictors of cardiac rehabilitation (CR) programmes in major hospitals in China.

What does this study add?

Cardiovascular disease (CVD) prevalence and its consequences are rising in China at a staggering rate. CR programmes are a cost-effective and high value strategy to help reduce mortality and morbidity rates among persons with CVD, but their availability in China has not been studied previously. This study sheds important light on the relative scarcity of CR programmes in China, and helps identify those hospitals in China that have successfully started such programmes.

How might this impact on clinical practice?

This paper will help stimulate greater awareness of the lack of CR programmes in China and promote greater interest in the dissemination of CR programmes throughout China in the coming years. The clinical impact is potentially huge for China, the populous country in the world, as it searches for ways to deal with the growing number of persons with CVD.

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