

# Factors predicting discontinuation of a hospital-based cardiac rehabilitation programme

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## Abstract

**Background:** Cardiac rehabilitation (CR) programmes play an important role in the management of patients with coronary artery disease. However, a significant proportion of patients do not participate or do not complete CR.

**Aim:** To assess the prevalence and predictors of discontinuation of a hospital-based CR programme and to investigate whether or not the completers and dropouts differed in relation to their baseline characteristics.

**Methods:** Data used for analysis were from a hospital-based CR programme involving 1986 discharged patients at Tehran Heart Centre between July 2004 and January 2006. The patients who completed all 24 sessions of the CR programme were compared with the dropouts.

**Results:** The CR completion rate was 18.1% (average of  $11.4 \pm 8.1$ , ranging from 1 to 78 sessions) including patients who completed 24 ( $n=284$ ) or more sessions ( $n=77$ ) of the CR programme. Factors predicting dropout were male gender (OR 1.441,  $p=0.0094$ ), younger age (OR 0.979,  $p=0.005$ ), and lower levels of education (OR 0.412,  $p < 0.0001$ ).

**Conclusion:** The present study demonstrated a relatively high rate of CR programme dropout. Only less than a fifth of the patients completed this hospital-based programme. Patients who were male and younger and had lower education levels were better likely to drop out of the CR programme. Social support and educational programmes may be helpful in achieving better compliance.

**Key words:** cardiac rehabilitation, dropout, attendance, coronary artery disease

Kardiologia Polska 2009; 67: 140-146

## Introduction

In the management of patients with coronary artery disease (CAD), cardiac rehabilitation (CR) programmes aim to help participants achieve lifestyle changes that will modify risk factors, using a combination of exercise, education, counselling, behavioural interventions, and support. A meta-analysis of pooled data from clinical trials and cohort studies has established significant reductions in all-cause and cardiovascular mortality of patients enrolled in exercise-based CR programmes [1-5]. Despite compelling research evidence identifying the biophysical and psychosocial benefits of participating in a multifaceted CR programme, estimates indicate that only 15-30% of eligible acute myocardial infarction (MI), coronary artery

bypass graft (CABG) surgery, or percutaneous transluminal coronary angioplasty (PTCA) patients attend and complete these programmes [6-10]. Actually, the extent to which secondary prevention services are effective depends on the patient's willingness and/or ability to adhere to the recommended strategies necessary to achieve the desired benefits. Cardiac rehabilitation programmes as secondary prevention services are clinically recommended for all patients with CAD [11].

Health care practitioners' patterns of practice influences the referral rate of patients to CR programmes. However, patient's characteristics and the availability of social support also influence the patient's decision-making regarding attendance at CR programmes [10, 12-18]. In this context, few studies have investigated

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**Received:** 11 October 2008. **Accepted:** 20 November 2008.

the predictors of completion of a CR programme, with most of the previous studies having considered only the cardiac rehabilitation attendance. Thus, we conducted a cohort study to identify the completion rate and predictors of discontinuation of an outpatient CR programme and also to investigate whether completers and dropouts differed with respect to their demographic characteristics, socioeconomic status, and clinical factors.

## Methods

### Design and participants

An analytic cohort study was undertaken with patients eligible for an outpatient CR programme provided by a tertiary university teaching hospital in Tehran, Iran that serves a mixed urban and rural population. The sampling pool consisted of 1986 patients eligible to attend the Tehran Heart Centre's CR programme between July 2004 and January 2006 due to previous acute MI, CABG, percutaneous coronary interventions (PCI), percutaneous transvenous mitral commissurotomy (PTMC), and valvoplasty. The investigation was approved by the institutional review board governing the participation of human subjects in research at Tehran University of Medical Sciences. Also, it conforms with the principles outlined in the Declaration of Helsinki.

For data extraction, the charts of patients who had completed at least one session of CR were reviewed. The patients selected for the study were CAD subjects who had no neurological impairments such as stroke, peripheral neuropathy, or traumatic brain injury; no severe musculoskeletal diseases such as fracture or amputation; and no complications during hospitalisation such as severe infection, shock, arrhythmia, or prolonged ventilator dependence.

### Procedure

All the patients were recommended to attend the exercise programme at the hospital three times a week. The complete CR programme was considered for 8 weeks, with a total of 24 exercise sessions. Each session was preceded by 5 min of stretching and calisthenics for warm-up, and the session finished with 5 min of stretching and calisthenics for cool-down. Exercise was performed for 20 min on a treadmill, 10-20 min on a bicycle ergometer, and 10-20 min on an arm-ergometer. Heart rate, blood pressure, and exercise intensity were monitored and supervised by a senior cardiopulmonary physical therapist during the exercise session. All the patients received psychological and dietary counselling. During the psychological sessions, the patients were offered coping strategies in order to accept and live with their cardiac incident. During the dietary counselling, the subjects received education sessions on healthy nutrition and were included in a food programme.

A dichotomous 'completion' variable was used to classify: 1) those who completed 24 or more sessions of group exercise provided by the CR programme (completers), and 2) those who did not complete the full sessions of the CR programme (dropouts). All independent variables were baseline characteristics identified a priori on the basis of research findings as potentially associated with completion and dropout. They were: socio-demographic factors, including age, gender, education (academic and secondary levels vs. primary level, very low level or none, comprising low level); employment status (retired, home duties, self-employment, high rank job, and manual occupation); cardiac diagnosis or procedure (AMI, CABG, PCI, PTMC, and valvoplasty); self-reported risk factors at admission, including high blood pressure, hyperlipidaemia, positive family history, diabetes mellitus, and smoking status (current smoker, former smoker, never smoked); left ventricular ejection fraction (LVEF) on echocardiography; treadmill indices at first session (velocity, calorie expenditure, heart rate<sub>max</sub>, and end-exercise heart rate); and blood pressure monitored during exercise.

### Statistical analysis

Missing data were present in less than 2.5% of the records. Numerical variables are presented as mean  $\pm$  SD, while categorical variables are summarised as absolute frequency and percentage. For the categorical variables, the statistical significance of the difference between the completers and dropouts was evaluated using the chi-square or Fisher's exact tests. The continuous variables were compared using the Student's t-test between the two groups. Power analysis showed that there was about 69% chance of detecting a significant difference using a two-sided test with significance level = 0.05.

A multivariate stepwise logistic regression model for risk factors predicting discontinuation was constructed. The associations of independent predictors with discontinuation in the final model were expressed as odds ratios (OR) with 95% confidence intervals (CI). Model discrimination was measured using the c statistic, which is equal to the area under the receiver operating characteristic (ROC) curve. Model calibration was estimated using the Hosmer-Lemeshow (HL) goodness-of-fit statistic (higher p values imply that the model fits the observed data better). For the statistical analysis, the statistical software SPSS version 13.0 for Windows (SPSS Inc., Chicago, IL) and the statistical package SAS version 9.1 for Windows (SAS Institute Inc., Cary, NC, USA) were used. All the P values were 2-tailed, with the statistical significance defined by  $p \leq 0.05$ .

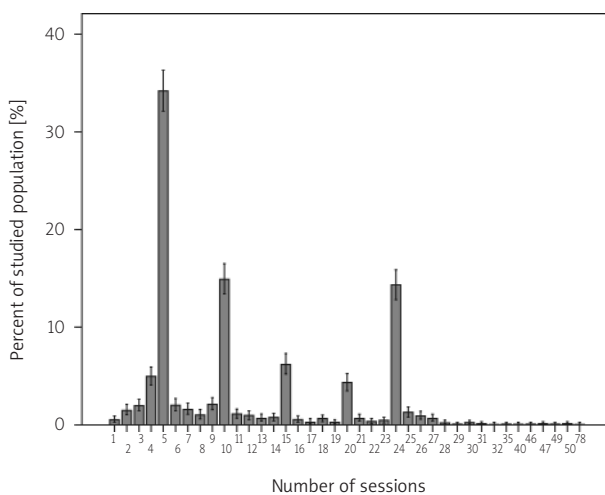
## Results

Of the 1986 patients who attended at least one session of the CR programme offered to them, 361 (18.1%) completed 24 sessions (Figure 1). Ages of the patients who

**Table I.** Sociodemographic and clinical characteristics of CAD patients enrolled in hospital-based cardiac rehabilitation programme

	Completers n=361	Drop-outs n=1625	p
Age [years]	57.8±10.4	56.8±10.7	0.098
Male gender	258 (71.5)	1186 (73)	0.558
Hypertension, n (%)	149 (41.3)	44 (36.4)	0.085
Diabetes mellitus, n (%)	84 (23.3)	384 (23.6)	0.883
Current smoker, n (%)	78 (21.6)	389 (23.9)	0.358
Hyperlipidaemia, n (%)	187 (51.8)	765 (47.1)	0.104
Family history, n (%)	147 (40.7)	566 (34.8)	0.035
Education status, n (%)			
Low level	108 (29.9)	753 (46.3)	<0.0001
Secondary and academic	253 (70.1)	872 (53.7)	
Employment status, n (%)			
Retired	95 (26.3)	350 (21.5)	0.007
Self-employment	76 (21.1)	386 (23.8)	
Home duties	81 (22.4)	370 (22.8)	
High rank occupation	23 (6.4)	193 (11.9)	
Manual occupation	86 (23.8)	326 (20.1)	
Prior CABG, n (%)	233 (64.5)	1071 (65.9)	0.621
Prior AMI, n (%)	9 (2.5)	32 (2)	0.527
Prior PCI, n (%)	85 (23.5)	358 (22)	0.532
Prior PTMC, n (%)	3 (0.8)	23 (1.4)	0.377
Prior valvoplasty, n (%)	8 (2.2)	4.4 (7.1)	0.058
LV ejection fraction [%]	51.7±10.2	51.4±10.6	0.636
Diastolic blood pressure [mmHg]	83.1±10.3	82.3 ±11.2	0.198
Systolic blood pressure [mmHg]	129 ±17.7	130 ±16.5	0.406
Heart ratemax [beats/min]	97.9±14.6	98.9±14.3	0.234
End exercise heart rate [beats/min]	89.2±13.3	90.6±13.6	0.091
Treadmill velocity [km/h]	3.5±0.7	3.5±0.8	0.226
Calorie expenditure [kcal]	35±7.1	33.8±7.9	0.056

Abbreviations: variables presented as mean ± SD, n (%), CAD – coronary artery disease, AMI – acute myocardial infarction, CABG – coronary artery bypass surgery, PCI – percutaneous coronary intervention, PTMC – percutaneous transvenous mitral commissurotomy



**Figure 1.** Continuation pattern of a hospital-based cardiac rehabilitation programme

enrolled in the CR programme ranged from 14 to 97, with a mean age of 57±10.7 years; and the majority (>70%) of the participants were men. The average of completed sessions was 11.4±8.1 (ranging from 1 to 78). The baseline demographic and clinical characteristics of the completers and dropouts are depicted in Table I.

The number of completed CR sessions revealed a trend of difference between females and males (11.8±8.2 vs. 11.2±8.0;  $p=0.131$ ). Patients with hypertension (11.9±8.5 vs. 11.1±7.8;  $p=0.031$ ) and high education level (12.4±8.4 vs. 10.1±7.4;  $p<0.0001$ ) attended significantly more sessions. Dropout had no significant association with cardiac diagnosis or procedure, cigarette smoking, hyperlipidaemia, or diabetes mellitus. However, there was a trend suggesting that the dropouts were younger ( $p=0.098$ ) and less hyperlipidaemic ( $p=0.104$ ). There was a significant correlation between family history and completion of the CR programme ( $p=0.035$ ). In addition, there was a trend suggesting a higher prevalence of hypertension in the completers ( $p=0.085$ ). Retired patients were significantly more common among the completers ( $p=0.007$ ). The completers were more likely to have a level of academic or secondary education ( $p<0.0001$ ).

Haemodynamic parameters, including left ventricular ejection fraction, systolic and diastolic blood pressure, and heart rate<sub>max</sub>, were similar between the completers and dropouts, whereas end-exercise heart rate and calorie expenditure had a trend of difference between the two groups.

The multivariate analysis revealed that lower levels of education, younger age, and being male independently predicted discontinuation of the CR programme (Table II). The final model had good discrimination (c statistic, 0.615; 95% CI 0.592-0.631) and calibration (Hosmer-Lemeshow statistic,  $p=0.804$ ).

## Discussion

Our cohort study describes a large sample of 1986 cardiac disease patients who attended a referral hospital-based CR programme, provides detailed information on the demographic and socioeconomic characteristics of the subjects, and evaluates potential factors associated with discontinuation of the programme sessions. Our patients, whether undergoing CABG, PCI, PTMC, or other therapeutic interventions, were recommended to attend an outpatient CR programme over two to four weeks after discharge, and this programme was adjusted for each patient. However, the majority of these patients did not complete the 24 sessions of CR; from 1986 subjects, only 18.1% completed all the exercise sessions.

The rate of dropout in our cohort population is slightly higher than those in recently reported studies. Reported rates of uptake of CR range from 15% to 59%.

Approximately 20-25% of patients drop out of exercise programmes within the first three months and about 40–50% at between 6 and 12 months [19-21]. Nevertheless, recent studies have revealed that patients with CAD, regardless of cardiac procedures, are more likely to complete exercise sessions of an outpatient CR programme [22, 23]. The low completion rate of the CR programme in our study can be attributed to different characteristics of the included participants. Furthermore, our heart centre is located in the capital of Iran, and it supplies cardiac care for a heterogeneous population as a referral hospital, which might explain why we lost the majority of the patients, who had temporary settlement in our region. It is also noteworthy that although the majority of the Iranian population are covered by health insurance, dropout and non-attendance of CR programmes in Iran might be related to economic problems. In our centre, the total cost of a CR programme is about US\$ 360. At the onset, the patients can pay the cost of each five, ten, or full sessions, and then they can renew their enrolment for further exercise sessions. Therefore, it is reasonable why our patients mainly completed only five (34.2%) or ten sessions (14.9%) of the CR programme. Recently, one insurance company has agreed to cover two-thirds of the total cost of a CR programme for post-CABG and post-MI patients. In this study, we did not assess the cost of this programme and its financial burden on each patient. Be that as it may, a patient's financial wherewithal seems to influence his or her compliance with a CR programme, regardless of other factors.

For CR programmes, poor uptake rates relate mainly to either service or patient factors. Service factors centre around the invitation to participate and logistical factors such as availability of services. We found that being male (OR 1.340) and younger (OR 0.980) and having lower educational levels (OR 0.407) were independent predictors of dropout in this study. A recent study carried out in Iran showed that those who completed a full CR programme were more likely to be female, non-smoking, and older and with lower risk of CAD [22]. While in another recent study, female patients were more likely to drop out of CR than men. Psychological distress, younger age, lower perception of consequences, higher perception of personal control, and lower illness perception of treatment control were predictors of early dropout from a CR programme [23]. A gender difference was suggested and was significant in our multivariable analysis. Our data showed that male patients had a significantly higher tendency to discontinue in the multivariate analysis. This finding is concordant with the predominant role of men in the socioeconomic activities of Iranian families in comparison with women. A high rate of female homemakers, totalling 70.7% (381 cases) in the present study, more free time to complete the cardiac rehabilitation programmes, and greater

**Table II.** Independent predictors of discontinuation of hospital-based cardiac rehabilitation programme

	OR	95% CI	p
Age	0.980	0.969-0.992	0.0006
Gender			
Female	1.00	1.026-1.749	0.0031
Male	1.340		
Educational status			
Low level	1.00	0.312-0.531	<0.0001
Secondary and academic	0.407		

Abbreviations: OR – odds ratio, CI – confidence interval, Hosmer-Lemeshow statistic,  $p=0.804$ ; area under the ROC curve  $c=0.6151$

attention to health in contrast to the difficult and time-consuming financial commitments of males (e.g., males who worked two or more shifts) are some of the reasons for the lower dropout rate in women than men. Female patients are significantly less likely to be invited to attend CR programmes [20, 24-27], and those who do not drive their own cars, live alone, have been widowed, or have possibly lost social support, have previously been identified as the ones less likely to participate in a CR programme [14, 28]. Also, physically inactive women are less likely to attend and more likely to drop out than are those who are physically active before hospital admission. However, our study failed to explain the whys and wherefores of such non-attendance as we did not consider non-attendees. These findings reveal that sociodemographic conditions may have different impacts on attendance and continuation of a hospital-based CR programme: women may be less likely to take part in the CR programme, but they are more likely than men to complete more sessions if they start it.

In the current study, younger age was a predictor of CR dropout. This may reflect reduced expectation and appreciation of the benefits of CR programmes. It is also possible that younger patients are more likely to have other commitments (e.g. early return to paid job) than older people. Nonetheless, this is in contrast to previous findings [29, 30] which claim that older people tend to drop out of CR programmes because they are less likely to be aware of its benefits. Poorer attendance amongst older patients, both men and women, have been reported in most previous findings [15, 26, 31-33], despite evidence that older patients can improve significantly by attending CR [34]. The failure of younger patients to complete their CR programme in the present study might be explained, in part, by their more severe socioeconomic constraints and less family support, as a result of which they did not have enough insight into the beneficial effects of the CR programme.

Another sociodemographic predictor of dropout was the level of education. Similar to the available literature, patients with lower levels of education were less likely to complete the CR programme [18]. Patients have identified



their main need as practical, honest advice about their condition and how to modify their life in order to avoid further problems. Many patients appear to give more weight to the information provided by family and friends than by health professionals. There is a widespread misconception among the general public and some health professionals that people should considerably limit their activity following MI in order to avoid a recurrence. The information provided is often inadequate and inconsistent, and might be frequently misunderstood by low educated patients. Additionally, patients of lower education and occupational levels often fail to attend programmes [18], reflecting lower socioeconomic status and likely financial constraints. Increases in knowledge may not be sufficient to produce changes in behaviour or lifestyle, but inpatient education has been shown to produce significant improvements in smoking behaviour, activity levels, and overall compliance with action to improve health. Education of both patients and their partners can result in improved knowledge, decreased disability, and changes in health behaviours [35, 36].

Our study has several strengths. By studying a large cohort sample and by analysing the completion patterns from the databank in the referral heart centre, we were able to produce a clearer picture of dropout than has been found in the past studies of smaller samples. Also, it contributes to the limited published studies of CR participation in our region. Few studies have investigated the predictors of the completion of a CR programme, with the bulk of the previous studies having considered the CR attendance. We were, therefore, able to identify the key sociodemographic and clinical predictors of dropout among all those which have been shown to influence programme participation. Furthermore, baseline characteristics and attendance status were based on patient self-report with external validation, as self-reporting of some health behaviours and risk factors is considered to be unreliable.

However, some limitations of the present study should be noted. Even with the large study sample, prediction of dropout might be limited by the pattern of patient participation (i.e., those who mainly completed five or ten sessions). Our study was confined to the investigation of sociodemographic and clinical factors. Other factors such as patient beliefs and perceptions, patient psychological and economic status, and the strength of the physician's recommendation can also influence patients' willingness to attend and continue CR programmes [24, 26, 31, 33, 37].

## Conclusion

Although the effect of CR is compelling and extensive for patients with CAD, only approximately 18.1% of eligible subjects completed this hospital-based programme. The findings of this study suggest that demographic characteristics such as age, male gender, and especially

lower education levels are the major factors related to discontinuation of CR programmes. Thus, for better adherence to CR programmes, a supportive referral should be advocated for all patients after discharge from hospital. There is a need for further investigations focusing on CR programmes dropout to determine the other predicting variables (e.g., socioeconomic status, patients' beliefs about their illness and referral patterns) and what approaches to dropout should be adopted in future studies. This strategy may consist of inpatient or home-based cardiac rehabilitation programmes and educational interventions, accompanying improvement of the policy of insurance companies.

## Acknowledgments

We would like to thank Leila Pirzadeh, MD, for her assistance with data collection; and Sorayya Etemadi MS, for her psychiatric counselling in the Cardiopulmonary Physical Therapy Unit.

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## Czynniki decydujące o przerwaniu programu rehabilitacji szpitalnej w chorobach układu krążenia

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### Streszczenie

**Wstęp:** W leczeniu osób z chorobą wieńcową rehabilitacja odgrywa ważną rolę, pozwala na odpowiednią modyfikację stylu życia i eliminację czynników ryzyka.

**Cel:** Ocena częstości i przyczyn przerywania programu szpitalnej rehabilitacji kardiologicznej oraz znalezienie ewentualnych różnic w wyjściowej charakterystyce chorych kończących i przerywających program rehabilitacji.

**Metody:** Oceniono przebieg rehabilitacji szpitalnej u 1986 chorych wypisanych z Tehran Heart Center w okresie od lipca 2004 do stycznia 2006 r. Porównano chorych, którzy ukończyli program rehabilitacji (obejmujący 24 sesje), z chorymi, którzy przegrali przedwcześnie program rehabilitacji.

**Wyniki:** Program rehabilitacji ukończyło 18,1% chorych (w tym 284 wzięło udział w planowanych 24 sesjach, a 77 dodatkowo w większej liczbie sesji). Analizowani chorzy uczestniczyli średnio w 11±8 sesjach treningowych (1–78 sesji). Czynnikiem prognozującym przedwczesną rezygnację z pełnego programu rehabilitacji były płeć męska (OR 1,441, p=0,0094), młodszy wiek (OR 0,979, p=0,005) i niższy poziom wykształcenia (OR 0,412, p <0,0001).

**Wnioski:** Wyniki niniejszej analizy wskazują na relatywnie dużą częstość przedwczesnej rezygnacji z pełnego programu szpitalnej rehabilitacji kardiologicznej. Chorzy skłonni do porzucenia rehabilitacji to mężczyźni, osoby młodsze i gorzej wykształcone. Odpowiednie wsparcie socjalne i właściwa edukacja mogą pomóc w przeciwdziałaniu temu niekorzystnemu zjawisku.

**Słowa kluczowe:** rehabilitacja kardiologiczna, przerwana, frekwencja, choroba wieńcowa

Kardiologia Pol 2009; 67: 140-146

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Praca wpłynęła: 11.10.2008. Zaakceptowana do druku: 20.11.2008.