



Cardiac rehabilitation for coronary patients: lifestyle, risk factor and therapeutic management. Results from the EUROASPIRE II survey

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KEYWORDS

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Aims The aim of this study is to describe lifestyle and risk factor management, together with the use of prophylactic drug therapies, from the EUROASPIRE II survey in patients participating in cardiac rehabilitation programmes (CRP) compared to those who do not.

Methods and results 5540 consecutive coronary patients from 47 centres in 15 countries were interviewed and examined about 1.4 years after hospital discharge for CABG, PTCA, AMI or myocardial ischaemia. 43.0% reported being advised to attend a CRP and of these 81.8% did so; 35.2% of all patients. Comparing coronary patients who participated in CRP with those who did not the prevalences of the following risk factors were all lower: smoking (18.7% vs 22.4%); obesity (28.2% vs 33.0%); raised blood pressure (48.8% vs 51.4%); and raised cholesterol (55.0% vs 60.2%); and prescriptions for prophylactic drug therapies were all higher: anti-platelets (89.8% vs 83.8%); beta-blockers (68.2% vs 60.0%); and lipid-lowering drugs (67.9% vs 57.0%).

Conclusions Only one third of all coronary patients reported attending a CRP. Although the prevalence of risk factors and use of prophylactic drug therapies is better in those who attended a CRP many patients had still not achieved the lifestyle and risk factor targets. The potential for comprehensive cardiovascular prevention and rehabilitation is considerable.

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Introduction

Coronary heart disease (CHD) is the major cause of premature disability and death in most European countries¹. Although mortality has been declining in recent years, the number of CHD patients may be

increasing because of life saving medical treatments for acute coronary disease including revascularisation and widespread use of prophylactic drugs². The overall objective of CHD prevention, both in patients with clinically established CHD, or other atherosclerotic disease, and high risk individuals is the same: to reduce the risk of major CHD, or other atherosclerotic disease events, and thereby reduce premature disability, mortality and prolong survival³. In 1969 cardiac rehabilitation was defined as "the sum of activities required to ensure the best possible physical, mental and social conditions, so that the cardiac patient may resume as normal a place

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as possible in the life of community"⁴. At that time patients in cardiac rehabilitation were recovering from acute myocardial infarction or cardiac surgery and the focus was on supervised exercise sessions and return to work. Subsequently, this speciality has gradually evolved into a more comprehensive lifestyle intervention: smoking cessation, healthy eating and increased physical activity. Risk factor management in terms of controlling blood pressure, lipids and diabetes, and the use of prophylactic drug therapies is also an integral part of this approach. Stress management, psychosocial and vocational components of a multifactorial prevention and rehabilitation programme are also important. This evolution in cardiac rehabilitation is reflected in the most recent WHO definition⁵: "The rehabilitation of cardiac patients is the sum of activities required *to influence favourably the underlying cause of the disease*, as well as the best possible physical, mental and social conditions, so that they may, by their own efforts preserve or resume when lost, as normal a place as possible in the community. Rehabilitation cannot be regarded as an isolated form of therapy but must be integrated with the whole treatment of which it forms only one facet". The principles of a cardiac prevention and rehabilitation programme based on this WHO definition were defined prior to this study by the Second Joint Task Force of the European and other Societies recommendations on prevention of CHD in clinical practice³.

Following the publication of these recommendations the EUROASPIRE II survey of 5556 coronary patients was carried out in 1999/2000 under the auspices of the Euro Heart Survey programme in 47 centres from 15 European countries⁶. This showed that lifestyle and risk factor management in coronary patients is far from optimal in Europe and there is considerable potential to reduce the risk of recurrent coronary and other atherosclerotic disease and improve life expectancy. The attitudes towards and practice of cardiac rehabilitation in Europe differ substantially between countries. Cardiac rehabilitation provision ranges from residential rehabilitation through to ambulatory programmes⁷. The second Joint European Societies recommendations³ defined the following lifestyle, risk factor and therapeutic goals: smoking cessation, making healthy food choices, and becoming physically active, body mass index (BMI) <25 kg/m², blood pressure <140/90 mmHg, total cholesterol <5.0 mmol/l, LDL-cholesterol <3.0 mmol/l, and the use of appropriate prophylactic drug therapies.

The aim of this paper is to describe lifestyle and risk factor management together with the use of prophylactic drug therapies in patients participating in cardiac rehabilitation programmes (CRP) compared to those who did not.

Study population and methods

Sample size and data collection

A detailed description of the study population and design of EUROASPIRE II survey has been published elsewhere⁶.

The EUROASPIRE II survey was conducted in 47 centres in selected geographical areas in Belgium (BEL/GHE), the Czech Republic (CZE/PP), Finland (FIN/KUO), France (FRA/LLRT), Germany (GER/MÜNS), Greece (GRE/ATCI), Hungary (HUN/BUD), Ireland (IRE/DUB), Italy (ITA/TV), the Netherlands (NET/ROT), Poland (POL/CRA), Slovenia (SLO/LJU), Sweden (SWE/MAL), Spain (SPA/BAR) and the UK (HL). The area included at least one hospital offering interventional cardiology and cardiac surgery, and one or more hospitals admitting patients with acute myocardial infarction and ischaemia. Within each hospital, consecutive patients, men and women ≤70 years of age at the time of index event or procedure with the following diagnoses or treatments for CHD were identified:

- (1) First elective or emergency coronary artery bypass grafting (CABG).
- (2) First elective or emergency percutaneous coronary angioplasty (PTCA), excluding patients with a history of CABG.
- (3) First or recurrent acute myocardial infarction (AMI), excluding patients with a history of CABG or PTCA.
- (4) First or recurrent acute myocardial ischaemia (Ischaemia) but no evidence of infarction, excluding patients with a history of CABG, PTCA or a previous AMI.

Data collection was conducted by trained research staff and was based on a retrospective review of hospital medical records and an interview and examination of the patients at least 6 months after hospitalisation. In each country the aim was to obtain information from a minimum of 400 living patients for an interview.

Methods

In this paper we describe lifestyle, risk factor management and use of prophylactic drug therapies at interview in patients who reported attending cardiac rehabilitation compared to those who did not. The study protocol at patient interview and examination has been described previously⁶. In brief, the information obtained at interview included: personal and demographic details, personal and family history of CHD, reported lifestyle and risk factor history in relation to smoking, hypertension, hyperlipidaemia and diabetes, and reported medication. The following measurements were performed: height and weight (SECA scales and measuring stick, model number 707), blood pressure (Omron 711 automatic digital sphygmomanometer, Matsusaka Co, Japan), serum total cholesterol (Roche Diagnostics), plasma glucose (Bayer) and breath carbon monoxide (Smokerlyser, Bedfont Scientific, UK, Model EC 50). To ensure the standardisation of measurements, all equipment was calibrated and serviced according to the manufacturer's recommendation.

Data management

All data were stored electronically onto notebook computers using a unique identification number for country,

Table 1
Size of the study population, age, gender and diagnostic category distribution, by centre at interview

	BEL/ GHE	CZE/ PP	FIN/ KUO	FRA/ LLRT	GER/ MÜNS	GRE/ ATCI	HUN/ BUD	IRE/ DUB	ITA/ TV	NET/ ROT	POL/ CRA	SLO/ LJU	SPA/ BAR	SWE/ MAL	UK/ HL	Total
By diagnostic category																
CABG	102	100	99	99	100	95	101	99	25	95	101	117	88	99	98	1418
PTCA	98	110	102	124	102	112	101	102	82	96	116	109	106	101	95	1556
AMI	51	100	99	87	98	108	82	98	94	98	115	118	111	101	99	1459
Ischaemia	9	99	46	54	100	75	104	46	57	68	95	102	93	91	68	1107
All	260	409	346	364	400	390	388	345	258	357	427	446	398	392	360	5540
By gender																
Women (%)	21.5	26.4	24.9	18.7	20.0	17.2	35.8	20.6	22.5	26.3	30.0	25.6	21.4	20.2	22.8	23.7
By age																
Median age	61.0	59.7	62.4	58.8	62.1	61.1	58.4	59.6	61.6	58.6	59.7	61.5	61.6	64.7	61.8	60.8
Age ≥60 yrs (%)	54.2	49.1	58.1	45.6	61.8	54.4	43.8	49.0	57.8	42.6	49.2	56.7	53.3	67.4	57.8	53.3
Men	51.5	43.8	55.8	43.6	59.7	52.6	41.4	47.1	56.0	40.7	47.2	51.5	49.2	66.1	58.3	51.1
Women	64.3	63.9	65.1	54.4	70.0	62.7	48.2	56.3	63.8	47.9	53.9	71.9	68.2	72.2	56.1	60.6

centre and individual and sent to the Co-ordinating centre (Cardiovascular Medicine, National Heart and Lung Institute, University of London), where they were stored under the provisions of the United Kingdom Data Protection Act.

Statistical analyses

In order to compare prevalences of risk factors between countries, it was calculated that a sample of 400 interviewed patients per country was sufficient to detect differences between groups of at least 10% with 80% power at the 5% significance level. Comparison of risk factor prevalences and use of medication between several groups was done according to the chi-square test. Adjustment for centre, diagnostic category, age and gender in a multivariate framework was done using logistic regression analyses. All statistical analyses were undertaken using SAS statistical software (version 6.12) in the Department of Public Health, Ghent University, Belgium.

Results

A total of 8181 medical records were reviewed and 5556 patients interviewed (median time 1.4 years after hospital discharge). The adjusted participation rate, after allowing for deaths and losses to follow-up, was 75.6%. Sixteen patients were additionally excluded for the present study because of incomplete information. The size of the study population and the distribution of age, gender and diagnostic category distribution by centre at interview are presented in Table 1. The number of patients varied between 258 in Italy and 446 in Slovenia. The distribution of diagnostic categories in the whole study population was: CABG 25.6%, PTCA 28.1%, AMI 26.3%, and Ischaemia 20%. 23.7% were women, the

highest proportion in Hungary, 35.8%, and the lowest in Greece, 17.2%. The median age of the whole study population was 60.8 years. 53.3% of patients were ≥60 years and the proportion of women for this age group was higher, 60.6% compared to men, 51.1%.

Table 2a shows the proportions of patients who reported participation in CRP, stratified by centre, diagnostic category and gender. Overall, 35.2% of the whole study population participated in some form of cardiac rehabilitation, with wide variations between centres and diagnostic categories, ranging from 1.0% in Spain to 60.8% in Slovenia, and from 10.7% in the Ischaemia group to 44.4% in the CABG group. 83.3% of patients reported full attendance, 7.3% attended more than half the sessions, and 9.4% attended less than half the sessions.

The proportions of patients who reported being advised to follow a cardiac rehabilitation programme (CRP) by centre, diagnostic category, gender and age at index event is presented in Table 2b. Less than half of the patients, 43.0%, were advised to attend a CRP, with wide variations between centres ranging from 2.5% in Spain to 70.8% in Slovenia. There were significant differences by diagnostic category, gender, age, smoking and obesity status, as well as the presence of hyperlipidaemia. By diagnostic category, the proportion of patients advised to participate in a CRP was the highest in the CABG group, 66.9%, followed by AMI, 49.0%, PTCA, 34.5%, and Ischaemia, 16.4%. The proportion of men was significantly higher, 45.7% as compared to women, 34.4%. By age at index event, 44.6% of patients <60 years and 41.2% of those ≥60 years were advised to follow a CRP. Some minor differences were found regarding proportions of patients advised to participate in a CRP on the basis of their risk factor status, as recorded in their discharge documents. Smokers received significantly more advice compared to non-smokers. The advice was given more frequently

Table 2a

Proportion of patients who attended the cardiac rehabilitation program, from the whole study population, by centre, diagnostic category and gender [% (n)]

	Cardiac rehabilitation attended ^a	
	No	Yes
By centre		
BEL/GHE	55.8 (145)	44.2 (115)
CZE/PP	50.1 (205)	49.9 (204)
FIN/KUO	87.3 (302)	12.7 (44)
FRA/LLRT	68.7 (250)	31.3 (114)
GER/MÜNS	43.0 (172)	57.0 (228)
GRE/ATCI	88.0 (343)	12.1 (47)
HUN/BUD	66.8 (259)	33.2 (129)
IRE/DUB	53.3 (184)	46.7 (161)
ITA/TV	83.0 (214)	17.0 (44)
NET/ROT	46.5 (166)	53.5 (191)
POL/CRA	66.5 (284)	33.5 (143)
SLO/LJU	31.8 (142)	68.2 (304)
SPA/BAR	97.5 (388)	2.5 (10)
SWE/MAL	65.8 (258)	34.2 (134)
UK/HL	77.5 (279)	22.5 (81)
By diagnostic category		
CABG	44.8 (636)	55.2 (782)
PTCA	72.8 (1133)	27.2 (423)
AMI	58.9 (860)	41.1 (599)
Ischaemia	86.9 (962)	13.1 (145)
By gender		
Men	62.6 (2645)	37.4 (1580)
Women	71.9 (946)	28.1 (231)
Total	64.8 (3591)	35.2 (1949)

^a One or more of the sessions.

to patients with hyperlipidaemia, 45.0% compared to normolipidaemics 41.5%. No significant differences were found on the basis of diabetes and hypertension status.

81.8% of the patients advised to participate in a CRP (Table 2b) did so either in part or fully. The minimum CRP participation rate was in Sweden with 51.3%. No significant differences in CRP participation rate were related to diagnostic category, gender, age at index event and risk factors recorded in the discharge documents.

Tables 3a and 3b present a comparison between patients who participated, either fully or partially, in CRP and those who did not (combining patients who were not advised to take part with those patients who were advised to do so but did not participate). The prevalence of risk factors according to participation in a CRP is presented in Table 3a. After adjustment for centre, diagnostic category, gender and age, the proportions of patients who were smoking, obese, or who had raised blood pressure, or elevated total cholesterol were significantly lower for patients participating in CRP than for those not attending any CRP. No significant difference

Table 2b

Proportion of patients advised to follow a cardiac rehabilitation program and of those advised, proportion attended [(%) n]

	Cardiac rehabilitation program	
	% Advised	Of those advised, % attended ^a
By centre		
BEL/GHE	62.7 (163/260)	70.6 (115/163)
CZE/PP	55.5 (227/409)	89.9 (204/227)
FIN/KUO	17.0 (59/346)	74.6 (44/59)
FRA/LLRT	37.4 (136/364)	83.8 (114/136)
GER/MÜNS	59.2 (237/400)	96.2 (228/237)
GRE/ATCI	19.7 (77/390)	61.0 (47/77)
HUN/BUD	44.1 (171/388)	75.4 (129/171)
IRE/DUB	54.2 (187/345)	86.1 (161/187)
ITA/TV	17.4 (45/258)	97.8 (44/45)
NET/ROT	60.5 (216/357)	88.4 (191/216)
POL/CRA	35.4 (151/427)	94.7 (143/151)
SLO/LJU	70.8 (316/446)	96.2 (304/316)
SPA/BAR	2.5 (10/398)	100.0 (10/10)
SWE/MAL	66.6 (261/392)	51.3 (134/261)
UK/HL	35.0 (126/360)	64.3 (81/126)
By diagnosis		
CABG	66.9 (949/1418)	82.4 (782/949)
PTCA	34.5 (537/1556)	78.8 (423/537)
AMI	49.0 (715/1459)	83.8 (599/715)
Ischaemia	16.4 (181/1107)	80.1 (145/181)
By gender		
Men	45.7 (1930/4225)	81.9 (1580/1930)
Women	34.4 (452/1315)	81.6 (369/452)
By age		
<60 years	44.6 (1317/2955)	83.4 (1099/1317)
≥60 years	41.2 (1065/2585)	79.8 (850/1065)
Total	43.0 (2382/5540)	81.8 (1949/2382)

^a One or more of the sessions.

was found with regard to reported diabetes. Table 3b illustrates the differences in the proportions of patients on prophylactic drug therapies. Overall, the proportions of patients on antiplatelet medication, beta-blockers and lipid-lowering drugs were significantly higher in the CRP group.

The therapeutic control of blood pressure and serum cholesterol is presented in Tables 4a and 4b. Overall, 51.2% of patients who reported participating in a CRP achieved the blood pressure goal compared to 48.6% who did not. Among those treated for blood pressure the proportions achieving goals were 50.9% for CRP and 47.9% for no CRP after adjustment for centre, diagnostic category, gender and age. The proportion of patients reaching the cholesterol goal was considerably higher in the CRP group, 45.0% compared to 39.8% in the no-CRP group. Among those on lipid-lowering medication, the proportion of patients reaching cholesterol goal was also

Table 3a
Prevalence of risk factors according to participation in a cardiac rehabilitation program [% (n)]

	Current smoking ^a		Obesity ^b		Diabetes ^c		Raised BP ^d		Raised cholesterol ^e	
	No Cr	CR	No Cr	CR	No Cr	CR	No Cr	CR	No Cr	CR
By centre										
BEL/GHE	23.4 (34/145)	21.7 (25/115)	30.3 (44/145)	23.5 (27/115)	17.2 (25/145)	10.4 (12/115)	46.2 (67/145)	41.7 (48/115)	81.4 (105/129)	70.6 (72/102)
CZE/PP	20.0 (41/205)	18.6 (38/204)	43.4 (89/205)	36.8 (75/204)	21.5 (44/205)	21.6 (44/204)	46.3 (95/205)	37.2 (76/204)	76.7 (155/202)	68.2 (137/201)
FIN/KUO	22.5 (68/302)	15.9 (7/44)	34.1 (103/302)	31.8 (14/44)	19.5 (59/302)	13.6 (6/44)	51.7 (156/302)	36.4 (16/44)	44.2 (132/299)	29.6 (13/44)
FRA/LLRT	26.4 (66/250)	19.3 (22/114)	38.6 (95/246)	35.1 (40/114)	30.0 (75/250)	21.9 (25/114)	54.8 (137/250)	54.4 (62/114)	59.7 (148/248)	62.0 (70/113)
GER/MÜNS	18.6 (32/172)	15.4 (35/228)	32.6 (56/172)	29.1 (66/227)	11.0 (19/172)	15.4 (35/228)	72.7 (125/172)	55.7 (127/228)	73.8 (121/164)	60.8 (135/222)
GRE/ATCI	23.9 (82/343)	34.0 (16/47)	28.0 (96/343)	27.7 (13/47)	19.5 (67/343)	34.0 (16/47)	48.0 (164/342)	46.8 (22/47)	66.7 (216/324)	47.6 (20/42)
HUN/BUD	27.4 (71/259)	34.9 (45/129)	38.2 (99/259)	34.1 (44/129)	18.9 (49/259)	24.8 (32/129)	39.4 (102/259)	33.3 (43/129)	61.7 (145/235)	57.8 (70/121)
IRE/DUB	33.2 (61/184)	18.6 (30/161)	33.2 (61/184)	19.2 (31/161)	10.9 (20/184)	6.2 (10/161)	52.7 (97/184)	41.6 (67/161)	61.9 (112/181)	44.3 (70/158)
ITA/TV	17.8 (38/214)	2.3 (1/44)	25.7 (55/214)	13.6 (6/44)	19.7 (42/213)	31.8 (14/44)	49.5 (106/214)	47.7 (21/44)	59.7 (80/134)	45.4 (15/33)
NET/ROT	28.9 (48/166)	27.8 (53/191)	32.5 (53/163)	23.6 (45/191)	17.5 (29/166)	9.4 (18/191)	57.9 (95/164)	47.1 (90/191)	50.9 (82/161)	38.5 (72/187)
POL/CRA	21.1 (60/284)	11.2 (16/143)	25.0 (71/284)	31.5 (45/143)	13.0 (37/284)	19.6 (28/143)	46.1 (131/284)	50.4 (72/143)	65.5 (173/264)	61.6 (82/133)
SLO/LJU	12.0 (17/142)	15.8 (48/304)	32.4 (46/142)	26.0 (79/304)	23.9 (34/142)	23.7 (72/304)	68.3 (97/142)	58.9 (179/304)	77.1 (101/131)	64.0 (171/267)
SPA/BAR	17.8 (69/388)	10.0 (1/10)	34.6 (133/384)	22.2 (2/9)	35.8 (139/388)	0.0 (0/10)	43.2 (166/384)	33.3 (3/9)	53.2 (202/380)	60.0 (6/10)
SWE/MAL	23.6 (61/258)	14.9 (20/134)	28.3 (73/258)	24.6 (33/134)	12.8 (33/258)	16.4 (22/134)	61.6 (159/258)	61.2 (82/134)	43.6 (112/257)	34.3 (46/134)
UK/HL	20.4 (57/279)	8.6 (7/81)	39.0 (108/277)	36.2 (29/80)	24.0 (67/279)	11.1 (9/81)	52.4 (145/277)	53.8 (43/80)	55.3 (146/264)	46.0 (34/74)
By diagnosis										
CABG	18.2 (116/636)	14.6 (114/782)	31.0 (197/635)	28.5 (222/780)	26.6 (169/636)	21.0 (164/782)	54.8 (348/635)	53.5 (418/781)	56.1 (345/615)	56.6 (416/735)
PTCA	22.4 (254/1133)	22.9 (97/423)	31.8 (359/1130)	24.2 (102/422)	17.3 (196/1133)	14.7 (62/423)	48.2 (545/1130)	41.7 (176/422)	56.9 (591/1039)	53.7 (217/404)
AMI	28.3 (243/860)	21.7 (130/599)	31.4 (269/856)	28.9 (173/599)	21.5 (185/859)	15.0 (90/599)	46.1 (396/859)	47.2 (283/599)	59.1 (482/815)	52.6 (298/566)
Ischaemia	20.0 (192/962)	15.9 (23/145)	37.3 (357/957)	35.9 (52/145)	19.6 (189/962)	18.6 (27/145)	57.7 (553/958)	51.0 (74/145)	67.7 (612/904)	60.3 (82/136)
By gender										
Men	24.5 (649/2645)	18.3 (289/1580)	30.2 (798/2638)	27.2 (429/1577)	18.8 (498/2644)	16.6 (263/1580)	49.4 (1304/2641)	47.9 (756/1578)	57.2 (1426/2495)	52.9 (791/1495)
Women	16.5 (156/946)	20.3 (75/369)	40.8 (384/940)	32.5 (120/369)	25.5 (241/946)	21.7 (80/369)	57.2 (538/941)	52.8 (195/369)	68.8 (604/878)	64.2 (222/346)
Total	22.4 (805/3591)	18.7 (364/1949)	33.0 (1182/3578)	28.2 (549/1946)	20.6 (739/3590)	17.6 (343/1949)	51.4 (1842/3582)	48.8 (951/1947)	60.2 (2030/3373)	55.0 (1013/1841)
Significance^f	P < 0.001		P = 0.02		P = 0.20		P = 0.001		P < 0.001	

^a Self-reported and/or CO in breath >10 ppm. ^b BMI ≥ 30 kg/m². ^c Self-reported. ^d SBP/DBP ≥ 140/90 mmHg. ^e Total cholesterol ≥ 5 mmol/l.

^f Significance of differences in prevalences between 'CR' and 'No CR' groups adjusted for centre, diagnostic category, gender and age.

Table 3b
Proportion of patients on prophylactic drug therapies according to participation in a cardiac rehabilitation program [% (n)]

	Anti-platelets		Beta-blockers		ACE inhibitors		Lipid-lowering		Anti-coagulants	
	No Cr	CR	No Cr	CR	No Cr	CR	No Cr	CR	No Cr	CR
By centre										
BEL/GHE	86.9 (126/145)	93.0 (107/115)	70.3 (102/145)	85.2 (98/115)	24.8 (36/145)	35.6 (41/115)	44.8 (65/145)	53.9 (62/115)	2.8 (4/145)	3.5 (4/115)
CZE/PP	82.9 (170/205)	92.2 (188/204)	69.8 (143/205)	77.4 (158/204)	49.8 (102/205)	44.1 (90/204)	51.2 (105/205)	63.2 (129/204)	2.9 (6/205)	4.4 (9/204)
FIN/KUO	79.8 (241/302)	97.7 (43/44)	86.4 (261/302)	100 (44/44)	25.5 (77/302)	15.9 (7/44)	60.9 (184/302)	88.6 (39/44)	11.9 (36/302)	2.3 (1/44)
FRA/LLRT	81.2 (203/250)	95.6 (109/114)	55.6 (139/250)	71.0 (81/114)	38.4 (96/250)	38.6 (44/114)	64.4 (161/250)	76.3 (87/114)	4.4 (11/250)	0.9 (1/114)
GER/MÜNS	82.6 (142/172)	89.0 (203/228)	63.4 (109/172)	71.5 (163/228)	33.7 (58/172)	52.6 (120/228)	61.0 (105/172)	72.8 (166/228)	5.8 (10/172)	4.4 (10/228)
GRE/ATCI	90.7 (311/343)	100 (47/47)	52.8 (181/343)	72.3 (34/47)	32.9 (113/343)	25.5 (12/47)	45.2 (155/343)	55.3 (26/47)	4.4 (15/343)	0.0 (0/47)
HUN/BUD	69.5 (180/259)	86.8 (112/129)	81.8 (212/259)	89.9 (116/129)	56.0 (145/259)	58.1 (75/129)	44.0 (114/259)	65.9 (85/129)	10.0 (26/259)	12.4 (16/129)
IRE/DUB	88.6 (163/184)	96.9 (156/161)	43.5 (80/184)	51.6 (83/161)	25.0 (46/184)	28.6 (46/161)	53.8 (99/184)	70.2 (113/161)	7.6 (14/184)	0.0 (0/161)
ITA/TV	91.1 (195/214)	93.2 (41/44)	63.1 (135/214)	52.3 (23/44)	52.3 (112/214)	50.0 (22/44)	58.4 (125/214)	65.9 (29/44)	0.5 (1/214)	4.6 (2/44)
NET/ROT	75.3 (125/166)	85.9 (164/191)	40.4 (67/166)	55.0 (105/191)	33.7 (56/166)	41.9 (80/191)	66.3 (110/166)	84.8 (162/191)	15.7 (26/166)	16.2 (31/191)
POL/CRA	85.9 (244/284)	89.5 (128/143)	61.6 (175/284)	61.5 (88/143)	48.9 (139/284)	45.4 (65/143)	43.0 (122/284)	39.9 (57/143)	7.0 (20/284)	4.9 (7/143)
SLO/LJU	79.6 (113/142)	83.6 (254/304)	66.9 (95/142)	65.1 (198/304)	55.6 (79/142)	61.2 (186/304)	45.1 (64/142)	64.5 (196/304)	4.9 (7/142)	10.9 (33/304)
SPA/BAR	85.8 (333/388)	100 (10/10)	46.4 (180/388)	80.0 (8/10)	22.2 (86/388)	10.0 (1/10)	65.2 (253/388)	60.0 (6/10)	5.9 (23/388)	0.0 (0/10)
SWE/MAL	91.9 (237/258)	92.5 (124/134)	62.0 (160/258)	66.4 (89/134)	16.7 (43/258)	23.1 (31/134)	74.0 (191/258)	81.3 (109/134)	7.0 (18/258)	11.9 (16/134)
UK/HL	81.6 (227/278)	80.2 (65/81)	41.7 (116/278)	51.8 (42/81)	27.3 (76/278)	28.4 (23/81)	69.1 (192/278)	70.4 (57/81)	4.0 (11/278)	4.9 (4/81)
By diagnosis										
CABG	86.8 (552/636)	89.1 (697/782)	56.4 (359/636)	62.0 (485/782)	36.2 (230/636)	39.3 (307/782)	63.2 (402/636)	66.4 (519/782)	8.5 (54/636)	7.3 (57/782)
PTCA	91.4 (1035/1132)	94.1 (398/423)	64.9 (735/1132)	72.8 (308/423)	33.3 (377/1132)	43.7 (185/423)	67.0 (758/1132)	72.1 (305/423)	5.0 (56/1132)	4.5 (19/423)
AMI	84.6 (728/860)	89.3 (535/599)	65.2 (561/860)	73.0 (437/599)	41.9 (360/860)	49.9 (299/599)	54.5 (469/860)	68.8 (412/599)	8.3 (71/860)	8.5 (51/599)
Ischaemia	72.2 (695/962)	83.4 (121/145)	52.0 (500/962)	69.0 (100/145)	30.9 (297/962)	35.9 (52/145)	43.2 (416/962)	60.0 (87/145)	4.9 (47/962)	4.8 (7/145)
By gender										
Men	86.0 (2273/2644)	90.4 (1429/1580)	59.8 (1581/2644)	67.5 (1067/1580)	34.5 (911/2644)	43.4 (685/1580)	58.1 (1536/2644)	67.5 (1066/1580)	6.2 (165/2644)	6.7 (106/1580)
Women	77.9 (737/946)	87.3 (322/369)	60.7 (574/946)	71.3 (263/369)	37.3 (353/946)	42.8 (158/369)	53.8 (509/946)	69.6 (257/369)	6.7 (63/946)	7.6 (28/369)
Total	83.8 (3010/3590)	89.8 (1751/1949)	60.0 (2155/3590)	68.2 (1330/1949)	35.2 (1264/3590)	43.2 (843/1949)	57.0 (2045/3590)	67.9 (1323/1949)	6.4 (228/3590)	6.9 (134/1949)
Significance^a	P < 0.001		P < 0.001		P = 0.68		P < 0.001		P = 0.15	

^a Significance of differences in prevalences between 'CR' and 'No CR' groups adjusted for centre, diagnostic category, gender and age.

Table 4a

Therapeutic control of blood pressure at interview according to participation in a cardiac rehabilitation program (CRP), by centre, diagnostic category and gender^a

	No BP lowering medication				BP lowering medication				All patients			
	No CRP		CRP		No CRP		CRP		No CRP		CRP	
	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)
By centre												
BEL/GHE	19	73.7	12	41.7	126	50.8	103	60.2	145	53.8	115	58.3
CZE/PP	22	68.2	18	61.1	183	51.9	186	62.9	205	53.7	204	62.8
FIN/KUO	23	60.9	0	-	279	47.3	44	63.6	302	48.3	44	63.6
FRA/LLRT	21	66.7	13	53.8	229	43.2	101	44.5	250	45.2	114	45.6
GER/MÜNS	24	25.0	22	59.1	148	27.7	206	42.7	172	27.3	228	44.3
GRE/ATCI	53	49.1	4	75.0	289	52.6	43	51.2	342	52.0	47	53.2
HUN/BUD	9	33.3	2	100	250	61.6	127	66.1	259	60.6	129	66.7
IRE/DUB	45	55.6	42	61.9	139	44.6	119	57.1	184	47.3	161	58.4
ITA/TV	13	53.8	2	50.0	201	50.2	42	52.4	214	50.5	44	52.3
NET/ROT	42	50.0	37	40.5	122	39.3	154	55.8	164	42.1	191	52.9
POL/CRA	27	55.6	20	55.0	257	53.7	123	48.8	284	53.9	143	49.6
SLO/LJU	12	33.3	19	47.4	130	31.5	285	40.7	142	31.7	304	41.1
SPA/BAR	58	67.2	1	100	326	54.9	8	62.5	384	56.8	9	66.7
SWE/MAL	51	52.9	23	43.5	207	34.8	111	37.8	258	38.4	134	38.8
UK/HL	67	38.8	20	50.0	209	50.2	60	45.0	277	47.6	80	46.2
By diagnostic category												
CABG	112	40.2	125	46.4	523	46.3	656	46.5	635	45.2	781	46.5
PTCA	129	57.4	42	61.9	1000	51.0	380	57.9	1130	51.8	422	58.3
AMI	89	67.4	47	61.7	770	52.3	552	52.0	859	53.9	599	52.8
Ischaemia	156	49.4	21	52.4	802	40.9	124	48.4	958	42.3	145	49.0
By gender												
Men	392	52.8	208	50.0	2248	50.2	1370	52.4	2641	50.6	1578	52.1
Women	94	52.1	27	74.1	847	41.8	342	45.0	941	42.8	369	47.2
Total	486	52.7	235	52.8	3095	47.9	1712	50.9	3582	48.6	1947	51.2
Significance^b	<i>P</i> = 0.37				<i>P</i> = 0.002				<i>P</i> = 0.001			

^a Goal for blood pressure: systolic blood pressure (BP) <140 and diastolic BP <90 mmHg.^b Significance of differences in % reaching goal between 'CR' and 'No CR' groups adjusted for centre, diagnostic category, gender and age.

significantly higher in the CRP group, 52.2% compared to 49.6% in the no-CRP group.

Discussion

The scientific evidence for lifestyle and risk factor intervention in coronary patients, which includes the use of prophylactic drug therapies, is compelling⁸. Yet, the principal results of EUROASPIRE II demonstrated a high prevalence of adverse lifestyle characteristics, other risk factors and under-use of prophylactic drug therapies in patients with CHD⁶. So there is a clinical need for a comprehensive multifactorial approach to CVD prevention and rehabilitation. Although cardiac rehabilitation has traditionally focused on exercise rehabilitation, these services are evolving to offer a more

comprehensive approach to all aspects of lifestyle and risk factor management. The most recent meta-analysis of 8940 patients from 48 trials of cardiac rehabilitation showed that a structured service, compared to usual care, was associated with a reduction in all-cause mortality: odds ratio 0.80 (95% CI: 0.68-0.93), and cardiac mortality 0.74 (0.61-0.96)⁹. This effect on total mortality was independent of CHD diagnosis (myocardial infarction, post revascularisation or angina) or type of cardiac rehabilitation.

However, despite the strength of this evidence our analysis of the EUROASPIRE II study shows that most coronary patients reported they had received no advice to follow a cardiac rehabilitation programme. Yet, of those who were advised to join such a programme most did so. So the attitude of the physician is an

Table 4b
Therapeutic control of cholesterol at interview according to participation in a cardiac rehabilitation program (CRP), by centre, diagnostic category and gender^a

	No lipid-lowering medication				Lipid-lowering medication				All patients			
	No CRP		CRP		No CRP		CRP		No CRP		CRP	
	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)	<i>n</i>	Reaching goal (%)
By centre												
BEL/GHE	74	8.1	48	10.4	55	32.7	54	46.3	129	18.6	102	29.4
CZE/PP	97	19.6	75	26.7	105	26.7	126	34.9	202	23.3	201	31.8
FIN/KUO	118	35.6	5	20.0	181	69.1	39	76.9	299	55.8	44	70.4
FRA/LLRT	87	29.9	26	30.8	161	46.0	87	40.2	248	40.3	113	38.0
GER/MÜNS	64	6.2	59	30.5	100	39.0	163	42.3	164	26.2	222	39.2
GRE/ATCI	182	29.1	18	38.9	142	38.7	24	62.5	324	33.3	42	52.4
HUN/BUD	130	33.1	39	20.5	105	44.8	82	52.4	235	38.3	121	42.2
IRE/DUB	83	28.9	47	38.3	98	45.9	111	63.1	181	38.1	158	55.7
ITA/TV	55	32.7	9	44.4	79	45.6	24	58.3	134	40.3	33	54.6
NET/ROT	56	21.4	27	29.6	105	63.8	160	66.9	161	49.1	187	61.5
POL/CRA	153	24.2	81	32.1	111	48.6	52	48.1	264	34.5	133	38.4
SLO/LJU	72	13.9	99	23.2	59	33.9	168	43.4	131	22.9	267	36.0
SPA/BAR	134	38.1	4	50.0	246	51.6	6	33.3	380	46.8	10	40.0
SWE/MAL	67	37.3	25	60.0	190	63.2	109	67.0	257	56.4	134	65.7
UK/HL	80	26.2	23	43.5	183	53.0	51	58.8	264	44.7	74	54.0
By diagnostic category												
CABG	228	28.5	245	28.6	387	53.0	490	50.8	615	43.9	735	43.4
PTCA	340	26.8	112	38.4	698	51.2	292	49.3	1039	43.1	404	46.3
AMI	367	29.2	173	26.6	448	50.4	393	56.5	815	40.9	566	47.4
Ischaemia	517	24.8	55	25.4	387	42.4	81	49.4	904	32.3	136	39.7
By gender												
Men	1045	29.0	482	31.3	1449	52.9	1013	54.6	2495	42.8	1495	47.1
Women	407	21.6	103	21.4	471	39.5	243	42.0	878	31.2	346	35.8
Total	1452	26.9	585	29.6	1920	49.6	1256	52.2	3373	39.8	1841	45.0
Significance^b	<i>P</i> = 0.004				<i>P</i> = 0.01				<i>P</i> < 0.001			

^a Goal for cholesterol: serum total cholesterol (TC) <5.0mmol/l.

^b Significance of differences in % reaching goal between 'CR' and 'No CR' groups adjusted for centre, diagnostic category, gender and age.

important determinant of whether a patient participates or not. If a physician does not recommend cardiac rehabilitation then the patient is most unlikely to join such a programme. There is considerable variation in reported participation between European countries. Most patients in Slovenia reported attendance at a cardiac rehabilitation programme compared to virtually no patients in Spain. These large differences are likely to reflect the heterogeneity of health-care systems in the participating countries and the traditions and availability of cardiac rehabilitation services. Overall most patients in this survey were not given the choice of a cardiac rehabilitation programme and as a consequence less than a third of all patients participated.

The patients' diagnosis and management were also related to reported advice on whether or not to follow a

cardiac rehabilitation programme. Those who had had coronary artery surgery were almost twice as likely to be recommended for cardiac rehabilitation than those revascularised by angioplasty. Similarly, patients with an acute myocardial infarction were three times more likely to be recommended for rehabilitation than those with myocardial ischaemia. Yet, the need for lifestyle intervention and control of risk factors, such as blood pressure and lipids, is just as great for those revascularised by PTCA or presenting with angina. Indeed the potential gain from cardiac rehabilitation for angina patients, who have not yet had a myocardial infarction, may be greater than for any other diagnostic group. Advice to follow a cardiac rehabilitation programme is also influenced by other factors. Male patients, younger (<60 years) patients, smokers, the obese and

hyperlipidaemic were all more likely to be advised to follow a CRP. So conversely, females and older patients were less likely to be advised CRP despite similar evidence of benefit from such programmes. Similar observations were made about cardiac rehabilitation in the Minnesota Heart Survey which enrolled 3841 patients admitted on suspicion of AMI to the coronary care units at six hospitals. Patients were contacted 1 year after their hospitalisation and asked if they had participated in a CRP since discharge. 47% of those with AMI compared to only 21% of those with angina had attended cardiac rehabilitation. The use of CRP was lower among women, older individuals, those with less education, and the unemployed. The strongest predictors of CRP utilisation were younger age and revascularisation procedures¹⁰.

A modern cardiovascular prevention and rehabilitation programme provides a comprehensive lifestyle intervention in relation to stopping smoking, making healthy food choices and becoming physically active. In addition it addresses the management of other risk factors such as blood pressure, lipids and glucose. Finally, it ensures appropriate prescribing and compliance with cardioprotective drug therapies^{8,11}. In this survey those patients who reported attending a cardiac rehabilitation programme had a lower prevalence of smoking and were less obese. More patients had achieved the blood pressure goal of <140/90 mmHg and the total cholesterol goal of <5.0 mmol/l recommended at that time. These results are all consistent with the meta-analysis which also found lower rates of self reported smoking; OR 0.64 (95% CI: 0.50-0.83); greater reductions in systolic blood pressure: weighted mean difference -3.2 mmHg (-5.4 to -0.9); and total cholesterol: weighted mean difference -0.37 mmol/l (-0.63 to -0.11) consistent with the adoption of a healthy lifestyle overall and the use of drug therapies⁹. For those on blood-pressure or lipid-lowering medication, therapeutic control was better in this survey in those participating in cardiac rehabilitation. Interestingly, for those not on lipid-lowering medication the proportion reaching goal was still higher in the CRP group compared to those not attending CRP which suggests an additional benefit from such programmes in terms of the overall effect of lifestyle intervention. All these differences cannot necessarily be attributed to CRP, because those who were advised to follow CRP, and chose to participate, are likely to be different from those patients who did not attend. However, the directions of these differences are all consistent with the most recent meta-analysis of cardiac rehabilitation which shows improved cardiovascular outcomes⁹.

Although these results are encouraging there is still considerable potential for cardiovascular prevention and rehabilitation programmes to further reduce the risk of cardiovascular disease. Among those patients who reported participating in a CRP programme almost one in five were still smoking cigarettes, over a quarter were obese, almost half had not achieved the blood pressure goal and over half had not achieved the cholesterol goal. The prevalence of reported diabetes was similar for those in CRP compared to those who

had no rehabilitation, suggesting that such programmes do not investigate for diabetes in their coronary patients. 19.5% of patients with fasting plasma glucose measurement had known diabetes. In addition, 8.5% had undiagnosed diabetes, raising the total prevalence of diabetes to 28.0%, and 18.9% of patients had impaired fasting glycaemia. So, 46.9% of all coronary patients had impaired fasting glycaemia or diabetes¹². If an oral glucose tolerance test had been performed the prevalence of impaired glucose regulation, including frank diabetes, would be even higher. The lifestyle and therapeutic opportunities to further reduce the risk of CVD in existing rehabilitation programmes are considerable. For the majority of patients who were not advised to follow CRP the opportunities and challenges for cardiovascular prevention and rehabilitation are even greater. All coronary patients should have the opportunity to access a fully comprehensive multi-disciplinary cardiovascular prevention and rehabilitation programme. And these programmes should address all aspects of lifestyle, control of all other risk factors and appropriate use of cardioprotective drug therapies.

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