

Original Scientific Paper

## Cardiac rehabilitation in Europe: results from the European Cardiac Rehabilitation Inventory Survey

Birna Bjarnason-Wehrens<sup>a</sup>, Hannah McGee<sup>b</sup>, Ann-Dorthe Zwisler<sup>c</sup>, Massimo F. Piepoli<sup>d</sup>, Werner Benzer<sup>e</sup>, Jean-Paul Schmid<sup>f</sup>, Paul Dendale<sup>g</sup>, Nana-Goar V. Pogosova<sup>h</sup>, Dumitru Zdrengea<sup>i</sup>, Josef Niebauer<sup>j</sup> and Miguel Mendes<sup>k</sup> on behalf of the Cardiac Rehabilitation Section European Association of Cardiovascular Prevention and Rehabilitation

<sup>a</sup>Institute for Cardiology and Sports Medicine, German Sport University Cologne, Germany, <sup>b</sup>Royal College of Surgeons, Dublin, Ireland, <sup>c</sup>Department of Cardiology, Rigshospitalet, Copenhagen, Denmark, <sup>d</sup>Heart Failure Unit, Department of Cardiology, G. da Saliceto Polichirurgico Hospital, Piacenza, Italy, <sup>e</sup>Landeskrankenhaus, Department of Interventional Cardiology, Feldkirch, Austria, <sup>f</sup>Swiss Cardiovascular Centre Bern, Cardiovascular Prevention & Rehabilitation, University Hospital, Bern, Switzerland, <sup>g</sup>Hartcentrum Hasselt and University of Hasselt, Belgium, <sup>h</sup>National Research Center for Preventive Medicine, Moscow, Russia, <sup>i</sup>University of Medicine and Pharmacy, Cluj-Napoca, Romania, <sup>j</sup>University Institute of Sports Medicine, Prevention and Rehabilitation, Paracelsus Private Medical University Salzburg, Austria and <sup>k</sup>Instituto Do Coração, Carnaxide, Portugal

Received 26 August 2009 Accepted 4 November 2009

**Background** Cardiac rehabilitation (CR) programmes support patients to achieve professionally recommended cardiovascular prevention targets and thus good clinical status and improved quality of life and prognosis. Information on CR service delivery in Europe is sketchy.

**Design** Postal survey of national CR-related organizations in European countries.

**Methods** The European Cardiac Rehabilitation Inventory Survey assessed topics including national guidelines, legislation and funding mechanisms, phases of CR provided and characteristic of included patients.

**Results** Responses were available for 28 of 39 (72%) countries; 61% had national CR associations; 57% national professional guidelines. Most countries (86%) had phase I (acute inpatient) CR, but with differing service availability. Only 29% reported provision to more than 80% patients. Phase II was also available, but 15 countries reported provision levels below 30%. Almost half (46%) had national legislation regarding phase II CR; three-quarters had government funding. Phase III was less supported: although available in most countries, 11 could not provide estimates of numbers participating. Thirteen reported that all costs were met by patients.

**Conclusion** Fewer than half of eligible cardiovascular patients benefit from CR in most European countries. Deficits include absent or inadequate legislation, funding, professional guidelines and information systems in many countries. Priorities for improvement include promoting national laws and guidelines specific for CR and increasing both CR programme participation rates and CR infrastructure. The European Association of Cardiovascular Prevention and Rehabilitation can have an important coordinating role in sharing expertise among national CR-related agencies. Ultimately, such cooperation can accelerate CR delivery to the benefit of cardiac patients across Europe. *Eur J Cardiovasc Prev Rehabil* 17:410–418 © 2010 The European Society of Cardiology

European Journal of Cardiovascular Prevention and Rehabilitation 2010, 17:410–418

**Keywords:** cardiac rehabilitation, cardiovascular disease, Europe, inpatient rehabilitation, outpatient rehabilitation

Correspondence to Dr Birna Bjarnason-Wehrens, Institute for Cardiology and Sports Medicine, German Sport University Cologne, Am Sportpark Müngersdorf 6, Cologne 50933, Germany

Tel: +49 221 49825020; fax: +49 221 4912906;

e-mail: bjarnason@dshs-koeln.de

Preliminary results were presented at the Annual Congress of the European Association of Cardiovascular Prevention and Rehabilitation, EuroPrevent, Paris, May 2007.

### Introduction

Cardiovascular disease (CVD) is the leading cause of death in Europe, responsible for 4.3 million deaths in 2008, that is, 48% of all deaths yearly. It is also responsible for almost a quarter (23%) of the disease burden in Europe, resulting in substantial direct cost

in terms of healthcare, as well as indirect costs on account of productivity losses [1]. The enormous development and resulting investment in high-technology diagnostic and therapeutic procedures for CVDs in recent decades ensures increased survival. Age-adjusted mortality rates have also decreased substantially in many European countries, that is, people are living longer with heart disease. The challenge is to optimize the disability-free survival including active participation in social and economic life for patients after cardiovascular events or interventions. As cardiovascular conditions are chronic and often reflect long-term patterns of unhealthy lifestyles and/or deconditioning of patients, benefit is not automatically achieved through high-technology interventions and pharmacological management alone. Patients need in addition to be supported to regain or maintain physical capacity and to achieve changes in lifestyle, well-being, social and vocational participation. Ultimately, patient self-management needs to be promoted if acute interventional approaches are to be enabled to deliver quality as well as length of life. This can be achieved through cardiac rehabilitation (CR) defined by the World Health Organisation (WHO) as the 'sum of activity and interventions required to ensure the best possible physical, mental, and social conditions so that patients with chronic or post-acute CVD may regain their proper place in society and lead an active life' [2]. CR is delivered through a programme of prescribed exercise and interventions designed to modify coronary risk factors with the use of appropriate pharmacological therapy and lifestyle changes. CR is not only indicated for incapacitated disabled patients, but for all patients with a diagnosis of acute myocardial infarction (MI), those who have undergone coronary revascularization [coronary artery bypass graft (CABG), percutaneous coronary interventions (PCI)] or other cardiac surgery (for instance valvular, transplantation, correction of congenital heart diseases), but also those with chronic stable angina, heart failure, peripheral arterial disease and high-risk groups for CVD, such as diabetes and metabolic syndrome [3]. Evidence of the wide-ranging benefits of CR have been established through meta-analysis [4,5] and it is now recommended (class I evidence) by the European Society of Cardiology, American Heart Association and the American College of Cardiology in the treatment of cardiovascular patients [6–9].

CR programmes are provided through well-established models based on residential or ambulatory programmes, differing across Europe according to local and national service frameworks. Available information about how many eligible patients benefit from the provision of CR services in Europe is scarce. Recent results from the EuroAspire study of CVD management more generally show that from 76 hospitals in 22 participating countries, only 45% of patients discharged from hospital after

acute cardiovascular management (AMI and revascularization) had documented evidence of referral for CR and only 34% evidence of participation in CR programmes [ranging from less than 1% (Cyprus, Greece and Spain) to 85% (Lithuania)] [10]. The European Association for Cardiovascular Prevention and Rehabilitation (EACPR), as part of its mission to promote cardiovascular prevention and rehabilitation throughout Europe, is concerned to develop a more complete profile of CR service provision, and overcome barriers to service delivery. As a first step, the EACPR therefore decided to undertake a European survey of the status of CR at national level with the aim of documenting services and service deficits.

## Methods

The study was designed as a postal questionnaire survey of national CR-related organizations in European countries.

## Measures

### **The European Cardiac Rehabilitation Inventory Survey questionnaire**

The questionnaire – the European Cardiac Rehabilitation Inventory Survey – was developed and refined by the committee members of the Cardiac Rehabilitation Section and Board of EACPR. The questionnaire included the following sections:

- (1) General population and cardiac-related service demographics about the participating country (e.g. number of inhabitants, number of hospitals currently receiving acute cardiac patients, number of currently active cardiologists).
- (2) CR-specific questions concerning:
  - (a) Availability/existence of national organization responsible for CR
  - (b) Programmes currently offered
  - (c) Number of eligible patients attending CR
  - (d) Cardiac diagnoses admitted to CR
  - (e) National legislation/laws regarding CR
  - (f) Institutions covering the costs of CR
  - (g) Overall responsibility for the CR programme.

Within the questionnaire, we differentiated between three phases of CR, defined as:

- (1) Phase I, in-hospital programme.
- (2) Phase II, early postdischarge programme. This period is of usually 2–16 weeks after discharge, where structured and closely monitored exercise, psychoeducational activities and lifestyle changes are encouraged intensively.
- (3) Phase III, long-term maintenance programme. This is the continuation period of usually less-intense supervision.

We also asked about the availability of differing locations – inpatient, outpatient or home-supervised CR programmes.

A second part of the questionnaire focused on professional CR education and accreditation. These results will be presented separately.

### Study sample

#### Identification and approach to national coordinators

The first step was the identification of leaders of national organizations and/or working groups concerning CR in European countries. For countries without specific national CR organizations, we used a number of approaches including informal contact by committee members of EACPR and/or by writing to the national societies belonging to the European Society of Cardiology. Thirty-nine countries were contacted.

Initially, we identified 21 national CR coordinators. The questionnaire was sent to the identified national coordinators and to the national societies of cardiology in all other countries, asking them to forward the surveys to the relevant professionals in their countries. The survey was sent through the European Heart House, the coordinating centre of the European Society of Cardiology, in November 2007. The results of the first 19 participating countries were presented at the EuroPrevent Congress in Paris, May 2008. This presentation was used to iden-

tify and motivate coordinators of the missing countries. In November 2008, a reminder letter was sent to the identified contact persons and to national societies, to maximize response rates. Figure 1 gives an overview of the participating countries. A total of 28 European countries completed the questionnaire by May 2009. These countries represent 72% of the European country members of the European Society of Cardiology, including more than 600 million inhabitants (over 80% of the total population of the 39 countries invited to participate). The demographic information provided about participating countries indicates that the survey profile represented approximately 10 000 hospitals currently receiving acute cardiac patients and approximately 45 000 active cardiologists.

### Results

A total of 17 countries (61%) reported as having a national organization or a working group responsible for CR. In eight countries this was a working group within the national society of Cardiology. Two of these focused solely on scientific and/or guideline activities. In three countries, a specialist national organization and a working group of the national society addressed this topic. Eleven countries (39%) reported as having neither an organization nor a working group dealing with CR.

In 16 countries (57%), CR was based on national guidelines or position papers. Countries not having their own guidelines or position papers mostly reported the use

Fig. 1



Participating countries.

of European and/or American guidelines on CR. Only two countries (7%) reported not using specific professional CR guidelines.

### Cardiac rehabilitation programmes currently available

A wide spectrum of CR programmes is currently available in Europe. Early postdischarge programmes were provided in all countries, with outpatient programmes being most commonly provided.

### Phase I cardiac rehabilitation programmes

In 86% of countries, phase I inpatient rehabilitation is offered. The typical duration is less than 1–2 weeks. The number of eligible patients participating in such a programme ranged between 4 and 100%. Eight countries (29%) reported more than 80% of eligible patients participating in phase I rehabilitation. However, 50% were not able to give any information about the number of patients participating. The cost of this treatment was covered by the government or ministry of health in most of countries (64%) and/or by private (25%) or obligatory (7%) health insurance companies in others. Only eight countries (29%) had national legislation/law(s) to govern the use of phase I CR.

### Phase II cardiac rehabilitation programmes

All countries reported the availability of phase II CR programmes but marked differences were observed in types and duration of the programmes. In most countries, outpatient (89%) and/or inpatient (75%) programmes existed, whereas home-based programmes were less often offered (28%) (Table 1). Phase II CR is offered only in an outpatient or home-based setting in seven (25%) countries. In the majority of countries (64%), both inpatient and outpatient programmes are available (Table 1).

Regarding which type of programmes were more dominant in countries offering both outpatient and inpatient

programmes, the majority of those countries (11 countries: 78%) (including Germany, Lithuania, Switzerland, France, Italy, Austria, Czech Republic, Poland, Croatia, Hungary and Belarus) reported that more than 50% (60–90%) of their patients participated in an inpatient programme.

The typical duration of phase II CR programmes also shows a wide spectrum, especially regarding the outpatient programme, ranging from 2 to 24 weeks duration. Programme duration between 6 and 12 weeks was most often reported, whereas very short (2–4 weeks) as well as longer duration (> 12 weeks) programmes were unusual. The typical duration of inpatient programmes was 2–4 weeks, and 12 weeks in the home-based programmes.

The number of eligible patients admitted to phase II CR differed from less than 3% (Spain) up to 90% (Lithuania). About half ( $n = 15$ , 54%) of the countries which were able to report on this estimated the number to be lower than 30%. More than 50% of eligible patients participated in phase II CR in only three countries (Table 2).

We also asked the national coordinators to classify which patients usually participate in phase II CR (Table 3). The results show that the group of patients usually admitted to phase II CR are patients after MI (82%) or CABG (86%). CR phase II post-PCI without MI is usually provided in only 36% of countries. In about 60% of countries, patients' post valvular surgery and in 46%, patients' post heart transplantation, are usually admitted to CR programmes. CR after other cardiac surgical procedures is much less common. Patients with the following conditions are only routinely provided with CR in a minority of countries: heart failure (14%), cardiomyopathies (14%), post implantable cardiac defibrillator/cardiac resynchronization therapy and post left ventricular assistance device implantation (14 and 11% respectively).

**Table 1** Types of phase II cardiac rehabilitation programmes and related laws by country ( $n = 28$ )

Type of programme(s) available	Country
Only inpatient programme	Romania, Russian Federation, Serbia
Only outpatient programme	Belgium, Cyprus, Denmark
Inpatient and outpatient programmes	Austria, Croatia, Finland, France, Germany, Hungary, Iceland, Italy, The Netherlands, Norway, Poland, Portugal, Slovak Republic, Switzerland
Only outpatient and home-based programmes	Ireland, Luxembourg, Sweden, United Kingdom
Inpatient, outpatient and home-based programmes	Republic Belarus, Czech Republic, Lithuania, Spain
National legislation/law(s)	
Legislation existent for inpatient cardiac rehabilitation	Austria, Croatia, Denmark, France, Germany, Hungary, Italy, Lithuania, Russian Federation <sup>a</sup> , Serbia, Slovak Republic, Switzerland
Legislation existent for outpatient cardiac rehabilitation	Belgium, Croatia, Denmark, France, Germany, Hungary, Italy, Lithuania, Slovak Republic, Switzerland
Legislation existent for home-based cardiac rehabilitation	Denmark, Hungary, Lithuania
No legislation or laws regarding phase II cardiac rehabilitation existent	Republic Belarus, Cyprus, Czech Republic, Finland, Iceland, Ireland, Luxembourg, The Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, United Kingdom

<sup>a</sup>In Russia, inpatient cardiac rehabilitation is only for working patients with first myocardial infarction, coronary artery bypass graft or unstable angina.

**Table 2** Number of eligible patients participating in phase II and phase III cardiac rehabilitation programmes by country (n=28)

Country	Phase II	Phase III
	%	%
Austria	30	20
Republic Belarus	40	5-10
Belgium	15-20	5
Croatia	40	4
Cyprus	4	6.5
Czech Republic	15-20	5-8
Denmark	20	Unknown
Finland	20-30	10
France	10-30	Unknown
Germany	≥ 50	25-40
Hungary	30	Unknown
Iceland	≥ 50	Unknown
Ireland	Unknown	Unknown
Italy	25-30 <sup>b</sup>	Not available
Lithuania	90 <sup>a</sup>	30
Luxembourg	40-50	Unknown
Netherlands	30	20
Norway	Unknown	Unknown
Poland	17	Not available
Portugal	4	4
Romania	10	10
Russian Federation	Unknown <sup>c</sup>	(100) <sup>d</sup>
Serbia	Unknown	Unknown
Slovak Republic	41	58
Spain	<3	Unknown
Sweden	40-50	Not available
Switzerland	30	Unknown
United Kingdom	40-50	Unknown

<sup>a</sup>Lithuania: 90% of patients with acute coronary syndrome, 95% after percutaneous coronary intervention and coronary artery bypass graft and 90% after myocardial infarction. <sup>b</sup>Italy: 75% post coronary artery bypass graft, 16% post-myocardial infarction 4% post-percutaneous coronary intervention. <sup>c</sup>Russian Federation: cardiac rehabilitation offered only for employed patients with first myocardial infarction, coronary artery bypass graft or unstable angina. <sup>d</sup>Russian Federation: phase III described as all working patients with first myocardial infarction (n=162 581 patients) 'under the supervision of a cardiologist for 24 weeks after phase II CR'.

In 13 of the participating countries (46%), national legislations or laws regarding phase II CR exist. Nine of these (32%) have legislations/laws regarding inpatient as well as outpatient CR. Three countries (11%) have legislation only for inpatient and one country only for outpatient CR. Three countries (11%) have legislation regarding home-based rehabilitation (Table 1). Fifteen of the participating countries (54%) reported no legislation or laws in this field.

Table 4 summarises whether some groups of patients are routinely excluded from phase II CR programmes (either by guidelines/legislation or in clinical practice). In most countries, no groups are routinely excluded from participation. Patient disability and lack of funding were the most common reasons given for exclusion.

The institution covering the costs of phase II CR is the government or ministry of health in most countries (75%). In about 50% of countries, private health insurance companies take part in covering costs and in a few countries (14%) costs are paid by the retirement insurance and/or the obligatory health insurance system (Table 5).

In all countries except the UK and Belarus, the overall responsibility for phase II CR is with the cardiologist, often in conjunction with a specialist in internal medicine and/or physiotherapy (36%), a CR manager, (29%) or a nurse or consultant physician (25%) (Table 6).

**Table 3** Types of cardiac patient populations usually admitted to take part in phase II cardiac rehabilitation (n=28)

Patients for whom cardiac rehabilitation phase II is provided	Never		Seldom/not usually		Mostly/usually		Always		Not specified	
	n	%	n	%	n	%	n	%	n	%
Acute coronary syndrome/acute myocardial infarction	-	-	5	18	19	68	4	14	-	-
Coronary artery bypass surgery	1	4	3	11	20	71	4	14	-	-
Stable coronary artery disease, no recent events or revascularization	5	18	20	71	2	7	-	-	1	4
Post-percutaneous coronary intervention – without acute coronary syndrome	2	7	16	57	9	32	1	4	-	-
Valvular heart surgery	2	7	9	32	15	54	2	7	-	-
Surgical correction of congenital heart disease	4	14	14	50	7	25	3	11	-	-
Cardiac transplantation	2	7	11	39	7	25	6	21	2	7
Other cardiovascular surgeries (such as aneurysmectomy, surgery of the aorta)	5	18	9	32	13	46	-	-	1	4
ICD/CRT implantation	4	14	19	68	4	14	-	-	1	4
Left ventricle assist device	10	34	12	43	1	4	2	7	3	11
Pacemaker implantation	12	43	15	54	1	4	-	-	-	-
Heart failure	2	7	22	79	3	11	1	4	-	-
Cardiomyopathies	7	25	15	54	3	11	1	4	2	7
Haemodynamic stable arrhythmia	13	46	13	46.4	-	-	-	-	2	7
Cardiac neurosis/anxiety	16	57	12	43	-	-	-	-	-	-
High-risk groups for cardiovascular disease, e.g. metabolic syndrome	8	29	20	71	-	-	-	-	-	-
Peripheral arterial disease	7	25	19	68	1	4	-	-	1	4
Other documented coronary artery disease	9	32	9	32	-	-	-	-	10	36

CRT, cardiac resynchronization therapy; ICD, implantable cardiac defibrillator.

**Table 4 Exclusion criteria for phase II cardiac rehabilitation by country (n=28)**

'Are any of the following groups routinely excluded from participation in phase II CR?'	Excluded by law or professional guideline				Excluded in practice – scarce resources, facilities not suited, high risk, etc							
	Yes		No		Yes		No		Possibly		Not specified	
	n	%	n	%	n	%	n	%	n	%	n	%
Age limits	2	7	26	93	4	14	20	71	1	4	3	11
Language limits – not speaking main language	–	–	28	100	5	18	19	68	1	4	3	10
Disability – other health problems limiting physical activity, cognitive impairment, etc	7	25	21	75	11	40	10	36	3	11	4	14
Funding – patients not funded by relevant institution	8	29	20	72	9	32	13	46	1	4	5	18
Distance – too far to travel to centre	1	4	27	96.4	10	36	13	46	2	7	3	11
Other	2	7	26	93	3	11	10	36	–	–	15	54

CR, cardiac rehabilitation.

**Table 5 Funding sources for CR by country (n=28)**

Institution	'Which institution covers the costs of CR in your country?'							
	Government/ministry of health		(Private) health insurance company		Retirement insurance organization		Others	
	n	%	n	%	n	%	n	%
CR phase								
Phase I	18	64	7	25	2	7	3	11
Phase II	21	75	11	39	4	14	5	18
Phase III	10	36	1	4	2	7	4	14

CR, cardiac rehabilitation.

**Table 6 Clinical responsibility for phase II and phase III cardiac rehabilitation by country (n=28)**

'Who has overall responsibility for cardiac rehabilitation?'	Phase II		Phase III	
	n	%	n	%
Overall responsibility				
Cardiologist	26	93	21	75
Specialist in internal medicine	10	36	10	36
Consultant physician (other than cardiologist/internal medicine)	7	25	8	29
Cardiac rehabilitation manager	8	29	6	21
Nurse	7	25	8	29
Exercise physiologist	3	11	3	11
Physiotherapist	10	36	13	46
Other	2	7	4	14
Not specified	–	–	3	11

### Phase III cardiac rehabilitation programmes

Of the 28 participating countries, 25 (89%) reported the availability of some kind of phase III long-term CR maintenance programmes. Most reported as having only a few groups with small number of participants. A clear exception was Germany with over 6600 'heart groups' including more than 110 000 actively participating patients [11]. Marked differences were seen in programme duration (from 3 weeks to lifelong). While six countries (31%) reported offering short-term phase III programmes ( $\geq 3$  to  $\leq 12$  weeks), most programmes offered were of longer duration [ $\geq 20$  to  $\leq 52$  weeks ( $n = 4$  countries); 1–2 years ( $n = 3$ ); and lifelong ( $n = 4$ )]. Percentages participating in phase III programmes ranged from 4% (Croatia, Portugal) to 58% (Slovak Republic) (Table 2). Eleven countries (39%) were not able to estimate the number of eligible patients participating in phase III CR (Table 2).

Only seven countries (25%) (Germany, Denmark, Lithuania, Serbia, Russia, Hungary and Croatia) stated that they had national legislation or law concerning phase III CR programmes. In 13 countries (46%) (Belgium, Croatia, Czech Republic, France, Iceland, The Netherlands, Poland, Portugal, Serbia, Slovak Republic, Spain, UK), the patient pays 100% of the cost for phase III CR. In five countries, patients may receive some (but in most cases only a small amount of) financial support for participation from national heart foundations, patient clubs, private health insurance companies, etc. In 10 countries (36%), the cost of participation is paid by the government and/or ministry of health, and in a few countries by retirement, private or obligatory health insurance companies. In these cases, responsible institutions bear 90–100% of the expenses.

In 21 countries, the overall responsibility for phase III CR is with a cardiologist, often in collaboration with a specialist in internal medicine and/or physiotherapist (Table 6).

### Discussion

This survey gives a very comprehensive overview of the current status of CR in Europe. It highlights the very differing level of development and coverage of CR services across countries. Although some have detailed national guidelines, funding mechanisms and provision of services to patients, others have few frameworks and limited service availability.

Regarding phase I, it is remarkable that so many patients are reported as not receiving phase I CR. It is possible that those providing information did not acknowledge

phase I CR as being provided unless there was an identified programme in place, but many patients do in fact get all of the components that would constitute a good phase I programme, although this is simply seen as delivering routine comprehensive care. This would be the optimistic interpretation of these data. Of more concern would be the possibility that provision of evidence-based comprehensive care is overlooked in acute settings. The challenges of providing such care are all more urgent, given the increasingly rapid turn-around time in hospital settings, particularly for interventional procedures such as PCI. As this phase of CR may be the only opportunity for CR intervention for many patients, it is of great concern that many do not seem to receive this service. Legislation to require such service provision is available in less than one-third of countries.

Regarding phase II, this was the phase most widely available across countries, although still utilized by a too small number of patients in some countries. Out-patient programmes were available in most countries. However, half of all countries delivered both types. Where both types of delivery were available, over half of the patients attended inpatient programmes, perhaps reflecting traditional patterns of rehabilitation service delivery in some countries. Although outpatient programmes can support participants to reach and maintain CR goals in their usual environment in medium to long term, especially longer-duration programmes, inpatient programmes provide valuable support for high-risk patients by promoting stable clinical conditions and rapid functional recovery [8].

Many phase II CR programmes were of short duration, especially inpatient programmes. Although an early start to CR is desirable, these short-term programmes provide little opportunity for patients to change lifestyle patterns in a sustainable manner, integrated into their regular family and work environments. A transfer of resources from intensive short-duration residential services to outpatient services of lesser intensity and longer duration for lower-risk patients (e.g. PCI) may support provision of services to a larger number of patients who would benefit. The need to find ways to extend the current coverage of programmes is evident by the numbers and types of patients who currently do not receive CR services. In two-thirds of countries, participation in phase II was 30% or lower (including 'unknown'). This is comparable with EuroAspire III levels [10] cross-confirming both estimates. Comparing with the results of the Carinex project, a 13-country European Union study of CR launched in 1996, the level of phase II provision does not seem to have increased much, if at all, in the last decade [12]. Patients post MI and CABG were most commonly provided by CR services while evidence on the benefits of CR for the increasing population of heart failure patients [13,14] is not reflected by 14% only receiving CR

services. The legislation currently provided in almost half of the countries needs to be extended to other countries if citizens of Europe are to be treated similarly, regardless of geography. Legislation provides an imperative to make available and to maximize resources to implement CR services. For instance in Germany, CR immediately after an acute event is guaranteed by law since 1974 [11]. This has provided a basis for establishing a robust system with 170 CR centres across the country and a participation rate of more than 50% of all eligible patients including a wide range of CR indications.

Regarding phase III, services lack resources. The goal of phase III is to maintain physical activity and other health-related lifestyle changes in the long term. It is acknowledged that many patients need support to maintain such change. Thus, phase III supports the health investments made in phase II. Phase III also appeared to be somewhat 'invisible', as the 11 countries surveyed could not provide information on likely number of patients participating. In many countries, patients covered all of the costs of phase III. The impression from responders is that the implementation of phase III is led by patients rather than professionally led in many countries. Only a quarter had legislation regarding this phase. Although the optimal balance of patient-professional management and patient-system funding of phase III may differ across countries, what is needed for CR phase III to flourish are implementation strategies and accountability, ideally through legislation, professional guidelines and examples of good practice and a continuing evidence base. The German system as an example provides such a model of integrated phase III programmes [11].

Some limitations of the study are important to consider. It is likely, as in all such surveys, that those responding may represent and also reflect a more positive profile of CR that pertains more widely. The risk is that this survey, despite its less than ideal profile, actually overestimates CR coverage in Europe. Comparing our results with data from some published national surveys [11,15-19] indicate broadly similar findings. The European Cardiac Rehabilitation Inventory Survey was not in a position to focus on CR quality control and therefore could not deliver information about the CR programme structure, process and/or outcome quality. Very few countries provide standardized quality control regarding these aspects. A study on CR services in England and Wales found that 199 of 244 centres (81%) admitting patients with cardiac conditions claimed to provide CR [20]. Of the 199 centres, 25 centres were randomly selected for a visit to obtain detailed information on the services. The quantity and quality of services varied widely. A study on outpatient CR in Scotland [21] found similar results. Among 53 programmes including exercise training, only 19 (35%) provided the level providing the most benefits; among 47 programmes including education, only 16 (34%) offered education in a manner that produced

benefits in controlled trials. Thus, evaluation of CR practices is necessary for a more comprehensive profile of CR service availability in Europe.

Overall, the findings of this comprehensive survey may serve to inform the priorities for promotion of CR as an evidence-based service for all patients with CVD across Europe. Two goals are paramount:

- (1) To increase the number of eligible patients enrolled in CR. This applies to:
  - (a) Phase I, II and III CR.
  - (b) All eligible cardiovascular conditions. At present, only some groups are routinely admitted to CR (particularly MI and CABG). Among other currently neglected groups, e.g. PCI and chronic heart failure, also need to be routinely included.
- (2) To implement national legislation and laws regarding CR
  - (a) This is an important basis for the further development and improvement of CR. Legislation can drive service development and delivery on professional evidence-based guidelines and so is a uniquely valuable mechanism for change.

In the current situation, the way to move forward for countries with less-developed CR systems is likely to influence their government through the national society to promote the launching on national laws and to involve professionals to establish local or national guidelines by developing formal working groups of interested professionals. There is much expertise available from colleagues within and across European countries to support development of these important platforms for expansion of CR services to a greater number of European citizens. The EACPR has an important cross-fertilizing role in sharing expertise and in supporting colleagues to develop better services at important milestones in effort in their own countries. Alongside the scientific exchange and development that the EACPR currently enables, it is timely that the association now creates a network of national coordinators of CR in Europe to share knowledge and experiences and to drive the development of legislative, funding and structural aspects of CR service provision. It is only by working together that CR can be positioned as a mainstream service promoted and recognized and supported by all cardiology national societies and foundations and funded as a priority for health systems across Europe, which is going to face an increasing burden of CVD in the coming generations.

### Acknowledgements

The authors thank the national coordinators as listed below as well as the staff members of the European Society of Cardiology's Heart House, especially

Sophie Squarta and Camille Pfaff, for their support. Werner Benzer and Christiane Marko, Austria; Sviatlana Georgievna Sujayeva, Republic Belarus; Paul Dendale, Belgium; Dusko Cerovec, Croatia; Ivan Karel, Czech Republic; Loizos Antoniadis, Cyprus; Anette Sjø, Denmark; Maire Rantala, Finland; Benedicte Vergés, France; Gerd Bönner and Peter Ritter, Germany; Attila Simon, Hungary; Sólrún Jónsdóttir and Magnús Jónasson, Iceland; Joan Love, Ireland; Raffaele Griffo, Italy; Jacob Klein, Israel; Donatas Vasiliauskas, Lithuania; Charles Delagardelle, Luxembourg; Irene Hellemans and Rick Goud, The Netherlands; Nils Erling Myhe, Norway; Ana Abreu, Portugal; Piotr Dylewicz, Poland; Dan Gaita, Romania; Nana-Goar V. Pogossova, Russian Federation; Stefan Ilic, Serbia; Zoltan Mikes, Slovak Republic; Carmen de Pablo Zarzosa, Spain; Bo Hedbäck, Sweden; Raphael Koller, Switzerland; Bob Lewin and Patrick Doherty, United Kingdom. Suggested reviewers are Professor Hugo Saner, Bern, Switzerland; Professor Helmut Gohlke, Germany.

Conflicts of interest and funding: none declared.

### References

- 1 European Heart Network. European cardiovascular disease statistics 2008. [Web Page] <http://www.ehnheart.org/files/statistics%202008%20web-161229A.pdf>. 2009.
- 2 WHO Expert Committee on Rehabilitation. Rehabilitation after cardiovascular diseases, with special emphasis on developing countries: report of a WHO Committee. *World Health Organ Tech Rep Ser* 1993; **831**:1122.
- 3 Giannuzzi P, Mezzani A, Saner H, Bjornstad H, Fioretti P, Mendes M, et al. Physical activity for primary and secondary prevention. Position paper of the Working Group on Cardiac Rehabilitation and Exercise Physiology of the European Society of Cardiology. *Eur J Cardiovasc Prev Rehabil* 2003; **10**:319–327.
- 4 Taylor RS, Brown A, Abraham S, Jolliffe J, Noorani H, Rees K, et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. *Am J Med* 2004; **116**:682–692.
- 5 Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Ann Intern Med* 2005; **143**:659–672.
- 6 Thompson PD, Buchner D, Pina IL, Balady GJ, Williams MA, Marcus BH, et al. Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease: a statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation* 2003; **107**:3109–3116.
- 7 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**:2675–2682.
- 8 Piepoli MF, Corra U, Benzer W, Bjarnason-Wehrens B, Dendale PAC, Gaita D, et al. Secondary prevention through cardiac rehabilitation. 2008 Update. From knowledge to implementation. A Position Paper from the Cardiac Rehabilitation Section of the European Association of Cardiac Rehabilitation and Prevention. *Eur J Cardiovasc Prev Rehabil* 2009 (in press).
- 9 Wenger NK. Current status of cardiac rehabilitation. *J Am Coll Cardiol* 2008; **51**:1619–1631.
- 10 Wood D, on behalf of the EUROASPIRE Investigators. Risk factor management in coronary patients—results from a European wide survey EUROASPIRE III. [Web Page] [www.bcs.com/documents/D\\_Wood\\_EUROASPIRE\\_III.ppt](http://www.bcs.com/documents/D_Wood_EUROASPIRE_III.ppt). 2008.
- 11 Karoff M, Held K, Bjarnason-Wehrens B. Cardiac rehabilitation in Germany. *Eur J Cardiovasc Prev Rehabil* 2007; **14**:18–27.



- 12 Vanhees L, McGee HM, Dugmore LD, Schepers D, van Daele P. A representative study of cardiac rehabilitation activities in European Union Member States: the Carinex survey. *J Cardiopulm Rehabil* 2002; **22**:264–272.
- 13 Rees K, Taylor RS, Singh S, Coats AJ, Ebrahim S. Exercise based rehabilitation for heart failure. *Cochrane Database Syst Rev* 2004; **3**:CD003331.
- 14 O'Connor CM, Whellan DJ, Lee KL, Keteyian SJ, Cooper LS, Ellis SJ, et al. Efficacy and safety of exercise training in patients with chronic heart failure: HF-ACTION randomized controlled trial. *JAMA* 2009; **301**:1439–1450.
- 15 Tramarin R, Ambrosetti M, De Feo S, Piepoli M, Riccio C, Griffo R. The Italian Survey on Cardiac Rehabilitation-2008 (ISYDE-2008). Part 3. National availability and organization of cardiac rehabilitation facilities. Official report of the Italian Association for Cardiovascular Prevention, Rehabilitation and Epidemiology (IACPR-GICR). *Monaldi Arch Chest Dis* 2008; **70**:175–205.
- 16 Lavin D, Hevey D, McGee HM, De La Harpe D, Kiernan M, Shelley E. Cardiac rehabilitation services in Ireland: the impact of a coordinated national development strategy. *Ir J Med Sci* 2005; **174**:33–38.
- 17 Brodie D, Bethell H, Breen S. Cardiac rehabilitation in England: a detailed national survey. *Eur J Cardiovasc Prev Rehabil* 2006; **13**:122–128.
- 18 Mendes M. National survey of cardiac rehabilitation programs in Portugal—situation in 1999. *Rev Port Cardiol* 2001; **20**:7–19.
- 19 Zwisler AD, Traeden UI, Videbaek J, Madsen M. Cardiac rehabilitation services in Denmark: still room for expansion. *Scand J Public Health* 2005; **33**:376–383.
- 20 Thompson DR, Bowman GS, Kitson AL, de Bono DP, Hopkins A. Cardiac rehabilitation services in England and Wales: a national survey. *Int J Cardiol* 1997; **59**:299–304.
- 21 Campbell NC, Grimshaw JM, Ritchie LD, Rawles JM. Outpatient cardiac rehabilitation: are the potential benefits being realized? *J R Coll Physicians Lond* 1996; **30**:514–519.