

# Standardization and quality improvement of secondary prevention through cardiovascular rehabilitation programmes in Europe: The avenue towards EAPC accreditation programme: A position statement of the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology (EAPC)

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Despite the proven efficacy and cost-effectiveness of contemporary cardiovascular rehabilitation programmes, the referral to/uptake of and adherence to cardiovascular rehabilitation remains inadequate. In addition, heterogeneity persists amongst different cardiovascular rehabilitation centres in Europe, despite the available scientific documents describing the evidence-based rehabilitation format/content. This position statement was elaborated by the Secondary Prevention and Rehabilitation (SP/CR) section of EAPC. It defines the minimal and optimal cardiovascular rehabilitation standards. In addition, it describes the relevant quality indicators of cardiovascular rehabilitation programmes to date. Compliance of European cardiovascular rehabilitation centres with these standards will improve cardiovascular rehabilitation process standardization in Europe and hence increase the quality of cardiovascular rehabilitation programmes.

## Keywords

Cardiac rehabilitation • secondary prevention • accreditation • standards

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## 1. Introduction

Cardiovascular diseases still remain one of the main causes of mortality and morbidity in Europe.<sup>1</sup> After significant improvement in the availability of novel pharmacological treatments, percutaneous cardiac interventions (PCIs) and cardiac surgery, it is now paramount to invest also in the improvement of cardiovascular rehabilitation (CR) programmes.<sup>2</sup>

CR started as an exercise-based programme, supported by its demonstrated benefits.<sup>3</sup> Evolving over time, it is currently a comprehensive patient-tailored programme that aims to improve the patient's physical, psychological, social and work condition, after an acute cardiac event or in the context of chronic cardiovascular disease with risk factors or incomplete revascularization.<sup>4</sup> Comprehensive CR should encompass a multidisciplinary intervention, including exercise training, risk factor control, psychosocial counselling, smoking cessation, patient education and vocational reintegration.<sup>4</sup>

Previous data, including recent meta-analysis have shown the efficacy of CR<sup>3,5-7</sup> to reduce mortality, myocardial infarction (MI) and improve functional capacity, psychosocial wellbeing and quality of life in coronary artery disease patients. Several benefits extend to patients with heart failure (HF) and patients with devices<sup>8-10</sup> or submitted to cardiac surgery,<sup>11</sup> among others. In addition, CR is considered cost-effective in cardiovascular disease.<sup>12</sup> The European Society of Cardiology (ESC) and the American Heart Association (AHA)/American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR), classify CR as a therapeutic intervention with class I indication (mandatory), based on the highest levels of scientific evidence (A and B, according to the indications) in multiple cardiac conditions. The main candidates for this intervention are coronary patients (with or without PCI), HF patients (with or without devices) and patients submitted to cardiac surgery (including revascularized, valvular and cardiac transplant patients).<sup>13</sup>

Despite its proven efficacy, some important gaps and challenges remain ahead of us in CR. As evidenced by the EUROpean Action on Secondary Prevention through Intervention to Reduce Events (EUROASPIRE) study IV<sup>14</sup> and V,<sup>15</sup> less than 50% of eligible coronary patients (43% and 34%, respectively) participate in CR programmes after an acute event, which widely differ in content/duration and intensity between the different European countries. Barriers to implementation are present at different levels: the patient, the physician and the health system.<sup>4</sup> Specific interventions may increase CR enrolment, adherence and completion as shown in the Cochrane systematic review and meta-analysis regarding intervention to promote patient's utilization of CR,<sup>16</sup> though the quality of evidence was low to moderate due to heterogeneity of the interventions used, among other factors. More research is needed, particularly to discover the best ways to increase programme completion. CR utilization needs to be promoted, always assuring minimal criteria of the CR programmes. CR, as with all medical interventions, will only produce its proven benefits if correctly performed according to tested protocols evidenced through rigorous peer-reviewed studies.

The European survey on cardiac rehabilitation performed in 2010, European Cardiac Rehabilitation Inventory Survey (ECRIS),<sup>17</sup> including 28 European countries, indeed showed that fewer than half of eligible patients benefit from CR in most European countries, with high heterogeneity in CR provision/content post-MI across Europe (3% to

more than 50% CR utilization rate). This has also recently been confirmed by the online data of the project 'Country of the month' of the European Association of Preventive Cardiology (EAPC), with 10% to >75% for CR uptake after MI.<sup>18</sup> Data from a recent global CR survey, show that across all Europe, there was an unmet regional need of 3,449,460 CR places annually, attesting that European CR capacity must be augmented.<sup>19</sup> In the Extra-HF Survey<sup>20</sup> it was observed that almost 40% of the surveyed cardiac centres in Europe that deal with HF patients did not implement exercise training programmes in these patients and furthermore only half of the HF patients admitted to general cardiology centres were proposed to attend exercise programmes, due to the lack of resources or logistics.

The use of minimum standards for the evaluation of the quality of CR has been tested elsewhere<sup>21</sup> and accreditation has been implemented in other countries such as the USA<sup>22</sup> and the UK<sup>23</sup> with varying levels of success.

The EAPC CR accreditation programme builds on previous minimum standard approaches by adding optimal quality indicators that serve as a vehicle to accelerate translation of scientific evidence into clinical practice. The metrics developed by the EAPC are intended to provide CR centres with a way to be acknowledged when providing high-level quality of care. In addition, this serves to encourage European CR centres to improve the standard of care delivery up to good clinical practice standards. The EAPC Secondary Prevention and Rehabilitation (SP/CR) Section developed the accreditation programme to benchmark and improve the quality of care for patients eligible for CR in the European CR centres. The present paper describes minimal and optimal CR quality standards and auditing processes in CR. Only through rational and balanced distribution of a greater number of CR centres, with programmes achieving the criteria defined in these recommendations, can we be guaranteed that all cardiovascular patients have equality of access to an evidence-based, cost-effective and safe intervention. The EAPC accreditation SP/CR programme criteria defined in this position paper, are confined to phase 2 of CR.

The overarching aim of the EAPC accreditation programme project in CR is to improve secondary prevention for all eligible patients. More specifically and using the SMART (Specific, Measurable, Attainable, Relevant, Timely) principles:<sup>24</sup> the goal is to provide formal accreditation on an European level, to those CR centres that meet at least the defined minimal standards. The principal aims of the EAPC SP/CR section accreditation programme may be further summarised as:

- Specific: to provide standards and key performance indicators (KPIs) enabling formal accreditation of those European CR centres, that meet at least the defined minimal CR requirements.
- Measurable: documentation of the standards being met by the European CR centres, participating in the EAPC accreditation programme will enable measurement and reporting of national trends in the quality of care delivered in the respective European CR centres.
- Attainable: through achieving KPIs and standards bring all CR programmes up to an evidence-based level of performance associated with improved patient benefit.
- Relevant: residents of the EU are entitled and should be reassured that the treatment and care they receive through CR is of good quality, accessible and equitable no matter where they live.

- Time-bound: the EAPC completed its feasibility/pilot phase and has already formally accredited several centres.

## II. Methodology

In developing the EAPC centre accreditation for SP/CR, the EAPC SP/CR section reviewed evidence-based guidelines and statements that would potentially inform the construct/content of the accreditation programme. Clinical practice guidelines and scientific statements in recent years, that were demonstrative of the application of SP/CR to different cardiovascular conditions and/or most directly contributed to the development of this accreditation programme description, are depicted in *Table 1*.<sup>13,25–43</sup> By publishing the minimal and optimal CR standards, defined as part of this EAPC accreditation

programme, the adoption of these standards is encouraged. In addition, it is hoped to facilitate the collection and analysis of data that reflect the current status of care delivery on an European-wide scale, in order to being able to focus future improvement efforts on the areas that need it the most.

Cardiovascular rehabilitation (CR) standards and quality indicators are defined in this document. Minimal CR standards are distinguished from optimal CR standards. Both structure- and process-based metrics are defined. Quality assessment is based on the definition of quality metrics.

Minimal CR standards are mandatory for the European CR centres to have if they want to become accredited. Optimal CR standards are not mandatory, but highly recommended to further improve the delivered care. Both the minimal and optimal CR standards are based on predefined structure- and process-based metrics. Structure-based

**Table 1 Clinical practice guidelines and other clinical guidance documents.**

### Clinical practice guidelines

AHA/ACCF guidelines for secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 Update<sup>25</sup>

2012 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation<sup>26</sup>

2013 ESC guidelines on the management of stable coronary artery disease<sup>27</sup>

2013 ACCF/AHA guidelines for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines<sup>28</sup>

2015 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation<sup>29</sup>

2016 European guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice<sup>30</sup>

2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure. The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology<sup>31</sup>

2018 AHA/ACC guidelines for the management of adults with congenital heart disease. Executive summary: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines<sup>32</sup>

2018 National Institute for Health and Care Excellence (NICE). Chronic heart failure: Management of chronic heart failure in adults in primary and secondary care. Clinical guidelines<sup>33</sup>

2018 ESC/EACTS guidelines on myocardial revascularization<sup>34</sup>

2018 ESC/ESH guidelines for the management of arterial hypertension. The Task Force for the management of arterial hypertension of the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH)<sup>35</sup>

2019 ESC/EAS guidelines for the management of dyslipidaemias: Lipid modification to reduce cardiovascular risk: The Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and European Atherosclerosis Society (EAS)<sup>36</sup>

2019 Clinical practice update on heart failure 2019: pharmacotherapy, procedures, devices and patient management. An expert consensus meeting report of the Heart Failure Association of the European Society of Cardiology<sup>37</sup>

### Scientific statements, consensus documents and position papers

2007 AHA scientific statement. Core components of cardiac rehabilitation/secondary prevention programmes<sup>38</sup>

2010 EAPC-CR section position paper: Secondary prevention through cardiac rehabilitation: From knowledge to implementation<sup>13</sup>

2011 ESC consensus document of the Heart Failure Association and the European Association for Cardiovascular Prevention and Rehabilitation. Exercise training in heart failure: From theory to practice<sup>39</sup>

2017 The BACPR standards and core components for cardiovascular disease prevention and rehabilitation<sup>40</sup>

2019 ESC position paper from the Committee on Exercise Physiology and Training and the Committee of Advanced Heart Failure of the Heart Failure Association. Exercise training in patients with ventricular assist devices: a review of the evidence and practical advice<sup>41</sup>

2019 American Diabetes Association standards of medical care in diabetes<sup>42</sup>

2020 EAPC position paper update. Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation<sup>43</sup>

ACC: American College of Cardiology; ACCF: American College of Cardiology Foundation; AHA: American Heart Association; BACPR: British Association for Cardiovascular Prevention and Rehabilitation; CR: cardiac rehabilitation; EAPC: European Association of Preventive Cardiology; EAS: European Atherosclerosis Society; ESC: European Society of Cardiology; ESH: European Society of Hypertension; EACTS: European Association of Cardiothoracic Surgery; SP: Secondary Prevention; ECG: Electrocardiogram.

metrics quantify both the human and infrastructural resources, that are needed to ascertain a high-quality standard of CR care delivery. The availability of adequate personnel, equipment and CR room environment is a sine qua non for the successful implementation of high quality CR. Process-based metrics are defined as the necessary core components of the process of CR care delivery, covering all relevant dimensions of secondary prevention. Quality metrics and/or quality indicators are measurements that reflect the quality of delivered care.

### III. Minimal and optimal standards in Europe

To start, it is clear that all eligible cardiac patients should be referred to CR. These include mainly patients with: (a) acute coronary syndrome<sup>26,29</sup> (Class I indication), (b) PCI and/or myocardial revascularization surgery<sup>26,27,29,34</sup> (Class I indication), (c) stable coronary artery disease<sup>27</sup> (Class I indication), (d) HF<sup>28,31,33,37,39,41,44</sup> (Class I indication), (e) cardiac transplant,<sup>45,46</sup> (f) left ventricular assist device and/or other implanted devices (including pacemakers, internal cardioverter defibrillators, cardiac resynchronizers),<sup>37,39,41,47,48</sup> (g) cardiac surgery (including valvular surgery, percutaneous valvular prosthesis or Mitralclip)<sup>49–52</sup> and (h) high cardiovascular risk factor profile (diabetes mellitus, arterial hypertension, dyslipidaemia, severe obesity).<sup>30,42</sup>

The timing of CR has a significant impact on fitness<sup>53</sup> and psychological outcomes.<sup>54</sup> CR should ideally begin during in-hospital stay (phase 1), proceed after discharge to early ambulatory or residential (phase 2) and be maintained for life (phase 3) in a continuum process. In some cases, patients are not hospitalized, like high cardiovascular risk patients without acute events, and enter directly into phase 2, which may be ambulatory (out-patient), residential (in-patient) or home-based, according to the health systems and legacy in different European countries.<sup>3</sup> It can be performed in the hospital setting, a specialised CR centre or, in some cases, at the patient's home (home-based). Phase 2 should be started as soon as possible after an acute event.<sup>55,56</sup> After discharge of MI and PCI patients, it is considered optimal starting CR in the first 14 days and minimally accepted at 15–30 days. After Coronary Artery Bypass Grafting (CABG) patients discharge, it is recommended, as optimal, starting CR at 28 days (may be earlier in experienced centres, with special care avoiding exercises that might interfere with sternum consolidation) and minimally accepted at 29–42 days. The duration of CR needs to be individualised for every patient according to their characteristics (e.g. age, physical condition, risk profile, adherence, cardiac condition, personal choice), but should include at least 24 sessions (minimal standard).

#### III.A. Structure-based metrics

*Table 2* elaborates on the CR structure-based metrics, that are defined as part of the EAPC SP/CR accreditation programme. For each metric, *Table 2* informs the reader about whether the metric is perceived as minimal and/or optimal.

#### III.A.a. Infrastructural structure-based metrics

Policies and procedures regarding the management of each facility are aimed at providing a safe, functional and effective environment.<sup>4</sup> The components of these facilities should include (a) planning of space utilization, (b) acquisition of equipment and maintenance, (c) reduction and control of environmental hazards and risks, (d) maintenance of safe conditions (there must be emergency access to all patient areas, and floor space must allow easy access for personnel and equipment) and patient comfort, (e) climate control (adequate temperature and humidity).<sup>4</sup>

A specific space and equipment for evaluating functional capacity are necessary for CR. The existence of an appropriate place to conduct a six-minute walk test (6MWT) (12 m hallway with markers in the corners) or an alternative test as incremental shuttle walk test (ISWT), for those patients who are not able to undertake an exercise test,<sup>57</sup> and a room (or laboratory) with treadmill and/or cycloergometer, for standard exercise testing performance to allow evaluation of patients cardiac risk and exercise prescription, are considered as minimal criteria. If the CR centre does not possess exercise test facilities, the standard exercise test must, as an alternative, be conducted via outsourcing. The existence of cardiorespiratory testing equipment in the exercise facilities is considered as an optimal criterion.

A gymnasium with adequate equipment for exercise sessions, waiting room, meeting room, consultation room, counselling area for group interventions and separate toilets and shower facilities is necessary for centre-based phase 2. After phase 1 early mobilization, phase 2 CR training should offer different activities, whenever possible, with the use of various ergometers and material for functional training, adapted to the needs of the population to treat. Monitoring must be available for cardiac patients considered high risk for exercise (see below *III.B.a.1. Patient evaluation, risk assessment and risk factors identification*). The low-risk patients do not need monitoring in most of the cases.

Regular audit is essential and aims to demonstrate that programmes are achieving the desired clinical outcomes, and it enables local evaluation and national comparison. Every CR service should be audited locally (against agreed service standards) and also registered with their respective national audit programme. Data on clinical outcomes and patient satisfaction plus service performance should be routinely collected. Data collection instruments are necessary to prospectively review the programme's internal procedures with the ultimate goal of enhancing the quality improvement process. Evaluation of performance dimensions, involve timeliness, effectiveness, continuity, safety, efficiency and evaluation of the patient.<sup>3</sup>

#### III.A.b. Human resources structure-based metrics

An optimal standard is the existence of a full-time dedicated multidisciplinary team operating in a designated area.<sup>4</sup>

The members of the team and a dedicated space should be available to cover diversified schedules during the day, from early morning to late evening, in order to overcome timetable barriers. The composition of the multidisciplinary team may differ, according to countries and availability, but it has to respect the knowledge and competences necessary for achieving the main central components of CR, being mandatory to include a cardiologist, an exercise specialist (physiotherapist or exercise physiologist, most frequently), a

**Table 2** Minimal and optimal structure-based CR metrics, as defined in the European Association of Preventive Cardiology (EAPC) SP/CR accreditation programme.

### **Infrastructural**

#### **Minimal**

Dedicated consultation area, for medical evaluation and prescription and psychological evaluation and intervention  
 Exercise facilities (laboratory/room) with equipment for assessment of functional capacity, including appropriate place to perform 6MWT (12 m long hallway with markers in the corners) or other functional tests and treadmill and/or cycleergometer for standard exercise testing  
 Dedicated facilities for exercise training, well ventilated, good temperature and humidity conditions, floor space approximately 4 m<sup>2</sup> per patient  
 Equipment for assessment of clinical status: sphygmomanometer, ECG, chemistry analysis, urine analysis (analysis may be outsourced)  
 Equipment (via outsourcing) for assessment of left ventricular function: echocardiography  
 Equipment (via outsourcing) for assessment of arrhythmias: ambulatory ECG Holter monitoring  
 Equipment for conducting an exercise training programme: for aerobic and strength training  
 Equipment for cardiac monitoring  
 The means, on site, to summon assistance in case of emergency in the exercise room to start life support: automated external defibrillator, material for intubation and ventilation, material for intravenous drugs administration  
 Emergency services available or <10 min away  
 List of medical equipment and devices in use including details on maintenance and validity (if necessary)

#### **Optimal**

Specific education and counselling area for group interventions  
 Electronic patient files  
 Investigation room (e.g. for echocardiography)  
 Dedicated exercise facilities (laboratory/room) with equipment for cardiorespiratory exercise testing  
 Resting/dress room with separate toilets and shower facilities  
 Lockers to safely store the patients' belongings while training  
 Equipment for assessment of left ventricular function: echocardiography and other imaging equipment depending on circumstances and type of patients  
 Equipment for assessment of arrhythmias: ambulatory ECG Holter monitoring  
 Equipment for assessment of psychosocial status: licensed tests and screening instruments (ideally computerised)

### **Human resources**

#### **Minimal**

A medical director with cardiology training is responsible for the oversight of programme policies and medical procedures. The medical director can have the role of programme director as well  
 Multidisciplinary team: cardiologist, nurse, exercise specialist, nutritionist  
 All professionals must have a written employment/agreement contract  
 For every profession within the centre an updated job description is available  
 The director of the clinic has attended a congress/symposia in the field of secondary prevention and/or cardiac rehabilitation, within the last 2 years, organised by recognised organisations such as the national cardiac societies or EAPC/ESC  
 Of the staff, 90% have completed a specialization course or attended a congress/symposia in the field of secondary prevention and/or CR, within 3 years, organised by recognised organisations such as the national cardiac societies or EAPC/ESC  
 All professionals directly involved in patient care possess a valid (less than 4 years old) certificate of cardio-pulmonary resuscitation training

#### **Optimal**

There is a programme director: any member of the team, with good organizational, management and interpersonal skills may have this role, to ensure proper organisation of the programme and consistency of policies and procedures with evidence-based guidelines  
 One of the staff members recently (actively) contributed to a relevant congress or peer-reviewed medical journal  
 Exclusively dedicated multidisciplinary team covering a wide range of schedules during the day  
 Multidisciplinary disciplinary team includes psychologist  
 Multidisciplinary team includes additional healthcare professionals: diabetologist, psychiatrist, social worker

### **Centre requirements**

#### **Minimal**

Protocol handling the complaints and list of complaints (it might be a general one from the hospital/clinic)  
 Protocol handling the adverse events and list of adverse events (it might be a general one from the hospital/clinic)  
 Organizational team meetings on a 2 weeks basis (which are documented)

#### **Optimal**

Organizational team meetings on a weekly basis (which are documented)  
 Strategic plan, not more than 5 years old (including future perspectives, objectives, care programmes, patient safety and enhancement of quality of care)  
 Annual evaluation report to monitor service delivery and outcomes

nutritionist and a nurse, as minimal standards. The optimal criteria would add psychologists, social workers, administrative personnel and other specialists for specific consultation and advise. These professionals may be available on request. Besides, the professional certification, and specific competence on CR, in some countries, the team members need to be trained to their task. Education and preparation of the team members according to their roles in the CR programme is fundamental.

It is important to define for each professional employee:<sup>4</sup> (a) the specific professional qualifications, (b) the educational training needed, (c) the responsibility for delivering services of appropriate standard of care, (d) the general duties (emergency procedures, liaison with other health care providers, basic skills in data collection and documentation, staff training and performance reviews), (e) the specific duties (patients' counselling, interactive discussion groups, exercise sessions supervising, processing referrals, programmes' management, coordinating programmes, discharge planning and follow-up).

The role of the programme medical coordinator/director should be covered optimally by a cardiologist with adequate training in CR.<sup>4</sup> He/she is encouraged to participate in EAPC training courses in CR (or national equivalents such as British Association for Cardiovascular Prevention and Rehabilitation, BACPR, training courses for UK programmes), to ascertain his/her competence in this regard. In the case when this is not possible, as might happen in some countries, the minimal criteria is that another medical doctor with cardiology and CR experience should take the coordination role. He/she will be responsible for organising the programme (safeguarding its effectiveness and safety) and supervise the CR team (guaranteeing that all the team members hold certification and are trained in basic life support and resuscitation and are operating well in their tasks). He/she should evaluate the patient's evolution, the achievement of all CR programme outcomes, supervise the quality of care offered by the team, guarantee the implementation of legislation and perform periodic reports on the CR activity.

The individual prescription of aerobic exercise intensity should optimally be determined by a cardiologist with training in exercise programmes, based in the results of an exercise test.<sup>43</sup> In some countries, exercise prescription to cardiac patients may be performed by exercise specialists with vast experience in cardiovascular disease patients, supported and validated by CR cardiologists, who have the responsibility for patient's safety (minimal standard). The exercise specialist task is to apply the prescription during the programme exercise sessions, informing the prescribing cardiologist of the way the patient and himself perceive the intensity, as well as the clinical response regarding the type of prescribed activity. The exercise specialist, physiotherapist or exercise physiologist, coordinates the exercise training under medical supervision and is responsible for the diversification and progression of training. The relationship between the number of exercise professionals and the number of patients may be different according to programmes, patient's clinical complexity and professional experience.<sup>58</sup> It is suggested as optimal the ratio of one exercise specialist for 5–10 low- or intermediate-risk patients/session.<sup>58</sup> The ratio for high-risk patients should be higher, optimally one professional to 2–3 patients, according to patient's risk severity.<sup>2</sup>

There should be always two healthcare professionals in the exercise room, for the sake of possible complications during exercise.

During the training sessions, in most cases, the cardiologist does not need to be continuously present in the gymnasium, however he/she will be obligated to be nearby, easily contactable and available to rapidly identify and intervene in case of complications and to resolve questions regarding the training or clinical problems, including adjustment of pharmacological therapy.<sup>2</sup> In the absence of a cardiologist, health personnel with adequate training in interpretation of electrocardiographic tracing should always be present. Trained personnel should be immediately available with adequate equipment to respond to medical emergencies.

Nutritionists will evaluate nutritional status and will intervene on weight modification and risk factor management, in conditions like diabetes and dyslipidaemia. Psychologists will do the screening of the patients for depression, anxiety, stress, hostility, personality disturbances and sexual dysfunction. They will intervene using interview and specific techniques, directing to a psychiatrist those patients who need this type of evaluation/intervention.

The CR team might need to ask for support from other specialist doctors, such as internists, endocrinologists or pneumologists, to manage the different comorbidities present in the patients. Cardiologists, nurses and nutritionists will have the greatest role in education, being responsible for nutritional, physical activity and exercise/sports advice. Social workers will help with vocational counselling and social integration and support.

All clinical data should be digitally stored in a specific CR database, optimally in connection with all the clinical information and ideally in connection to the other national CR databases.

It is important to provide an organizational chart, presenting the number of people within each professional discipline in the team, the number of permanent or temporary consultants and the staff to patient ratio. While more than one member of the team can share more than only one task, some tasks require specific skills and training and should be performed by an especially designated health professional. Determination of the tasks attribution and responsibilities in advance, will avoid misunderstanding and tension in the team.

### III.A.c. Centre requirements

Regular meetings are important to facilitate communication between team members and to provide opportunities to discuss complex clinical cases and evaluate the ongoing programme. Such meetings should occur every 2 weeks (minimal) or weekly (optimal), and should be attended by all team members. The centre will need to have protocols for handling adverse events and complaints (minimal criteria) and should have an updated strategic plan, as well as to perform annual evaluation of delivery and outcomes (optimal criteria).

### III.B. Process-based metrics

Table 3 elaborates on the CR process-based metrics, that are defined as part of the EAPC SP/CR Accreditation Programme. For each metric, Table 3 informs the reader on whether the metric is perceived as minimal and/or optimal. All of the minimal criteria are essential to a CR programme and need to be observed. The remaining criteria will improve the programme quality but may not be present.

**Table 3** Minimal and optimal process-based cardiac rehabilitation (CR) metrics, as defined in the European Association of Preventive Cardiology (EAPC) CR accreditation programme.**Minimal**

Programme protocols with duration  $\geq 24$  sessions  
 Patient evaluation and risk factors identification (see III.B.a.1. in text)  
 Exercise risk assessment (see III.B.a.1. in text)  
 Adherence to medication counselling  
 Physical activity counselling (see III.B.a.2. in text)  
 Prescription of exercise training (see III.B.a.3. in text)  
 Nutritional counselling (see III.B.a.4 in text)  
 Limitation of alcohol consumption counselling (see III.B.a.4. in text)  
 Weight control management (see III.B.a.5. in text)  
 Lipid management (see III.B.a.6 in text)  
 Blood pressure monitoring and management (see III.B.a.7. in text)  
 Diabetes management (see III.B.a.8. in text)  
 Smoking cessation counselling (see III.B.a.9. in text)  
 Limitation of alcohol consumption counselling  
 Psychosocial management (see III.B.a.10 in text)  
 Multidisciplinary team educational meetings for patients every two weeks CR results evaluation (see III.B.a.14 in text)  
 Plan at discharge and long-term approach, containing a structured follow-up (i.e. coaching by phone, consultations, mails and posts) and relevant contact information (see III.B.a.13. in text)  
 Written and/or digital health behaviour and risk factor modification (see III.B.a.12. in text)  
 Long-term approach regarding physical activity (see III.B.a.13. in text)  
 Protocols for exercise programmes with emergency protocol (see III.B.a.3. in text)  
 Protocols of delivered care available and up to date (i.e. adjusted to the most recently published version of the European guidelines on cardiovascular disease prevention in clinical practice)

**Optimal**

Programme protocols duration  $\geq 36$  sessions  
 Driving, flying and sports counselling  
 Sexual counselling  
 Vocational counselling and support (see III.B.a.11. in text)  
 ECG monitoring when appropriate (essential for high-risk patients)  
 Alternative programmes: supervised or self-delivered) such as: cardiac tele-rehabilitation, facilitated home-based training sessions, Web-based training sessions, community based training  
 System in place to identify and invite all patients with an indication for secondary prevention and CR (e.g. automatic referral)  
 Multidisciplinary team educational meetings for patients every week  
 Invitation of spouses and partners of patients to participate in health behaviour and risk factor modification education and counselling sessions  
 Extensive CR to all priority groups: myocardial infarction, coronary percutaneous intervention, coronary surgery, heart failure

**III.B.a. Components of Cardiac Rehabilitation****III.B.a.1. Patient evaluation, risk assessment and risk factors identification**

- Clinical history including risk factors screening, cardiovascular atherosclerotic risk assessment, comorbidities, disabilities, psychological stress, vocational situation, physical activity level, symptoms intensity (New York Heart Association, Canadian Cardiac Society), physical examination
- Exams including ECG, echocardiogram, symptom-limited exercise testing (6MWT if exercise testing is not possible), blood testing, Holter-24-hour
- Risk assessment for exercise
- Education on each component of CR and purpose, and on self-monitoring and self-management

The cardiac patient has to be medically evaluated by the cardiologist before starting any CR intervention, which will be tailored to guarantee efficacy and safety. Enough time is necessary for an accurate medical evaluation of the patient, in a specific consultation area. Although time consuming, it should include a detailed clinical history, looking at severity of symptoms, stability of disease, cardiac risk factors and comorbidities, a cardiac and general physical examination, identifying the potential presence of frailty, disabilities, locomotor problems or cognitive/psychologic dysfunction.

All coronary risk factors need to be identified and individually targeted for interventions, pharmacological and non-pharmacological. Hypertension, diabetes or glucose intolerance, dyslipidaemia, smoking habits, obesity and sedentarism are several of the modifiable risk factors which need to be identified, quantified and subject to definition of target values (see specific subsections). An individual plan

should be defined from the beginning to achieve all target goals, which will be monitored and periodically evaluated. If necessary, patients can be directed to specific specialists, to reinforce the management of risk factors control (diabetes, smoking cessation, obesity, dyslipidaemia, hypertension).

Functional capacity testing is obligatory for CR planning. The patient, if capable, should always undertake a standard exercise test, at the CR centre (optimal standard) or outside/outsource (minimal standard). These tests are used for functional aerobic capacity evaluation, risk stratification and exercise prescription. In the case of HF patients, cardiorespiratory exercise test is very important for adequate exercise prescription and prognostic purposes. The existence of this resource and appropriate staff to conduct such tests in the CR centre is considered an optimal standard. If the patient is not able to undertake a standard exercise test (treadmill or cycloergometer), some functional tests might be used, like the 6MWT or ISWT. The possibility to perform these alternative functional tests is considered a minimal standard for CR. These tests are useful for evaluating respective functional improvement pre and post-CR. The 6MWT, albeit a good test of walking ability, is not suitable for exercise risk stratification. The reason is the impossibility to quantify the 5 MET exercise risk threshold using the 6MWT, as brisk walking (e.g. walking at 100 m/min, 3.7 mph or 6 km/h) in a healthy adult population, is around 3.8 METS. The natural cadence and brisk walking speeds of conventional CR patients, with a mean age of 67 years of age with two additional comorbidities, is likely to be less than healthy adults. This means that the MET values from the 6MWT (a non-incremental natural cadence test) will not yield the necessary level of data to guide exercise risk assessment around the 5 MET threshold.

Also, an echocardiogram should always be performed to evaluate, besides structural abnormalities of the heart, cardiac systolic and diastolic function, knowing that left ventricular systolic function is fundamental for risk stratification. This exam can be done via outsourcing (minimal standard) or at the CR centre (optimal standard).

Other exams, like 24-hour-Holter-monitoring (outsourcing or at the centre), might be necessary (e.g. suspicion of arrhythmias). Recent blood testing is always necessary (i.e. lipids, glucose, haemoglobin levels) and most frequently performed via outsourcing (minimal standard).

Exercise risk stratification is obligatory, for safety reasons, and will be performed by medical evaluation using clinical, blood testing, ergometric, echocardiographic and other results. There are different ways to evaluate the cardiovascular risk of exercise.<sup>59</sup> According to AACVPR, patients can be stratified in three groups: high, intermediate and low risk.<sup>60</sup> A number of parameters are used for this effect, separating the high and low risk, respectively, as follows:

- Functional capacity (<5 METS vs  $\geq$  7 METS)
- Left ventricular ejection fraction (<40% vs >50%)
- Presence of cardiac symptoms/signs (present for <5 METS vs absent)
- Dysrhythmia (complex ventricular arrhythmia vs no arrhythmia)
- Haemodynamic disturbances (present vs absent)
- Depression (present vs absent).

The timing of examinations should not delay the planned initiation of CR.

Expected outcomes:

- Formulation of an individualised plan for a specific disease and a specific patient for a safe tailored SP/CR programme.

### III.B.a.2. Physical activity counselling

- Recommend gradual increase in daily life activities, minimum 2.5 h/week of moderate aerobic activity, multiple bouts, each >10 min, 4–5 days/week
- Emphasise sedentarism as a risk factor
- Advise individualised physical activity
- Reassure regarding protocol safety
- Encourage involvement in leisure activities
- Inform the patients on risk of relapses.

Expected outcomes:

- Increased participation in domestic, occupational and recreational activities, improved physical activity status, improved psychological well-being and independence.

### III.B.a.3. Exercise training

- Submaximal endurance training with gradual increase; intensity prescription based on exercise testing
- Resistance training, minimum twice per week.

Regarding exercise training, exercise prescription needs to be performed by a CR physician (cardiologist), or in some countries initial exercise prescription is performed by a recognised experienced exercise specialist needing medical (CR cardiologist) support and validation (minimal criteria), in order to achieve the expected result and not to harm the patient (see [Table 4](#)). In general, clinicians (cardiologists) who are trained and competent in exercise prescription would oversee CR exercise assessments and prescription.

Protocols should be adapted (tailored) to each specific patient, in order to guarantee feasibility, efficacy, safety and adherence. Exercise should be supervised by an exercise specialist, according to previous risk stratification, under medical coordination, and monitored in high risk patients (ECG, besides symptoms and haemodynamic parameters monitoring).

**Table 4** Exercise training and physical activity counselling recommendations.

Individualised medical exercise prescription indicating an exercise training structured programme (guaranteeing efficacy and safety)*
Supervision of exercise training, in presence, by physiotherapist, exercise physiologist or rehabilitation nurse, under medical coordination
Promotion of and counselling on physical activity

\*In some countries, medically supported and validated experienced exercise specialists prescription (by cardiac rehabilitation cardiologist).

The promotion of physical activity should be carried out by all staff that engage with cardiac patients. In addition to exercise training, the CR team should agree clear physical activity goals with the patient.

Expected outcomes:

- Increased cardiorespiratory fitness, flexibility, muscular endurance and strength, by at least 5–10%.
- Reduction of symptoms and attenuated physiological responses.
- Improved psychological well-being.

#### III.B.a.4. Nutritional counselling

- Assessment of diet composition, eating habits and alcohol consumption.
- Education of patient and family of dietary goals and healthy food choices
- Integration of behaviour-change models and compliance strategies in counselling sessions
- Evaluation of general nutritional status by a nutrition consultant in a nutrition consultation room, where expert advice for individual healthy choices can be obtained.

Nutrition is essential for a healthy life, which explains the need for nutritional evaluation, counselling and intervention, whenever necessary (see [Table 5](#)).

Obese, hypertensive or dyslipidaemic patients need specific counselling, information and consultation to be reevaluated. Patients with diabetes, severe obesity, frailty, sarcopenia or cachexia need very specific counselling and more profound and specialised intervention.

Expected outcomes:

- Modification of risk factors associated to unhealthy or inadequate diet.

#### III.B.a.5. Weight control management<sup>30</sup>

Assessment:

- Nutritional status, dietary habits and physical activity habits
- Measure weight, height, body mass index (BMI) and abdominal circumference.

Definition of normal weight (BMI 18.5–24.9 or abdominal circumference <94 cm in man and <80 cm in women), overweight (BMI ≥25 and <30 or abdominal circumference ≥94 and <102 cm in men or ≥80 cm and <88 cm in women) and obese (BMI ≥30 or abdominal circumference ≥102 cm in men or ≥88 cm in women) patients.

**Table 5** Nutritional evaluation and counselling recommendations.

Evaluation of nutritional status by a nutrition consultant in a nutrition consultation room
General counselling regarding nutrition in healthy life
Intervention and counselling regarding nutritional status, like obesity or frailty and sarcopenia, and modifiable risk factors, like diabetes, hypertension and dyslipidaemia.

Intervention on patients:

- Education regarding diet, exercise, behaviour
- Nutritional counselling
- Physical activity counselling
- Exercise programme (specific for weight loss)
- Psychological counselling (if necessary)
- Monitoring and coaching weight loss
- Obesity specialist referral (severe cases and/or refractory to lifestyle changes).

Many CR patients are overweight or obese, placing themselves at increased risk for diabetes. Also, weight control is most important in those who are already diabetic or have other major risk factors.

The majority of CR patients however fail to lose weight during the programme, due to a combination of factors including low energy expenditure in CR. Weight gain after a myocardial infarction has been associated with increased risk for diabetes.

Collaboration with hospital-based weight loss programmes with a psychologist with expertise in weight loss might be necessary.

Expected outcomes:

- If the patient has a normal BMI (18.5–24.9), maintenance of the weight.
- If the patient is obese (BMI >30) or overweight (BMI 25–29.9) reduction of 5–10% of body weight in 6 months and modification of associated risk factors.
- Attainment of abdominal circumference <80 cm in women and <94 cm in men.
- Outcomes should be adjusted for patients who start a smoking cessation programme at the same time as they start CR, as successful smoking cessation is associated with weight gain.<sup>42</sup>

#### III.B.a.6. Lipid management<sup>36</sup>

Lipid profile assessment: total cholesterol, low-density lipoprotein-cholesterol (LDL-C), high-density-lipoprotein cholesterol (HDL-C), triglycerides, apolipoproteins measurement

Cardiovascular atherosclerotic risk assessment:

- Very high risk: documented atherosclerotic cardiovascular disease (documented by clinical or unequivocal imaging); Diabetes with target organ damage or at least three major risk factors or early type 1 diabetes long-duration (>20 years); severe chronic kidney disease (glomerular filtration rate <30 ml/kg/min), 10%; familial hypercholesterolaemia with atherosclerotic cardiovascular disease or another major risk factor; SCORE ≥ 10%
- High risk: markedly elevated single risk factors, familial hypercholesterolaemia without other major risk factors; diabetes without target organ damage and duration ≥10 years or one additional risk factor; SCORE 5–9%
- Moderate risk: young patients type 1 diabetes <35 years of age; type 2 diabetes with age until 50 years old, diabetes duration <10 years without other risk factors; SCORE 1–4%
- Low risk: SCORE <1%.

Dyslipidaemia treatment:

- Healthy diet, weight control, regular physical activity, smoking cessation (without weight gain)
- Medication according to cardiovascular risk and expected outcomes achievement.

Expected outcomes:

- Expected outcomes are according to the cardiovascular atherosclerotic risk level and LDL-C. Consequently, the targeted approach to lipid management is primarily aimed at reducing atherosclerotic risk by substantially lowering LDL-C.

LDL-C goals (primary):

- Very-high risk: a therapeutic regimen that achieves  $\geq 50\%$  LDL-C reduction from baseline and an LDL-C goal of  $< 1.4$  mmol/l ( $< 55$  mg/dl). No current statin use is likely to achieve this goal, which requires high-intensity LDL-lowering combination therapy
- High risk: a therapeutic regimen that achieves  $\geq 50\%$  LDL-C reduction from baseline and an LDL-C goal of  $< 1.8$  mmol/l ( $< 70$  mg/dl)
- Moderate risk: a goal of  $< 2.6$  mmol/l ( $< 100$  mg/dl)
- Low risk: a goal of  $< 3.0$  mmol/l ( $< 116$  mg/dl)
- For patients with atherosclerotic cardiovascular disease who experienced a second vascular event within 2 years (not necessarily of the same type as the first event) while taking maximally tolerated statin therapy, an LDL-C goal of  $< 1.0$  mmol/l ( $< 40$  mg/dl) may be considered.

Non-HDL-C goals (secondary):

- Very-high risk  $< 2.2$  mmol/l ( $< 85$  mg/dl)
- High-risk  $< 2.6$  mmol/l ( $< 100$  mg/dl)
- Moderate risk people  $< 3.4$  mmol/l ( $< 130$  mg/dl).

Apolipoprotein B (ApoB) goals (secondary):

- Very high risk  $< 65$  mg/dl
- High risk  $< 80$  mg/dl
- Moderate risk  $< 100$  mg/dl

Triglycerides:

- no goal, but  $< 1.7$  mmol/l ( $< 150$  mg/dl) indicates lower risk and higher levels indicate a need to look for other risk factors.<sup>36</sup>

### IIIB.a.7. Blood pressure monitoring and management<sup>35</sup>

Blood pressure assessment:

- Measurement at rest, considering as cut-point for hypertension (HTN), office systolic blood pressure (SBP) 140 mmHg and/or diastolic blood pressure (DBP) 90 mm Hg, equivalent to a 24-hour ambulatory blood pressure monitoring average of 130/80 mm Hg, or a home blood pressure monitoring average 135/85 mm Hg
- Classification of blood pressure: high-normal blood pressure (BP) (130–139/85–89 mm Hg), grade 1 HTN (140–159/89–99 mm Hg), grade 2 HTN (160–179/100–109 mm Hg), grade 3 HTN (160–179/100–109 mm Hg)
- Attention to visit-to-visit BP variability which is associated with increased cardiovascular and renal disease risk.

Blood pressure control:

- Lifestyle intervention (sodium restriction, alcohol moderation, healthy eating, regular exercise, weight control and smoking cessation) in high-normal BP and hypertension (grades 1, 2, 3)
- Drug treatment consideration in high normal BP, in very-high-risk patients with cardiovascular disease (CVD)

- Drug treatment in hypertension (grades 1,2,3), initiating two drugs most of the times, except for frail old and very old patients, which should begin on monotherapy.

Expected outcomes:

- Office BP  $< 140/90$  mm Hg in all patients (targeted to 130/80 mm Hg or lower in most patients when treatment is well tolerated).
- Office SBP in the range 120–129 mm Hg in most  $< 65$  years patients receiving BP-lowering drugs.
- Office SBP targeted to a range of 130–139 mm Hg in older patients (aged  $\geq 65$  years) receiving BP-lowering drugs, with close monitoring of adverse effects.
- Office DBP target of  $< 80$  mm Hg for all hypertensive patients, independent of the level of risk and comorbidities.
- Office BP 120–129/80 mm Hg in people with diabetes.
- Office pressure in people with chronic kidney disease 130–139/90 mm Hg.
- SBP should not be decreased: below 120 mm Hg in diabetic and in patients with  $\geq 65$  years; below 130 mm Hg in chronic kidney disease patients.

### III.B.a.8. Diabetes management

- Intensive behavioural lifestyle intervention programme to achieve and maintain loss of body weight and glycaemic, BP and lipid goals control
- Individualised meal plan with reduced calories, in appropriate portion sizes
- Increase moderate-intensity physical activity (such as brisk walking) to at least 150 min/week
- Pharmacological treatment
- Diabetes self-management education and support programmes.

Expected outcomes:

- $> \text{HbA1c}$  goal  $< 7\%$  (53 mmol/mol) in general for non-pregnant adults; preprandial capillary plasma glucose 80–130 mg/dl (4.4–7.2 mmol/l); peak postprandial capillary plasma glucose 180 mg/dl (10.0 mmol/l). More or less stringent glycaemic goals may be appropriate for individual patients. Goals should be individualised based on duration of diabetes, age/life expectancy, comorbid conditions, known CVD or advanced microvascular complications, hypoglycaemia unawareness, and individual patient considerations. Postprandial glucose may be targeted if HbA1c goals are not met despite reaching preprandial glucose goals. Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes
- HbA1c goals as 6.5% (48 mmol/mol) for selected individual patients (if this can be achieved without significant hypoglycaemia or other adverse effects of treatment as in polypharmacy) with short duration of diabetes, type 2 diabetes treated with lifestyle or metformin only, long life expectancy, or no significant CVD.
- HbA1c goals as 8% (64 mmol/mol) may be appropriate for patients with a history of severe hypoglycaemia, limited life expectancy, advanced microvascular or macrovascular complications, extensive comorbid conditions, or long-standing diabetes in whom the goal is difficult to achieve despite diabetes self-management education, appropriate glucose monitoring, and effective doses of multiple glucose-lowering agents including insulin.
- Loss of 7% of initial body weight (at least).<sup>61–63</sup>

### III.B.a.9. Smoking cessation

- Education and encouragement to smokers not to smoke through special cessation and motivational programmes, pharmacotherapy, structured follow-up and coaching, behavioural advice.

Expected outcomes:

- Long-term abstinence from smoking

### III.B.a.10. Psychosocial management

- Screening for depression, anxiety, anger, hostility, social isolation, occupational or family distress, sexual dysfunction, substance abuse
- Intervention in small groups or individual level, though counselling and education on heart disease, stress management, relaxation techniques and lifestyle changes, as vocational counselling.

This component is fundamental in CR, relating to quality of life, adherence and prognosis. It includes patients evaluation and interventions by psychologists and/or psychiatrists (see [Table 6](#)).

Psychological baseline evaluation of all patients will allow the screening of psychosocial wellbeing such as depression, anxiety, anger, hostility and personality disturbances, through interview and questionnaires.

Patients identified to have psychological disturbances will be directed to psychologist consultation and with psychiatric disease to psychiatric consultation.

Psychological intervention (psychologist or psychiatrist) will use appropriate behavioural techniques such as cognitive-behavioural techniques (CBTs) or behavioural activation for lifestyle modification, cardiovascular risk factor control and adherence to pharmacological and non-pharmacological therapy, sexual dysfunction, smoking cessation management and relaxation techniques when indicated. Other approaches to improve care and outcomes might be used, like yoga, tai-chi and dancing.

Expected outcomes:

- Minimising psychosocial problems and acquisition of stress management skills, improved psychosocial wellbeing and health-related quality of life evaluated by validated tools.

### III.B.a.11. Vocational advice

Return to prior activities need to be discussed with the patient and family and promoted, unless there is a contra-indication.

**Table 6 Psychological/psychiatric evaluation and intervention.**

Evaluation of all patients by a psychologist using appropriate questionnaires prior to the start of cardiac rehabilitation
Referral of patients with psychological problems to a psychologist for psychological intervention
Referral to psychiatrist of patients with depression, anxiety, stress, other psychiatric disturbances for diagnosis confirmation and therapeutic intervention

The social worker, or a generalist doctor, according to different countries, should support the reintegration in work of the patient or, in case he is disabled for that work, attest his incapacity and suggest (if incapacity is partial) an alternative type of work. In case of economic incapacity for the acquisition of fundamental medication and transport to the CR centre, economic support should be provided by the social assistant. The social worker will guide those patients who are disabled and need to reach specific institutions or get home-based assistance (see [Table 7](#)).

Use most recent evidence to achieve optimal reintegration of acute coronary syndrome patients on returning to work.<sup>64</sup>

A social worker should be available to help resolving social and economical problems that affect transportation to the CR programme, consultations, examinations and also medication adherence, among others. Especially old, low-income and low-level education patients may benefit from this support.

### III.B.a.12. Education

Education and information need careful communication. Patients should be taught and empowered in order to manage their own disease. A list of topics needs to be covered by the CR team members. Counselling for lifestyle modification (healthy) and risk factor control should be performed by all the members of the multidisciplinary CR team. Clear information in plain language should be used, according to the characteristics and literacy of the patient. Spouses and partners of patients should be considered to participate in educational and counselling session regularly.

Health behavioural change and education need to include all relevant core components, like the increase of physical activity, adequate healthy diet with individual adjustments, risk factors management and proper medication intake (see [Table 8](#)).

Expected outcomes:

- Adherence to lifestyle changes, to exercise programme and to medication.

### III.B.a.13. Long-term strategies

Strategies are necessary to maintain long-term the effects of CR:

- Follow-up in consultations, by phone and/or by mail, by a doctor and/or nurse
- Follow-up with coaching and motivational techniques, by a psychologist and/or a nurse
- Long-term scheduled single education and exercise sessions
- Referral to community CR programmes (phase 3 or long-term CR).

**Table 7 Social support recommendations.**

Patient support in work reintegration
Economic support if necessary for medication and consultations
Orientation to institutions or home support for those patients who are disabled

**Table 8 Education, information and recommendations.**

Lifestyle risk factor management:
Physical activity increase and exercise
Healthy eating
Tobacco cessation and relapse prevention
Cardiovascular disease information: aetiology, mechanisms, clinical presentations, therapeutics, prognosis
Medical risk management: risk factor targets and ways to control, counselling (sports, exercise, return work, driving)
Psychosocial health management
Long-term adherence strategies to pharmacological and non pharmacological therapy

Patients should have previous empowerment through educational programmes for long-term adherence, but maintaining the contact with the patients will reinforce habit change, risk factor management and medication adherence.

The follow-up in person during medical consultations, and by phone and/or by mail by a nurse is essential. Also, the follow-up with coaching and use of motivational techniques, by a psychologist and/or a nurse are important.

If possible, the schedule at the end of phase 2 CR of single education and exercise sessions (at 6 months or 1 year intervals), might help maintaining the adherence to healthy lifestyle and risk factors control.

Also, after ending phase 2, the patient should be referred to a community-based long-term CR programme (phase 3). A long-term programme is fundamental for maintaining phase-2 CR gains.

Expected outcomes:

- Long-term adherence to medication and to a healthy lifestyle.

### III.B.a.14. CR results evaluation

CR programmes need to include patients' gains evaluation after the phase 2 programme conclusion (see [Table 9](#)).

After the programme completion, symptoms and risk factors need assessment; blood analysis, exercise test, echocardiogram and other examinations (e.g. Holter) need to be performed for evaluation of cardiac function and functional capacity changes; several validated questionnaires should be completed to evaluate the improvement in quality of life, status of depression or anxiety, nutritional status; status of physical activity should be checked. A discharge letter after phase 2 to the attendant physician with a strategic long-term prevention plan, taking into account the active problems, is essential.

Expected outcomes:

- Objective quantification of all gains after phase 2 – CR programme – clinical, psychological, quality of life, functional capacity, risk factors control, nutritional status improvement.

**Table 9 CR results evaluation after.**

Symptoms and risk factors evaluation
Exercise testing, echocardiogram and blood analysis – functional capacity, cardiac function, arrhythmias, risk factors control
Quality of life questionnaire and other specific questionnaires, e.g. anxiety and depression
Nutritional status and physical activity evaluation

## IV. Quality metrics/indicators

Similar to the quality indicators, described by the American College of Cardiology (ACC) 2018 clinical performance and quality measures for CR,<sup>65</sup> quality indicators of the Canadian Society of Rehabilitation<sup>66,67</sup> and BACR quality indicators,<sup>68</sup> the EAPC SP/CR section defined several quality indicators (see [Table 10](#)). Most of them are included as KPIs in the EAPC accreditation programme. Both internal (within the CR centre) and external evaluation should be performed on a cyclic, repetitive and periodical basis. The EAPC Accreditation Programme Evaluation Committee will be responsible for periodical re-evaluation and re-accreditation of European CR centres, compliant with the minimal/optimal standards and quality indicators defined in this position statement.

## V. Conclusion

Heterogeneity persists amongst different Cardiovascular Rehabilitation Centres in Europe, despite of CR evidence-based solid data published in many scientific documents.

This position statement, elaborated by the EAPC Secondary Prevention and Rehabilitation Section, defines the minimal and optimal CR standards and in addition sets the relevant CR quality indicators to date, aiming to improve preventive cardiology practice and consequently cardiovascular health.

Compliance of the European Cardiovascular Rehabilitation centres with these recommendations will certainly improve CR standardization process and allow to measure CR quality of care improvement in Europe.

EAPC accreditation of Secondary Prevention and Cardiac Rehabilitation centres of the ESC members and ESC affiliated countries, is expected to effectively promote a higher quality and more homogeneous cardiovascular rehabilitation in Europe and beyond.

## VI. Areas for future research

Future research should include:

- The assessment of the impact of the EAPC Secondary Prevention and Cardiac Rehabilitation centres accreditation programme on CR quality of care
- The potential improvement of future SP/CR accreditation programmes

**Table 10** Quality indicators.*Quality indicators*

- % Patients eligible to CR referred after discharge to CR programme (>80%)
- % Eligible patients to CR, enrolled after discharge (>50%)
- Median waiting time from referral to start of CR (within 14–28 days)<sup>a</sup>
- % CR uptake (minimal 24 sessions with an aim of 36 sessions)
- % CR adherence (>75% completes the programme)
- % Drop-out (<25%)
- % Patients with a recorded assessment before starting CR (>80%)
- % Patients with a recorded assessment after starting CR (>80%)
- % Pharmacological adherence improvement (>80%)
- % Weight reduction in obese and overweight (>5%)<sup>b</sup>
- % Functional capacity improvement (>5%)
- % Muscle strength improvement (>5%)
- % Quality of life score improvement (>10%)
- % Anxiety/depression score improvement (>10%)
- % Smoking cessation (>50%)
- % BP control in hypertension (>50%)
- % Lipids control in dyslipidaemia (>50%)
- % Glycaemic control in diabetes (>50%)

BP: blood pressure; CR: cardiac rehabilitation; MI: myocardial infarction.

<sup>a</sup>14 Days for MI and 28 days for CABG.

<sup>b</sup>Except for those on smoking cessation where maintenance of weight is acceptable.

- Standards for an EAPC European cardiovascular rehabilitation database
- Formal benchmarking analysis of the provision of CR in Europe by centres.
- Standards and quality criteria for Home-based Cardiovascular Rehabilitation including Telerehabilitation.

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