



ACPICR

Association of Chartered Physiotherapists
In Cardiovascular Rehabilitation

2023
4th Edition



ACPICR Standards

Standards for Physical Activity and Exercise in
the Cardiovascular Population

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The Association of Chartered Physiotherapists in Cardiovascular Rehabilitation is a professional network of the Chartered Society of Physiotherapy.

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Introduction

Cardiovascular Rehabilitation (CR) is a continually evolving specialty within physiotherapy. In 1995 the Association of Chartered Physiotherapists in Cardiac Rehabilitation (ACPICR) was established to develop the interests of all physiotherapists involved in CR. In 2019 the name was changed to the Association of Chartered Physiotherapists in Cardiovascular Rehabilitation.

The group is recognised as a professional network by the Chartered Society of Physiotherapy (CSP) and the British Association for Cardiovascular Prevention and Rehabilitation (BACPR), the national multi-disciplinary organisation for CR professionals.

This 4th edition of the standards has been developed through a review of the evidence for best practice and consensus of expert opinion in the exercise component of CR, by a working party of the ACPICR. They have been peer-reviewed by the BACPR Exercise Professionals Group (BACPR-EPG) and other individuals. A full list of the peer reviewers can be found on page 93.

Aims of the Publication

This document complements and elaborates on the BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation, particularly its section on physical activity and exercise training [1]. This publication aims to provide a reference guide for current CR exercise professionals to deliver safe and effective exercise to all eligible individuals with, or at high risk of developing cardiovascular disease (CVD), ultimately supporting these individuals to become more active in line with the United Kingdom (UK) physical activity guideline most appropriate for them [2]. Whilst these standards focus mainly upon early (core) rehabilitation, they provide useful information to support exercise professionals working across the CR pathway.

This publication provides:

- a detailed framework of best practice to support development of new programmes and benchmarking of existing programmes
- guidance for managing the complex and high-risk individual
- guidance for health and safety
- guidance for the setting of local and national standards
- evidence to support line managers and CR practitioners in securing a quality service

The content of this publication is not exhaustive and therefore further reading is recommended. Guidance on competitive and recreational sport and individuals is not provided across all of the diagnostic groups; instead please refer to European Society of Cardiology (ESC) guidelines on sports cardiology and exercise in individuals with CVD [3].

In addition, this publication should be used in conjunction with the CSP Quality Assurance Standards for Physiotherapy Service Delivery [4] and the CSP Code of Members' Professional Values and Behaviour [5]. Clinical Exercise Physiologists should consult The Scope of Practice for a UK Clinical Exercise Physiologist (CEP-UK) [6].

For those individuals whose practice is not regulated by the CSP, CEP-UK or Health and Care Professions Council (HCPC), the standards should be applied within the realms of one's own profession's standards, e.g. The Membership Code of Conduct of the The Chartered Institute for the Management of Sport and Physical Activity (CIMSPA) [7], or The Code of Practice of the British Association of Sports & Exercise Sciences (BASES) [8].

Provision of CR

The BACPR defines CR as: "The coordinated sum of activities required to influence favourably the underlying cause of CVD, as well as to provide the best possible physical, mental and social conditions, so that the patients may, by their own efforts, preserve or resume optimal functioning in their community and through improved health behaviour, slow or reverse progression of disease" [1].

It is important to recognise therefore that whilst the broad evidence base for the efficacy of CR is exercise focused, emerging evidence and practice must respect that exercise is but one sub- component of lifestyle risk factor management, and that equal value should be placed on the other main components including health behavioural change and education, psychosocial health, medical risk management and long-term strategies [1]. For further detail, please refer to the BACPR Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation [1].

New to this Update

- All 12 standards have been reviewed and updated in line with current guidelines and evidence
- The appendices have been expanded to include detail on remotely-delivered cardiovascular rehabilitation and on individuals with left ventricular (LV) thrombus, abdominal aortic aneurysm (AAA), diabetes mellitus, spontaneous coronary artery dissection (SCAD), and non-obstructive coronary artery disease (NOCAD)
- The ACPICR Peer Review [9] document has been updated to allow for ongoing monitoring through an audit process

For all 12 standards and for the appendices providing considerations for individuals with specific diagnoses/conditions, key messages have been used to highlight the main points.

STANDARD 1: Recruitment and referral

The BACPR Standards and Core Components document [1] outlines that comprehensive CR, inclusive of the physical activity and exercise component, should be offered to priority groups irrespective of age, sex, ethnic group or other clinical conditions. These groups are:

- acute coronary syndrome (ACS)
- coronary revascularisation
- heart failure
- stable angina
- pre-/post-implantation of cardiac defibrillators and resynchronisation devices
- post-heart valve repair/replacement
- post-heart transplantation and ventricular assist devices
- adult congenital heart disease (ACHD)

The document [1] also acknowledges that there are other populations known to benefit from CR:

- atrial fibrillation
- non-obstructive coronary artery disease (NOCAD)
- peripheral arterial disease (PAD)
- SCAD

and notes that individuals at high risk of developing CVD may benefit from the comprehensive lifestyle interventions and risk factor management that CR provides.

Whilst recognising that resource limitations may prohibit CR services from widening their rehabilitation offer beyond the priority groups, the BACPR highlights that an overlap in risk factors across the cardiovascular and chronic disease spectrums ideally places CR teams to provide high quality, cost-effective interventions to those with and without established CVD [1].

Regardless of the referring cardiac diagnoses, there should be an agreed and co-ordinated local recruitment policy/protocol for the physical activity advice and the exercise component of CR [1].

Criteria:

- 1.1** There is an identified medical contact assuming responsibility for clinical issues that arise from CR.
- 1.2** The referral should include:
 - Source of referral
 - Designation of referrer
 - Contact details of referrer
 - Agreed minimum individual information:
 - demographics
 - sufficient detail of presenting condition (including results of any recent, relevant investigations and treatments)
- 1.3** The protocol should have clear referral criteria and include mechanisms to manage:
 - Inappropriate referrals
 - Individuals who are not ready to commence
 - Individuals who are unable/unwilling to participate or continue with the programme
 - Re-offer of and re-entry to CR

Key Message

The physical activity and exercise component, as part of comprehensive CR:

- should be offered to all priority groups irrespective of demographics or other clinical conditions
- may be accessed by a wider population with/without established CVD where resources allow
- should have an agreed and co-ordinated local recruitment policy

STANDARD 2: Initial assessment

All individuals should be assessed and advised on appropriate physical activity and exercise as early as possible within the rehabilitation process. There should be thorough screening, and an assessment prior to undertaking physical activity and exercise [10]. Assessment should be in person, wherever possible, even when a home-based programme is to be undertaken. However, individuals should not be disadvantaged if they cannot attend an in-person appointment. It is acknowledged that prescribing structured exercise training may not be appropriate when a face-to-face assessment has not been conducted, and an incremental approach to physical activity advice and exercise prescription may be more suitable.

Criteria:

- 2.1** The assessment should encompass the relevant sections identified in the CSP Quality Assurance Standards [4]
- 2.2** Any contraindications to exercise testing and training should be identified in line with American College of Sports Medicine (ACSM) guidelines [10]:
 - **Absolute Contraindications [10]**
 - Acute myocardial infarction (MI) within two days
 - Ongoing unstable angina
 - Uncontrolled cardiac arrhythmia with haemodynamic compromise
 - Active endocarditis
 - Symptomatic severe aortic stenosis
 - Decompensated heart failure
 - Acute pulmonary embolism, pulmonary infarction, or deep venous thrombosis
 - Acute myocarditis or pericarditis
 - Acute aortic dissection
 - Physical disability that precludes safe and adequate testing
 - **Relative Contraindications [10]**
 - Known obstructive left main coronary artery stenosis
 - Moderate-to-severe aortic stenosis with uncertain relationship to symptoms
 - Acquired, advanced or complete heart block
 - Recent stroke or transient ischaemic attack
 - Mental impairment with limited ability to co-operate
 - Resting hypertension with systolic blood pressure >200mmHg or diastolic >110mmHg
 - Uncorrected medical conditions (e.g. significant anaemia, electrolyte imbalance or hyperthyroidism)

In the presence of any of these relative contraindications, exercise professionals should use their clinical judgement to give individualised advice about physical activity at an appropriate level.

2.3 The results of previous investigations should be taken into consideration and interpreted, including:

- Electrocardiogram (ECG)
- ECG exercise tolerance test (ETT)/cardiopulmonary exercise test (CPET)
- Echocardiogram (echo)/Dobutamine stress echo
- Diagnostic angiogram
- Cardiac Magnetic Resonance Imaging (MRI)/Computed Tomography (CT)
- Myoview/Thallium scan
- Intravascular Ultrasound (IVUS)/Fractional Flow Reserve (FFR)
- Biochemistry results including Troponin/Creatine Kinase (CK)/B-type Natriuretic Peptide (BNP)
- Any other medical assessment that highlights physical activity limitations

2.4 The individual's understanding of their diagnosis, investigations and treatment should be ascertained.

2.5 All relevant information regarding the individual's current health status should be considered including outcomes from specialist and generalist primary and acute care consultations.

2.6 All relevant medication (including dosage and frequency) and supplements should be documented and the individual's understanding and compliance discussed.

2.7 All relevant signs and symptoms should be established:

- Angina
- Shortness of breath/dyspnoea
- Palpitations
- Arrhythmias
- Dizziness/lightheadedness
- Orthopnoea
- Ankle swelling
- Fatigue
- Weight gain of >1.8kg in 2-3 days
- Ascites
- Paroxysmal Nocturnal Dyspnea (PND)
- Cough
- Claudication
- Abnormal auscultatory findings (respiratory and cardiac where indicated)

2.8 All relevant comorbidities should be identified. Any mobility issues, use of aids and adaptations and input from relevant support services should be identified.

- 2.9** Physical measures should be taken including:
- Heart rate (HR)/rhythm
 - Blood Pressure (BP)
 - Weight
 - Oxygen saturation level (SpO₂) if concurrent lung pathology, adult congenital heart disease (ACHD) or pulmonary hypertension
 - Body Mass Index (BMI)
 - Waist circumference
 - Blood glucose if relevant
- 2.10** Questionnaires used as part of the assessment process to assess physical and psychosocial health and well-being should be analysed and discussed with the individual
- 2.11** Prior and current participation in physical activity should be established
- 2.12** Readiness to participate in both physical activity and exercise should be established including psychological status, health beliefs and stage of change (*Standard 4*)
- 2.13** **S**pecific, **M**easurable, **A**chievable, **R**elevant, **T**imely goals that can be **E**valuated and **R**evised (SMARTER goals) in relation to physical activity and exercise and vocation should be agreed (e.g. returning to work, activities of daily living (ADL) or sport).
- 2.14** Risk stratification should be carried out using recognised criteria to determine the level of exercise intensity prescribed and supervision required [11].
- 2.15** Training heart rate should be calculated using recommended methods.
- 2.16** A functional capacity test (FCT) should be undertaken.

The choice of test should be dependent on the individual's ability, prior exercise habits, co-existing morbidities and environment/availability of equipment. The test should:

- be performed following standardised procedures
- have an established endpoint i.e. sub-maximal or symptom-limited
- start at a low enough intensity (<40% heart rate reserve [HRR])
- include a range of intensities up to 70-75% HRR / Borg Rating of Perceived Exertion [RPE] Scale® 14 / Borg 10-point Category Ratio [CR10] Scale® 4.5
- allow monitoring of the exercise response using a combination of HR, RPE, BP, SpO₂ and observation

All signs and symptoms should be documented during the test, and following the test until the individual has fully recovered.

Key Message

There should be a thorough initial assessment which comprehensively encompasses all available and relevant subjective and objective information relating to the individual's physical and psychosocial health and well-being. This should include a functional capacity test.

This assessment should enable establishment of the individual's risk stratification, and should incorporate goal setting.

STANDARD 3: Informed consent

Valid consent must be obtained from the individual prior to carrying out an assessment, functional capacity test or intervention. The CR professional should consult and be aware of guidance on consent issued by their relevant health departments, regulating bodies and local policies and procedures [4,5,12-16].

Criteria:

- 3.1** Consent may be explicit (written or oral) or implied behaviour.
- 3.2** All forms of consent must be documented in the individual's records or on a relevant local consent form [17]
- 3.3** The individual must be informed of their right to decline treatment at any stage. If the individual does decline, this must be documented in the individual's record, including the reasons if known.
- 3.4** If the individual's condition or treatment plan changes significantly, or the individual reports new information, further consent must be given and documented.

Key Message

Consent must be obtained and documented, and reviewed regularly, ensuring that any changes in the individual's condition(s) and treatment plan are taken into account.

STANDARD 4: Health behaviour change to assist individuals to become more physically active

Health behaviour change is integral to enabling adoption of any healthy behaviour, including becoming more physically active [1].

Criteria:

- 4.1** Evidence-based health behaviour change theories and techniques should be used, e.g. motivation theory [18] and techniques included in the taxonomy of behaviour change techniques [19].
- 4.2** Communication style should promote an individual-centred approach, e.g. motivational interviewing [20]
- 4.3** Individual beliefs about exercise should be considered in order to address fears, misconceptions and to solve problems.
- 4.4** The exercise consultation should include discussing previous activity levels, interests, barriers, self-confidence and social support, thereby developing personal and realistic goals.
- 4.5** Informed choice regarding all physical activity options available should be given, as this may improve uptake and adherence, e.g. mainstream exercise classes, low level exercise classes, local options of classes of suitable intensity/structure, gym programmes, home exercises, videos, walking plans, structured health walks.
- 4.6** The physical activity should be enjoyable, non-inhibiting, non-competitive and individualised in order to promote confidence and success [21].
- 4.7** Goals set should be SMARTER with regular follow-up to assess progress and advise on further goal setting [22,23]. Goals should be re-evaluated following any change from initial assessment i.e. clinical need, response and attitude to exercise.
- 4.8** Relapse prevention strategies and problem solving should be discussed in order to facilitate long- term physical activity.
- 4.9** Education and support should be provided to enable individuals to become more physically active. Consideration of referral to other professionals may be appropriate to maximise independence and activity (e.g. community rehabilitation teams, pulmonary rehabilitation, falls prevention services, elderly rehabilitation centres, stroke rehabilitation services, or social prescribers).

- 4.10** It is essential to encourage activity that is achievable. For low functioning or sedentary individuals the initial goal may be to form physically active habits or behaviour, reduce sedentary time and improve functional capacity or simply to prevent decline.
- 4.11** An individual should be educated regarding the benefits of regular physical activity and understand that their programme is individualised to their needs and their condition.

Key Message

In meeting the individual's needs, health and behaviour change and education are integral to all components of rehabilitation.

The goals belong to the individual; they have to be meaningful for an individual to have ownership and to want to strive to achieve them.

STANDARD 5: Safety information for physical activity

All individuals should receive safety information prior to commencing a structured exercise training programme or independent physical activity [10].

Criteria:

- 5.1** There should be documented evidence [4,17] that the individual has received and understood information relating to the following:

Preparation for physical activity

- Benefits and purpose of physical activity
- Suitable clothing and footwear
- Pre- and post-exercise eating and drinking
- Exercise environment, circuit and equipment where appropriate
- No smoking for ≥ 1 hour prior to exercise
- Ensuring essential medication is available (e.g. glyceryl trinitrate [GTN])

Pre-screening information

- When not to exercise (e.g. fever, concerning symptoms)
- Relevance of change in medication i.e. titration or ceasing medications
- Relevance of progressive symptoms despite apparent adherence with the prescribed medication
- Relevance of deteriorating exercise performance/functional capacity despite apparent adherence to the exercise programme
- Self-monitoring or additional relevant measures (e.g. blood glucose testing)

How to exercise safely

- Importance of the warm-up, cool down and appropriate exercise intensity
- Self-monitoring using HR monitoring (where appropriate) and RPE scales
- Recognition of signs and symptoms of over-exertion, metabolic dysfunction (hypoglycaemia and hyperglycaemia) or any relevant abnormal exercise response
- Management of chest pain and severe breathlessness
- Adaptations for co-existing morbidities

Any significant change in status may mean that exercise is contraindicated until relevant problems are resolved (*Standard 2*).

- 5.2** The individual should be supported to self-monitor and self-manage, using this information, to help them become a confident and safe independent exerciser. The information may need to be reinforced as part of ongoing education.

Key Message

The individual should receive ongoing education on how to exercise safely, thereby graduating towards being a confident and safe independent exerciser.

STANDARD 6: Structured exercise programming

The following recommendations are based on providing exercise in typical UK cardiovascular rehabilitation settings. These may seem more conservative than the evidence and guidelines from other countries which are based on the assumption that exercise programming and monitoring is determined from more precise maximal cardiopulmonary exercise tests which provide details on an individual's maximal physiological values (including e.g. ECG changes) and high intensity exercise tolerance.

Exercise training should be prescribed according to the FITT (**F**requency, **I**ntensity, **T**ime and **T**ype) model [3,24,25]. The primary focus of the exercise programme should be to elicit a training effect and optimise total energy expenditure over the week [3,24,25]. The frequency, intensity and duration of exercise can be varied to suit the individual, and should be progressed as appropriate [24,26].

Although typically described as being either aerobic (cardiovascular – CV) or resistance (RT) training, the types of exercise included in programmes should comprehensively address all aspects of physical fitness (cardiovascular endurance, muscle strength and endurance, body composition and flexibility) taking into account the specific goals and capabilities of each individual [24,25]. Every exercise session should include a warm up, conditioning phase and cool down.

Throughout the structured exercise session, attention should be paid to breathing pattern, posture and positioning and the types of movement that would prevent hypotension, instability and falls.

Although the same principles for exercise training apply for all individuals, special considerations and adaptations for specific groups can be found in the appendices. Whilst these appendices provide guidance across a range of cardiovascular conditions, as the population ages, CR participants show an increasing prevalence of a wider range of chronic conditions, and around 50-80% present with multimorbidity (two or more co-existing conditions) [27]. In this group, outcomes are often reduced [27,28]. Programmes should provide flexibility in their delivery to meet the complex needs of these individuals [28], in line with relevant condition-specific guidance documents. Collaboration with other specialist health and social care services may be required to provide the comprehensive support required.

Criteria:

6.1 Warm-up

A low intensity, graduated warm-up provides an essential transition to the conditioning component of a structured exercise session, allowing the body to adapt to the physiological, biomechanical and bioenergetic demands that accompany the onset of exercise [10]. This occurs via an increase in myocardial tissue metabolism, endothelial-induced relaxation of the smooth muscle within coronary artery walls,

and to a lesser extent, an increase in sympathetic drive [29]. The resultant vasodilation may increase the individual ischaemic threshold and prevent angina at the onset of exercise [30]. Gradual increases in coronary and systemic blood flow also enable the key organs to prepare for the exercise metabolically, thermally and neurologically – optimizing capability and performance within the exercise session [31].

By increasing skeletal muscle temperature, the warm-up increases muscle metabolism, intramuscular neural conduction, muscle fibre performance and oxygen uptake kinetics [31-33]. Subsequently, there is reduced muscle and joint stiffness, and enhanced postural control, balance, muscle power and exercise tolerance [31-35]. Enabling individuals to practice the activities contained within the conditioning component allows feedback and correction to ensure safe and effective technique.

A warm up should:

- Mobilise joints and warm up all large muscle groups that will be engaged in the exercise training session
- Include pulse raising activities which are appropriate in content to the activities being performed in the conditioning phase
- Include stretching interspersed with pulse raising moves to maintain HR
- Perform a re-warm after preparatory stretching before commencing the conditioning component
- Allow for alternative intensities of aerobic work
- Increase exercise effort gradually, so that by the end of the warm up the following should have been reached:
 - HR within 20 beats per minutes (bpm) of training/target heart rate (THR)
 - RPE - BORG <11 (RPE scale) or <3 (CR10)

Whilst evidence and guidelines on warm-up duration specify that this component should last for a minimum of 10 minutes [25,35], it is widely accepted that sufficient incorporation of graduated mobilising, pulse raising and stretching activities requires a total duration of 15 minutes. For lower functioning individuals the period of warm-up should be reduced proportionally to the length of the conditioning phase (e.g. for an individual who can only manage a 10-minute conditioning component, a 5-minute warm-up will be more appropriate).

6.2 Conditioning Phase – Aerobic or Cardiovascular (CV) Training

6.2.1 Frequency

In order to improve functional capacity, exercise should be undertaken at least three times per week [3,24,25].

6.2.2 Intensity

There is a delicate balance in achieving an exercise intensity which optimises CV fitness gains, whilst being safe for, and acceptable to the individual [36]. In the absence of maximal data from a baseline cardiopulmonary exercise test, for the majority of individuals, moderate intensity aerobic exercise training within these corresponding ranges will be most suitable [25]:

- 40-70% HRR (VO_2 max)
- 11-14 (BORG RPE scale)
- 2-4 (CR10 scale)

For low functioning, more sedentary or high risk individuals it will be more appropriate to start training at the lower end of these intensity targets: 40% HRR, which corresponds with RPE 11 (BORG RPE scale) and 2 (CR10) [25,26].

More active individuals or lower risk individuals should work towards the higher end of these intensity targets: 70% HRR which corresponds with RPE 14 (BORG RPE scale) and 4 (CR10) [25,26].

When an individual demonstrates improved aerobic endurance (achieving increased or desired exercise duration), intensity should be progressed, as appropriate at regular intervals, to ensure that the programme continues to induce improvements [26].

6.2.3 Time (Duration)

Whilst duration and frequency of training are interchangeable, within a structured exercise session a minimum duration of 20 minutes is recommended for the conditioning phase - which can be progressed to 60 minutes as appropriate [25].

6.2.4 Type

Aerobic training recommended to improve CV fitness involves large muscle groups, performing dynamic activities resulting in increases in heart rate and energy expenditure [3,25].

Aerobic training can be continuous or interval-based, and is often delivered via cycling, walking or circuit training exercises. Interval training is useful for those unable to sustain a continuous workload at the desired intensity. By providing a greater challenge to the cardiopulmonary, peripheral and metabolic systems, interval training can elicit a more efficient training effect [3].

While muscle strengthening exercises can be performed as a part of the active recovery phases within interval type training, when an individual progresses towards continuous aerobic training and active recovery duration subsequently reduces, consideration should be given to how to maintain and progress the muscle strengthening training dose within the session.

6.3 Conditioning Phase – Resistance Training (RT)

RT is most effective when delivered in combination with CV exercise as observed during a conventional CR exercise session [38]. It should be performed following the main warm-up and CV activities, and following a partial cool down. However, RT can also be delivered as an independent session focusing on the specific muscular requirements of the individual.

There are a multitude of ways in which RT can be delivered to develop muscular strength, power or endurance. A whole-body approach targeting the major muscle groups (aiming to work the larger muscle groups prior to the smaller muscle groups) delivered in circuit training classes can ensure muscle balance.

6.3.1 RT Assessment

For optimal design and prescription of an RT programme, determining an individual's strength using a one-repetition maximum (1RM) test for each particular muscle group is advocated [39], however although generally safe if performed without Valsalva manoeuvre, this test may not be tolerable in some individuals (e.g. due to musculoskeletal [MSK] pain). If not determined from assessment, a 1RM can be estimated from a higher number of repetitions (reps) up to a maximum of 10 reps, using a recognised formula [40].

Alternative methods of predicting the 1RM include the use of the Borg CR10 Scale (a 4-5 rating after two reps providing an estimated 40-60% of 1RM) or, upon completion of one training set, use of the Repetitions in Reserve [41] scale (the less reps an individual feels they can perform during a movement, the higher they would score on the CR10).

6.3.2 Frequency

RT sessions should deliver enough stimulus to ensure that a progressive overload occurs in the targeted muscles. Following this overload, a subsequent recovery period is required, allowing for muscular adaptation. Individual differences must be considered to ensure sufficient recovery from the RT session. Recommendations suggest a minimum time period of 48 hours between bouts of RT [10]. Therefore, 2-3 RT sessions per week will allow for these recovery times to be met.

6.3.3 Intensity

Determining initial weight load to be lifted by individuals can be estimated as being 30-40% of 1RM for the upper body movements and 50-60% of 1RM for lower body movements [39].

Those new to RT should commence training at the lower ends of these ranges, whilst those with more RT experience could commence towards the higher ends.

6.3.4 Time

- *Set(s)*
A set comprises of the number of consecutive reps performed. Depending on an individual's aims and their existing training level, RT programmes may start with 1 set, progressing up to 3 sets for each muscle group.
- *Repetitions*
Individuals should aim to achieve 8-10 reps in each set [10]. Typically, when an individual can perform >10 reps the weight load should be increased. If the concentric and eccentric phases of the movement are performed for 3 seconds each, the working muscle group will have a total time under tension of 6 seconds per rep. If 10 reps are performed the duration of the set will be 1 minute. Consideration is required to ensure that the total volume of work performed [42] by the individual within a RT session is known (e.g. one exercise consisting of one set performed for 10 reps with a weight load of 10kg would result in a volume of 100kg).
- *Recovery*
A minimum period of 1 minute between sets should be taken to ensure that the individual has recovered from their previous efforts. Longer periods may be required depending on individual differences, muscle group worked and/or amount of weight lifted [43].

6.3.5 Type

RT can be performed utilising bodyweight, pulley systems, portable equipment (e.g. cuffs, kettlebells, resistance bands, and ankle weights), free weights and specialised weight training machines. Specific RT approaches (i.e. supersets, giant sets, drop sets, pyramid sets) are best delivered in a traditional gym-based setting. Consideration is required to ensure that all individuals receive specific and effective RT guidance based on their distinct needs and capabilities.

6.4 Cool Down

A graduated cool down (a 'reverse of the warm up') has been found to aid faster restoration of vagal and sympathetic tone, whilst maintaining venous return and preventing blood pooling in the extremities – reducing the risk of complications such as hypotension, ischaemia and arrhythmias which can occur within the first 30 minutes after stopping an exercise session [35,44-46]. Performing a partial cool down prior to RT will reduce the likelihood of these complications during the RT component of training.

Cool down exercise should gradually return the cardiorespiratory system to near-resting levels within 10 to 15 minutes. The duration should be a minimum of 10 minutes, however as with the warm-up, for low functioning individuals the length of the cool down should be moderated to the length of the conditioning component (e.g. for the individual who can only manage a 10-minute conditioning component, a 3-minute cool down will be more appropriate).

Exercise effort should be gradually decreased relating to the individual's exercise prescription. Stretching to improve flexibility can be incorporated into the cool down. Individuals should be supervised for a minimum of 15 minutes from the end of the cool down.

6.5 Considerations for High Intensity Interval Training (HIIT)

The benefits of an exercise training programme generally increases, albeit incrementally, with its intensity [47]. HIIT is a mode of exercise training that allows individuals to tolerate higher intensities of exercise by alternating between short bouts of high and low intensity exercise. There is some disagreement on what constitutes 'high intensity' exercise, but it is often considered to be >85% peak power output or VO₂max [48].

A recent, large-scale randomised controlled trial, involving UK CR programmes, investigated effects of HIIT and moderate intensity steady-state (MISS) exercise in individuals with stable coronary heart disease (CHD) [49]. The trial found that low-volume HIIT improved cardiorespiratory fitness more than MISS training, by a clinically meaningful margin [49]. 'Low-volume HIIT' was a twice-weekly protocol (10 x 1-minute HIIT work phases @ 85-90% peak CPET workload, interspersed with 10 x 1-minute AR phases @ 20-25% peak, with progressive increases in intensity). Importantly, this trial demonstrates positive outcomes from HIIT in typical UK healthcare settings.

In accordance with these findings, systematic reviews and meta-analysis have shown that in those with stable CHD or heart failure, HIIT can improve peak aerobic fitness to a greater extent than MISS training [50,51]. Conversely, a randomised controlled trial involving those with heart failure [52] failed to show that HIIT improved peak aerobic fitness more than MISS training. However, the intensity of exercise conducted by those in the HIIT group was only ~10% higher than that performed by the moderate intensity continuous training group. Thus, the differences in intensity may not have been sufficient to lead to differential changes in aerobic fitness in the two exercise groups.

The UK HIIT or MISS trial [49] concluded that HIIT is both safe and well tolerated in those with stable CHD. Though the evidence base confirms that HIIT is safe method of exercising for those with stable CHD or heart failure [49,53], there is still a higher volume of information relating to the safety of MISS training in individuals with cardiac disease, and the safety of HIIT performed by those with other types of cardiac disease is under-reported. In clinical trials, the attrition and adherence rates of exercise training using HIIT appear to be similar to those involving MISS training [53]. Using HIIT is therefore unlikely to have a negative effect on programme completion, if it is used in populations similar to those recruited in clinical trials.

Although it is acknowledged that existing trials investigating HIIT have prescribed exercise training using data from maximal CPET, which is not routinely available for many UK CR exercise professionals; HIIT (and in particular low-volume HIIT) does appear to be emerging as a safe and effective option of exercise training for

appropriately screened individuals as part of an individualised exercise prescription. As such, and in line with a number of published international guidelines, it is envisaged that UK guidelines will in future follow a similar approach, recommending the progression of appropriate individuals from moderate to higher exercise intensities, over the course of an early (core) CR programme.

6.6 Balance and Flexibility Recommendations

Although balance and flexibility decrease with increasing age, across all age groups both of these aspects of fitness can be improved [25], and it may be pertinent to include both types of work within a CR exercise session tailoring their emphasis to suit the needs of those attending.

Evidence suggests that a programme of stretching exercises increases tendon flexibility, improves joint range of motion and function, and enhances muscular performance [25,54]. Typically static stretches (slow stretch of a muscle/tendon group and holding the position) are most commonly performed within a CR exercise session, usually as part of the warm-up and cool down. Performance of stretches helps regulate warm-up and cool down intensity, and should pose no harm to any individual if taught correctly, and appropriately modified where required. Warm-up stretches also act as a useful guide to assess individuals' proprioceptive/motor control abilities and joint mobility limitations before commencing the conditioning component. When stretching, ensure that venous return is maintained.

To improve flexibility, stretches should be [25,37]:

- performed 2-3 times per week
- held for approximately 30 seconds to point of tightness or slight discomfort
- repeated 2-4 times, accumulating 60 seconds per stretch

A further benefit of flexibility exercise is enhanced postural stability and balance, particularly when combined with RT [25]. Although improving balance is not generally recognised as an overarching goal of CR, it may be an individual's goal, particularly where a balance deficit and fear of falling is limiting their ability to fully engage in any exercise session, reducing their outcomes from the programme [54]. Notably, in older adults, a few studies have demonstrated that incorporating balance work within CR elicits enhanced improvements in exercise capacity [55,56]. The 'Super Six' [57] is an example of a set of simple balance exercises which could be incorporated within an exercise session, or taught for the individual to do at home.

6.7 Considerations for Lower Functioning Individuals

Lower functioning individuals unable to sustain a workload of 3 METS (metabolic equivalents) – e.g. walking at 2mph - should be advised to incorporate short frequent bouts of physical activity into their daily routine, gradually increasing the duration and reducing the frequency of these bouts as their exercise endurance improves. Activities should be varied and functional, encompassing CV work, muscle strengthening, balance and flexibility.

6.8 Seated Exercise Considerations

Seated exercise programmes provide an opportunity to allow low functioning individuals (e.g. elderly and/or frail) to engage in regular exercise. The evidence suggests that seated exercise improves muscular strength, systolic blood pressure and heart rate response, balance and everyday living activities, whilst reducing body fat and falls risk [58,59]. Seated exercise programmes should follow the same principles as ambulatory exercise and include a warm up, conditioning phase and a cool down component.

Seated exercise can be delivered in a variety of ways:

- in separate components i.e. aerobic exercise followed by RT, or as part of a circuit interval training programme
- with equipment including bikes, rowers and arm ergometers
- using rhythmic body movements or supported/unsupported bodyweight exercises
- alongside an ambulatory CR circuit training class or delivered independently as a low functional capacity programme

Seated exercise, though potentially lowering the metabolic demand, can lead to an increase in intrathoracic pressures and activities should be performed appropriately to prevent this (e.g. with correct posture and breathing technique whilst maintaining venous return) [60]. As the individual progresses (i.e. an increase in aerobic endurance is evident) they should be moved onto a mix of supported and unsupported ambulatory exercise, which will provide greater dynamic challenges to continue to improve fitness.

6.9 General Exercise Session Considerations

Ensure that:

- correct posture is maintained throughout
- there is balance of opposing muscle groups, and use of a variety of different muscle groups throughout sessions to gain global strengthening and to allow individuals to exercise for longer
- feet are kept moving to maintain venous return [60]
- adaptations and supervision of exercise are appropriate for those with comorbidities
- music tempo and volume are appropriate to the session component
- when indicated, floor work (e.g. relaxation exercise and stretching) is done after a cool down period when the cardiovascular system has returned to near-resting state [61,62]

Avoid:

- overuse of any one muscle group
- sustained breath holding and isometric exercises [25]
- rapid changes in position (this can lead to hypotension particularly in elderly individuals and those on blood pressure lowering medications)
- exercises performed in lying during the main conditioning phase

6.10 Summary of Recommendations (FITT)

	Frequency <i>Days per week</i> <i>How often?</i>	Intensity <i>How much exertion?</i> <i>How hard?</i>	Time <i>Minutes per day?</i> <i>How long?</i>	Type <i>What specific activity?</i> <i>What sort?</i>
CV fitness	3 times per week	Moderate BORG RPE 11-14 CR10 2-4 40-70% HRR	20-60 minutes [plus 15-minute warm up and 10-minute cool down]	Can be continuous or interval training; Large muscle groups worked rhythmically
Resistance training	2-3 times per week	Upper body: 30-40% 1RM Lower body: 50-60% 1RM	Minimum 1-3 sets of 8-10 reps	Main muscle groups
Flexibility and balance	2-3 times per week	To mild discomfort	Each stretch held for 30 seconds, performed 2-4 times	Main joint/muscle groups
De-conditioned individual unable to sustain 3 METS	Incorporate into daily routine	Moderate BORG RPE 11 CR10 2 40% HRR	5-10minute bouts (gradual increase to accumulate 30 minutes per day)	Activities to improve function, muscle strength and endurance, posture, balance and coordination (<i>e.g. walking, low step-ups, sit to stand, seated activities</i>)

Key Message

Structured exercise should:

- be tailored to the individual's goals and capabilities
- provide an effective dose of training to improve fitness
- include aerobic, muscle strengthening, and balance and flexibility exercise
- include a warm-up and cool down

STANDARD 7: Screening, monitoring and progression

Previously, the ACPICR recommended that the initiation of physical activity and exercise should be continuously monitored and evaluated. This helps to ensure safety, intervention efficacy, and that the intervention remains relevant to the individual's changing circumstances. Where possible, this is still recommended. However, the increased emphasis on providing home-based programmes to widen CR access may make continuous monitoring impractical in some individuals. Regular monitoring for those participating in home-based CR is still essential but may e.g. take the form of regular phone calls, e-mails, or video conferences. Individuals who choose to participate in home-based programme should not be disadvantaged, and should be contacted regularly. The level of monitoring should be specific to the individual's needs with the aim of progressing towards individual self-monitoring.

Criteria:

7.1 Screening

This should take place prior to each physical activity/exercise session to ensure that it is safe to participate and should include:

- Presence of systemic illness
- Change in signs and symptoms
- Impact of any changes in comorbidities since assessment
- Change in medication or medication dose
- Medication availability, for example GTN
- Details of health status reviews
- Results of further investigations
- Wound healing
- Glucose check for individuals with diabetes (all individuals with diabetes are at risk of hypoglycaemia, particularly those newly diagnosed or those new to exercise)
- Response to recent physical activity – home or recent exercise session.
- Change in psychological status which may affect performance e.g. anxiety, depression or anger

Physical activity/exercise should be adapted in light of the pre-screening findings. Individuals should be educated to self-monitor when exercising independently and should be able to contact a qualified and competent healthcare professional in the event that they are uncertain about whether to undertake the activity or abstain.

7.2 Monitoring

Exercise intensity should be monitored using a combination of:

- HR and BP response
- Rate Pressure Product (RPP)
- RPE achieved
- Observation/discussion
- Pulse oximetry for SpO₂ levels where indicated (e.g. in ACHD)
- METs at a given HR or RPE, as linked with a given pace or speed or physiological effort required of a given daily activity [63]

7.2.2 HR response

This can be monitored manually, with a HR monitor, or by pulse oximetry, during CV exercise. Individuals should work within their pre-determined THR range during CV exercises and a post-cool down HR should be obtained, to ensure that the individual has returned to their near-resting level. In certain situations, medication or clinical status may influence the effectiveness of using HR as a monitoring tool (e.g. where there are arrhythmias, HR control medication, or following cardiac transplant).

7.2.3 BP response

Resting BP should be taken:

- Using a properly maintained, calibrated, validated device and appropriately sized cuff
- With tight clothing removed around arm to be tested and the arm supported at heart level and hand relaxed (use the same arm for consistency)
- With no talking during the measurement procedure
- In sitting and standing (those with LV dysfunction and postural hypotension)

A manual blood pressure monitor should be used in the presence of arrhythmias. Should resting BP be borderline or above the level to contraindicate exercise (*Standard 2*) the individual should be advised to rest for a further 5 minutes and BP should be rechecked. If BP remains borderline, allow the individual to complete the warm up and recheck their BP response. BP should be assessed on a case-by-case basis, and the reading considered in relation to the timing of and compliance with antihypertensive medication.

Initially an exercise BP should be taken to monitor and confirm an appropriate exercise response. If it is not practical to monitor BP at the time of CV exercise, BP should be taken as soon as the conditioning component is completed. Should the SBP fall >20mmHg (in the absence of suitable explanation i.e. individual has rushed or is stressed), this may be indicative that the intensity is too high for the individual to maintain the necessary cardiac output to meet the activity demands. In this circumstance, the intensity should be reduced and the individual monitored more closely [10].

7.2.4 RPE

RPE can be monitored using either the BORG RPE (6-20 scale) or CR10 scale. When educating individuals about how to rate their exertion a number of key points should be considered [64]:

Keep the chart in view at all times. Ensure the participant understands the concept of sensing the different physical responses to exercise (such as breathlessness and strain/fatigue in the muscles) prior to using the rating scale.

Anchor to known exertions (e.g. 'no exertion' is sitting still, 'maximal exertion' is the concept of pushing the body to the absolute physical limit). Consider exposing the individual to several levels of exercise intensity to demonstrate different levels on the scale. Focus on the verbal descriptors prior to linking this with a corresponding numerical value.

Encourage the individual to focus on all the different sensations elicited from the exercise being performed (i.e. breathlessness and muscular sensations) and pool to give an overall rating. If there is an over-riding sensation, differentiated ratings can be used.

Explain that there is no right or wrong rating, the rating needs to be what the individual perceives. To achieve this, avoid advising a target RPE initially and instead set exercise intensity to a level which elicits the appropriate rating. With time and ongoing use the individual will then realise the appropriate target levels (this may take up to 3 or 4 sessions) [21,65,66]. It is also important to ensure the rating is taken during exercise, rather than asking the individual to recall the rating after the exercise has ended.

When using RPE it is useful to compare the HR response with the RPE level stated, along with observation, to determine if the individual is competent with self-pacing or whether further education is required.

Recent evidence suggests that when using RPE to guide exercise intensity for training adaptation, baseline cardiorespiratory fitness should also be taken into account. Exercise conducted at an intensity corresponding to the ventilatory anaerobic threshold (VAT) has been suggested as the minimum training intensity required to elicit training adaptations [67]. On average, individuals with a lower functional capacity (~5 METs) who are exercising at an RPE of 10 (range 9-12) may be working at an intensity corresponding to the VAT. This is likely to rise to 12 (range 11-13) in individuals who have a functional capacity of ~6.5 METs. Those who have a higher functional capacity (~8.5 METs) may need to exercise at an RPE of at least 14 (range 13-15) for them to be working at an intensity corresponding to the VAT [68].

7.2.5 Observation & Discussion

It is essential to observe and talk to individuals, to ensure their safety by monitoring the absence of signs and symptoms of over exertion:

- Excessive breathlessness/accessory muscle usage
- Excessive fatigue
- Chest pain (or other signs of cardiac ischaemia, e.g. jaw tightness)
- Excessive sweating
- Dizziness/Lightheadedness
- Nausea
- Poor colour (e.g. cyanosis, pallor)
- Poor quality of movement

This also allows monitoring of their adherence to the exercise prescription, posture and technique.

7.3 Progression

7.3.1 Individual progression should be based upon the agreed individual goals and evaluation of outcome measures taken at appropriate times.

7.3.2 Progression should consider all aspects of the FITT principle (*Standard 6*). The primary aim is to increase the duration and intensity of exercise. Once the recommended duration of 20 minutes of continuous CV exercise has been achieved then the intensity of exercise should be increased. Intensity can be progressed to 70% of HRR or 14 on the BORG RPE scale or 4.5 on CR10.

7.3.3 Progression may be achieved by increasing ratios of:

- CV : active recovery time
- Work : active rest
- Standing : seated exercise

7.3.4 Once an appropriate HR and BP response, and the individual relationship between HR and RPE has been established, a gradual reduction in the use of these objective measures should be considered, and self-monitoring and management encouraged.

Key Message

The individual must be screened before each exercise session, to ensure safety.

A comprehensive approach to monitoring, encompassing a variety of subjective and objective measures, should be used.

The exercise prescription should reviewed regularly and progressed in line with this review and the individual's goals.

STANDARD 8: Home-based programmes and independent exercise

Home-based programmes are a safe and effective form of physical activity and exercise [69]. Evidence demonstrates no significant difference between home and hospital-based rehabilitation in terms of mortality, risk factors, health related quality of life, cardiac events and exercise capacity [70-72]. They are as cost effective and sometimes more than, group based sessions [70,72].

Individuals should be offered a home programme as part of their rehabilitation either alongside or instead of structured group sessions. This may enhance engagement by overcoming barriers (e.g. physical, psychosocial, economic, demographic or geographic) to participation [73-75].

Criteria:

- 8.1** The exercise prescription should be based on a validated FCT. If unable to carry out a FCT, prescription should be based on assessment of current activity levels in conjunction with clinical evaluation or using validated tools. This could be achieved via the use of physical activity questionnaires [76,77], e.g. Duke Activity Status Index or previous levels of activity to current capacity. The reliability and validity of delivering FCTs through remote methods has yet to be established.
- 8.2** Several options for home-based prescription should be considered:
- An individualised prescribed physical activity plan, for example graduated walking/jogging programme or home-based circuit
 - Validated home-based programmes, for example Heart Manual [78] BHF Active Heart, Healthy Heart [79], REACH-HF [74,75]
 - Digital exercise option produced by CR team (e.g. DVD or online)
 - Recreational activities (e.g. golf, dancing)
- 8.3** In addition to usual considerations when developing a home-based programme, the following should be considered:
- Individual's choice of type of home-based programme
 - Home environment including availability of equipment
 - The option of completing at a convenient time of day e.g. consider work pattern/hours
 - Minimising interruptions from telephone, family members and pets
- 8.4** To ensure safe unsupervised exercise, individuals will require thorough instructions and the practitioner should ensure that the instructions have been understood as comprehensively outlined in *Standards 5* and *7*.

- 8.5** Individuals should be issued with:
- Exercise resources (e.g. copy of the exercise routine/DVD/manual)
 - Written safety advice
 - RPE monitoring scale
 - Home exercise diary
 - Any equipment needed i.e. weights/resistance bands if available.
- 8.6** Adherence and compliance to home physical activity plans should be regularly monitored during supervised exercise sessions or via telephone contact, email, video call systems or with further home visits. The video call system should be agreed with the local information governance team.
- Monitoring enables:
- Appropriate progression
 - Modification of the exercise programme
 - Correction of exercise technique to ensure safety
 - Review of SMARTER goals
 - Any other issues to be highlighted and addressed
- 8.7** Lower functioning, higher risk and more vulnerable individuals should have:
- More regular contact and supervision
 - If required, the ability to allow family members to be part of the rehabilitation session to support in between contacts
 - Exercises incorporated into their daily routine (including exercises for flexibility, balance and posture (*Standard 6*))
 - Access to other services for aids or adaptations to ensure safety and improve physical activity/exercise levels
 - Access to hospital or community based group programmes, once a suitable level of function has been achieved
- 8.8** Consider referral to appropriate exercise opportunities in the individual's local community.

Key Message

Home-based programmes are a safe and effective alternative to group/centre-based sessions. As home programmes are often unsupervised, it is essential that the individual receives thorough instructions and appropriate support and monitoring.

STANDARD 9: Long-term physical activity planning

Strategies to help individuals sustain physical activity and exercise in the long term should be employed [1]. After completing the early or core CR programme a final assessment should take place to empower the individual to engage and adhere to a long-term physical activity programme; the aim being that they are confident independent exercisers taking responsibility for their own health in the long-term.

Opportunities for such physical activity programmes are dependent on local provision and individual preferences (e.g. the individual may choose a supervised maintenance class or a walking group, or a new or previous recreational activity or sport).

Criteria:

- 9.1** Before being considered for transference to a long-term programme the individual should be clinically stable and competent to exercise independently, safely and effectively according to an individual exercise prescription [80].

They should therefore be able to:

- Identify appropriate modes of physical activity to participate in (i.e. via use of METs tables)
- Recognise and monitor their optimum level of exercise intensity (i.e. understand prescribed RPE and/or HR training zones)
- Recognise the signs and symptoms of over exertion and take appropriate action (e.g. stop/reduce activity level, take GTN)
- Self-pacing during physical activity and exercise
- Progress exercise and physical activity effectively
- Demonstrate adherence to home-based physical activities
- Identify goals for long-term physical activity and exercise programmes

- 9.2** A detailed discharge assessment of changes and improvements should be undertaken with the individual.

- 9.3** In order to support long-term maintenance of physical activity and exercise, individuals should be provided with:
- Contact details of their early CR team and details of medical follow-up
 - Advice on long-term physical activity and exercise prescription and modification
 - Information on appropriate local community physical activity and exercise opportunities
 - Advice on how to deal with relapse and overcoming barriers
 - Advice on the importance of social support and information on local support groups (with onward referral as appropriate)

- 9.4** Information should be made available to carers and families so that they may encourage adherence to long-term physical activity and exercise goals.

- 9.5** There should be documented evidence that advice on long-term physical activity has been given to the individual, carer and family.
- 9.6** When transferring an individual to long-term structured supervised exercise sessions [80,81]:
- The individual should be transferred to an appropriately qualified exercise professional with a specialist exercise instructor qualification in line with the CIMSPA
 - The transfer process to the designated exercise professional should involve completing a detailed early phase transfer form [81]. This form gives information on the individual's index cardiac event, previous medical history, medication, risk factors, any pending investigations, symptoms during exercise and exercise prescription (total CV time achieved, training heart rate ranges and RPE) achieved during early CR
 - It is the responsibility of the exercise professional to provide safe and suitable exercise environments (e.g. community centres, church halls, local authority leisure facilities or private health clubs). Some may also offer remote/virtual and hybrid exercises sessions.
 - The exercise professional should know when to refer an individual back to the primary healthcare team or the early CR programme
- 9.7** A CR summary should be produced and made available to primary and acute care and community services involved in the long-term support of the individual.

Key Message

After completing the early CR programme a final assessment should take place to empower the individual to engage and adhere to a long-term physical activity programme. They should be made aware of all physical activity opportunities available to them.

There should be a detailed transfer process and clear communication to all relevant care/support providers.

STANDARD 10: Outcome measures

Consistent measuring of outcomes is an essential component in the evaluation of the effectiveness of CR and is vital for quality improvement.

Outcomes provide meaningful feedback to individuals on their progress, and can encourage the maintenance of healthy behaviours. Outcomes also provide data to determine the efficacy of, and refine the content of, a programme. They can also help justify the value of services both clinically and financially.

CR outcomes should include:

- Self-reported health-related quality of life
- Clinical outcomes
- Achievement of individual-centered goals
- The individual's care experience
- The individual's level of engagement

Criteria:

10.1 Reliable and valid outcome measures should be used. Outcome measures should be:

- Clinically relevant and meaningful
- Comparable between programmes of varying sizes and resources

10.2 Programmes should work in partnership with national data systems to establish a robust audit system, measure uptake and evaluate adoption of the BACPR standards and core components [1].

10.3 In order to assess improvement in functional capacity, a repeat FCT should be undertaken to assess for any improvement in exercise capacity. Changes in distance, time, METS, rest stops, HR and heart rate walking speed index, RPE response and change in symptoms should be recorded and interpreted.

10.4 Outcome measures for the older adult may include the achievement of functional independence and prevention of premature disability.

Key Message

Consistent measuring of outcomes is an essential component in the evaluation of the effectiveness of rehabilitation and is vital for quality improvement.

Outcomes should be valid and reliable, clinically relevant and meaningful to the service and to the individual.

STANDARD 11: Health and safety

Local protocols for health and safety should be followed at all times. The safety of individuals during the exercise component of CR is paramount. This will be optimised with an accurate risk stratification assessment which includes an FCT, thorough induction to the programme (*Standard 5*) and an appropriate exercise prescription (*Standard 6*) by competent staff. All individuals should be screened prior to each exercise session to ensure they are safe to participate (*Standard 7*). All staff should be trained and updated regularly in local protocols for life support, moving and handling, infection control and fire.

Criteria:

11.1 Staffing

Each exercise session should be appropriately staffed with a minimum of one appropriately qualified exercise professional at all supervised exercise sessions. In early CR a minimum of one appropriately trained CR professional who meets the criteria identified by the BACPR-EPG [82] should be present at all supervised group exercise sessions. Staff supporting the delivery of the supervised exercise component should refer to the BACPR-EPG document [83] detailing core competences for the physical activity and exercise component of CR.

Staff-to-individual ratios for instruction/supervision will depend on how early in the individual's rehabilitation process the exercise is being delivered, their level of risk stratification, and the extent of any specialist help or supervision they require for co-existing physical or psychological/cognitive disabilities. The ACPICR currently recommends a minimum staff-to-individual ratio of 1:5 in the early CR programme. This can be reduced as and when individuals progress towards or are deemed as safe independent exercisers.

Irrespective of venue, staff supervising individuals during CR exercise sessions should have maintained their competences in basic life support (BLS), defibrillator training and have access to advanced life support (ALS) services at every supervised exercise session [84].

11.2 Emergency protocols

Appropriate resuscitation equipment including a defibrillator should be readily available at every supervised exercise session, irrespective of venue. There should be evidence of a locally agreed protocol for medical emergencies during an exercise session, and access to a telephone. Appropriate incident reporting systems should be used to report any clinical or adverse events which may occur and there should be a written emergency procedure clearly displayed in the exercise area. Resuscitation equipment must be maintained in accordance with local protocols.

11.3 Venue and environment

A risk assessment of the environment should be carried out. The size of the exercise area should allow for appropriate space around individuals and equipment (e.g. the floor space

required for aerobic exercise per individual is 1.8-2.3m² and 0.6m² per space per individual using exercise equipment) [85].

The temperature should be maintained between 18-23°C and humidity below 65% [85]. If physical activity does occur in environments outside of these parameters, appropriate precautions and advice must be given which includes considerations for clothing, hydration, exercise intensity and duration (including frequency of monitoring). This will help to maintain the expected physiological responses that would normally occur within recommended environmental parameters. Drinking water should be available at all times.

All exercise equipment must be maintained in accordance with local protocols and in line with manufacturer's guidelines, with risk of use appropriately assessed in keeping with standard health and safety practices. Local infection control procedures should be followed at all times (e.g. cleaning of equipment, hand washing, disposal of sharps).

11.4 Risk of exercise-induced adverse events

The risk of exercise-induced adverse events will be minimised with incorporation of:

- Individualised assessment and prescription
- Risk stratification, pre-screening, monitoring and supervision
- Graduated warm-up of 15 minutes and cool down of 10 minutes
- Moderate to vigorous intensity exercise/physical activity
- Keeping the feet moving during active recovery
- Avoiding breath holding and Valsalva manoeuvre
- Avoiding floor work during the conditioning phase
- Adaptation for co-existing morbidities
- Observation of individuals for 15 minutes post cessation of exercise

11.5 Lone working

Local policies and procedures for working alone should be followed at all times. Safe systems of work (e.g. a local tracking procedure) must be put in place and reviewed regularly to eliminate or reduce the risks associated with lone working. Staff should receive appropriate training and practical advice which enables them to recognise and reduce risk as far as reasonably practicable. Personal protective equipment such as lone worker devices, mobile phones and personal alarms may be used to ensure staff safety.

A full risk assessment should take place when visiting an individual's home. This should be completed in line with local policies and additional staff should be available if there are concerns around lone working risk.

Key Message

Safety of staff and exercising individuals is paramount. National health and safety guidelines and local operational policies should be applied when conducting health and safety assessments.

STANDARD 12: Documentation

Clear, concise and accurate records must be kept which fully reflect each episode of care. The most appropriate style of record keeping will be determined by the clinical setting and may include paper or electronic formats (or a mixture of both), shared records, uni-professional records and records held by the individual. Local policies relating to information governance must be followed, and legal requirements adhered to, including Caldicott principles and requirements relating to General Data Protection Regulation (GDPR) [86]. Records must also satisfy the requirements set out in profession-specific codes of conduct [4,5]. Detailed guidance on record keeping is available from The Chartered Society of Physiotherapy [17] and National Health Service (NHS) Professionals [87].

Criteria:

- 12.1** Records must be completed as soon as possible after an event has occurred.
- 12.2** Written records should be legible and written in permanent black ink to enable legible photocopying or scanning of documents if required.
- 12.3** All entries in a record must be dated (to include date/month/year), timed accurately and signed. Amendments should be dated, timed and signed, and the original entry still clearly visible. The individual's full name must be documented on all pages, along with their date of birth, hospital number or NHS number. Every page must be numbered.
- 12.4** Where used, electronic recording systems should be able to show who has made the record, show any revisions or amendments, and should have a means of locking the notes.
- 12.5** The information contained within the record must be accurate and written in such a way that the meaning is clear. Short forms or abbreviations should only be used if there is an agreed list developed locally that is accessible to anyone entering information into or viewing the health record.
- 12.6** Clinical records must be stored in a secure and confidential manner, adhering to local protocols in place.
- 12.7** Onward referral to other services/agencies must be done in a secure and confidential manner, adhering to local policies that are in place.

Key Message

There is a professional and legal requirement to maintain accurate and up-to-date health records. Records should adhere to local and government information governance and data protection policy, and can be in the most suitable format for the clinical setting.

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Abbreviations

AAA	abdominal aortic aneurysm
AACVPR	American Association of Cardiovascular and Pulmonary Rehabilitation
ABPI	ankle brachial pressure index
ABPM	ambulatory blood pressure monitoring
ACHD	adult congenital heart disease
ACM	arrhythmogenic cardiomyopathy
ACPICR	Association of Chartered Physiotherapists in Cardiovascular Rehabilitation
ACS	acute coronary syndrome
ACSM	American College of Sports Medicine
ADL	activities of daily living
AF	atrial fibrillation
AHA	American Heart Association
ALS	advanced life support
AR	active recovery
ARVC	arrhythmogenic right ventricular cardiomyopathy
AV	atrioventricular [node]
BACPR	British Association for Cardiovascular Prevention and Rehabilitation
BASES	British Association of Sports and Exercise Sciences
BHF	British Heart Foundation
BiVAD	bi-ventricular assist device
BLS	basic life support
BMI	body mass index
BNP	b-type natriuretic peptide
BP	blood pressure
bpm	beats per minute
CABG	coronary artery bypass graft surgery
CBG	capillary blood gas
CEP-UK	Clinical Exercise Physiology UK
CHD	coronary heart disease
CHO	carbohydrate
CIMSPA	Chartered Institute for the Management of Sport and Physical Activity
CK	creatine kinase
CLASP	Cardiovascular Limitations and Symptoms Profile
cm	centimetre
CO ₂	carbon dioxide
CPET	cardiopulmonary exercise test
CR	cardiovascular rehabilitation
CR10	10-point Category Ratio Scale
CR100	Borg centiMax® Scale
CRT(-D/-P)	cardiac resynchronisation (defibrillator/pacemaker) therapy
CSP	Chartered Society of Physiotherapy
CST	Chester Step Test
CT	computed tomography
CV	cardiovascular
CVD	cardiovascular disease
DAPT	dual anti-platelet therapy

DASI	Duke Activity Status Index
DBP	diastolic blood pressure
DKA	diabetic ketoacidosis
ECG	electrocardiogram
Echo	echocardiogram
EF	ejection fraction
EPG	Exercise Professionals Group [of the BACPR]
EQ-5D	European Quality of Life Five Dimension Questionnaire
ESC	European Society of Cardiology
ETT	exercise tolerance test
FCT	functional capacity test
FITT	frequency, intensity, time and type
FFR	fractional flow rate
FGM	flash glucose monitor
GDPR	General Data Protection Regulation
GTN	glyceryl trinitrate
HbA1c	haemoglobin blood glucose
HBPM	home blood pressure monitoring
HCPC	Health Care Professionals Council
HF	heart failure
HFmrEF	heart failure with mildly reduced ejection fraction
HFpEF	heart failure with preserved ejection fraction
HFrfEF	heart failure with reduced ejection fraction
HHS	hyperosmolar hyperglycaemic state
HIIT	high-intensity interval training
HR	heart rate
HRmax	maximum heart rate
HRR	heart rate reserve
HRrest	resting heart rate
HTN	hypertension
IC	intermittent claudication
ICD	implantable cardioverter defibrillator
INOCA	ischaemia with no objective coronary artery disease
INR	international normalised ratio - prothrombin time
IPAQ	International Physical Activity Questionnaire
ISWT	Incremental Shuttle Walk Test
IVUS	intravascular ultrasound
KCCQ	Kansas City Cardiomyopathy Questionnaire
kg	kilogram
LV	left ventricular
LVAD	left ventricular assist device
LVF	left ventricular function
LVEF	left ventricular ejection fraction
MET	metabolic equivalent
MI	myocardial infarction
MISS	moderate intensity steady-state [training]
MLHFQ	Minnesota Living with Heart Failure Questionnaire

mmHg	millimetres of mercury
MRI	magnetic resonance imaging
MSK	musculoskeletal
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NOCAD	non-obstructive coronary artery disease
NYHA	New York Heart Association [classification of symptoms]
OAC (D-)	oral anti-coagulation [direct oral anti-coagulation]
O ₂	oxygen
PAD	peripheral arterial disease
PND	paroxysmal nocturnal dyspnoea
PROM-CR	Patient-Reported Outcome Measure - Cardiovascular Rehabilitation
QLMI	Quality of Life after Myocardial Infarction questionnaire
QRS	QRS interval [of ECG]
QT	QT segment [of ECG]
REACH	Rehabilitation Enablement in Chronic Heart Failure
reps	repetitions
ROM	range of movement
RPE	rating of perceived exertion
RPP	rate pressure product
RT	resistance training
SA	sino-atrial [node]
SBP	systolic blood pressure
SCD	sudden cardiac death
SCAD	spontaneous coronary artery dissection
SF 36	Short Form-36 questionnaire
SF 12	Short Form-12 questionnaire
SGLT2i	sodium-glucose cotransporter-2 inhibitors
S-ICD	subcutaneous implantable cardioverter defibrillator
SMARTER	specific, measurable, achievable, relevant, timely, evaluated, revised [goals]
SpO ₂	oxygen saturation level
SPPB	Short Physical Performance Battery
ST	ST-segment [of ECG]
STS	sit-to-stand
TAH	total artificial heart
TAVI	transcatheter aortic valve implantation
THR	training/target heart rate
T1/T2 DM	type 1/type 2 diabetes mellitus
UK	United Kingdom
VAD	ventricular assist device
VAT	ventilatory anaerobic threshold
VF/T	ventricular fibrillation/tachycardia
VO ₂ max	maximum rate of oxygen consumption
1RM	1 repetition maximum
6MWT	Six-minute Walking Test
24hr	24 hour

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Standard 1: Recruitment and referral

The physical activity and exercise component, as part of comprehensive CR:

- should be offered to all priority groups irrespective of demographics or other clinical conditions
- may be accessed by a wider population with/without established CVD where resources allow
- should have an agreed and co-ordinated local recruitment policy

Standard 2: Initial assessment

There should be a thorough initial assessment which comprehensively encompasses all available and relevant subjective and objective information relating to the individual's physical and psychosocial health and well-being. This should include a functional capacity test. This assessment should enable establishment of the individual's risk stratification, and should incorporate goal setting.

Standard 3: Informed consent

Consent must be obtained and documented, and reviewed regularly, ensuring that any changes in the individual's condition(s) and treatment plan are taken into account.

Standard 4: Health behaviour change to assist individuals to become more physically active

In meeting the individual's needs, health and behaviour change and education are integral to all components of rehabilitation. The goals belong to the individual; they have to be meaningful for an individual to have ownership and to want to strive to achieve them.

Standard 5: Safety information for physical activity

The individual should receive ongoing education on how to exercise safely, graduating towards being a confident and safe independent exerciser.

Standard 6: Structured exercise programming

Structured exercise should:

- be tailored to the individual's goals and capabilities
- provide an effective dose of training to improve fitness
- include aerobic, muscle strengthening, and balance and flexibility exercise
- include a warm-up and cool down

Standard 7: Screening, monitoring and progression

The individual must be screened before each exercise session, to ensure safety. A comprehensive approach to monitoring, encompassing a variety of subjective and objective measures, should be used. The exercise prescription should be reviewed regularly and progressed in line with this review and the individual's goals.

Standard 8: Home-based programmes and independent exercise

Home-based programmes are a safe and effective alternative to group/centre-based sessions. As home programmes are often unsupervised, it is essential that the individual receives thorough instructions and appropriate support and monitoring.

Standard 9: Long-term physical activity planning

After completing the early rehabilitation programme a final assessment should take place to empower the individual to engage and adhere to a long-term physical activity programme. They should be made aware of all physical activity opportunities available to them. There should be a detailed transfer process and clear communication to all relevant care/support providers.

Standard 10: Outcome measures

Consistent measuring of outcomes is an essential component in the evaluation of the effectiveness of rehabilitation and is vital for quality improvement. Outcomes should be valid and reliable, clinically relevant and meaningful to the service and to the individual.

Standard 11: Health and safety

Safety of staff and exercising individuals is paramount. National health and safety guidelines and local operational policies should be applied when conducting health and safety assessments.

Standard 12: Documentation

There is a professional and legal requirement to maintain accurate and up-to-date health records. These records should adhere to local and government policy on information governance, and can be in the format that best suits the clinical setting.
