EDITED BY
JENNIFER JONES | JOHN BUCKLEY
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CARDIOVASCULAR PREVENTION AND REHABILITATION IN PRACTICE

SECOND EDITION

WILEY Blackwell

Cardiovascular Prevention and Rehabilitation in Practice

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Foreword

The International Council for Cardiovascular Prevention and Rehabilitation (ICCPR) wishes to congratulate the British Association for Cardiovascular Prevention and Rehabilitation (BACPR) on this practitioner-focused textbook. Its main aim is to take its internationally recognised Standards and Core Components and show how they can be put 'into practice'. In 1995 the UK (via the BACR) was one of only a handful of countries in the world to have produced a set of National Guidelines in the form of a textbook. Since then, the BACR (now the BACPR) have gone on to publish three editions of their Standards and Core Components (2007, 2012/2013, and 2017/2018). As BACPR was one of the three founding members of the ICCPR (along with Canada and the USA), its Standards and Core Components have always, and will continue to be, featured as an important reference in our website compilation of key cardiac rehabilitation resources (http://globalcardiacrehab.com/). These resources promulgate advocacy, value, and guidance for cardiac rehabilitation as an obligatory part of any modern or developing cardiovascular health service. One of the hallmarks of UK programmes and the BACPR's approach is delivering a large proportion of services in the community and in patients' homes, which is a model the ICCPR promotes for developing countries. We have no doubt this textbook will become a valued resource for cardiac rehabilitation and cardiovascular disease prevention specialists around the world.

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Preface

CARDIOVASCULAR PREVENTION AND REHABILITATION IN PRACTICE

This comprehensive book covers all the aspects of prevention and rehabilitation that are important to those who help cardiac patients to return to normal health – and also guide them to reduce to a minimum the risks of recurrence. The scope of the problem is described, followed by the nature and standards of cardiac rehabilitation (CR) and how behaviour can be changed to ensure the adoption of a healthier lifestyle. The roles of the professionals involved in treating patients leads to the need for patients to know how best to work for their own recovery.

The British Association for Cardiac Rehabilitation (BACR) was set up in 1992 and the first guidelines were published in 1995. Since then much has been achieved. In 1992 less than half of all hospitals treating heart patients had active CR programmes; today the figure is 100%. In 2000 the UK Department of Health (DoH) published the National Framework for CHD and included CR as Standard 12, ushering in the general acceptance of CR as a vital part of the management of cardiac patients. In 2010 the BACR adopted its new name, British Association for Cardiac Prevention and Rehabilitation (BACPR), to recognise its role in cardiovascular prevention together with rehabilitation. The BACPR then set out the standards and core components for cardiovascular prevention and rehabilitation in the UK. Now all centres are requested to report their performance to the National Audit of Cardiac Rehabilitation (NACR) annually using patient level data. The NACR annual report details national performance and how it is improving.

The scientific evidence base for prevention and rehabilitation is compelling – the challenge is effective implementation in everyday clinical practice. Although much has been achieved there is still much to do, both in the UK and globally, to appropriately fund service provision to levels and standards used in the underpinning research trials. In 2013 the DoH produced a Cardiovascular Disease Outcomes Strategy, which has provided guidance on the recommended percentage uptake of CR in eligible patients. Encouragingly, in the UK, uptake of CR has grown to world leading levels, but this is still only at 50%. Not only is this

figure well below the recommended uptake level, there remain inequities and poor representation for women and ethnic minorities. Patients following heart surgery or an acute coronary syndrome are more likely to be included than those with exertional angina. Other presentations of atherosclerotic disease such as stroke and peripheral arterial disease are rarely included. Only a few heart failure patients receive exercise rehabilitation. Again, whilst there are improvements in the percentage of recruited patients being assessed both before and after the programme these are still not at recommended levels, and longer term outcomes are not usually measured at all.

The BACPR is working hard to improve this national picture by setting out the Standards and Core Components described in this book. These have been used to create a certification process for which all centres are invited to apply. The standards for qualifying for this certification have been set relatively low to encourage as many centres as possible to apply but so far only a minority have done so. Over time the number of centres attaining those standards, and exceeding them, should rise with the ambition of reaching 100%.

This book describes what is needed to bring the level of prevention and rehabilitation received by cardiac patients up to acceptable levels. It makes interesting and educational reading. You have got this far – now read on!

Dr Hugh Bethell
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(now BACPR)

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CHAPTER 1

Cardiovascular Disease Prevention and Rehabilitation

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Abstract

This chapter presents the current burden of cardiovascular disease (CVD) together with the historical context of cardiac rehabilitation (CR) and its evolving evidence base. In accordance with the growing emphasis on secondary prevention and the benefits gained, including people with manifestations of atherosclerosis beyond coronary heart disease (CHD), the rationale for referring to cardiovascular prevention and rehabilitation programmes (CPRPs) in contemporary practice is discussed. Despite rehabilitation's proven benefits, participation still has much room for growth, and approaches to redress this challenge form a key feature of this chapter and textbook more widely. Finally, a brief insight into future perspectives are explored in recognition of the value of new technologies and connected health approaches that offer opportunities in the scalability of services, provide further choice, and potentially reach more people.

Keywords: *cardiovascular disease, cardiac rehabilitation, prevention, health*

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Key Points

- Whilst age-adjusted mortality rates are falling in high-income countries, cardiovascular disease still remains the single largest cause of mortality in the United Kingdom (UK), Europe, and globally.
- More people are, however, surviving acute cardiovascular events, which contributes to a growing and ageing population who are living with long-term conditions.
- Cardiac rehabilitation has evolved from its traditional components of exercise, education, and psychology to now include a broadened focus on the wider physical and psycho-social lifestyle issues that lead to the underlying causes of the disease along with the related behavioural and medical management needs.
- The evidence for cardiac rehabilitation is compelling. There is now a growing emphasis, which reaches beyond outcomes of reducing morbidity and mortality, towards greater patient-centred improvements in health-related quality of life and reduced costly unplanned hospital readmissions.
- Despite the benefits, uptake to cardiac rehabilitation remains less than desirable. Programmes need to ensure to apply evidence-based approaches to increase uptake and programme adherence.
- As services develop to treat any atheromatic condition as part of a 'single family of diseases' there is a need to consider all elements of disease management and prevention within the terminology of cardiac rehabilitation.
- There is a growing interest in the use of technologies and connected health solutions in delivering successful cardiac rehabilitation, and whilst these are encouraged, novel approaches also require rigorous evaluation. As such, contemporary cardiovascular prevention and rehabilitation programmes need to participate in driving vital research to address priority health needs and inform better the prevention and management of cardiovascular disease.

1.1 RATIONALE AND AIMS

Adverse trends in non-communicable diseases (NCDs) are being seen worldwide. In low and low–middle income countries, premature mortality from cardiovascular disease (CVD) continues to rise. Whilst significant reductions are being observed across most high-income countries, CVD remains the leading cause of mortality. In addition, the number of people surviving an acute cardiac event has risen greatly resulting in a growing population living with atheromatic

CVD. Coronary heart disease (CHD) and cerebrovascular disease constitute the most important preventable NCDs and completing a cardiac rehabilitation (CR) programme is strongly recommended (Class 1 indication). A multidisciplinary CR programme aims to address the underlying causes of the disease, enable patient empowerment and self-care, and optimise health and wellbeing. Despite its demonstrated benefits and endorsement by most recognised cardiovascular societies, participation remains vastly underutilised. This chapter aims to provide a brief historical background to traditional CR and its evidence base together with a review of current perspectives and future directions. To increase uptake there is a need for services to evolve and innovate. This includes employing different modes of delivery and offering flexibility when attempting to attract either new or hitherto hard to reach 'in-scope' groups. The rationale for advocating for the provision of CPRPs as opposed to CR also features strongly. This is in recognition that preventive medicine and comprehensive intensive lifestyle and risk factor management are key if reductions in overall mortality together with a plethora of other health-related benefits are to be realised in contemporary practice.

1.2 THE BURDEN OF CVD

Atheromatic CVD remains the world's number one cause of death and disability (Global Burden of Disease 2015). Low- and middle-income countries (LMICs) are most affected and account for 80% of all CVD deaths (Bovet and Paccaud 2011). In high-income countries, although age-adjusted mortality for this disease has seen significant decline over the last 30 years, it remains the leading single disease burden. These trends concur in the United Kingdom (UK) where deaths from CVD cause more than a quarter of all deaths, or around 150 000 each year (British Heart Foundation 2018). As one of the key NCDs, the World Health Organization (WHO) has acknowledged that the prevention and/or management of CVD requires the implementation of nine different health and medical strategies, including reductions in smoking, poor nutrition/salt intake, alcohol, physical inactivity, obesity, and diabetes and hypertension, along with increasing the availability of medical and counselling therapies to prevent heart attacks and strokes and the availability of essential medicines and technologies to treat CVD and other NCDs (World Health Organization 2013). The British Association for Cardiovascular Prevention and Rehabilitation (BACPR) has identified a number of core components (British Association for Cardiovascular Prevention and Rehabilitation [BACPR] 2017; Figure 1.1) that include all of these WHO targets.

CVD is an umbrella term for all diseases of the heart and circulation, including heart disease, stroke, heart failure, cardiomyopathy, atrial fibrillation,

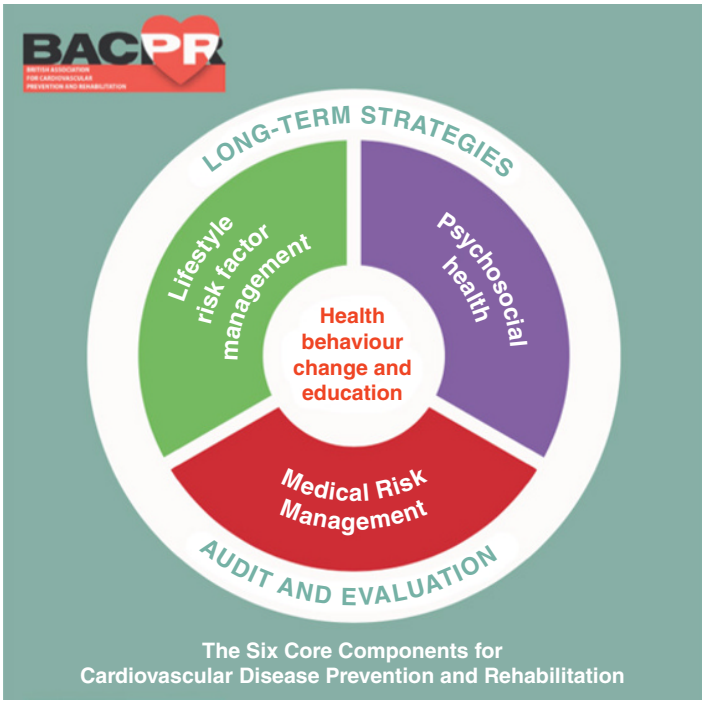

FIGURE 1.1 Core components of cardiac rehabilitation (CR) as defined by the British Association for Cardiovascular Prevention and Rehabilitation (BACPR).

peripheral arterial disease, chronic kidney disease, or any other functional disorder of the cardiovascular system. Of all CVDs, CHD is the leading cause of mortality and disease burden worldwide (WHO 2018), resulting in approximately 8.9 million deaths and 164.0 million disability-adjusted life years (DALYs) globally in 2015 (Kassebaum et al. 2016; Wang et al. 2016). In the UK specifically, CHD is responsible for around 66 000 deaths each year, an average of 180 people each day, or one every eight minutes (British Heart Foundation 2018). The total cost of premature death, lost productivity, hospital treatment, and prescriptions relating to CVD is estimated at £19 billion each year (British Heart Foundation 2018). This is highly relevant to CR, given that CHD is largely preventable with up to 90% of the risk of a first heart attack being due to nine lifestyle risk factors that can be changed (Yusuf et al. 2004). These global and national trends in mortality from CVD highlight there is a growing need for better investment in prevention-based strategies.

In high-income countries, whilst age-adjusted CVD mortality is declining morbidity is increasing, placing an escalating and untenable strain on their healthcare systems. Advances in diagnosis, revascularisation, pharmacotherapy, and overall more successful treatment of acute illness have contributed to these reductions in mortality, but simultaneously result in a growing population of

people surviving acute cardiac events and living longer with chronic l,ong-term conditions, such as heart failure. Currently, there are more than 6 million new cases of CVD in the European Union (EU) and more than 11 million in Europe as a whole, every year. With almost 49 million people living with the disease in the EU, the cost to the EU economies is high at €210 billion a year (European Heart Network 2017). In the UK alone, there are an estimated 7 million people living with CVD; 2.3 million of these individuals are living with CHD – over 1.4 million men and 850 000 women (British Heart Foundation 2018). This places a growing and unsustainable burden on healthcare resources and consequently the demand for effective secondary prevention is intensifying. Availability of interventions that complement standard medical care and aim to reduce further events in those with established disease is now a pressing and urgent priority.

The burden from CVD is not solely applicable to secondary prevention. One third of apparently healthy Europeans have three or more risk factors and these risks are increasing as the population ages. The UK, like many countries in the world, is faced with a looming epidemic given the negative trends being consistently observed in diabetes and obesity. There are 3.7 million adults in the UK diagnosed with diabetes. In addition, hundreds of thousands more are living with undiagnosed Type 2 diabetes and these figures are all projected to increase (British Heart Foundation 2018). Around a quarter of adults in the UK are obese and of concern is that around 28% of children in the UK are overweight or obese. Further, growing epidemics in numbers leading a sedentary lifestyle (two out of five adults do not achieve recommended levels of physical activity), poor diet (only a quarter of adults and one in six children consume the recommended five portions of fruit and vegetables per day), persistent smoking (17% of adults), raised blood pressure (30% of all adults), and high blood cholesterol levels (50% of adults) contribute to the increasing burden and prevalence of atherosclerotic CVD (British Heart Foundation 2018). This further supports the clear need to prioritise preventive care. Distinguishing secondary from primary prevention is, to a large extent, artificial, as all patients with any form of atherosclerosis or presenting with increased multifactorial risk require lifestyle, risk factor, and therapeutic management to reduce their overall risk of developing, or having recurrent, disease.

This provides a strong rationale for opportunities for service transformation from CR to CPRP, which include the full spectrum of patients – from those with any form of established CVD, to those who are asymptomatic but at high risk of future adverse cardiovascular events.

In addition, patients with other non-infectious diseases, particularly those with chronic respiratory conditions and certain forms of cancer, may also benefit from CR (Koene et al. 2016; Lim et al. 2012). Thus, there is an opportunity to further expand the scope and influence of prevention and rehabilitation services that may, in turn, release financial resources to enable more cost-effective deployment of staff and facilities (Kaiser et al. 2013).

1.3 DEFINING CR AND CARDIOVASCULAR PREVENTION AND REHABILITATION

Since the 1960s, early prevention programmes, termed CR, have been the traditional model for delivery of secondary prevention for patients with CHD. Early programmes focused on supervised exercise to counter de-conditioning following bypass surgery and to improve exercise capacity following myocardial infarction (MI). These programmes later evolved to include an educational component (usually in a group format) aimed at educating patients about the importance of lowering multiple risk factors, including smoking, diet, and psychosocial wellbeing (Thompson and De Bono 1999).

Our knowledge about which cardiovascular risk factors to modify and methods available for modifying them have greatly expanded. Consequently, comprehensive CR in contemporary practice continues to include exercise training and education for patients with coronary artery disease *in conjunction with* a growing emphasis on prevention and strategies targeting chronic disease management. Exercise is but one sub-component of lifestyle risk factor management, and equal value should be placed on the other main components, including psychosocial health, medical risk factor management, and central to all these, health behaviour change and education. This is reflected in the BACPR's definition of CR (Box 1.1) and model of the core components for cardiovascular prevention and rehabilitation (Figure 1.1).

Over the past decade, the emphasis of CR programmes has moved towards being integrated chronic disease management and prevention programmes in order to slow disease progression, prevent future cardiac events, and maintain or enhance quality of life whilst living with the burden of underlying CVD (BACPR 2017). The BACPR (2017) grounds its goals in a comprehensive lifestyle management approach in models of behaviour change (i.e. smoking cessation, healthy nutrition, and physical activity) by using a variety of strategies (including

Box 1.1 What Is Cardiac Rehabilitation/Cardiovascular Prevention and Rehabilitation?

The coordinated sum of activities* required to influence favourably the underlying cause of cardiovascular disease, 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.

*The BACPR's six core components for CVD prevention and rehabilitation constitute the coordinated sum of activities

family-based, group-based or community-based approaches, to more structured and complex individual patient approaches). Risk factor management in terms of effective control of blood pressure, lipids, and glucose to defined targets, and the appropriate prescription and adherence to cardioprotective drugs, are now integral parts of this approach, which are inextricably linked with lifestyle behaviours and augmented by medical treatment. Finally, the psychosocial and vocational elements required to help patients to regain a life as fully as possible are also provided (Piepoli et al. 2014).

With this regard, the term 'rehabilitation' for some may have negative connotations (e.g. associated images of drug addiction or of being completely incapacitated, or people with other non-cardiac manifestations of CVD). Many programmes in the UK, Canada, and Australia have re-branded themselves to emphasise a more positive approach around patient empowerment and enhanced wellbeing by using such terms as "healthy heart programme", "action heart", "healthy hearts and minds", to name but a few. Medical fraternities in Europe and the US for over three decades have used the term 'preventive cardiology' to define such a comprehensive approach. More recently, the National Health Service for England at the National Institute for Health Care Excellence (NICE) has endorsed the concept of prevention and rehabilitation services for long-term conditions (Department of Health 2013; NICE 2013), and there are services addressing this by including people with, for example, pulmonary disease and/or cancer. Cardiovascular rehabilitation and prevention services are in a prime position to deliver these larger integrated rehabilitative services.

Internationally, the BACPR, along with its equivalent societies in Canada, the US, and Australia, have led in the founding and formation of an official alliance under the umbrella of the World Heart Federation, called the International Council for Cardiovascular Prevention and Rehabilitation (ICCPR; www.globalcardiacrehab.com). As of 2017, the ICCPR includes over 29 prevention and rehabilitation organisations from around the world with the single aim to promote a comprehensive approach to the prevention of and rehabilitation from CVD as an obligatory component to any developing cardiology service (Grace et al. 2013).

Practice Application

People following a transient ischaemic attack (TIA) and stroke or with peripheral arterial disease and many others at risk of or with manifestations of CVD can benefit from a structured CPRP but may not associate benefit if they are referred to 'CR'. Some may associate the term 'rehabilitation' with people who need help to regain function and this could impact on their attendance if they perceive themselves to be functionally well. Incorporating social marketing approaches, based on evaluating the needs and motivators of your target audience, can positively influence participation.

1.4 THE COMPELLING CASE FOR CARDIOVASCULAR PREVENTION AND REHABILITATION

CR, with a strong focus on secondary prevention, has a robust evidence base for reducing mortality and morbidity, saving healthcare costs and enhancing the quality and productivity of people's lives (Cowie et al. 2019). For overall mortality, although several recent studies, meta-analyses and recommendations of national and international guidelines suggest a beneficial effect in patients with CHD, the effect of multi-component CR in the modern era of statins and acute revascularisation remains controversial (Rauch et al. 2016).

Meta-analyses of CR trials up to 2010 showed a significant reduction in all-cause mortality but many of these trials were conducted before the modern management of acute coronary syndromes. There have been major advances in cardiology practice together with improvements in public health, which have contributed to considerably lower mortality rates following acute coronary syndromes. As a consequence, the influence that CR post MI or revascularisation may have on specifically mortality in contemporary practice is becoming more limited.

This is reflected in findings from systematic reviews and meta-analyses over time. For example, the 2011 Cochrane review involved 47 trials randomising a total of 10 794 patients and found that exercise-based CR was associated with significant reductions in overall and cardiovascular mortality and reduced hospital admissions. It was not associated with reduced risk of morbidity in terms of the risk of recurrent MI or risk of revascularisation (Heran et al. 2011). In 2016, Cochrane published an update, as there were 16 new trials, to reassess the effectiveness of exercise-based CR compared to usual care. This most recent systematic review and meta-analysis found significant reductions in cardiovascular mortality (risk ratio [RR] 0.74, 95% CI 0.64–0.86), and hospital admissions (RR 0.82, 95% CI 0.70–0.96) but no benefit in terms of total mortality (Anderson et al. 2016).

However, a further meta-analysis, including not just exercise-based CR but prevention trials as well found that CPRPs that are able to prescribe cardioprotective medications, and that intensively manage six risk factors or more, can reduce all-cause mortality and recurrent MI (Van Halewijn et al. 2017). Findings from the COURAGE trial also support the importance of managing risk factors intensively. The better the control of six protocol-specified risk factors 1 year after randomisation, the higher the probability of survival during a mean follow-up of 6.8 years. Of the four risk factor goals most strongly associated with long-term survival, three were lifestyle variables (not smoking, physical activity, and healthy diet), and the fourth variable (systolic blood pressure) was influenced by health behaviours (Maron et al. 2018).

Practice Application

Ensure your programme does not place overemphasis on the exercise component. Comprehensive programmes that actively address medical risk factor management through proactive initiation and uptitration of pharmacotherapies coupled with intensive lifestyle modification that are driven to achieve therapeutic targets and manage psychological health status have very different outcomes to exercise-focused programmes.

Certainly, mortality should not be considered the only measure of effectiveness. Reductions in unplanned hospital admissions are of great relevance, especially given the growing strains on acute services. There has been a significant reduction in acute hospital admissions (reduced from 30.7 to 26.1%, NNT 22), which is a key determinant of the intervention's overall cost-efficacy (Dalal et al. 2015; Shields et al. 2018). For individuals with a diagnosis of heart failure, CR may not reduce total mortality but does impact favourably on hospitalisation, with a 25% relative risk reduction in overall hospital admissions and a 39% reduction (NNT 18) in acute heart failure related episodes (Sagar et al. 2015). The consequences of relapse and readmission are enormous in terms of quality of life, associated morbidity, and financial impact, thus the more recent emphasis on the importance of CR for heart failure patients within national and international guidelines. In terms of direct measures of anxiety, depression, and quality of life, CR demonstrates consistently favourable outcomes for all patient groups, and for those with heart failure, a clinically relevant (and highly statistically significant) change in the Minnesota Living with Heart Failure questionnaire point score of 5.8 (Sagar et al. 2015).

Improvements in quality of life associated with CR extend to all priority patient groups (Anderson et al. 2016). Whilst optimal medical therapy and percutaneous intervention for management of CHD may add 'years to life', the potential for CR to add 'life to years' should not be under-estimated, and there is growing recognition that promotion of CR should focus upon its ability to provide cost-effective and cost-saving secondary CVD prevention (Shields et al. 2018). There are a number of strongly associated benefits, extending beyond mortality that remain very important to highlight. For example, CPRPs improve functional capacity and perceived quality of life whilst also supporting early return to work and the development of self-management skills (Anderson et al. 2016; Yohannes et al. 2010). Furthermore, those who have participated in CR after MI have shown significantly better adherence to their cardioprotective medications (Shah et al. 2009).

Practice Application

When communicating the benefits of CR, practitioners should augment their emphasis beyond just reductions in all-cause and cardiac mortality and stress the important benefits of influencing patient wellbeing in light of the growing number of surviving individuals living longer with the burden of CVD. In the context of pursuing cost savings and efficiencies in a healthcare system, the significant benefits in reduced costly hospital readmissions associated with participation in a cardiovascular prevention and rehabilitation programme should be one of the prime messages to funders, along with enhanced patient wellbeing.

1.5 SERVICE PROVISION AND UPTAKE

Although there are class IA recommendations for CR in the American Heart Association (AHA) and American College of Cardiology (ACC) management guidelines and performance measures, only around 20% of eligible patients are apparently referred in the United States (Menezes et al. 2014). Even amongst patients who are appropriately and/or automatically referred to CR, participation rates remain concerning.

Given its clinical and cost effectiveness for CVD management, it is imperative that structures are in place to maximise CR uptake, adherence, and completion. The 2017 BHF National Audit of Cardiac Rehabilitation (NACR) reported that overall mean uptake to CR in the UK has reached 51% (of all eligible patients), which brings the UK's uptake into the top 2% of countries in Europe (National Audit of Cardiac Rehabilitation 2017). Although these data represent a steady increase in uptake, a modelling study conducted by NHS Improvement in 2013 advocated that increasing uptake of CR to 65% of all eligible individuals in England would reduce emergency cardiac admissions by 30%, releasing more than £30 million per year into the NHS, which could be used within rehabilitation and re-enablement (Kaiser et al. 2013).

Predictors of sub-optimal participation include poor functional status, higher body mass index, tobacco use, depression, low health literacy, and long travel distances (Menezes et al. 2014). Furthermore, international data show unacceptable levels of modifiable risk factors at follow-up in the majority of people with CHD and other vascular disease (Kotseva et al. 2016; Steg et al. 2007). Moreover, non-attendees are less likely to believe that rehabilitation is necessary (Cooper et al. 2007) yet have higher baseline risk and poorer risk factor knowledge than those who attend (Redfern et al. 2007).

CR is effective and value for money; nevertheless, current service provision and uptake varies considerably. The application of the BACPR's six service standards aims to reduce this variation in care whilst effectively increasing participation uptake, adherence, and full programme completion (BACPR 2017). Early assessment and goal-setting together with early programme commencement are emphasised in recognition of the associated benefits in improved service uptake and potential reductions in hospital readmissions. The provision of a menu of best practice approaches run by a skilled multidisciplinary team in strong partnership (integration) between primary and secondary care is essential to improve uptake and completion rates of individualised and patient-centred programmes.

As centre-based and home-based CR do not appear to generate different outcomes, or incur substantially different healthcare costs, the CR setting can be individually tailored to patients' preferences. In some cases, home-based CR has demonstrated a higher utilisation rate (uptake, adherence, and completion), therefore services have the opportunity for innovative delivery to enhance patient recruitment (Anderson et al. 2017; Brual et al. 2012; Taylor et al. 2015).

1.6 EMPLOYING EVIDENCE-BASED APPROACHES TO INCREASE PARTICIPATION

In addition to providing choice and alternative models of service delivery such as home-based programmes, there are several important other approaches known to increase uptake and participation. If a CR clinician engages with a patient in an acute hospital setting, and begins to undertake personalised goal-setting at this point, then this may lead to higher uptake (Cossette et al. 2012).

It is also clear that the greatest benefits to programme uptake occur when participation commences early. Early programme initiation has been found to be both safe and feasible, and improves patient uptake and adherence (Aamot et al. 2010; Eder et al. 2010; Fell et al. 2016; Haykowsky et al. 2011; Maachi et al. 2007). This is a time when people are particularly receptive to changing their health behaviour and therefore avoiding delays is critically important.

In the UK, the National Audit of Cardiac Rehabilitation report highlights a mean delay of 28 days to commence an outpatient CR programme post-MI (National Audit of Cardiac Rehabilitation 2017), which may in part explain the average uptake of 51%. Commencing programme orientation within 10 days of discharge and initiating structured activity early are associated with increased

uptake and improved patient outcomes (Aamot et al. 2010; Haykowsky et al. 2011; Pack et al. 2013). An early appointment to outpatient CR at hospital discharge has been shown to significantly improve attendance in a randomised, single-blind, controlled trial (Pack et al. 2013). In this comparison 148 patients with a non-surgical qualifying diagnosis for CR were randomised to receive an orientation appointment to the programme either within 10 days (early) or at 35 days (standard). The primary end point was attendance at the orientation appointment. Unlike many other studies in CR there was a good balance in sex and ethnicity; 56% of participants were male and 49% were black, with balanced baseline characteristics between groups. The median time (95% confidence interval) to orientation was 8.5 (7–13) versus 42 (35 to NA [not applicable]) days for the early and standard appointment groups, respectively ($P < 0.001$). Attendance rates at the orientation session were 77% (57/74) versus 59% (44/74) in the early and standard appointment groups, respectively, which demonstrates a significant 18% absolute and 56% relative improvement (relative risk, 1.56; 95% confidence interval, 1.03–2.37; $P = 0.022$). This simple technique could potentially increase participation in CPRPs nationwide.

A further evidence-based approach is the use of motivational invitation techniques. A review by Davies et al. (2010) included a wide variety of databases and found 10 randomised controlled trials that were suitable for inclusion (three trials of interventions to improve uptake, and seven of interventions to improve adherence). The studies evaluated a variety of techniques to improve uptake or adherence and in many studies a combination of strategies was employed. The quality of studies was generally low. All three interventions targeting uptake of CR were effective. Two of seven studies intended to increase adherence to exercise as part of CR had a significant effect (one of which was of poor quality).

The interventions evaluated included motivational letters (Wyer et al. 2001), motivational telephone contact (Hillebrand et al. 1995), and coordination of care by a trained nurse, together with patient self-monitoring of contact with health professionals (Jolly et al. 1999). The multifaceted nature of the latter trial meant that it was not possible to identify which were the active components of the intervention that brought about the increase in uptake.

Practice Application

All CPRPs should draw upon the evidence base and employ approaches that are known to increase uptake and programme completion. Early assessment and programme commencement, motivational approaches to invitation letters, and scheduled telephone contact have all been shown to be effective.

In this same review by Davies et al. (2010) seven studies of interventions to improve adherence were identified. A wide variety of techniques, and combinations of techniques, were evaluated including goal-setting, action planning, self-monitoring (of exercise, daily activities, bodyweight, heart rate, smoking, and contact with health professionals), feedback, problem-solving and coping strategies, written and oral commitment, stress management, persuasive written and telephone communication, and small group interaction and peer modelling. The majority of studies found no significant effect of the interventions on adherence. Two studies found significant effects in exercise participation following programme completion (Duncan and Pozehl 2002; Sniehotta et al. 2006). It should be noted though that the follow up period for both of these two studies was less than 12 weeks. The former trial investigated the effectiveness of an adherence facilitation intervention consisting of goal-setting, graphic feedback, and provider guidance to support adherence to home exercise in a sample of patients with heart failure. The sample consisted of 13 patients with an ejection fraction of 40% or less who were randomly assigned to either the exercise only group ($n = 6$) or the exercise with adherence facilitation group ($n = 7$). Results indicated that patients who received the intervention demonstrated higher exercise adherence and greater confidence in continuing to exercise in the future (Duncan and Pozehl 2002). However, the study sample was very small and the risk of bias was difficult to assess due to a lack of information in the study report.

Sniehotta et al. (2006) found that developing coping plans to overcome anticipated barriers together with action plans was more effective than action planning alone or usual care. Action planning alone was not more effective than usual care, suggesting that coping plans were the most important component in the combined intervention. However, randomisation was achieved by alternate allocation, which is a weak method. Adherence to exercise was self-reported and there was no information within the study report about whether those assessing outcomes were blind to the participants' treatment allocations. These factors may have introduced bias into the results of the study.

In summary, there is a wealth of data reporting on the barriers to attendance at CPRPs and possible interventions to address these. However, much of the research is of poor quality with few studies including any blinding and little consistency in the definition of adherence. Furthermore, few studies reported the effects of the interventions on clinical outcomes or health-related quality of life and none provided information about costs or resource implications. The differences between the strategies used in the studies identified mean that it is difficult to make clear recommendations. Following a review of the evidence a summary of strategies that may increase uptake and programme completion is provided in Figure 1.2. In designing an effective preventive cardiology programme these should be considered. However, further high quality research is needed.

Interventions to increase uptake	Interventions to increase adherence
▪ Motivational letters* ▪ Motivational telephone contact* ▪ Home visits* ▪ Coordination of care by a trained nurse* ▪ Automatic referral systems* ▪ Inpatient visit by cardiac rehabilitation liaison* ▪ Early programme orientation (<10 days)* ▪ Use of lay volunteers ▪ Offering choice ▪ Provide transport ▪ Care for dependents	▪ Planning and goal-setting* ▪ Signed commitment or diary* ▪ Gender-tailored programmes* ▪ Early programme orientation*

**Supported by RCT data.*

FIGURE 1.2 Summary of interventions to increase uptake and adherence to exercise-based cardiac rehabilitation (CR).

1.7 FUTURE PERSPECTIVES

In efforts to increase participation there is recognition of the need to include interventions that are targeted at reducing specific barriers to referral and participation, offering choice (e.g. home-based, evening sessions, etc.) and the use of modern technologies (internet, phone, and other communication tools). Regarding the use of innovative strategies and the value of reaching out to more people who would benefit from a CPRP, new delivery models must be adopted, especially for patients at low or low-to-intermediate risk. These include the use of telemedicine as well as internet-based, home-based (including Smartphone-based home care models), and community-based programmes to provide alternatives to conventional, medically supervised, facility-based programmes (Clark et al. 2015; Varnfield et al. 2014). Moving traditional CR out of the hospital setting and into community-based venues may increase accessibility and provides an environment removed from acute illness, thereby promoting health and wellbeing. Consequently, in a climate that is calling for innovation, it is essential for the multidisciplinary team to also be equipped to deliver and rigorously evaluate novel approaches in prevention and rehabilitation. The team must ensure to draw on the evidence base and when engaging in new approaches do so with the intention of contributing to driving vital high quality research in CVD prevention and rehabilitation. Experimental delivery models for cardiovascular prevention and rehabilitation should not be widely adopted until they have been shown to be both clinically effective and cost effective (Balady et al. 2011).